A Debating Ontology for Argumentative Dialogue Systems

Bachelor Thesis

by

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Abstract

This thesis designs and implements an ontology which encodes the argumentative structure of natural language debates. This Debating Ontology will constitute the database for a prospective Argumentative Dialogue System, whose artificial agent conducts spoken language debates against human opponents on a specific subject, drawing from the argument structure encoded in the ontology. We use methods of argumentation mining to break down a written sample debate into its argument components and relations employing annotation techniques. To this end, we devise an argument annotation scheme as well as detailed annotation guidelines. In addition, we extract a set of keywords from the debate’s argument components which will be utilized for the Natural Language Understanding of arguments via similarity matching. We also provide guidelines for said keyword extraction. We design and implement the Debating Ontology, test it and evaluate the quality of the argument annotation and extracted keywords. Both evaluations yield promising results.
Declaration of Authenticity

I certify that I have prepared this Bachelor Thesis by my own without any inadmissible outside help.

Ulm, 03 November 2017

(Saskia Langhammer)
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1. Introduction

1.1. Motivation

Spoken language dialogue systems, which allow users to interact with computers using spoken natural language, can be found nowadays in various domains of everyday life. Examples include intelligent personal assistants such as Apple’s Siri or Amazon Alexa, conversational in-car navigation systems, technical support dialogue systems, chat bots for casual conversation [9], tutoring systems for educational purposes and various other applications. Yet, to our knowledge, neither the educational nor the entertainment realm currently offers a means for users to engage in a debate with a spoken language dialogue system.

A debate is a form of persuasion dialogue where two opponents hold differing opinions pertaining to a certain topic and attempt to persuade one another of their respective point of view by constructing convincing chains of arguments. Seeing as argumentation is a crucial aspect of human intelligence essential for tasks such as reasoning, understanding new concepts and deducing new knowledge [6], dialogue systems which engage in argumentation with human users could be a useful way to improve one’s deductive skills. However, Argumentative Dialogue Systems have so far been implemented rather scarcely (see section 3.2 for a brief overview).

Currently ongoing research by Rach et al. [8] focuses on developing such an Argumentative Dialogue System. In order to be able to engage in a debate on a specific topic with a user, this system requires continuous access to the underlying argument structure of the debate at hand, which will ideally be stored in a database. Since said argument structure comprises both arguments and their relations, the use of an ontology seems suitable for this task. However, before a debate can be encoded into an ontology, it must be broken down into its argument components and relations. This can be achieved through methods of argumentation mining. Furthermore, in order to function properly in a debating scenario, an Argumentative Dialogue System based on spoken language requires a way of understanding the user’s utterances by mapping them to specific argument components of the debate.

In this thesis, we devise and implement a database for said Argumentative Dialogue System in the form of an ontology. This ontology will serve both to store the argument structure of debates and as an aid to achieving the Natural Language Understanding of human opponents’ utterances. The latter is achieved by extracting keywords from a debate’s argument components against which the spoken user statements can be matched. To this end, we select a sample debate, conduct an argument annotation of its contents employing methods of argumentation mining, and extract the aforementioned keywords.
1. Introduction

from its argument components. The resulting elements are then encoded into the ontology. In order to facilitate future expansions of said ontology, we provide concise guidelines for both the argument annotation and keyword extraction processes. With this work, we essentially operate at the intersection of the two research fields of Dialogue Systems and Argumentation Mining, transferring human-produced content into a structured, machine-readable format and enhancing it with additional features. The outcome suggests that we have created a suitable basis and starting point for a future Argumentative Dialogue System.

1.2. Overview

We proceed as follows. Chapter 2 discusses the scientific background which this thesis ties into, which is mainly the work of Rach et al. [8]. Chapter 3 briefly reviews related research conducted in the fields of Argumentation Mining and Argumentative Dialogue Systems, focusing on actual implementations of such systems. In chapter 4 we devise an argument annotation scheme suitable for our purpose and provide detailed guidelines for the annotation of natural language debates, including instructions on how to handle inter-annotator disagreement. These guidelines aim to facilitate future annotation of additional debates. In compliance with said guidelines, we perform a manual argument annotation of a complete natural-language sample debate. In chapter 5, we establish guidelines on how to extract keywords from a debate’s argument components, and perform said keyword extraction on our annotated sample debate. Chapter 6 describes, in detail, the design and implementation of the Debating Ontology designated to hold the debate’s argument structure. The results of the argument annotation and keyword extraction processes are then encoded into the ontology. A basic test of the Debating Ontology’s effectiveness as well as an evaluation of both the argument annotation and keyword extraction is conducted in chapter 7. Chapter 8 comprises the conclusion.
2. Background

The "Dialogue Systems" group at the University of Ulm’s Institute of Communications Engineering conducts multi-faceted research pertaining to various aspects of human-machine Spoken Language Dialogue Systems. One of the main lines of current research concerns itself with devising an Argumentative Dialogue System [8], a type of non-cooperative dialogue system in which an artificial agent and a human opponent engage in a spoken language debate on a specific topic with the goal of resolving their conflicting points of view. To this end, they each attempt to build a convincing argument chain in order to persuade the other party of their point of view, at the same time aiming to debase the opponent’s line of argumentation. While there exist various attempts at formal descriptions of such persuasive dialogue systems [7], there are relatively few practical implementations (see section 3.2 for a brief overview), as they find themselves faced with multiple challenges, among them the development of an appropriate agent strategy and the handling of Natural Language Understanding of arguments [8]. The present project approaches these issues as follows:

2.1. Agent Strategy: Debates as Stochastic Games

In the proposed Argumentative Dialogue System, a debate between two opponents is treated as a Stochastic Game [1], or more precisely, a zero-sum game [8]. The appropriate agent strategy is derived from this notion. The artificial agent will learn this strategy and optimize his agent policy in agent-versus-agent training scenarios based on Reinforcement Learning, where positive and negative rewards constitute the appropriate incentive or punishment for the agent’s behavior.

The formal system serving as the foundation of the Argumentative Dialogue System is based on the framework for two-party persuasion dialogues proposed by Prakken [7]. Taking into account the assumed game character of a debate, permitted agent moves are not limited to the stating of explicit arguments ("claim" and "argue" moves), but also include purely strategical moves which do not contribute new argumentative content ("why", "concede" and "retract" moves) but serve to distract, delay or challenge the opponent’s line of argumentation. All possible moves must target a previous move already executed earlier in the debate, however this need not be the directly preceding move. Permitted relations between argument components within the applied argumentative framework are "attack" and "support".

While engaging in a debate, we "assume that both sides have full knowledge of the underlying argument structure." [8] This is where the proposed Debating Ontology ties into the system: Said ontology will hold a machine-readable representation of the rel-
2. Background

relevant debate’s entire argument structure. The argument structure will be stored as a directed graph or tree whose nodes and edges correspond to argument components and argument relations respectively. By accessing this database and traversing said argument graph, both agents can determine potential next moves for themselves and select the most promising one in accordance with their learned strategy.

In order to encode a debate’s argument structure into the Debating Ontology, we must first extract it. This will be achieved by methods of argumentation mining, namely the annotation of the debate’s argument components and relations. We perform this task on a selected sample debate in chapter 4, building upon the work of Stab/Gurevych [12] [13] [11], then transfer the results into an ontology designed specifically to hold the argument structures of an arbitrary number of debates in a machine-readable form (see chapter 6).

2.2. Natural Language Understanding of Arguments

In addition to having a suitable debating strategy and being aware of the debate’s argument structure, it is crucial that the agent also be able to “understand” a human opponent’s utterances. In the context of the proposed Argumentative Dialogue System, this means that – provided an automatic speech recognition unit has successfully decoded a spoken utterance into a textual representation – he needs to be able to match this textual representation of the utterance to one of the nodes (i.e. argument components) of the argument graph, thereby ascertaining which move the opponent has made and, consequently, which moves are available to himself at this point in the debate. This is where another key feature of the Debating Ontology comes into play: In addition to verbatim argument components and relations, the ontology will also contain sets of keywords representing each argument component. Human opponents’ utterances will then be matched not against the argument components themselves, but against the keywords representing them. Ultimately, we map the utterance to the argument component with whose keywords it achieves the highest similarity match.

The reasons for devising this additional feature are as follows: The phrasing of argument components, if taken directly from the text of the sample debate, will in many cases be very specific. If one attempted to match human utterances against them directly, similarities may be missed due to the idiosyncratic wording, or may be found where none exist. Hence we design the keywords to act as both an abstraction and a summary of their respective argument component, using the most common vocabulary and syntax available and condensing the content wherever possible. By matching natural language utterances against them rather than the actual argument components, we hope to achieve more truthful semantic similarity matches than could be done otherwise. The keyword extraction process for the selected sample debate is detailed in chapter 5. The extracted keywords are then fitted into the Debating Ontology (see chapter 6) alongside the argument components and relations annotated earlier.
3. Related Work

3.1. Argumentation Mining

Argumentation Mining is an emerging field of research at the intersection of computational linguistics, natural language processing, machine learning and argumentation theory. Its goal is the automatic extraction of argumentative structures from unstructured, human-produced natural language sources with a view of producing new knowledge from them by further processing them with the help of logic and reasoning. Possible future applications include decision making, market analysis, information extraction as well as reasoning engines over web-based arguments. [5]

Some studies in the research field of Argumentation Mining focus solely on the identification of argument components while neglecting argument relations (see [12] and [13] for discussion). Others limit themselves to a specific domain such as legal texts [6]. Moreover, text corpora resulting from argumentation mining endeavors are often unreliable in that no inter-annotator agreement score or discussion thereof is included (see [12]). The works of Stab/Gurevych [12] [13] and Habernal/Gurevych [2] attempt to remedy these shortcomings. They have taken first steps towards the computational analysis of argumentative discourse structures for use in educational applications, working towards automated argument extraction via supervised machine learning approaches:

In [12], Stab/Gurevych devise an argument annotation scheme for persuasive essays which incorporates not only argument components but argument relations as well (both will be needed for automated argument extraction). They provide detailed annotation guidelines based on this scheme [11] and verify their effectiveness in an annotation study which yields substantial inter-rater agreement. Applying said annotation scheme, the authors produce a corpus of 90 annotated persuasive essays spanning a great variety of topics. This corpus is meant to serve as training data for future automatic identification of argument components and relations via supervised machine learning methods.

Building on the above, Stab/Gurevych [13] present a novel approach for identifying argumentative discourse structures, again in persuasive essays. The presented approach also allows for implicit discourse structures to be recognized, where discourse markers are either absent or used misleadingly. The recognition of argument components is achieved through multi-class classification. In order to identify argumentative relations, pairs of argument components are classified as either "support" or "non-support". For the purpose of argument component and argument relation detection, the authors introduce two sets of structural, lexical, syntactic and contextual features. Experimental results are promising.

Building in turn on [12] and [13], Habernal/Gurevych [2] apply methods of argumentation mining to user-generated web discourse, utilizing an extended Toulmin model. The
authors expand the scope of their research to include aspects of web discourse which, as of yet, do not have a theoretical foundation (e.g., rhetorical questions and figurative language), and attempt to model them in the "pathos" dimension of argument, however with limited success. A comprehensive annotated corpus is created covering different registers and domains of user-generated web content. On this corpus, the authors attempt to perform automated argument structure detection using various methods of machine learning, experimenting with a number of linguistic features in the process. Subsequently, they propose a machine-learning-based computational model for argument component detection.

An earlier approach also incorporating both argument detection and the identification of argumentative discourse structures was presented by Mochales Palau/Moens [6]. Unlike [13], this work interprets argumentation relations as being either a coordination, a subordination or a multiple argumentation relation [6]. For argument structure detection, the authors focus on a context-free grammar based on manually derived rules. However, this methodology is tailored mainly to the domain of legal texts which have a highly standardized style of argumentation. Moreover, the authors rely on discourse markers, making their approach unsuitable for recognizing implicit argument structures [13]. Nevertheless, the work of Stab/Gurevych [13] partially utilizes ideas proposed here.

3.2. Argumentative Dialogue Systems

Currently, there is only a limited number of works on Argumentative Dialogue System implementations. Excepting the work of Rach et al. [8], which constitutes the motivation for this thesis and was discussed in chapter 2, key representatives include the following:

Yuan et al. [14] propose and implement a prototype for a human–computer educational debating system intended to improve students’ debating and reasoning skills as well as their domain knowledge. For this system, which is based on computational dialectics, the authors suggest the use of the "DE" dialogue model as well as a set of strategic heuristics enabling the system to function as a participant in a dialogue. The basic principle is thus: The system asks a human user their opinion on a specific topic, then adopts the opposing stance, thus initiating a debate on said topic.

Rosenfeld/Kraus [10] have developed a methodology for an automated agent named SPA – Strategical POMDP Agent – designed to persuade humans to change their attitude or behavior through argumentative dialogues. This methodology combines argumentation modeling, machine learning from natural dialogues and Markovian optimization techniques. It is based on the Weighted Bipolar Argumentation Framework (WBAF) developed by the authors. Crucially, no predefined protocol for dialogue is assumed. Moreover, within the proposed framework, arguments are allowed to have a continuous justification level rather than merely being labeled as either justified or not. In extensive field experiments, the authors were able to show that SPA significantly outperforms a baseline agent and performs approximately on par with human debaters when attempting to persuade humans to change their attitude or behavior.
In a recent paper, Rakshit et al. [9] introduce an argumentative chat bot named Debbie intended to conduct casual conversations with human users in the form of arguments. Debbie is the first of its kind to function based on argument retrieval, i.e. it draws arguments from a dedicated database which were extracted from existing dialogue corpora, and utilizes them in the debate. The text material from said corpora has been annotated with regards to agreement or disagreement, stance, sarcasm and argument quality among other things. A working prototype of the agent is presented, which is currently able to converse on three different topics encoded in the database. Once confronted with the user’s choice of topic and stance, it retrieves a ranked list of appropriate replies from the database. It then aims to keep the debate going. Initial results are promising.
4. Debate Annotation

4.1. Selection of a Sample Debate

A sample debate for argument annotation and encoding into the Debating Ontology was selected from the Debatabase of the idebate.org website\(^1\). The reasons for this choice are as follows: Firstly, idebate.org is operated by the International Debate Education Association (IDEA), a global network of organizations devoted to debating education. Its freely accessible Debatabase, aimed at debaters as well as the interested general public, ”is an authoritative collection of over seven hundred debates mostly written by experienced debaters”\(^2\). Hence, the debates offered here can be expected to meet certain quality standards regarding both form and content. Secondly, all debates presented here explore both sides of their respective topic. Lastly, all Debatabase debates adhere to a specific structure which both facilitates the quick screening for suitable candidates and potentially aids the argument annotation process later on.

With this in mind, the ”Top 100 Debates” category within Debatabase, containing the 100 most-read debates of the collection, was searched for specimens that offered a balanced number of at least five points pro and contra the major claim. This threshold was decided upon in order to ensure sufficient richness of the argument graph. The selected sample debate ”This House believes that marriage is an outdated institution”\(^3\) satisfies these conditions. Its raw text can be found in appendix A.

For future incorporation of more debates into the Debating Ontology, the Debatabase website should be considered as a possible source since it holds ample suitable material.

4.2. Argument Annotation Scheme

In the ontology, we aim to model a debate as a directed, connected, non-circular graph, i.e. a tree, where the argument components constitute the nodes and the argument relations constitute the edges. As for the exact nature of those nodes and edges, the work of Stab/Gurevych \[12\] as discussed in chapter 3 has proven suitable for our purpose, even though its objectives differ from ours in several regards. Firstly, it is focused on annotating the argumentative structure of persuasive essays, a form of written document in which the author (and only active party) attempts to persuade the reader (the passive

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\(^1\)https://idebate.org/debatabase (last accessed 24 October 2017)

\(^2\)https://idebate.org/find-out-more-about-debatabase (last accessed 24 October 2017)

\(^3\)https://idebate.org/debatabase/religion-marriage-society-family/house-believes-marriage-outdated-institution (last accessed 24 October 2017)
4. Debate Annotation

party) of a single point of view by providing supportive arguments and disproving anticipated counter-arguments. Debates on the other hand involve two active parties with two opposing viewpoints, both striving to persuade the other. Secondly, the long-term goal of Stab/Gurevych’s work is to create a sizable corpus of manually annotated persuasive essays with a view to "utilize the created corpus as training data for supervised machine learning methods in order to automatically identify argument components as well as argumentative relations" [12]. This automatic identification of argument components and relations is to be used in educational applications which will enable students to analyze the argumentative structure of their own essays, improving their writing ability in the process [12]. Our goal on the other hand is to create a sizable database of debates broken down into their argumentation structure which can be used by the agent of an Argumentative Dialogue System to conduct his own argumentation in an agent-versus-human debating scenario. Furthermore, both argument components and keywords contained in the ontology will be crucial for the Natural Language Understanding of human utterances. Nevertheless, the view on argumentative components and relations proposed by Stab/Gurevych coincides with ours. Hence, we mostly adopt the proposed annotation scheme to model the argumentative discourse structure of debates, deviating where necessary.

4.2.1. Argument Components

We distinguish between three types of argument components:

- Major Claim
- Claim
- Premise

A debate usually has one major claim, which formulates the overall topic around which the debate is built. One of the two dialogue participants – the proponent – will defend it, the other participant – the opponent – will attack it. The major claim is normally targeted by at least one claim, but may also be targeted by premises. A debate usually has more than one claim. Claims can only target the major claim, not other claims or premises. A claim is usually targeted by at least one premise. A debate usually also has more than one premise. They can target other premises, claims or the major claim.

4.2.2. Argument Relations

We distinguish between two types of argument relations:

- supports
- attacks
4.3. Argument Annotation Guidelines

These relations exist between two argument components. Note that the major claim does not target (support or attack) any component, but can only be targeted by other components. All other argument components can target no more than one other component, but can be targeted by more than one. No argument component can target itself.

4.2.3. What not to include

Dodge moves such as challenge moves (equivalent to asking ”Why?” in reaction to an argument component) as well as ”concede” and ”retract” statements do not represent an argument component. Instead, they are part of the debating agent’s argumentation strategy as proposed in [8]. They will therefore not be included in the Debating Ontology, hence they need not be annotated in our sample debate, should they exist.

A simplified graphical representation of the argument annotation scheme showing some exemplary argument components and their permissible relations can be found in fig. 4.1.

![Diagram](image)

Figure 4.1.: Argument Annotation Scheme

4.3. Argument Annotation Guidelines

The following guidelines are mainly based on work by Stab/Gurevych [11] [12], but will deviate where necessary. They are meant to aid annotators in the process of annotating debates. All subsequent examples are taken from our selected sample debate (see appendix A).

4.3.1. Preliminaries

First, a common annotation format should be agreed on among all annotators. In our case, each argument component will receive a unique identifier which begins with letters denoting the type of Argument component (“MC” for major claims, ”C” for claims, ”P” for premises) followed by the running number of the debate. Since in our case, there is
only one debate to annotate, the number will be “1”. As there is only one major claim per
debate, the unique identifier for our major claim is already complete: ”MC1”. Claims and
premises however will receive a category running number appended with an underscore.
This means claims will be denoted ”C1_01”, ”C1_02” and so on throughout the debate,
premises ”P1_01”, ”P1_02” etc. Argument relations ”support” and ”attack” will be de-
noted by letters ”s” and ”a”. In the debate text, all argument components except for the
major claim are annotated together with their argument relation. For instance, ”C1_01s”
means ”Claim 01 of debate 1 supporting the major claim”. Since claims can target noth-
ing but the major claim, it is unnecessary to state the target of the relation. This is not
the case for premises however, which can target all types of components. Therefore, we
need to add the target of their argument relation to the identifier, e.g. ”P1_01 s C1_01”
for ”Premise 01 of debate 1 supporting Claim 01 of debate 1”. Lastly, the annotation is
enclosed in square brackets and placed in the debate text directly in front of the argument
component it refers to. Both annotation and argument component are to be underlined,
like in the following example:

”[P1_13 a P1_10] Being able to leave a marriage, though, does not make marriage a
meaningless charade”

4.3.2. Annotation of Argument Components

At the outset, the annotator should read through the entire debate at least once in order
to gain an understanding of its overall topic and content. Afterwards, they should go
through the debate paragraph after paragraph to perform the annotation.

Annotation of the Major Claim

The first component to be annotated is the major claim. It represents the topic the entire
debate revolves around. Hence, your understanding of the debate gained from reading
through it earlier should prove helpful for identifying it. The major claim will most likely
be placed at or near the beginning of the debate. It is usually indicated by a stance
expression (in our case ”This House believes that...”), however this could also be left
implicit. Like all claims, it constitutes a controversial statement that can either be true
or false and should not be accepted without further support [11]. Hence, you will find
other statements supporting or attacking it (these will be claims or premises). However,
unlike other claims, the major claim will not support or attack any other statements
itself. If in doubt, follow the lines of argumentation linking one component to the next
through attack or support relations, until you reach a ”dead end”. To be safe, it is
advisable to do this for more than one line of argumentation. Should you arrive at the
same component in each case, then this, by process of elimination, must be your major
claim. Annotate it as described above. Should it occur more than once in the debate,
annotate the first occurrence and ignore the remaining ones. In our sample debate, the
major claim is ”[MC1] marriage is an outdated institution”. Note that in our case, the
specific structure of the Debatabase debates greatly facilitates the identification of the
major claim which simply corresponds with the document’s heading. The same is true for many claims located in subheadings. However, you should never fully rely on such structural elements when identifying argument components, as they can be misleading (see section 4.4).

### Annotation of Claims

A claim is the central component of an argument. As indicated above, it is a controversial assertion that is either true or false and must be further supported by reasons or justifications (the premises). As the name suggests, it “claims” something to be true. Hence, like the major claim, a claim is often marked by a stance indicator such as ”I think/believe that...”, however this is not guaranteed. It can only attack or support the major claim directly. Thus, again following the line of argumentation in the text, if we find there is another component (or more) between this one and the major claim, it cannot be a claim. The fact that premises can target the major claim as well may be a source of confusion. To distinguish the two, we should determine their function: An utterance stating facts or giving examples in order to support or disprove another is by definition not a claim but a premise. On the other hand, claims will usually be supported or attacked by premises. Consequently, if a (suspected) premise links to an argument component with indicators such as ”hence”, ”as a result”, ”therefore” etc., the component is likely a claim. Note however that such textual indicators can be used misleadingly. An example for a claim in our sample debate is ”[C1.09a] Marriage is an important institution to religious people” which attacks the major claim and is supported by premise ”[P1.53 s C1.09] there are still such huge numbers of people who practice religions to which marriage is integral”.

### Annotation of Premises

Unlike a claim (see above), a premise is not an assertion, but rather a reason or justification for a claim in the shape of real-world facts, examples, or other data. If they are linked to a claim via an ”attack” relation, these facts function as a rebuttal aimed at disproving said claim. Premises can target other premises, claims or the major claim. We have learned earlier that claims cannot target anything other than the major claim. Consequently, anything that targets an argument component other than the major claim must by default be a premise. If a component does target the major claim however, we need to determine whether it is a claim or a premise by again verifying its function: if it makes a controversial assertion in need of proof, it is a claim. If it provides proof or justification in favor or to the detriment of the major claim using facts or examples, it is a premise. Textual premise indicators include ”because”, ”for instance”, ”research has found that” and many more. In our sample debate (and possibly in general), premises are by far the most frequent type of argument component. An example would be ”[P1.02 s P1.01] in 2010 in the UK there were 119589 divorces; 11.1 per 1000 married population” supporting premise ”[P1.01 s C1.01] so many marriages end in divorce with the resulting splits affecting the children”.

Please note that according to Stab/Gurevych, the distinction between claims and premises may in some cases depend solely on the context, i.e. the structure of the specific
4. Debate Annotation

argument. Assuming we have a scenario where "A supports B, B supports C", then by definition B cannot be a claim, regardless of whether it satisfies all the characteristics of a claim as outlined above. In other words, whether an argument component is a claim or a premise sometimes depends only on its position in the argument chain. [12] This may make the annotation process seem less intuitive at first, however it results in greater certainty regarding its outcome.

For a comprehensive list of textual claim and premise indicators, see appendices A and B of [11].

Annotation of Argument Relations

We have found that conducting the annotation of argument relations strictly after the annotation of argument components, as proposed in [11] and [12], does not mirror reality, as the identification of an argument component and the determination of its "support"/"attack" relation are closely intertwined, if not interdependent. Hence, for our purposes they will take place more or less simultaneously. A "support"/"attack" relation can exist between a claim and the major claim, a premise and the major claim, a premise and a claim or a premise and another premise. A "support" relation holds between a source and target component if the source statement justifies, confirms or underpins the target statement. Rephrasing can be helpful in this context. Ask yourself if "[target] because [source]" is a meaningful statement. If so, annotate a "support" relation between the two. Similarly, in an "attack" relation, the source component rebuts or disproves the target component. If the statement "It is not true that [target] because [source]" is meaningful, you should annotate an "attack" relation. [11]

For the determination of argument relations, it may be useful to proceed one paragraph at a time. In each paragraph first identify a claim. Then try to find at least one premise which has an obvious "support" or "attack" relation to the claim and annotate the relation accordingly. Now for each premise left unconnected, try if it relates to one of the already related components. If in doubt, try rephrasing. In this way, you build an argument tree starting from the aforementioned claim. [11] After doing this for each paragraph and then relating all claims to the major claim, the annotation of argument relations should be complete. In our sample debate, the "POINTS FOR" and "POINTS AGAINST" headers often prove useful for determining the nature of an argument relation. An example for the procedure outlined above would be to identify "[C1_05s] Undermines same-sex couples and single parent families as legitimate ways of raising children" as the claim in the fifth paragraph of the "POINTS FOR" section, then matching premise "[P1_32 s C1_05] The existence of marriage is essentially saying that same-sex couples and single parents are less able of raising children than heterosexual couples" to it via a "support" relation. The remainder of the paragraph will be worked through from there.
4.3.3. Identifying Irrelevant Statements

In the sample debate, note that the passages underlined with a dashed line instead of a solid line are irrelevant for the argumentative structure intended for encoding in the Debating Ontology, as they do not denote autonomous argument components of the debate. While these passages may seem, at first glance, to denote separate argument components, upon reflection they turn out to be mere rhetorical devices common in debating. In some cases they reiterate an existing argument component, usually from within the same paragraph (e.g. "This undermines same-sex couples and single parent families raising children." is a reiteration of C1_05 "Undermines same-sex couples and single parent families as legitimate ways of raising children"). In other cases they constitute a challenge move – equivalent to asking "Why?" – against an existing argument component by simply negating said component whilst not providing any new argument of their own (e.g. "marriage does not necessarily promote a better way to raise children" is a challenge move against C1_10 "Marriage promotes a better way to raise children"). Lastly, depending on whether the paragraph at whose end they appear is geared towards attacking or supporting the major claim, they may simply repeat the respective attack or support stance against the major claim, somewhat forming the equivalent of a "q.e.d." closing statement (e.g. "marriage cannot be outdated" in the C1_09 paragraph attacks MC1 "marriage is an outdated institution", while "it is clearly an entirely outdated institution" in the C1_03 paragraph supports it).

4.3.4. Inter-Annnotator Agreement

In order to ensure a sufficient level of consistency for the annotation, it is recommended to employ at least three different annotators who work independently of each other. In any case it is advisable to have an uneven number of annotators. Before embarking on independent annotation tasks, all annotators should complete a training phase. Ideally, this will consist of familiarizing themselves with the annotation guidelines and performing training annotations on a number of debates together as a group. This will enable them to resolve possible differences of opinion and gain a common understanding of the task at hand. Once the training is completed, each annotator will perform debate annotation independently of the other annotators. Once the individual annotation processes are completed, all annotators should review the outcome together. In case of differing annotation results, the procedure should be as follows: If two out of three annotations (or, for a different number of annotators, the majority) arrived at the same conclusion regarding the passage in question, their version will be declared the status quo. Should all three annotators have produced different results, they will attempt to decide in a group discussion which of the three is to be valid. Should this prove impossible, the verdict of the supervisor is binding.
4. Debate Annotation

4.3.5. Rephrasing of Argument Components

For our purpose, the identified argument components must be usable as utterances of a spoken dialogue system, where they will possibly occur in an order different from the original debate, and should moreover be neutral in tone. Since our sample debate is originally a written text, it may be necessary to rephrase the wording of argument components in certain cases, such as:

**Elliptical sentences:**
Elliptical sentences such as "Unreasonable commitment to expect of people." (C1_02) should be extended to full sentences where possible: "Marriage is an unreasonable commitment to expect of people." This ensures the unambiguously of the utterance, even when used out of sequence, and is also preferable from a stylistic point of view.

**Implicit references:**
Implicit reference to a subject or object through use of a pronoun instead of a noun (e.g. P1_47: "It gives many rights in areas like property rights and pension benefits.") may also make an utterance ambiguous in a dialogue, provided it is used out of sequence. They should be made explicit: "Marriage gives many rights in areas like property rights and pension benefits.

**Use of brackets:**
While it is common for written texts to provide data sources and other additional information in brackets (e.g. P1_19: "50% of all divorcees in the UK going on to remarry. (Office for National Statistics)") the same is not true for spoken dialogue. Hence, the respective passages should be incorporated into the textual flow instead: "50% of all divorcees in the UK go on to remarry according to the Office for National Statistics.

**Impersonal reference to debate participants:**
In a written debate, it may be suitable to label the (often hypothetical) opposing party "the opposition" (e.g. P1_39: "marriage clearly does not offer the stability that the opposition claims it does.") and oneself "the proposition", however this is not the case for the spoken dialogue system we are aiming at. In a direct confrontation between two debating parties, it is preferable to simply use "you" and "I/we" instead: "Marriage clearly does not offer the stability you claim it does." Alternatively, one might consider circumventing the issue by employing the passive voice: "it still has not been proven that..." instead of "the opposition still have not proven that..." (P1_28).

There will likely be other instances where a rephrasing of the original argument component wording is in order. The annotator should handle these at his or her discretion.

4.4. Discussion

The sample debate "This House believes that marriage is an outdated institution" with all relevant annotations included in the running text can be found in appendix B. The
annotation process yielded one major claim, ten claims and 61 premises.

Considering the specific format of our chosen debate (and, indeed, of all debates contained in the Debatabase on idebate.org), where within the "POINTS FOR" and "POINTS AGAINST" sections there are boldface statements heading paragraphs split into "Point" and "Counterpoint" sub-paragraphs, we observe the following: In most, but not all cases, the boldface paragraph header (e.g. "Unreasonable commitment to expect of people") corresponds with the claim the respective paragraph is built around, supporting or attacking the major claim. In two out of ten cases however, the claim is instead hidden inside the paragraph whereas the paragraph header merely contains one of the premises supporting the related claim. This serves as a reminder that one should not rely on formal aspects when annotating texts.

An easier-to-read, structured overview of all argument components – rephrased where necessary – and their respective relations to each other is provided in appendix C, table C.1. This table reflects the argument component wording after completion of the rephrasing process discussed in section 4.3.5. The contents of the "hasKeywords" column of said table will be discussed in chapter 5.
5. Keyword Extraction

5.1. Motivation

As discussed earlier (see section 2.2), in order to achieve Natural Language Understanding of human opponents' utterances in the future, the system must be able to match said utterances semantically to the argument component they resemble the most. The specifics of the matching methods to be employed will be determined at a later point. Since the phrasing of argument components is at times specific and idiosyncratic and might therefore obscure the outcome of matching attempts, it seems advisable to perform the matching not against the actual wording of the argument component, but against a somewhat abstracted representation of its content. To this effect, we devise a keyword extraction process, whereby we extract a set of keywords from each argument component meant to represent, at the same time, a summary and generalization of its content. Section 5.2 provides guidelines for this process. The examples given to illustrate the process are taken from our selected sample debate "Marriage is an outdated institution", on which, after completion of the annotation using methods of argumentation mining (see results in appendix B and appendix C), we perform a keyword extraction.

5.2. Keyword Extraction Guidelines

The two main objectives for extracting keywords from argument components are firstly to summarize and generalize the content of the argument component, then secondly to ensure the uniqueness of the keyword set in comparison with other keyword sets.

5.2.1. Content Summarization and Generalization

Content Summarization

For our purpose, summarizing the content of an argument component means shortening the original statement as much as possible without abandoning core semantic elements. This can be achieved for instance by omitting articles, or omitting the forms of the verb "to be" where appropriate, as the meaning is often understood implicitly from a telegram-style of phrase. Thus, in our sample debate, MC1 "Marriage is an outdated institution." for instance has the keyword set "marriage outdated institution". Furthermore, try to identify parts of the statement which are not essential to its meaning, and leave them out: C1.08 "Marriage has relevance to modern society in a legal sense." for instance merely has the keywords "legal relevance". It may be appropriate in some cases to use commas to separate parts of the keywords from one another. This may be the case for enumerations...
of facts such as in P1_07: "According to the Office for National Statistics in 1999, the average age, in the UK, to get married is approximately 30 years old. Life expectancy in the UK is approximately 80 years." which has the keyword set "UK, average age married 30 years, life expectancy 80 years”.

### Content Generalization

Generalizing the content of an argument component means we will attempt to employ both the most simple syntax and most common vocabulary possible to express the core semantic content. In terms of vocabulary choice, we should strive to reduce the specificity of a statement by replacing unusual words with more common synonyms. For instance, in C1_02 "Marriage is an unreasonable commitment to expect of people.”, the word "unreasonable" may hinder a semantic similarity matching with differently phrased but equivalent statements due to its specificity. Hence, it is not advisable to merely extract keywords along the lines of "commitment, unreasonable to expect”, retaining the word “unreasonable”. Instead, we should attempt to determine the essential meaning conveyed by the argument component - which is that one should not expect a commitment such as marriage from other people. This suggests combining the verb ”expect” with some type of negation in the keywords. Bearing this in mind, ”commitment, should not expect” was chosen as the associated keyword set. Thanks to more generalized wording, we hope to facilitate correct semantic matchings of human utterances against this keyword set. In terms of syntax, try using simple sentences with the most common word order, i.e. subject-predicate-object. P1_01 "So many marriages end in divorce with the resulting splits affecting the children.” for instance has the keyword ”divorce affects children”.

The sets of keywords resulting from the above procedures will often have short sentence character, thereby facilitating future matching via methods possibly incorporating sentence similarity matching. Note that summarization and generalization may introduce additional similarities between keyword sets, which may need to be addressed in the next step (see section 5.2.2).

### 5.2.2. Uniqueness

Once the summarization and generalization of content is completed, we must attempt to establish the uniqueness of a keyword set. This is crucial to ensuring that a semantic similarity scoring of utterances will lead to an unambiguous match among the available keyword sets. However, the uniqueness objective is, in a way, contradictory to the generalization objective, and is therefore not always achieved easily.

Identify (provisional) pairs of keyword sets which are similar or even identical to one another, most likely because their associated argument components are similar as well. Try to detect distinguishing elements in the wording of the argument components, and introduce those into the keyword sets in order to make them more distinct. In our sample debate for instance, P1_15 "Our society no longer respects marriage as a permanent institution.” is similar in terms of content to P1_45 "Society no longer respects the institution..."
of marriage.” We determine that the main difference between the two pertains to the word "permanent". Hence, if not already done so, we use the word "permanent" in one set of keywords, but not the other, so as to make the two more unique: This results in the keyword set "society no longer respects as permanent institution" for P1,15 as opposed to "society no longer respects institution" for P1,45.

If this should fail, perhaps due to two argument components being virtually identical in content, the Argumentative Dialogue System will still provide a fallback to distinguish between components: At each turn in the debate, the system only matches the received human utterance against the keyword sets of argument components that are permitted at the current location of the argument tree. This will usually prevent a mismatch with the keyword set of an identical-sounding argument component located elsewhere in the argument graph. On the other hand – as we saw in the random dialogue generated in chapter 4 (see appendix D) – the opponent is allowed to "jump" to a different location in the tree, addressing a previously made statement. In such cases however, the system also detects the aim of the opponent’s utterance. Considering all this, a confusion of similar argument components should be avoided successfully.

Note that the word “marriage” itself (and its variations) as the central topic of our sample debate will be used rarely in keyword sets, seeing as, due to its frequency, it does not contribute to their uniqueness and can be implicitly understood as the subject of most statements, should no other subject be provided. If anything, frequent inclusion of the word “marriage” in the keywords will undermine their uniqueness. Thus, for instance, P1,20 "Marriage no longer leads to a stable or permanent relationship." only has keywords "no longer leads to stable or permanent relationship". Exceptions to this rule include the major claim MC1, whose keyword set reads "marriage outdated institution” as it establishes the debate’s topic.

5.3. Discussion

Considering all of the above, we conclude that keyword extraction is a difficult and delicate task with multiple potential solutions, the adequacy of which can only be determined in practice. Hence, the process outlined above should be subject to regular revision. Nevertheless we attempt an evaluation of the quality of the extracted keywords in section 7.2. An overview of the sample debate including argument components with their full – in some cases rephrased – text as well as their associated keyword sets can be found in appendix C, table C.1.
6. Implementation of the Debating Ontology

The Debating Ontology was developed in the Web Ontology Language (OWL), which is a World Wide Web Consortium standard, using the Protégé 5.2.0 ontology editor, a well-documented and well-supported open source application developed at Stanford University. Protégé was decided upon thanks to its extensibility, customizability, and support of numerous features and plug-ins. The below implementations were accomplished with the help of [3].

6.1. Taxonomy

The design requirements for the Debating Ontology are closely informed by the annotation scheme proposed in section 4.2, since the ontology is designated to hold the outcome of the argument annotation conducted in chapter 4. However, in addition to the argument components (Major Claim, Claim, Premise) and argument relations (attack, support) described there, we also require two attributes for each argument component to hold its related text as well as its associated set of keywords. The implementation of the ontology’s taxonomy is detailed below.

6.1.1. Classes

The class hierarchy was implemented as follows:

- ArgumentComponent
  - MajorClaim
  - Claim
  - Premise

Argument components are modeled as classes. Hence, firstly, the ArgumentComponent class was created, which acts as a superclass for the three types of argument components defined in our argument annotation scheme. While the ArgumentComponent class itself is never instantiated in the ontology, it greatly facilitates the definition of object and data properties later on that are common to all its subclasses. Subsequently, the three classes MajorClaim, Claim and Premise were created as subclasses of ArgumentComponent, and were made disjoint.
6. Implementation of the Debating Ontology

6.1.2. Object Properties

Object properties were implemented adhering to the following hierarchy:

- targets
  - supports
  - attacks
- isTargetedBy
  - isSupportedBy
  - isAttackedBy

Argument relations are modeled as object properties, since they link class instances with class instances. Much like with the classes, the introduction of a superproperty "targets" for the two permissible argument relations "attacks" and "supports" proved useful. The superproperty "targets" was made functional and asymmetric, hence its subproperties "attacks" and "supports" inherited these features. Furthermore, "targets" was given ArgumentComponent as both domain and range. We then defined "isTargetedBy" as the inverse property of "targets", which makes it inverse functional and asymmetric and also gives it ArgumentComponent as domain and range. The two subproperties of "isTargetedBy", "isAttackedBy" and "isSupportedBy", once again inherit their superproperty's features and constitute the inverse properties of "attacks" and "supports" respectively.

6.1.3. Data Properties

In order to store an argument component's text and keywords, the following data properties were implemented for the ArgumentComponent class (and subsequently inherited by its subclasses):

- hasText
- hasKeywords

Data property "hasText" will serve for storing the text of argument components as taken from the annotation performed in chapter 4 (possibly slightly rephrased) in string format. Data property "hasKeywords" is meant to store argument components' keywords as extracted in chapter 5, also in string format. Both properties are made functional, disjoint from one another, and given ArgumentComponent as domain and data type xsd:string as range.

6.1.4. Class Axioms

Lastly, all restraints pertaining to the above classes were formulated. The ArgumentComponent superclass was defined as equivalent to an anonymous class whose instances have
6.1. Taxonomy

exactly one "hasText" and exactly one "hasKeywords" relation to an xsd:string data type respectively, indicating that every argument component must have one text and one set of keywords each. A screen shot from Protégé detailing this definition can be found in fig. 6.1. Since classes MajorClaim, Claim and Premise are all subclasses of ArgumentComponent, they are automatically defined as subclasses of the aforementioned anonymous class, and thus inherit the above "hasText" and "hasKeywords" constraints. Note that as not all argument components target or are targeted by other argument components, we cannot stipulate any axioms pertaining to the "targets" and "isTargetedBy" object properties here.

Furthermore, the MajorClaim class, in addition to being a subclass of ArgumentComponent, was declared equivalent to an anonymous class whose instances are an ArgumentComponent and are targeted by some (meaning at least one) instance of the Claim class, as per the argument annotation scheme proposed in section 4.2. The major claim may also be targeted by one or more premises, however this is not a prerequisite of its definition and is therefore not modeled here. The respective Protégé screen shot is provided in fig. 6.2.

The Claim class, apart from being a subclass of ArgumentComponent, was declared
6. Implementation of the Debating Ontology

equivalent to an anonymous class whose instances are an ArgumentComponent and are
targeted by some (i.e. at least one) instance of the Premise class and target exactly one
instance of the MajorClaim class, once again in accordance with section 4.2. The respec-
tive Protégé screen shot is contained in fig. 6.3. It is debatable whether a claim needs to
be supported or attacked by any premises at all. For our purpose, it was decided that no
claim should remain unsupported or unchallenged in a debate. If a different approach is
desired, the Protégé class definition can be amended at any time.

The Premise class, as well as being a subclass of ArgumentComponent, was additionally
declared a subclass of an anonymous class whose instances are an ArgumentComponent
and target exactly one other instance of the ArgumentComponent class, as stated in
the argument annotation scheme in section 4.2. The respective Protégé screen shot is
provided in fig. 6.4. Note that unlike the other classes, it is not possible to define an
equivalent anonymous class for the Premise class, as premises are not the only argument
components that target exactly one other argument component. Claims do so too, there-
fore formulating this behavior as an equivalent class of the Premise class would lead to
the ontology becoming logically inconsistent.

A simplified representation of the ontology data model is given in fig. 6.5. In contrast to
the Argument Annotation Scheme shown in fig. 4.1, this diagram not only models classes
6.2. Encoding the Annotated Sample Debate into the Ontology

(argument components "MajorClaim", "Claim" and "Premise") and their object properties ("support" and "attack" relations), but also their data properties ("hasText" and "hasKeywords") along with their respective string values. Note that unlike this diagram suggests, the two data properties "hasText" and "hasKeywords" are associated with all argument components.

![Debating Ontology Data Model](image)

6.2. Encoding the Annotated Sample Debate into the Ontology

After implementing the above taxonomic structure, we now import the argument components and relations obtained from the annotation of our sample debate in section 4.3 as well as the keywords extracted in chapter 5 into the ontology. To this end, we add one individual to the instances of the MajorClaim class, ten individuals to the instances of the Claim class and 61 individuals to the instances of the Premise class. We make all individuals disjoint. The naming of the individuals follows a similar convention to the one detailed in section 4.3 excepting that the argument type is now stated in full. In other words, in the ontology, MC1 is named MajorClaim1, C1_01 is named Claim1_01, P1_01 is named Premise1_01 and so on. For each individual, we add two data property assertions: We assign its actual argument text to it via the "hasText" data property, and the related set of keywords via the "hasKeywords" property, both with data type xsd:string. Lastly, for every individual we add all "attack", "support", "isAttackedBy" and "isSupportedBy" relations linking it to other individuals, as per the annotation outcome in section 4.3. These properties will be implemented as object property assertions. An example screen shot of the object and data property assertions of an individual (Claim1_08) is provided in fig. 6.6.
6. Implementation of the Debating Ontology

![Figure 6.6.: Example - Property Assertions for Claim1_08 in Protégé](image)

6.3. Discussion

The Debating Ontology is hereby complete for the purpose of this thesis. Its logical consistency was verified successfully using Reasoners FaCT++ 1.6.5 and HermiT 1.3.8.4313. The completed ontology is contained in the file `DebatingOntology.owl`\(^1\). The argumentation structure represented within it corresponds with the contents of table C.1 in appendix C. The Debating Ontology affords virtually unlimited expansion through the addition of more debates as well as the addition of more argument component individuals and relations to existing debates. A modification or expansion of the encoded taxonomy (i.e. classes, object and data properties) is equally possible. For future work, it is for instance conceivable to expand the ArgumentComponent class by another data property "hasEvidence", which could be used for storing additional facts or data supporting an argument component. Furthermore, the long-term goal of achieving automated argument extraction will require an extensive corpus of training debates for artificial agents. These debates will most likely contain additional linguistic features, which could also be added to the ontology as data properties.

For a basic test of the Debating Ontology’s effectiveness along with an evaluation of the encoded argument annotation, see section 7.1.

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\(^1\)Semantic Web Resource URI: http://www.semanticweb.org/saskia/ontologies/DebatingOntology
7. Test and Evaluation

7.1. Evaluation of the Argument Annotation

A basic way of evaluating the quality of the debate annotation conducted in section 4.3 as well as the quality of the underlying argument annotation scheme proposed in section 4.2 is to test the Debating Ontology by generating a human-readable debate from its contents, and to assess this debate in terms of logical argument flow and naturalness. To this end, a method `generate_dialogue()` was implemented in Python 2.7, tying into existing Python code authored by M.Sc. Niklas Rach. The existing code implements agent-versus-agent debate scenarios where the agents learn their argumentative strategy via Reinforcement Learning. Both agents access the Debating Ontology in order to determine their respective moves for their next turn. The `generate_dialogue()` method is called on the argument graph of the sample debate encoded in the ontology. It receives as input an agent-versus-agent dialogue in a non-text, machine readable format which was generated after a specified number of training epochs, and produces as output the equivalent sequence of human-readable text-based dialogue between players A and B.

In our framework, which treats a debate as a Stochastic Game, there are five possible agent moves: "claim", "argue", "why", "concede" and "retract". Of these five, only the "claim" and "argue" moves correspond directly with argument components from the ontology. The "challenge" ("why") move ("I doubt that.", "I find that hard to believe.") challenges an argument component that was stated earlier – but not necessarily in the directly preceding move – by the opposing player. The "concede" move agrees with one of the opponent’s previous arguments. The "retract" move is aimed at a statement made by the active player himself that has been challenged by the opponent earlier, and retracts it. For all of these moves, the `generate_dialogue()` method prints the text of the argument component they are aimed at, as well as additional auxiliary verbalizations where needed.

7.1.1. Generating a Test Dialogue from the Debating Ontology

In this section, we will test the effectiveness of the Debating Ontology and the `generate_dialogue()` method by generating an agent-versus-agent dialogue where both agents have optimized their strategy through Reinforcement Learning and are drawing from the argument structure encoded in the ontology. We will then attempt to assess the logical coherence as well as the naturalness of the debate flow. This constitutes, at the same time, an evaluation of the annotation scheme devised in chapter 4 as well as of the quality of the concrete annotation performed on the sample debate.

Our random sample dialogue was generated after 50 epochs of Reinforcement-Learning-based agent training. It comprises a total of 118 agent moves. In this scenario, agent A is
the proponent championing the major claim (MC1 "Marriage is an outdated institution.")
whereas agent B acts as the opponent attacking it. A truncated excerpt of the generated
dialogue comprising the first 20 agent moves can be found in appendix D.

7. Test and Evaluation

7.1.2. Evaluation of the Generated Test Dialogue

Logical Debate Flow

The overall argument flow of the generated sample dialogue seems sufficiently logical,
as can be seen in exchanges such as: "Marriage is a religious institution in a society of
decaying religion." – "It is still the case that marriage has religious significance for nearly
half the country." or "You said earlier: Marriage is an outdated institution. I find that
hard to believe." – "There needs to be a new more inclusive institution that is open to
all religions and those of no religion. It is clear that marriage can no longer perform
this function for everyone in society." No instances can be found where the connection
between consecutive argument components is unclear or nonsensical.

The excessive use of "challenge" moves ("I find that hard to believe.", "I doubt that.")
as well as the frequent referral to earlier statements ("You said earlier:.", "You disagreed
earlier when I said:"") tend to mar the overall impression of the dialogue flow, as they seem
somewhat unintuitive or even unnecessary. However, both these phenomena are due to
the nature of the learned agent strategy and the applied framework, and are unconnected
to the annotation or the ontology, wherefore they should not influence the outcome of
this evaluation. In fact, the inclusion of dodge moves and the possibility to refer to earlier
statements are among the features which distinguish the present approach from others.

Furthermore, it becomes apparent that using the current implementation, the system
does not seem to produce any "concede" moves. However, since these are also not con-
ected to the annotation, this too has no relevance for the present evaluation.

Naturalness of the Dialogue

As could be expected, in those cases where argument components follow one another
directly with no auxiliary phrases added, the dialogue seems sufficiently natural, even
though the argumentative relations are often left implicit (e.g. "Marriage is an outdated
institution." – "Marriage promotes a better way to raise children.").

In contrast, wherever auxiliary text blocks are deployed, be it to express disagreement
("But I think:"), "challenge" moves ("I doubt that."), references to earlier statements
("You said earlier:.", "You disagreed earlier when I said:"), or "retract" moves ("I retract
my statement.") they appear slightly rigid and are easily recognizable as ready-made.
This is primarily due to the fact that there is little to no variation between auxiliary
phrases that have the same purpose. While the "challenge" move for instance has two
variants ("I find that hard to believe." being the second), the "retract" move merely has one.
7.2. Evaluation of the Extracted Keywords

Discussion
Considering all of the above, it is our opinion that the Debating Ontology fulfills its task of encoding meaningful and logical argument structures effectively. This indicates that the applied argumentation scheme suits its purpose, and that the argument annotation of the selected sample debate was conducted satisfactorily. That being said, for future work it would be preferable to devise more diverse and flexible auxiliary text blocks, thereby remedying the currently slightly rigid nature of the dialogue flow.

It should be understood that the above test can in no way replace a more thorough evaluation of the argument annotation. For future work, it would for instance be advisable to conduct a study in which a debate generated from the Debating Ontology is compared to a real-life debate in order to properly assess the quality of the annotation as well as the effectiveness of the natural language dialogue generation. Alternatively, one or more dialogues generated from the ontology could be made available to a number of test subjects, who are then asked to evaluate them with regards to perceived naturalness, understandability of the dialogue flow etc. These things are, however, beyond the scope of this thesis.

7.2. Evaluation of the Extracted Keywords

As discussed earlier, the keywords were extracted from the argument components in order to eventually aid the Natural Language Understanding of a human opponent’s arguments. The wording of a human’s natural language utterance will very likely differ from the wording of the respective argument component encoded in the ontology. Yet we need to match one to the other in order to determine at which point in the argument graph the debate currently stands. This is essential for the artificial agent to determine his next move.

Li et al. [4] have devised a method for measuring the similarity between two sentences, using semantic nets and corpus statistics. For the future, this may prove a suitable approach for matching human utterances to one of the keyword sets contained in the Debating Ontology and, by extension, to the argument component associated with it. However, this will likely not be achieved for some time. Nevertheless, the approach proposed by Li et al. also lends itself to evaluating the quality of the keyword extraction performed in chapter 5: Just like, in the future, we will match a spoken human utterance to the set of keywords which most closely represents its content, thereby matching it to the argument component associated with said set of keywords, we will now attempt to match each argument component in the ontology to one of the keyword sets, ideally – provided the keywords are sufficiently effective – to its own.

To this end, a Python-based implementation\footnote{https://github.com/sujitpal/nltk-examples/blob/master/src/semantic/short_sentence_similarity.py (last accessed 30 October 2017)} of the sentence similarity measurement scheme proposed by Li et al. will be employed to calculate the semantic similarity scores between the argument components obtained in chapter 4 and the keywords extracted.
7. Test and Evaluation

in chapter 5. The results will serve as a basic indicator of the quality of the keyword extraction process. Ideally, each argument component should match best with its own set of keywords, which would make it likely that a human opponent’s utterance conveying the same content with different wording would also be matched to that argument component’s set of keywords.

7.2.1. Semantic Similarity Scores

The sentence similarity method proposed by Li et al. originally calculates the overall similarity score of a sentence pair as a combination of their semantic similarity score with their word order similarity score, factoring in the latter to a lesser degree (factor 0.15 versus factor 0.85 for semantic similarity) [4]. Seeing as the keyword extraction process conducted in chapter 5 entails significant rephrasing and shortening of the argument components’ contents, especially in light of attempting to use the most common vocabulary and sentence structure possible, the word order similarity component is expected to be of little avail in our scenario. A test using the 0.15 factor confirmed this conjecture, yielding lower overall similarity scores. The word order similarity factor has therefore been set to 0, effectively equating the overall sentence similarity score with the semantic similarity score (now weighted 1).

Additional Python code was developed and tied into short_sentence_similarity.py, pairing all 72 argument components contained in the Debating Ontology with all 72 sets of keywords. For the 5,184 resulting pairs, the sentence similarity score is calculated. Subsequently, we determine for every argument component with which of the 72 keyword sets it achieves the highest similarity score and therefore, the best semantic match. Ideally, every argument component should achieve maximum similarity with its own set of keywords.

This objective of matching every argument component with its own keyword set was not fulfilled initially, however it could be achieved after subsequent keyword adjustments (see section 7.2.2 for details). The resulting list of semantic similarity scores between all 72 argument components and their respective keywords, obtained from running the code discussed above on the contents of the Debating Ontology, can be found in table 7.1. Scores range from 0 to 1, whereby 0 indicates no semantic similarity and 1 indicates semantic identity.

7.2.2. Statistical Analysis

Accuracy

The final result of the semantic similarity matching process indicates that all 72 argument components could be matched to their correct keyword sets. This corresponds with an accuracy of 1, calculated as the number of correct matches divided by the number of argument components to match.

However, this outcome was not achieved immediately: After initial completion of the keyword extraction process on the sample debate (see chapter 5), the sentence similarity
7.2. Evaluation of the Extracted Keywords

The method produced a maximum similarity score mismatch in 12 out of 72 cases. In other words, 12 of 72 argument components were erroneously matched to keyword sets which were not their own, resulting in an initial accuracy of 0.8333. Subsequently, all keyword sets were reviewed once more with regards to the uniqueness objective postulated in section 5.2.2. Where appropriate, adjustments were made to further differentiate similar keyword sets from one another. A second application of the sentence similarity method yielded an accuracy of 0.9861, meaning that 71 of 72 argument components had now been matched to the correct set of keywords. The above keyword uniqueness review procedure was repeated, whereupon a third application of the sentence similarity method yielded the desired accuracy of 1.

**Arithmetic Mean**

The arithmetic mean (or average) of all 72 semantic similarity scores between the sample debate’s argument components and their respective keyword sets was calculated as 0.700416414507.

**Range**

The range of the 72 semantic similarity scores, i.e. the difference between the largest (0.956040351805) and smallest (0.398918556897) values present, is 0.557121794908.

**Standard Deviation**

The standard deviation of the 72 similarity scores as per table 7.1 is 0.131430704167. Assuming a normal distribution, this means that the majority of scores, approximately 68%, lies within one standard deviation from the average, i.e. roughly between 0.57 and 0.83. Almost all scores, approximately 95%, lie within two standard deviations from the average, i.e. roughly between 0.44 and 0.96.

**7.2.3. Discussion**

Taking the above statistics into account, we can conclude that the keyword extraction performed on the sample debate in chapter 5 has yielded satisfactory results. All 72 sets of keywords have achieved sufficient uniqueness to ensure that their associated argument components are matched with them in terms of semantic similarity. This is, of course, in no way a guarantee for a seamless future keyword mapping of spoken human utterances. It does however serve as a basic indicator that by and large, the keywords extracted in this work can be expected to serve their designated purpose.

Note that the statistical deviations observed above are to be expected due to the nature of the keyword extraction process, which comprises both syntactic and vocabulary alterations to the wording of argument components. In fact, its very purpose is to rephrase and abbreviate argument components in a way that maximizes their potential for semantic matching. In light of this, the value of a similarity score between an argument component and its keyword set is only significant in relative terms, not in absolute terms.
7. Test and Evaluation

The crucial point is that it should surpass all other similarity scores that same argument component has with incorrect keyword sets. In layman’s terms, it need not be high – only higher than the others. In this context, similarity scores below the 0.5 mark need not be a cause for concern, provided they still lead to a correct matching.

For the future, it would be advisable to perform the described semantic similarity matching between argument components and keywords for all debates added to the Debating Ontology, ideally agreeing on threshold values for the resulting statistics.
Table 7.1: Keyword Similarity Scores of Debate "Marriage is an outdated institution"

<table>
<thead>
<tr>
<th>Argument Component</th>
<th>Keyword Similarity Score</th>
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<td>Claim1_01</td>
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<tr>
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</table>
8. Conclusion

8.1. Summary

In this work, we have described an argument annotation scheme suitable for annotating written natural language debates with regards to their inherent argumentative structure, and have applied it to a sample debate. Furthermore, we have devised a keyword extraction scheme and applied it to the annotated sample debate. For both these processes, we have provided comprehensive guidelines aimed at facilitating the future annotation and keyword extraction of additional debates. We have designed and implemented an easily extensible ontology intended to hold the extended argument structure of debates attained through annotation and keyword extraction, and have encoded the argument structure and keywords of the sample debate into it. We have performed a basic test to evaluate the effectiveness of said ontology by generating a sample dialogue from it. The resulting dialogue displays a satisfactory logical argument structure. Based on the generated sample dialogue, we have also conducted a basic evaluation of the argument annotation process. Lastly, we have evaluated the quality of the extracted keywords by calculating their semantic similarity with the respective argument components. Both evaluations achieved acceptable results.

Overall, the outcome of this thesis suggests that with the development of the Debating Ontology, we have succeeded in devising a suitable basis and starting point for the database component of our future Argumentative Dialogue System. Moreover, thanks to the provision of guidelines and the extensibility of the ontology we have facilitated future growth of the Debating Ontology through the inclusion of additional debates and features.

8.2. Future Work

Future work in this context could comprise – but is not limited to – the following: Firstly, as addressed earlier, the Debating Ontology can be extended in various ways. The long-term goal of annotating and adding further debates is a given, especially in light of the possible future automation of argument extraction. In order to achieve this, a great number of annotated debates will be required to serve as training data. Furthermore, linguistic and other feature extraction in the vein of [13] and [2] will most likely have to be devised and conducted to aid the automation of argument extraction. If such features are introduced, an adjustment of the ontology data model will be in order, since additional data properties will have to be implemented to hold the extracted features and link them to the respective argument components. However, this can be done easily with the help of
8. Conclusion

Protégé. Lastly, the Debating Ontology can also be extended by adding more individuals (i.e. instances of the Claim and Premise classes) and "supports" or "attacks" argument relations (object properties) to an existing debate. Note that an assignment of additional "hasText" and "hasKeywords" data properties is not permissible since both properties are functional. This characteristic could however be changed in the data model of the ontology should this be desired.

In the long run, it is also conceivable that not only the argument recognition and annotation can be automated, but the extraction of keywords as well, for instance through the use of word nets.

Moreover, perhaps at some point in the future, human opponents’ utterances can not only be mapped to existing argument components, but – in case they are recognized as new facts not yet contained in the database – automatically assimilated into the existing argument structure of the ontology, thereby broadening its arsenal.

Open questions regarding the future of the Argumentative Dialogue System include the following: Would it make sense to allow the same argument component to serve as multiple nodes in the argument graph? It would thus be utilized at multiple points in the debate, targeting different argument components in each case. So far, our annotation scheme and ontology data model do not allow for an argument component to target more than one other component. However, in our sample debate alone, several instances occur where two argument components have a near-identical wording. These cases are noted in square brackets in table C.1 of appendix C (compare for instance P1,19: "50% of all divorcees in the UK go on to remarry according to the Office for National Statistics.” and P1,42: "50% of all divorcees in the UK go on to remarry according to the National Office for Statistics in 1999."). Such a step should however be considered carefully, as its implications would be severe.

On a different note, in the future one might consider abandoning the distinction between claim and premise altogether, and only allowing for a major claim and a set of premises supporting or attacking the major claim and one another. This seems reasonable especially in light of the fact that an argument component can, in some cases, be interpreted as either a claim or a premise, depending solely on its position in the argument chain (see remarks in section 4.3.2 for details). The main objection against this notion is that, in the context of Reinforcement Learning, we may want to assign a lower reward to a claim (a mere assertion) than to a premise (a justification for an assertion). However, the very case outlined above shows that this functional distinction is not always accurate, rendering a difference in rewards moot.

To conclude, the endeavor of developing a spoken language Argumentative Dialogue System is currently at an early stage, with many issues still to be tackled, not least the Natural Language Understanding of human opponents’ spoken utterances using the keywords extracted earlier in this work. This thesis has merely laid the groundwork for the Argumentative Dialogue System’s database component, the Debating Ontology. It is our hope that the ontology itself together with the guidelines on argument annotation and keyword extraction provided in this thesis will aid the progression of the Argumentative Dialogue System project.
Bibliography

[1] Merwan Barlier, Julien Pérolat, Romain Laroche, and Olivier Pietquin. Human-
machine dialogue as a stochastic game. In Proceedings of the SIGDIAL 2015 Con-
ference, The 16th Annual Meeting of the Special Interest Group on Discourse and 


power.cs.man.ac.uk/protegeowltutorial/resources/ProtegeOWL TournamentP4_v1_3.pdf, 
March 2011.

Similarity Based on Semantic Nets and Corpus Statistics. IEEE Transactions on 
Knowledge and Data Engineering, vol. 18, no. 08, pages 1138–1150, August 2006.


Detection, Classification and Structure of Arguments in Text. In Proceedings of the 
12th International Conference on Artificial Intelligence and Law, ICAIL ’09, pages 
98–107, New York, NY, USA, 2009. ACM.


[8] Niklas Rach, Wolfgang Minker, and Stefan Ultes. Towards an Argumentative Dia-
logue System. In Proceedings of 17th Workshop on Computational Models of Natural 
Argument (CMNA’17), June 2017.


[10] Ariel Rosenfeld and Sarit Kraus. Strategical argumentative agent for human per-
suasion. In ECAI 2016 - 22nd European Conference on Artificial Intelligence, 29 
August-2 September 2016, The Hague, The Netherlands - Including Prestigious Ap-
Bibliography


A. Raw Sample Debate ”Marriage is an outdated institution”

This House believes that marriage is an outdated institution

Marriage is an institution that has existed in most societies around the world for an incredibly long time. It is, traditionally, the union between a man and woman in both a religious and a legal sense. Marriage offers a stable relationship that is recognised by the state and by whatever religion the couple choose to follow, as well as providing a good environment in which to raise children. However, with ever rising amounts of premarital cohabitation, single parent families and children born outside of wedlock, as well as the decline in adherence to religion, it seems that the institution is losing much of its appeal. In this debate, the proposition must prove that the institution of marriage has ceased to have relevance to modern society.

POINTS FOR

Does not provide any more of a stable environment for child rearing than a regular monogamous relationship

Point

The main objective of marriage is often said to be bringing up children in a stable environment. However in 2010 in the UK there were 119589 divorces; 11.1 per 1000 married population. Furthermore in the same year, the median duration of a marriage remained at a low level of 11.4 years. (Rogers, 2011) This clearly does not fulfill the initial basic aim of marriage as so many marriages end in divorce with the resulting splits affecting the children. In fact, a much more stable environment can be provided by a better relationship, even without matrimonial vows (Cherlin 2009). This relationship should not have to be through marriage; rather it would simply be a partnership in the way that many couples already live today.

Counterpoint

Once a couple get married, they have made an official and legal commitment, which makes it more difficult for them to split up. This means that, irrespective of divorce

statistics, adding marriage to a relationship will only serve to make it more stable and give the children of that relationship more security. Therefore marriage still gives benefits in modern society and is not outdated. (Waite 2000)

**Unreasonable commitment to expect of people**

**Point**

The average age, in the UK, to get married is approximately 30 years old. (Office for National Statistics 1999) Life expectancy in the UK is approximately 80 years. (Office for National Statistics 1999) This means the average marriage expects people to commit to maintain a certain way of life for a period that is longer than they have actually been alive. This goes hand in hand with the rise of social acceptability of people having more than one life partner in their life to show that either marriage is an unreasonable expectation of someone or a meaningless charade that is not actually expected to be maintained. (Cherlin 2009)

**Counterpoint**

This argument only works under the assumption that we live in a society where divorce does not exist. If a person enters into a marriage without full awareness of what they have committed to and later need to get out of that marriage, they are free to.

Being able to leave a marriage, though, does not make marriage a meaningless charade, as the proposition claims. It is still more difficult to leave a marriage than it is to leave a non-marital committed relationship and so it makes a big difference.

**Frequency and accessibility of divorce undermines the entire purpose of marriage**

**Point**

With pre-nuptials, which essentially amount to pre-planning for divorce, heavily on the rise, and divorces becoming ever easier to obtain, it is clear that our society no longer respects marriage as a permanent institution. Serial monogamy is also becoming ever more common, with 50% of all divorcees in the UK going on to remarry. (Office for National Statistics)

Since the purpose of marriage has always been to foster a stable and permanent relationship, it is clearly an entirely outdated institution as it no longer leads to a stable or permanent relationship.

**Counterpoint**

The purpose of marriage is not an eternal, unrelenting union, whether it is wanted or not. The purpose of marriage is to foster a more stable relationship than would be possible without marital vows. Therefore, the fact that divorce is becoming more common and easier to obtain does not undermine the institution of marriage at all.
Marriage should be for all but Marriage is a religious institution in a society of declining religion

Point
The proposition believes that they have proven that marriage no longer has a social or practical function. This leaves its only function as one of religious significance. However, with the percentage of people in the UK who identify as having no religion having risen by nearly 20% in the last 20 years and the percentage of people who identify as religious having dropped by approximately the same amount (British Social Attitudes Surveys 2007). Church attendance is even lower at a mere 6% (whychurch.org.uk). As a result there needs to be a new more inclusive institution that is open to all religions and those of no religion. It is clear that marriage can no longer perform this function for everyone in society.

Counterpoint
Firstly, the opposition does not accept that the proposition have proven that marriage has no function outside of religion. However, even if they had proven this, they still have not proven that marriage has no religious function and, therefore, have lost the debate anyway.

The proposition asserts that because numbers of religious people in the UK are declining, this means marriage is no longer relevant religiously. The fact is that nearly 50% of people in the UK still identify as religious. (British Social Attitudes Survey 2007) The fact that this is less than before is meaningless; it is still the case that marriage has religious significance for nearly half the country.

Undermines same-sex couples and single parent families as legitimate ways of raising children

Point
As explained in the first proposition point, one of the primary functions of marriage is seen to be to raise children. Marriage is therefore seen as the best way to raise children. This undermines same-sex couples and single parent families raising children.

The existence of marriage is essentially saying that same-sex couples and single parents are less able of raising children than heterosexual couples. Marriage, therefore, can be seen to promote outdated ideals that our society no longer holds and, as such, is itself an outdated institution.

Counterpoint
The idea that the existence of marriage undermines other methods of raising children is ridiculous. This is equivalent to saying that making it legal for same-sex couples to adopt undermines raising children as a heterosexual couple or as a single parent.

Some people choosing to raise children in a certain way does not prevent or inhibit other people doing so in a different way.
A. Raw Sample Debate "Marriage is an outdated institution"

POINTS AGAINST

Removes the transient and casual aspects of a monogamous relationship, thus giving a child a far more stable environment.

Point
Marriage represents a commitment and a bond that is, although not unbreakable, difficult to break. This may not be appropriate for couples who wish to have a more casual relationship, however, it offers a more stable and official relationship, which is far preferable to a more transient relationship when it comes to raising a child. (Waite 2000)

Counterpoint
The fact that 40% of marriages end in divorce and that this is on the rise (National Office for Statistics 1999) shows that marriage clearly does not offer the stability that the opposition claims it does. In fact, it seems that marriage offers no more stability than a stable relationship, thus making it redundant in terms of raising children.

Remarriage rate shows that even people who go through failed marriages retain faith in the institution of marriage

Point
50% of all divorcees in the UK go on to remarry. (National Office for Statistics 1999) This shows that, although their own marriage failed, they retain faith in the institution of marriage. The fact that, even when marriage has failed to work for them once, many people wish to give it another go shows that it is still meaningful to society. If an institution is so meaningful and relevant to modern society in this way, it cannot possibly be outdated.

Counterpoint
The fact that 50% of all divorcees (National Office for Statistics 1999) go on to remarry does not, as the opposition claims, show that marriage is a meaningful and relevant institution but quite the opposite. What this means is that a huge number of people vow to spend the rest of their life with another person, forsaking all others until death do them part, on multiple occasions. This does not show that society still has faith in marriage, it shows that society no longer respects the institution of marriage.

Marriage represents a legal bond which protects both parties in a relationship

Point
Marriage has relevance to modern society in not only an emotional, religious and practical sense but also in a legal sense. According to Sir Mark Potter in English Law marriage is regarded as an "age-old institution" that is "by longstanding definition and acceptance" a formal relationship between a man and a woman primarily designed for producing and rearing children. It gives many rights in areas like property rights and pension benefits,(Travis, 2011) A marital bond gives important rights to both parties in cases of events
such as severe injury, bereavement or even divorce. An institution cannot be outdated if it retains legal importance in modern society.

Counterpoint
If marriage’s main function is to protect against bereavement and divorce then it is essentially protecting against harms that it itself brings. Without marriage, bereavement and divorce would cease to be as serious harms as they currently are.

Marriage is an important institution to religious people

Point
Nearly 50% of people in the UK identify as being part of some religion. (British Social Attitudes Survey 2007) Marriage is an integral part of most major religions, particularly Christianity, where it is one of the sacraments (Lehmkuhl, 1910) which are necessary for salvation (Vatican.va). which encompasses over 40% of the population of the UK. (British Social Attitudes Survey 2007) While there are still such huge numbers of people who practice religions to which marriage is integral, marriage cannot be outdated.

Counterpoint
In the last 20 years, the number of people in the UK who identify as religious has declined by 20%. This shows that religion as a whole is becoming less important and, with it, marriage is becoming less important. (British Social Attitudes Survey 2007)

Marriage promotes a better way to raise children

Point
Marriage promotes raising children as part of a monogamous couple. Without marriage, the frequency of single parent families would rise. Statistically, children who come from single parent families are more likely to live under the poverty line, more likely to be convicted of a criminal offence, more likely to become ill, less likely to complete every level of education and more likely to grow up to have low incomes themselves. (O’Neill 2002) Clearly then, marriage provides a lot of goods to children of married families, thus it provides goods in modern society and therefore cannot be outdated.

Counterpoint
These statistics do not conclusively prove that married life is a better way to raise a child in every case. It is harmful to promote a message that a marriage is always a better way to raise a child than a single parent family. For instance, in the case of an abusive relationship or an individual who is clearly a completely unsuitable parent, it would be better for the parent who was suitable to raise the child by themselves than to hold up a marriage that was harmful to the raising of that child.

The choice is not always between a good marriage and single parent life but often between a harmful marriage and single parent life, so marriage does not necessarily promote a better way to raise children. (Cherlin 2009)
A. Raw Sample Debate "Marriage is an outdated institution"

B. Annotated Sample Debate "Marriage is an outdated institution"

This House believes that [MC1] marriage is an outdated institution

[Marriage is an institution that has existed in most societies around the world for an incredibly long time. It is, traditionally, the union between a man and woman in both a religious and a legal sense. Marriage offers a stable relationship that is recognised by the state and by whatever religion the couple choose to follow, as well as providing a good environment in which to raise children. However, with ever rising amounts of premarital cohabitation, single parent families and children born outside of wedlock, as well as the decline in adherence to religion, it seems that the institution is losing much of its appeal. In this debate, the proposition must prove that the institution of marriage has ceased to have relevance to modern society.]

POINTS FOR

[C1_01s] Does not provide any more of a stable environment for child rearing than a regular monogamous relationship

Point

The main objective of marriage is often said to be bringing up children in a stable environment. However [P1_02 s P1_01] in 2010 in the UK there were 119589 divorces; 11.1 per 1000 married population. Furthermore [P1_03 s P1_01] in the same year, the median duration of a marriage remained at a low level of 11.4 years. (Rogers, 2011) This clearly does not fulfill the initial basic aim of marriage as [P1_04 s C1_01] so many marriages end in divorce with the resulting splits affecting the children. In fact, [P1_04 s C1_01] a much more stable environment can be provided by a better relationship, even without matrimonial vows (Cherlin 2009). This relationship should not have to be through marriage; rather it would simply be a partnership in the way that many couples already live today.

B. Annotated Sample Debate "Marriage is an outdated institution"

Counterpoint

[P1_06 s P1_05] Once a couple get married, they have made an official and legal commitment, which makes it more difficult for them to split up. This means that, irrespective of divorce statistics, [P1_05 a C1_01] adding marriage to a relationship will only serve to make it more stable and give the children of that relationship more security. Therefore [a MC1] marriage still gives benefits in modern society and is not outdated. (Waite 2000)

[C1_02s] Unreasonable commitment to expect of people

Point

[P1_07 s P1_08] The average age, in the UK, to get married is approximately 30 years old. (Office for National Statistics 1999) Life expectancy in the UK is approximately 80 years. (Office for National Statistics 1999) This means [P1_08 s P1_10] the average marriage expects people to commit to maintain a certain way of life for a period that is longer than they have actually been alive. This goes hand in hand with the [P1_09 s P1_10] rise of social acceptability of people having more than one life partner in their life to show that [P1_10 s C1_02] either marriage is an unreasonable expectation of someone or a meaningless charade that is not actually expected to be maintained. (Cherlin 2009)

Counterpoint

[P1_11 a C1_02] This argument only works under the assumption that we live in a society where divorce does not exist. [P1_12 s P1_11] If a person enters into a marriage without full awareness of what they have committed to and later need to get out of that marriage, they are free to.

[P1_13 a P1_10] Being able to leave a marriage, though, does not make marriage a meaningless charade, as the proposition claims. [P1_14 s P1_13] It is still more difficult to leave a marriage than it is to leave a non-marital committed relationship and so it makes a big difference.

[C1_03s] Frequency and accessibility of divorce undermines the entire purpose of marriage

Point

With [P1_16 s P1_15] pre-nuptials, which essentially amount to pre-planning for divorce, heavily on the rise, and [P1_17 s P1_15] divorces becoming ever easier to obtain, it is clear that [P1_15 s P1_20] our society no longer respects marriage as a permanent institution. [P1_18 s P1_15] Serial monogamy is also becoming ever more common, with [P1_19 s P1_18] 50% of all divorcees in the UK going on to remarry. (Office for National Statistics)

Since the purpose of marriage has always been to foster a stable and permanent relationship, [s MC1] it is clearly an entirely outdated institution as [P1_20 s C1_03] it no longer leads to a stable or permanent relationship.
Counterpoint

[P1_21 a P1_20] The purpose of marriage is not an eternal, unrelenting union, whether it is wanted or not. [P1_22 s P1_21] The purpose of marriage is to foster a more stable relationship than would be possible without marital vows. Therefore, [Challenge Move 'Why?' against C1_03] the fact that divorce is becoming more common and easier to obtain does not undermine the institution of marriage at all.

Marriage should be for all but [P1_23 s C1_04] Marriage is a religious institution in a society of declining religion.

Point

The proposition believes that they have proven that [P1_24 s P1_23] marriage no longer has a social or practical function. This leaves its only function as one of religious significance. However, with [P1_25 s P1_23] the percentage of people in the UK who identify as having no religion having risen by nearly 20% in the last 20 years and [P1_26 s P1_23] the percentage of people who identify as religious having dropped by approximately the same amount [20%] (British Social Attitudes Surveys 2007). [P1_27 s P1_23] Church attendance is even lower at a mere 6% (whychurch.org.uk). As a result [C1_04s] there needs to be a new more inclusive institution that is open to all religions and those of no religion. It is clear that marriage can no longer perform this function for everyone in society.

Counterpoint

Firstly, [Challenge Move 'Why?' against P1_24] the opposition does not accept that the proposition have proven that marriage has no function outside of religion. However, even if they had proven this, [P1_28 a P1_23] they [the opposition] still have not proven that marriage has no religious function and, therefore, have lost the debate anyway.

The proposition asserts that because numbers of religious people in the UK are declining, this means marriage is no longer relevant religiously. [P1_29 s P1_30] The fact is that nearly 50% of people in the UK still identify as religious. (British Social Attitudes Survey 2007) The fact that this is less than before is meaningless; [P1_30 a P1_23] it is still the case that marriage has religious significance for nearly half the country.

[C1_05s] Undermines same-sex couples and single parent families as legitimate ways of raising children.

Point

As explained in the first proposition point, one of the primary functions of marriage is seen to be to raise children. [P1_31 s C1_05] Marriage is [therefore] seen as the best way to raise children. [Reiteration of C1_05] This undermines same-sex couples and single parent families raising children.

[P1_32 s C1_05] The existence of marriage is essentially saying that same-sex couples and single parents are less able of raising children than heterosexual couples. [P1_33 s MCI]
Marriage, therefore, can be seen to promote outdated ideals that our society no longer holds and, as such, is itself an outdated institution.

**Counterpoint**

[P1.33 a C1.05] The idea that the existence of marriage undermines other methods of raising children is ridiculous. [P1.34 s P1.33] This is equivalent to saying that making it legal for same-sex couples to adopt undermines raising children as a heterosexual couple or as a single parent.

[P1.35 s P1.33] Some people choosing to raise children in a certain way does not prevent or inhibit other people doing so in a different way.

**POINTS AGAINST**

[C1.06a] Removes the transient and casual aspects of a monogamous relationship, thus giving a child a far more stable environment.

Point

[P1.36 s P1.37] Marriage represents a commitment and a bond that is, although not unbreakable, difficult to break. This may not be appropriate for couples who wish to have a more casual relationship, however, [P1.37 s C1.06] it offers a more stable and official relationship, which is far preferable to a more transient relationship when it comes to raising a child. (Waite 2000)

Counterpoint

The fact that [P1.38 s P1.39] 40% of marriages end in divorce and [that] this is on the rise (National Office for Statistics 1999) shows that [P1.39 a C1.06] marriage clearly does not offer the stability that the opposition claims it does. In fact, it seems that [P1.40 s P1.41] marriage offers no more stability than a stable relationship, thus making it [P1.41 a C1.06] redundant in terms of raising children.

[C1.07a] Remarriage rate shows that even people who go through failed marriages retain faith in the institution of marriage

Point

[P1.42 s P1.43] 50% of all divorcees in the UK go on to remarry. (National Office for Statistics 1999) [Reiteration of C1.07] This shows that, although their own marriage failed, they retain faith in the institution of marriage. The fact that, [P1.43 s C1.07] even when marriage has failed to work for them once, many people wish to give it another go shows that, if it is still meaningful to society. If an institution is so meaningful and relevant to modern society in this way, it cannot possibly be outdated.

Counterpoint

[P1.44 s P1.45] The fact that 50% of all divorcees (National Office for Statistics 1999) go on to remarry does not, as the opposition claims, show that marriage is a meaningful
and relevant institution but quite the opposite. What this means is that a huge number of people vow to spend the rest of their life with another person, forsaking all others until death do them part, on multiple occasions. This does not show that society still has faith in marriage, it shows that society no longer respects the institution of marriage.

[P1.46 s C1.08] Marriage represents a legal bond which protects both parties in a relationship

Point
[C1.08a] Marriage has relevance to modern society in not only an emotional, religious and practical sense but also in a legal sense. According to Sir Mark Potter in English Law marriage is regarded as an "age-old institution" that is "by longstanding definition and acceptance" a formal relationship between a man and a woman primarily designed for producing and rearing children. [P1.47 s P1.46] It gives many rights in areas like property rights and pension benefits. [Travis, 2011] [P1.48 s P1.47] A marital bond gives important rights to both parties in cases of events such as severe injury, bereavement or even divorce. An institution cannot be outdated if it retains legal importance in modern society.

Counterpoint
[P1.49 a P1.48] If marriage's main function is to protect against bereavement and divorce then it is essentially protecting against harms that it itself brings. [P1.50 s P1.49] Without marriage, bereavement and divorce would cease to be as serious harms as they currently are.

[C1.09a] Marriage is an important institution to religious people

Point
[P1.51 s P1.53] Nearly 50% of people in the UK identify as being part of some religion. (British Social Attitudes Survey 2007) [P1.52 s P1.53] Marriage is an integral part of most major religions, particularly Christianity, where it is one of the sacraments (Lehmkuhl, 1910) which are necessary for salvation (Vatican.va), which encompasses over 40% of the population of the UK. (British Social Attitudes Survey 2007) While there are still huge numbers of people who practice religions to which marriage is integral, marriage cannot be outdated.

Counterpoint
[P1.54 s P1.55] In the last 20 years, the number of people in the UK who identify as religious has declined by 20%. This shows that religion as a whole is becoming less important and, with it, marriage is becoming less important. (British Social Attitudes Survey 2007)
B. Annotated Sample Debate "Marriage is an outdated institution"

[C1_10a] Marriage promotes a better way to raise children

Point

Marriage promotes raising children as part of a monogamous couple. Without marriage, the frequency of single parent families would rise. Statistically, children who come from single parent families are more likely to live under the poverty line, more likely to be convicted of a criminal offence, more likely to become ill, less likely to complete every level of education and more likely to grow up to have low incomes themselves. (O’Neill 2002) Clearly then, marriage provides a lot of goods to children of married families, thus it provides goods in modern society and therefore cannot be outdated.

Counterpoint

These statistics do not conclusively prove that married life is a better way to raise a child in every case. It is harmful to promote a message that a marriage is always a better way to raise a child than a single parent family. For instance, in the case of an abusive relationship or an individual who is clearly a completely unsuitable parent, it would be better for the parent who was suitable to raise the child by themselves than to hold up a marriage that was harmful to the raising of that child.

The choice is not always between a good marriage and single parent life but often between a harmful marriage and single parent life, so marriage does not necessarily promote a better way to raise children. (Cherlin 2009)
C. Argument Overview of Sample Debate
"Marriage is an outdated institution"

Table C.1.: Argument Overview of Debate "Marriage is an outdated institution"

<table>
<thead>
<tr>
<th>ArgC</th>
<th>hasText</th>
<th>hasKeywords</th>
<th>Relation</th>
<th>Target</th>
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<tbody>
<tr>
<td>MC1</td>
<td>Marriage is an outdated institution.</td>
<td>marriage outdated institution</td>
<td>isSupportedBy</td>
<td>C1_01, C1_02, C1_03, C1_04, C1_05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isAttackedBy</td>
<td>C1_06, C1_07, C1_08, C1_09, C1_10</td>
</tr>
<tr>
<td>C1_01</td>
<td>Marriage does not provide any more of a stable environment for child rearing than a regular monogamous relationship.</td>
<td>not more stable environment for raising children than regular relationship</td>
<td>supports</td>
<td>MC1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isSupportedBy</td>
<td>P1_01, P1_04</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isAttackedBy</td>
<td>P1_05</td>
</tr>
<tr>
<td>C1_02</td>
<td>Marriage is an unreasonable commitment to expect of people.</td>
<td>commitment, should not expect</td>
<td>supports</td>
<td>MC1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isSupportedBy</td>
<td>P1_10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isAttackedBy</td>
<td>P1_11</td>
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C. Argument Overview of Sample Debate "Marriage is an outdated institution"

Table C.1.: Argument Overview of Debate "Marriage is an outdated institution" (continued)

<table>
<thead>
<tr>
<th>ArgC</th>
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<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1_03</td>
<td>The frequency and accessibility of divorce undermines the entire purpose of marriage.</td>
<td>divorce frequent and accessible, undermines purpose</td>
<td>supports</td>
<td>MC1</td>
</tr>
<tr>
<td>C1_04</td>
<td>There needs to be a new more inclusive institution that is open to all religions and those of no religion. It is clear that marriage can no longer perform this function for everyone in society.</td>
<td>new institution needed, open to all religions, open to atheists</td>
<td>supports</td>
<td>MC1</td>
</tr>
<tr>
<td>C1_05</td>
<td>Marriage undermines same-sex couples and single parent families as legitimate ways of raising children.</td>
<td>undermines same-sex and single parents raising children</td>
<td>supports</td>
<td>MC1</td>
</tr>
<tr>
<td>C1_06</td>
<td>Marriage removes the transient and casual aspects of a monogamous relationship, thus giving a child a far more stable environment.</td>
<td>removes transient casual aspects, more stable environment for children</td>
<td>attacks</td>
<td>MC1</td>
</tr>
<tr>
<td>C1_07</td>
<td>The remarriage rate shows that even people who go through failed marriages retain faith in the institution of marriage.</td>
<td>remarriage shows divorcees retain faith</td>
<td>attacks</td>
<td>MC1</td>
</tr>
<tr>
<td>C1_08</td>
<td>Marriage has relevance to modern society in a legal sense.</td>
<td>legal relevance</td>
<td>attacks</td>
<td>MC1</td>
</tr>
</tbody>
</table>
## Table C.1: Argument Overview of Debate "Marriage is an outdated institution" (continued)

<table>
<thead>
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<th>Relation</th>
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</thead>
<tbody>
<tr>
<td>C1_09</td>
<td>Marriage is an important institution to religious people.</td>
<td>important religious institution</td>
<td>attacks</td>
<td>MC1</td>
</tr>
<tr>
<td>C1_10</td>
<td>Marriage promotes a better way to raise children. [Similar argument as P1_31.]</td>
<td>better way to raise children</td>
<td>attacks</td>
<td>MC1</td>
</tr>
<tr>
<td>P1_01</td>
<td>So many marriages end in divorce with the resulting splits affecting the children.</td>
<td>divorce affects children</td>
<td>supports</td>
<td>C1_01</td>
</tr>
<tr>
<td>P1_02</td>
<td>In 2010 in the UK there were 119589 divorces; 11.1 per 1000 married population.</td>
<td>UK, 2010, 119589 divorces</td>
<td>supports</td>
<td>P1_01</td>
</tr>
<tr>
<td>P1_03</td>
<td>In the same year, 2010, the median duration of a marriage remained at a low level of 11.4 years according to Rogers 2011.</td>
<td>median duration 11.4 years</td>
<td>supports</td>
<td>P1_01</td>
</tr>
<tr>
<td>P1_04</td>
<td>A much more stable environment can be provided by a better relationship, even without matrimonial vows.</td>
<td>“better relationship provides more stable environment”</td>
<td>supports</td>
<td>P1_01</td>
</tr>
<tr>
<td>P1_05</td>
<td>Adding marriage to a relationship will serve to make it more stable and give the children of that relationship more security.</td>
<td>more stable relationship, more security for children</td>
<td>attacks</td>
<td>C1_01</td>
</tr>
<tr>
<td>P1_06</td>
<td>Once a couple get married, they have made an official and legal commitment, which makes it more difficult for them to split up.</td>
<td>official legal commitment, more difficult to split up</td>
<td>supports</td>
<td>P1_05</td>
</tr>
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</table>
### Table C.1: Argument Overview of Debate "Marriage is an outdated institution"

(continued)

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>P1_07</td>
<td>According to the Office for National Statistics in 1999, the average age, in the UK, to get married is approximately 30 years old. Life expectancy in the UK is approximately 80 years.</td>
<td>UK, average age married 30 years, life expectancy 80 years</td>
<td>supports</td>
<td>P1_08</td>
</tr>
<tr>
<td>P1_08</td>
<td>The average marriage expects people to commit to maintain a certain way of life for a period that is longer than they have actually been alive.</td>
<td>expects commitment for longer than alive</td>
<td>supports</td>
<td>P1_10</td>
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<tr>
<td></td>
<td></td>
<td>supports</td>
<td>isSupportedBy</td>
<td>P1_07</td>
</tr>
<tr>
<td>P1_09</td>
<td>Social acceptability of people having more than one life partner in their life is on the rise.</td>
<td>social acceptability of multiple life partners increasing</td>
<td>supports</td>
<td>P1_10</td>
</tr>
<tr>
<td>P1_10</td>
<td>Either marriage is an unreasonable expectation of someone or a meaningless charade that is not actually expected to be maintained.</td>
<td>unreasonable expectation, meaningless charade</td>
<td>supports</td>
<td>C1_02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>supports</td>
<td>isSupportedBy</td>
<td>P1_08,</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>isSupportedBy</td>
<td>P1_09</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>isAttackedBy</td>
<td>P1_13</td>
</tr>
<tr>
<td>P1_11</td>
<td>This argument only works under the assumption that we live in a society where divorce does not exist.</td>
<td>only true assuming divorce does not exist</td>
<td>attacks</td>
<td>C1_02</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isSupportedBy</td>
<td>P1_12</td>
</tr>
<tr>
<td>P1_12</td>
<td>If a person enters into a marriage without full awareness of what they have committed to and later need to get out of that marriage, they are free to.</td>
<td>people who need to get out are free to</td>
<td>supports</td>
<td>P1_11</td>
</tr>
<tr>
<td>P1_13</td>
<td>Being able to leave a marriage, though, does not make marriage a meaningless charade.</td>
<td>able to leave, not meaningless charade</td>
<td>attacks</td>
<td>P1_10</td>
</tr>
</tbody>
</table>
Table C.1.: Argument Overview of Debate "Marriage is an outdated institution"
(continued)

<table>
<thead>
<tr>
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<th>Relation</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1_14</td>
<td>It is still more difficult to leave a marriage than it is to leave a non-marital committed relationship and so it makes a big difference.</td>
<td>more difficult to leave marriage than non-marital relationship</td>
<td>isSupportedBy</td>
<td>P1_14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>supports</td>
<td>P1_13</td>
</tr>
<tr>
<td>P1_15</td>
<td>Our society no longer respects marriage as a permanent institution. [Similar argument as P1_45.]</td>
<td>society no longer respects as permanent institution</td>
<td>supports</td>
<td>P1_20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isSupportedBy</td>
<td>P1_16, P1_17, P1_18</td>
</tr>
<tr>
<td>P1_16</td>
<td>Premuptial agreements, which essentially amount to pre-planning for divorce, are heavily on the rise.</td>
<td>prenuptial agreements planning for divorce increasing heavily</td>
<td>supports</td>
<td>P1_15</td>
</tr>
<tr>
<td>P1_17</td>
<td>Divorces are becoming ever easier to obtain.</td>
<td>divorces becoming easier</td>
<td>supports</td>
<td>P1_15</td>
</tr>
<tr>
<td>P1_18</td>
<td>Serial monogamy is also becoming ever more common.</td>
<td>serial monogamy becoming more common</td>
<td>supports</td>
<td>P1_15</td>
</tr>
<tr>
<td>P1_19</td>
<td>50% of all divorcees in the UK go on to remarry according to the Office for National Statistics. [Same argument as P1_42.]</td>
<td>UK, 50% remarry</td>
<td>supports</td>
<td>P1_18</td>
</tr>
<tr>
<td>P1_20</td>
<td>Marriage no longer leads to a stable or permanent relationship.</td>
<td>no longer leads to stable or permanent relationship</td>
<td>supports</td>
<td>C1_03</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isSupportedBy</td>
<td>P1_15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isAttackedBy</td>
<td>P1_21</td>
</tr>
<tr>
<td>P1_21</td>
<td>The purpose of marriage is not an eternal, unrelenting union, whether it is wanted or not.</td>
<td>purpose not eternal union</td>
<td>attacks</td>
<td>P1_20</td>
</tr>
</tbody>
</table>
Table C.1.: Argument Overview of Debate "Marriage is an outdated institution" (continued)

<table>
<thead>
<tr>
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<th>Relation</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1_22</td>
<td>The purpose of marriage is to foster a more stable relationship than would be possible without marital vows.</td>
<td>purpose more stable relationship than without marriage</td>
<td>supports</td>
<td>P1_21</td>
</tr>
<tr>
<td>P1_23</td>
<td>Marriage is a religious institution in a society of declining religion.</td>
<td>religious institution, society of declining religion</td>
<td>supports</td>
<td>C1_04</td>
</tr>
<tr>
<td>P1_24</td>
<td>Marriage no longer has a social or practical function. This leaves its only function as one of religious significance.</td>
<td>no social or practical function, only religious function</td>
<td>supports</td>
<td>P1_23</td>
</tr>
<tr>
<td>P1_25</td>
<td>The percentage of people in the UK who identify as having no religion has risen by nearly 20% in the last 20 years according to the British Social Attitudes Surveys of 2007.</td>
<td>UK, people with no religion increased 20%</td>
<td>supports</td>
<td>P1_23</td>
</tr>
<tr>
<td>P1_26</td>
<td>The percentage of people who identify as religious has dropped by approximately 20%, according to the British Social Attitudes Surveys of 2007. [Similar argument as P1_54.]</td>
<td>religious people decreased 20%</td>
<td>supports</td>
<td>P1_26</td>
</tr>
<tr>
<td>P1_27</td>
<td>Church attendance is at a mere 6% according to whychurch.org.uk.</td>
<td>church attendance low, 6%</td>
<td>supports</td>
<td>P1_23</td>
</tr>
<tr>
<td>P1_28</td>
<td>You still have not proven that marriage has no religious function and, therefore, have lost the debate anyway.</td>
<td>not necessarily no religious function</td>
<td>attacks</td>
<td>P1_23</td>
</tr>
</tbody>
</table>
Table C.1.: Argument Overview of Debate "Marriage is an outdated institution"
(continued)

<table>
<thead>
<tr>
<th>ArgC</th>
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<tbody>
<tr>
<td>P1_29</td>
<td>The fact is that nearly 50% of people in the UK still identify as religious according to the British Social Attitudes Survey in 2007. [Similar argument as P1_51.]</td>
<td>UK, 50% still religious</td>
<td>supports</td>
<td>P1_30</td>
</tr>
<tr>
<td>P1_30</td>
<td>It is still the case that marriage has religious significance for nearly half the country.</td>
<td>religious significance for half the country</td>
<td>attacks</td>
<td>P1_23</td>
</tr>
<tr>
<td>P1_31</td>
<td>Marriage is seen as the best way to raise children. [Similar argument as C1_10.]</td>
<td>best way to raise children</td>
<td>supports</td>
<td>C1_05</td>
</tr>
<tr>
<td>P1_32</td>
<td>The existence of marriage is essentially saying that same-sex couples and single parents are less able of raising children than heterosexual couples.</td>
<td>marriage says, same-sex single parents less able to raise children</td>
<td>supports</td>
<td>C1_05</td>
</tr>
<tr>
<td>P1_33</td>
<td>The idea that the existence of marriage undermines other methods of raising children is ridiculous.</td>
<td>undermines other ways of raising children, ridiculous to say</td>
<td>attacks</td>
<td>C1_05</td>
</tr>
<tr>
<td>P1_34</td>
<td>This is equivalent to saying that making it legal for same-sex couples to adopt undermines raising children as a heterosexual couple or as a single parent.</td>
<td>equivalent, same-sex adoption undermines heterosexual single parent adoption</td>
<td>supports</td>
<td>P1_33</td>
</tr>
<tr>
<td>P1_35</td>
<td>Some people choosing to raise children in a certain way does not prevent or inhibit other people doing so in a different way.</td>
<td>people may raise children in different ways</td>
<td>supports</td>
<td>P1_33</td>
</tr>
</tbody>
</table>
### Table C.1.: Argument Overview of Debate "Marriage is an outdated institution"

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<tbody>
<tr>
<td>P1_36</td>
<td>Marriage represents a commitment and a bond that is, although not unbreakable, difficult to break.</td>
<td>commitment, bond hard to break</td>
<td>supports</td>
<td>P1_37</td>
</tr>
<tr>
<td>P1_37</td>
<td>Marriage offers a more stable and official relationship, which is far preferable to a more transient relationship when it comes to raising a child.</td>
<td>more stable, better than transient relationship for raising children</td>
<td>supports</td>
<td>C1_06</td>
</tr>
<tr>
<td>P1_38</td>
<td>40% of marriages end in divorce and this is on the rise according to the National Office for Statistics in 1999.</td>
<td>40% divorce, increasing</td>
<td>supports</td>
<td>P1_39</td>
</tr>
<tr>
<td>P1_39</td>
<td>Marriage clearly does not offer the stability you claim it does.</td>
<td>not offering stability</td>
<td>attacks</td>
<td>C1_06</td>
</tr>
<tr>
<td>P1_40</td>
<td>Marriage offers no more stability than a stable relationship.</td>
<td>no more stable than stable relationship</td>
<td>supports</td>
<td>P1_41</td>
</tr>
<tr>
<td>P1_41</td>
<td>Marriage is redundant in terms of raising children.</td>
<td>redundant for raising children</td>
<td>attacks</td>
<td>C1_06</td>
</tr>
<tr>
<td>P1_42</td>
<td>50% of all divorcees in the UK go on to remarry according to the National Office for Statistics in 1999. [Same argument as P1_19.]</td>
<td>UK, 50% remarry, 1999</td>
<td>supports</td>
<td>P1_43</td>
</tr>
<tr>
<td>P1_43</td>
<td>Even when marriage has failed to work for them once, many people wish to give it another go.</td>
<td>when failed, many try again</td>
<td>supports</td>
<td>C1_07</td>
</tr>
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<tr>
<td>P1_44</td>
<td>The fact that 50% of all divorcees, according to the National Office for Statistics in 1999, go on to remarry does not, as you claim, show that marriage is a meaningful and relevant institution but quite the opposite. What this means is that a huge number of people vow to spend the rest of their life with another person, forsaking all others until death do them part, on multiple occasions.</td>
<td>50% remarry, shows marriage not meaningful, multiple commitments</td>
<td>supports</td>
<td>P1_45</td>
</tr>
<tr>
<td>P1_45</td>
<td>Society no longer respects the institution of marriage. [Similar argument as P1_15.]</td>
<td>society no longer respects institution</td>
<td>attacks</td>
<td>C1_07</td>
</tr>
<tr>
<td>P1_46</td>
<td>Marriage represents a legal bond which protects both parties in a relationship.</td>
<td>legal bond, protects both parties</td>
<td>supports</td>
<td>C1_08</td>
</tr>
<tr>
<td>P1_47</td>
<td>Marriage gives many rights in areas like property rights and pension benefits.</td>
<td>gives many rights</td>
<td>supports</td>
<td>P1_46</td>
</tr>
<tr>
<td>P1_48</td>
<td>A marital bond gives important rights to both parties in cases of events such as severe injury, bereavement or even divorce.</td>
<td>gives rights to both parties, bereavement, divorce</td>
<td>supports</td>
<td>P1_47</td>
</tr>
<tr>
<td>P1_49</td>
<td>If marriage’s main function is to protect against bereavement and divorce then it is essentially protecting against harms that it itself brings.</td>
<td>protects against harms itself brings</td>
<td>attacks</td>
<td>P1_48</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isSupportedBy</td>
<td>P1_50</td>
</tr>
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Table C.1.: Argument Overview of Debate "Marriage is an outdated institution"
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<tr>
<td>P1_50</td>
<td>Without marriage, bereavement and divorce would cease to be as serious harms as they currently are.</td>
<td>without marriage, bereavement divorce less harm</td>
<td>supports</td>
<td>P1_49</td>
</tr>
<tr>
<td>P1_51</td>
<td>Nearly 50% of people in the UK identify as being part of some religion according to the British Social Attitudes Survey of 2007. [Similar argument as P1_29.]</td>
<td>UK, 50% people have some religion</td>
<td>supports</td>
<td>P1_53</td>
</tr>
<tr>
<td>P1_52</td>
<td>Marriage is an integral part of most major religions, particularly Christianity, which encompasses over 40% of the population of the UK according to the British Social Attitudes Survey of 2007.</td>
<td>important to most major religions, particularly Christianity, UK 40%</td>
<td>supports</td>
<td>P1_53</td>
</tr>
<tr>
<td>P1_53</td>
<td>There are still such huge numbers of people who practice religions to which marriage is integral.</td>
<td>still important to many religions</td>
<td>supports</td>
<td>C1_09</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isSupportedBy</td>
<td>P1_51, P1_52</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isAttackedBy</td>
<td>P1_55</td>
</tr>
<tr>
<td>P1_54</td>
<td>In the last 20 years, the number of people in the UK who identify as religious has declined by 20% according to the British Social Attitudes Survey of 2007. [Similar argument as P1_26.]</td>
<td>UK, last 20 years, religious people declined 20%</td>
<td>supports</td>
<td>P1_55</td>
</tr>
<tr>
<td>P1_55</td>
<td>Religion as a whole is becoming less important and, with it, marriage is becoming less important.</td>
<td>religion becoming less important, therefore marriage less important</td>
<td>attacks</td>
<td>P1_53</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>isSupportedBy</td>
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<tr>
<td>P1_56</td>
<td>Without marriage, the frequency of single parent families would rise. Statistically, children who come from single parent families are more likely to live under the poverty line, more likely to be convicted of a criminal offence, more likely to become ill, less likely to complete every level of education and more likely to grow up to have low incomes themselves.</td>
<td>children of single parents likely, poverty, crime, illnes, low education, low income</td>
<td>supports</td>
<td>P1_57</td>
</tr>
<tr>
<td>P1_57</td>
<td>Marriage provides a lot of goods to children of married families.</td>
<td>provides many advantages for children</td>
<td>supports</td>
<td>C1_10</td>
</tr>
<tr>
<td>P1_58</td>
<td>These statistics do not conclusively prove that married life is a better way to raise a child in every case.</td>
<td>statistics do not prove better way to raise children</td>
<td>attacks</td>
<td>P1_56</td>
</tr>
<tr>
<td>P1_59</td>
<td>It is harmful to promote a message that a marriage is always a better way to raise a child than a single parent family.</td>
<td>bad to say marriage always better than single parent for raising children</td>
<td>attacks</td>
<td>P1_56</td>
</tr>
<tr>
<td>P1_60</td>
<td>For instance, in the case of an abusive relationship or an individual who is clearly a completely unsuitable parent, it would be better for the parent who was suitable to raise the child by themselves than to hold up a marriage that was harmful to the raising of that child.</td>
<td>if bad marriage or unsuitable parent, better single parent raises child</td>
<td>supports</td>
<td>P1_61</td>
</tr>
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<tr>
<td>P1_61</td>
<td>The choice is not always between a good marriage and single parent life but often between a harmful marriage and single parent life.</td>
<td>choice often between bad marriage and single parent</td>
<td>supports</td>
<td>P1_59</td>
</tr>
</tbody>
</table>
D. Sample Dialogue Generated from Debating Ontology (Truncated)

Player A:

Marriage is an outdated institution.

Player B:

Marriage promotes a better way to raise children.

Player A:

I find that hard to believe.

Player B:

You said earlier: Marriage is an outdated institution.
But I think: Marriage is an important institution to religious people.

Player A:

I find that hard to believe.

Player B:

You said earlier: Marriage is an outdated institution.
I find that hard to believe.
D. Sample Dialogue Generated from Debating Ontology (Truncated)

Player A:

There needs to be a new more inclusive institution that is open to all religions and those of no religion. It is clear that marriage can no longer perform this function for everyone in society.

Player B:

I doubt that.

Player A:

Marriage is a religious institution in a society of declining religion.

Player B:

It is still the case that marriage has religious significance for nearly half the country.

Player A:

You disagreed earlier when I said: Marriage is an outdated institution. Well I say: Marriage undermines same-sex couples and single parent families as legitimate ways of raising children.

Player B:

You said earlier: Marriage is an outdated institution. But I think: Marriage has relevance to modern society in a legal sense.

Player A:

I doubt that.
Player B: 

Marriage represents a legal bond which protects both parties in a relationship.

Player A: 

I find that hard to believe.

Player B: 

You said earlier: Marriage undermines same-sex couples and single parent families as legitimate ways of raising children. But I think: The idea that the existence of marriage undermines other methods of raising children is ridiculous.

Player A: 

I doubt that.

Player B: 

You said earlier: Marriage is an outdated institution. But I think: Marriage removes the transient and casual aspects of a monogamous relationship, thus giving a child a far more stable environment.

Player A: 

Marriage clearly does not offer the stability you claim it does.

Player B: 

I doubt that.