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### The structure of argument patterns on a social Q&A site

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#### Abstract

This study investigates the argument patterns in Yahoo! Answers – a major question and answer (Q&A) site. Mainly drawing on the ideas of Toulmin, argument pattern is conceptualized as a set of five major elements: claim, counter-claim, rebuttal, support and grounds. The combinations of these elements result in diverse argument patterns. Failed opening consists of an initial claim only, while non-oppositional argument pattern also includes indications of support. Oppositional argument pattern contains the elements of counter-claim and rebuttal. Mixed argument pattern entails all five elements. The empirical data were gathered by downloading from Yahoo! Answers one hundred discussion threads discussing global warming – a controversial topic providing a fertile ground for arguments for and against. Of the argument patterns, failed openings were most frequent, followed by oppositional, non-oppositional and mixed patterns. In most cases, the participants grounded their arguments by drawing on personal beliefs and facts. The findings suggest that oppositional and mixed argument patterns provide more opportunities for the assessment of the quality and credibility of answers, as compared to failed openings and non-oppositional argument patterns.

#### Introduction

Social question and answer (Q&A) sites are gaining increasing popularity among information seekers. For example, Yahoo! Answers attracted 62 million unique visitors per month in the United States alone in 2010 (Gazan, 2011, p. 2302). The utilization of social Q&A sites is based on the interaction between the “askers” and “answerers”. The former post their questions to a public, freely accessible Q&A site and then receive comments from answerers, i.e., anyone who are willing to share his or her knowledge about the issue at hand. Social Q&A sites also allow the commenting on questions and answers, thus providing opportunities for developing arguments for and against the answers posted by the contributors.

So far, there is a lack of empirical studies focusing on the ways in which argument patterns are structured in Q&A discussions. The analysis of argument patterns is also important because it helps to understand the ways in which the contributors attempt to construct their answers as credible. On the other hand, such an analysis is useful because it demonstrates how diverse argument patterns provide varying potential for the participants of Q&A discussion to evaluate the credibility of answers available on these sites. To examine these issues, the study makes use of Toulmin’s (2003) classic model of argument patterns originally developed in the 1950s. As explained later on,

this model suits particularly well for the analysis of asynchronous discourses occurring in online forums.

The argument patterns are analyzed by focusing on a sample of Q&A threads discussing global warming. Yahoo! Answers was selected as the source of the empirical data because of its dominant status among social Q&A sites. It is believed that due to this position Yahoo! Answers is able to attract a wide variety of questions and alternative answers whose credibility is debated. Global warming is a particularly suitable topic for the analysis of arguments since it is subject to multiple interpretations. There are a number of arguments for and against global warming as a phenomenon affecting people's daily life and well-being. Global warming refers to the rising average temperature of Earth's atmosphere and oceans and its projected continuation. It is believed that global warming is mainly caused by increasing concentrations of greenhouse gases produced by human activities such as burning fossil fuels. The issues of global warming have been debated since the 1990s and there is a growing body of books, articles, films and other material about this topic (see, for example, Bradley, 2011; Hoggan & Littlemore, 2009). For example, *Inconvenient Truth*, a documentary film about former US Vice President Al Gore's campaign in 2006 greatly increased the visibility of the issues of global warming all over the world (Johnson, 2009).

From its inception, the debate about global warming has resulted in divided opinions, ranging from the denial of climate change to predictions of climate crisis (Myerson & Rydin, 1996, p. 92). Researchers have provided conflicting evidence about the nature and effects of global warming. This raises the question of which evidence counts most: whom to believe? An additional problem is that there seem to be all too many arguments for and against the assumptions of global warming and there are no solution directly arising from such arguments. Diverse arguments may have so many rivals that they could not possibly say whether they have won or not (Myerson & Rydin, 1996, p. 216). It is evident that similar problems dealing with the construction of credible arguments are also faced in discussions taking place on social Q&A sites.

The present study is structured as follows. Literature review provides background for the empirical study by discussing the main findings of Q&A studies so far. Then, the conceptual framework and empirical research design are specified, followed by the report of the empirical findings. The last sections discuss the significance of the research findings and present ideas for future research.

## **Background**

The majority of Q&A studies conducted so far are empirical investigations focusing on the content of questions and answers, as well as the ways in which Q&A sites are used. Recently, Gazan (2011), Oh (2012) and Shah and associates (2009) have provided excellent reviews of the Q&A studies. They can be classified into three main categories: conceptual studies, user-centered investigations and content-centered studies. So far, the number of conceptual studies has remained low. Drawing on structuration theory and the concept of communities of practice, Rosenbaum and Shachaf (2010) approached Q&A practices as collaborative problem-solving activity in which the participants are engaged while answering questions and evaluating questions and answers. Gazan (2009) provides another example of conceptual studies.

He demonstrated that a Q&A community becomes self-aware through rituals of membership, debates about normative behavior, and the formation of sub-communities of like-minded users. The conversations surrounding these questions serve as public spaces where competing ideas about appropriate content, rules, and behavior are debated.

User-centered investigations have addressed diverse topics such as the types of questioners (Gazan, 2007) and answerers (Gazan, 2006), as well as the motivations of answerers (Oh, 2012). Since content-centered Q&A studies are most relevant for the present study, they are discussed in more detail. These investigations have focused on evaluating the quality of answers (Fichman, 2011; Shah et al., 2009, p. 207) and information-seeker satisfaction in community question answering (Agichtein et al., 2009). A study of Answerbag conducted by Gazan (2006) revealed that answers from *synthesists*, i.e., those who provide links and supporting evidence in their answers but claim no expertise of their own, tend to be rated more highly than answers from *specialists*, who claim expertise but provide no supporting evidence. Similarly, Harper and associates (2009) found that answers with citations and other supporting evidence tend to receive higher ratings than those without. Adamic and associates (2008) showed that the length of the answer is most indicative of best answers across topic categories. In certain topic categories, however, the number of competing answers and the history of the answerer were more likely to predict answer quality.

Kim and Oh (2009) explored the criteria by which the questioners choose the best answer from among all the answers given to their questions in Yahoo! Answers. Socio-emotional criteria such as agreement, emotional support, effort, and taste were recognized as the most frequently used to evaluate answers. More recently, Kim (2010) explored the criteria by which the users of Yahoo! Answers evaluate answer credibility. In total, twenty-two criteria were identified and they were grouped into three categories: message criteria, source criteria, and others. The questioners used each criterion either positively or negatively or both in credibility judgments. The fact criterion was one of the message criteria. A factual assertion made in the answer positively impacted on credibility judgment while a lack of fact-based information resulted in a negative credibility judgment. Other message criteria included, for example, quality, accuracy, clarity, currency, spelling and grammar, tone of writing, bias, and usefulness. Source criteria were related to the credibility of a source or sponsor of the website (e.g., author's perceived expertise). Other criteria were related to the credibility of a website as a whole (e.g., design and look).

### **Conceptual framework**

Literature review indicated that the evaluation of the quality and credibility of answers occupies a central role in content-centered Q&A studies. As noted above, the present study is mainly interested in the ways in which diverse argument patterns being shaped along with Q&A discussions provide opportunities for the judgment of the credibility of answers.

In general, *argumentation* can be defined as a process involving at least two individuals engaged in dialogue, each contending differing positions and trying to persuade each other (Tindale, 2004, pp. 2-3; p. 23). Potentially, argumentation is not restricted to dealing with overt disagreements only. Argumentation also enables the

introduction and reinforcement of new ideas, as well as the attempts to achieve understanding and agreement even when the starting position of each is virtually unrecognizable to others. Zarefsky (2008, p. 632) characterizes argumentation as the “practice of justifying claims under conditions of uncertainty”. Therefore, argumentation establishes not what is “objectively” true but what a person should consider to be true. It involves proffering and testing claims against the scrutiny of others. The claims that withstand critical scrutiny, though they cannot be verified, can be taken as true and acted upon with a high degree of confidence. *Argument* may be characterized as a product of the argumentation process. Johnson (2000, p. 168) defines argument as “a type of discourse or text – the distillate of the practice of argumentation - in which the arguer seeks to persuade the Other(s) of the truth of a thesis by producing the reasons that support it”.

There are alternative theoretical approaches to argumentation with varying emphasis on logical, rhetorical and practical factors as constituents of argument and argumentation (see, for example, Fogelin, 1987; Perelman & Olbrechts-Tyteca, 1969; Van Eemeren & Houtlosser, 1999). The present study draws on the argument pattern developed by Stephen Toulmin (2003). This model was chosen because it clearly defines the main elements of argument as operationalisable categories; in addition, the model focuses on practical argumentation in mundane contexts. Toulmin developed his model in the 1950s as a logician. On the other hand, he maintained that formal logic was becoming increasingly remote from practical considerations having to do with the criticism and evaluation of arguments in everyday use. In response to this development, Toulmin’s own efforts were largely devoted to creating a structural model for the assessment of practical or “substantial” arguments in their own right (Healy, 1987, p. 1). Toulmin’s innovation centered on the development of a schema for the rational assessment of practical arguments by preferring a jurisprudential analogy to a purely syllogistic model in the analysis “substantial” arguments. This analogy suggested that if the competing arguments are broken down, the participants can better evaluate their relative merits, and make progress toward a more objective understanding.

However, the idea of the rational assessment of arguments cannot always be realized in mundane contexts. In online discussion forums, for example, the participants often post nonsense and they may draw on emotive appeals such as ad hominem attacks without regard to the merits of the claim. In some cases, motivated participants may create multiple accounts in order to give the illusion that multiple individuals share their views. Notwithstanding such limitations of rational discussion, Clark and his associates (2007, p. 350) provide convincing support for the empirical applicability of Toulmin’s model in the study of argumentation taking place in online environments that use asynchronous threaded communication, and involve well-defined or complex problems. The above features are also characteristic of discussions occurring on Q&A sites. As demonstrated in the empirical study below, Toulmin’s model was successfully applied to the analysis of Q&A discussions. Even though the messages contained “irrational” elements such as emotive appeals, their role remained marginal.

Toulmin (2003, pp. 87-100) specifies six elements of argument as follows; the illustrating examples related to the issues of global warming are developed by the present author:

*Claim*: the conclusion whose merits an arguer seeks to establish; an assertion or proposition an arguer wants another to accept (for example, “In the United States, global warming increases the occurrence of heavy rainfall”).

*Data*: the facts an arguer appeals to as a foundation for the claim. For instance, data may consist of facts provided by official statistics (for example, “In the United States, total annual precipitation increased at an average rate of 6.1 percent since 1900”).

*Warrant*: the statement authorizing the movement from the data to the claim. A warrant legitimizes the claim by showing the data to be relevant. The warrant may be explicit or unspoken (implicit), and it answers the question ‘Why does that data mean your claim is true?’ (for example, “The data available from US rainfall statistics cover a period of 200 years”).

*Backing*: gives additional support to the warrant. Backing must be introduced when the warrant itself is not convincing enough to the readers or the listeners (for example, “US rainfall statistics are collected consistently over time by government agencies”).

*Qualifier*: indicates the strength of the leap from the data to the warrant and may limit how universally the claim applies (for example, “It is highly evident that US rainfall statistics are reliable”).

*Rebuttal*: statements recognizing the restrictions to which the claim may legitimately be applied. Thus, rebuttal admits to those circumstances or situations where the claim would not hold. Usually, rebuttals include attacks on the data used to bolster a claim or attacks directly on a claim (for example, “The increasing occurrence of heavy rainfall in the United States is mainly caused by other factors such as *El Nino* oscillation”).

The primary structure of argument involves the movement from the data (evidence) to the claim (endpoint or conclusion) based on the reasoning provided by the warrant. Additional concepts may clarify the move from data to conclusion: a backing may reinforce the warrant, and a rebuttal shows objections to the claim (Feinberg, 2010, p. 497). The strength of Toulmin’s model resides in its ability to evaluate arguments. Data, claims, warrants, backings, rebuttals, and qualifiers are field-invariant elements of arguments. However, what counts as a warrant, backing, or data, however, are field-dependent features (Jimenez-Alexandre et al., 2000, p. 762). Thus, for example, the appeals to justify claims used to craft historical explanations for global warming would not necessarily be the same kind of appeals used to support claims for the increase of the pollution of air over time.

Toulmin’s model has been successfully applied in empirical studies conducted in diverse contexts such as classroom dialogue among students (Jimenez-Alexandre & Pereiro-Munoz, 2002; Jimenez-Alexandre et al., 2000; Spatariu et al., 2004), online learning environments (Clark & Sampson, 2007; Clark et al., 2007) and analysis of classificatory arguments (Feinberg, 2010). More specifically, the model has been used in the studies focusing on the identification of the elements of argument and the process of argumentation, especially in terms of how students provide warrants for claims. These studies have provided a great deal of information about the form and type of reasoning that students use when they construct arguments based on their everyday experiences (Clark & Sampson, 2007, pp. 260-261). These studies have revealed, for example, that arguments constructed by high-school students tend to rely heavily on claims that lack backings and warrants. Moreover, students do not usually provide warrants for their claims unless they are challenged (Clark & Sampson, 2007, p. 261).

On the other hand, the empirical application of Toulmin's model is not without difficulties. Several researchers (for example, Erduran et al., 2004; 2005; Clark & Sampson, 2007, p. 261; Clark et al., 2007, p. 349) have reported problems making objective distinctions between the elements of data, warrant and backing when analyzing dialectic argumentation. It is often difficult to differentiate between data and warrant, or warrant and backing, resulting in poor reliability. To avoid these problems, Erduran and associates (2005) collapsed the elements of data, warrant, and backing into a single category of *Grounds*.

The present study follows this methodological idea by employing the composite category of *Grounds*. Further, drawing on the idea of Jimenez-Aleixandre and associates (2000), and Clark and Sampson (2007), two new elements, that is, *Counter-claim* and *Support* were added to the conceptual framework. This is because the participants of dialogue may not merely rebut an initial claim by directly attacking such a claim itself or questioning its grounds. The participants may also present counter-claims indicating disagreement with the initial claim, for example, "global warming increases the occurrence of heavy rainfall". In this context, a counter-claim may assert that "the occurrence of heavy rainfall does not correlate with the rising average temperature of Earth's atmosphere". The participants can also indicate support by agreeing with a claim, counter-claim or rebuttal presented in the discussion. In order to strengthen the focus of the empirical study, "qualifiers" identified by Toulmin (2003) were not examined in the present study. Thus, finally, the following elements of argument are analyzed in the present study: (1) Claim, (2) Counter-claim, (3) (3) Rebuttal, (4) Support, and (5) Grounds.

Clark and Sampson (2007) employed similar categories in a study of the structural nature of the argumentation among students in an online learning environment. In their study, the combinations of messages containing elements of argument were labeled as oppositional and non-oppositional *discourse episodes*. Such episodes were used as units of analysis, too. Similarly, in the present study, the unit of analysis is the combination of messages containing elements of argument about a particular topic. Since this study is not interested in the process of argumentation occurring in the context of discourse episodes, an alternative concept was chosen to denote the combination of the elements of argument, i.e., *argument pattern*. If only an initial claim is presented by the asker or an answerer, eliciting no comments from any of the participants, the argument pattern can be named as *failed opening*. If the initial claim is supported by one or more participants, we may speak about a *non-oppositional* argument pattern. If the initial claim is questioned by presenting counter-claim(s) and/or rebuttal(s), the argument pattern is named as *oppositional*. Finally, if a discourse incorporates an initial claim, counter-claim(s) and/or rebuttal(s), and support, the argument pattern is labeled as *mixed*. Figure 1 illustrates the structure of the above argument patterns.

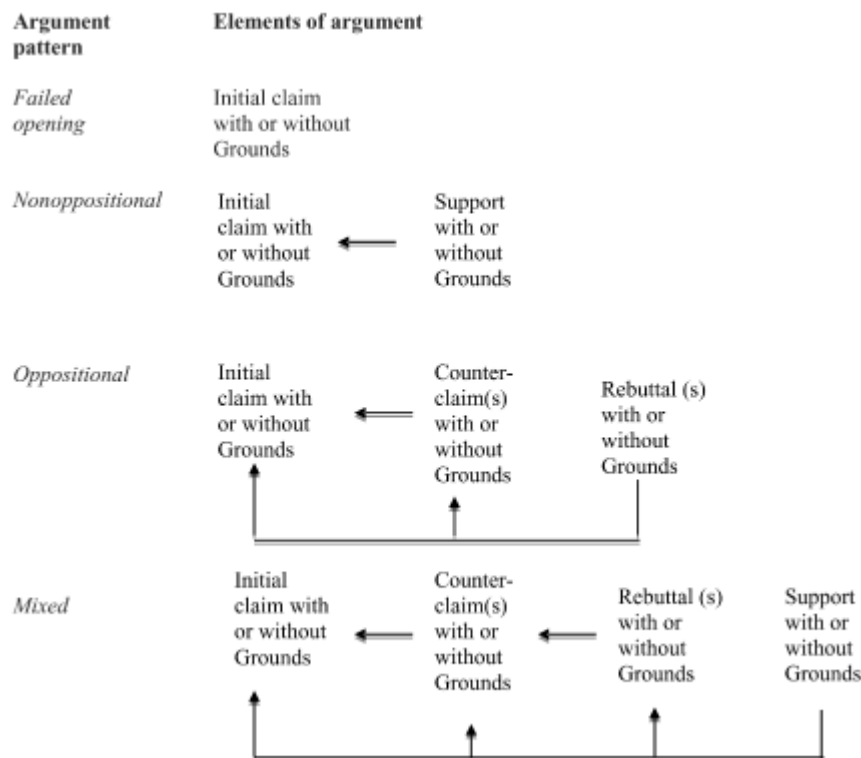


FIG. 1. The framework of the study.

Figure 1 suggests that depending on the number of elements, four argument patterns can be identified. The oppositional argument pattern differs from the failed opening and non-oppositional argument pattern in that the number of elements and their order in oppositional argumentative discussion can vary: an initial claim presented by a participant may be followed by a counter-claim or a rebuttal. Sometimes, however, an oppositional pattern may include fewer counter-claims or rebuttals. The mixed argument pattern incorporates the elements of oppositional and non-oppositional patterns. Similar to the oppositional pattern, an initial claim may be followed by counter-claim(s) and/or rebuttal(s). In addition, a mixed pattern includes one or more indications of support. The order of the elements may vary, depending on whether the initial claim is first supported or whether it is questioned by a counter-claim or rebuttal. As the discourse proceeds, further counter-claims can be presented, and they may be supported or rebutted within a mixed pattern. In all four patterns specified in Figure 1 above, the elements of argument can be bolstered with grounds of some kind; these elements may also appear without any grounds.

### Research questions

Drawing on the conceptual framework presented in Figure 1 above, the present study addresses the following research questions:

RQ1: How are the argument patterns structured in Q&A discussions?

RQ2: How frequently do various patterns appear in such discussions?

RQ3: What kind of opportunities to assess the credibility of answers do various argument patterns provide for the participants of Q&A discussions?

To sharpen the focus of the study, a few limitations were necessary. First, the focus is placed on the structure and content of argument, not the process of argumentation (cf.

Clark et al., 2007, pp. 347-348). Second, the ways in which the presentation order of the elements of argument are associated with the potential of assessing the credibility of answers will not be examined. Third, no attempt will be made to specify how the diverse argument patterns provide opportunities to evaluate (i) the quality of the answer's information content, distinct from (ii) the credibility of the author of the message, i.e., answerer. In this study, following the idea of Kim (2010), the credibility of answer entails both aspects.

### **Empirical data and analysis**

The empirical study focuses on Q&A threads discussing the issues of global warming on the site of Yahoo! Answers (<http://answers.yahoo.com/>). On this site, the process of asking and obtaining answers to a question is quite simple: an asker (or questioner) posts a question under a relevant category from twenty-five top-level topic categories and it becomes an open question. Once the question is posted, any user (answerer) can post an answer to it. Among all answers posted, the questioner can select the best answer or, alternatively, allow the community to vote for the best answer. When a best answer is chosen, either by the questioner or by the vote, the question becomes a resolved question (Kim, 2010). Figure 2 illustrates Yahoo! Answers through which participants are interacting.



[Advanced Search](#)

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!

**Resolved Question** [Show me another >](#)

**How does global warming negatively impact coral reefs?**

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**Best Answer - Chosen by Voters**

It doesn't - obviously don't what is this warming of which you speak? where is it happening and how much? Non-existent features don't have any kind of impact on anything.

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**40% 4 Votes**

↓ 3 people rated this as good

Action Bar

 Interesting!
  Email
  Comment (0)

**Other Answers (11)**
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**Answer #1**

It isn't so much the effect of temperature on coral reefs as it is ocean acidification which is affecting coral reefs. Ocean acidification is reducing the concentration of carbonate ions in the ocean, which is reducing the ability of corals to build their structures.

[http://www.earthtimes.org/antarctica/...](http://www.earthtimes.org/antarctica/)

I don't know if temperature has much effect on coral. Most marine animals do poorly in warm water because oxygen is less soluble in warm water. But healthy coral gets its oxygen from symbiotic algae.

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**20% 2 Votes**

↓ 3 people rated this as good

😊

**Answer #2**

To my knowledge:

Corals are fairly sensitive to temperature, needing a particular fairly narrow range of temperatures to survive. Global warming changes ambient temperatures, and corals can't get up and move to a better location.

Corals need water at a particular depth. Global warming changes sea levels. Again, corals can't move.

Corals make carbonaceous shells. Ocean acidification, which 1. shares a cause with global warming (excess atmospheric CO2), and 2. I believe is somewhat exacerbated by global warming, makes it harder for organisms to form carbonaceous shells, since the shells sometimes dissolve as fast as they can be formed.

Science(s)

Please check out my open questions

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↓ 2 people rated this as good

😊

**Answer #3**

It doesn't, this is another "non-fact" overripe hot out to prove the myth of Global Warming, reefs are being damaged by man in the form of overfishing, dynamiting, fresh water extraction, pesticides herbicides wash off etc but not repair our Global Warming. Go to any non-take zone in the world and you'll find the coral is growing back.

[http://www.zimbic.msu.com/d4562815.html...](http://www.zimbic.msu.com/d4562815.html)

[http://www.ncbi.nlm.nih.gov/pubmed/19111111...](http://www.ncbi.nlm.nih.gov/pubmed/19111111)

<http://www.sciencedaily.com/releases/2011...>

And I hope none "of the usual suspects", ie die-hard warmies who appear regularly on here are rushing to refute this.

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**0% 0 Votes**

↓ 4 people rated this as good

😊

**Answer #4**

They're dying

There are two factors that affect them, the warming temperatures and the increased acidity as the oceans absorb some of the excess CO2.

Science(s)

[http://www.epa.gov/global\\_warming/faq...](http://www.epa.gov/global_warming/faq)

<http://www.sciencedaily.com/releases/200...>

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**10% 1 Vote**

↓ 3 people rated this as good

😊

**Answer #5**

We do not precisely know the full life of coral reefs, as they spread over centuries, & are beyond our easy reachability, lab. ozone verification potentials, & ..... The some equilibrium, CO2 concentrations, sea-level acidity variations, food, oxygen supply, -all these can make them grow or affect their life cycles. As they are so primitive, the concept of life- food-death need not apply for them! Thus the little studied corals are as strange to us as aliens!

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**0% 0 Votes**

↓ 1 person rated this as good

😊

**Answer #6**

A prolonged increase in ocean temp will kill coral. This happened at Kanton in the Phoenix Islands a few years ago. The water increased only 1 degree but it stayed stationary and didn't move, killing the coral there. It is in the process of bouncing back, only because the fish were protected and kept the area clean.

[http://www.pcf.org/press/CantonIsland...](http://www.pcf.org/press/CantonIsland)

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FIG 2. Yahoo! Answers interface.

The empirical data were downloaded in December 2011 by taking a sample of 100 Q&A threads available in topic category Environment/ Global warming. The messages had been posted to these threads within the period of 24 November – 6 December 2011. Only threads containing 5 or more messages were taken in the sample because it appeared that shorter threads do not sufficiently enable the development of argumentative discussion. The threads meeting the above criterion were chosen from the sub-sections of “In voting/most popular” (altogether 18 threads), ”Open/most popular” (47 threads), and “Resolved questions/ newest” (35 threads). The sub-sections provided similar material for the study: there were no particular differences with regard to the topics of discussion and the length of the threads, for example.

The downloaded threads were first read carefully several times in order to identify individual messages explicitly focusing on the phenomena of global warming or more broadly: climate change caused by the rising average temperature of Earth’s atmosphere. Messages (or parts of messages) discussing peripheral issues, which only indirectly are related to global warming (for example, pollution of air) were excluded from the analysis. The relevant parts of the messages, i.e., a sentence or fewer related sentences were then coded by making use of the categories specified in Figure 1 above. First, the initial claim presented about a particular topic, for example, the risk of flooding caused by global warming, was identified in the message posted by the asker or an answerer. If the initial claim was bolstered with Grounds of some kind, the type of the Grounds was coded, too. Then, other messages commenting on the initial claim within the same thread were scrutinized to identify other elements of argument related to the initial claim. A code was assigned to each element (for example, rebuttal) when it occurred for the first time within a message; other instances of the same element, for example, restatement of a rebuttal within the same message, were simply ignored. In this way, a sub-thread consisting of messages containing elements of argument was identified. A sub-thread thus formed is the unit of analysis, too. Drawing on the conceptual framework presented in Figure 1 above, a combination of such elements forms an instance of unique argument pattern, for example, initial claim => counter-claim => support of initial claim. In cases in which another participant initiated discussion about a relevant topic, for example, the melting of icebergs as a cause for flooding, the initial claim about this topic started a new sub-thread with diverse elements of argument. Therefore, the same thread can entail one or more sub-threads indicating the instances of unique argument patterns.

In the coding of Grounds, the type of evidence was specified by using the following categories: fact, personal belief, opinion of other people and emotive appeals. These categories were identified inductively from the research data. *Fact* was understood as something that has really occurred or is actually the case and is potentially verifiable (testable) though not necessarily true. In the coding, a ground was defined as a fact if the arguer provided explicit evidence for the existence of the state of affairs by referring to statistical data or scientific reports, for example. *Personal beliefs* were defined as subjective assumptions about the nature, value and meaning of the state of affairs articulated by the participants. *Opinion of other people* was defined as subjective views presented by other individuals. *Emotive appeals* denote the affectively colored assessments of the characteristics of other participants. For

example, emotive appeals can be used to undermine the credibility of a rebuttal by labeling its presenter as a “denialist” of global warming or a “warmist” exaggerating the risks of climate change.

In order to strengthen the validity of the coding, the initial coding was checked iteratively by the present author. Because the study is exploratory and does not aim at statistically representative generalizations of Q&A sites, the requirement of the consensus on coding decisions based on interrater reliability can be compromised without endangering the reliability of the exploratory study. According to Miles and Huberman (1994, p. 65), check-coding the same data is useful for the lone researcher, provided that code-recode consistencies are at least 90%. Following this idea, check-coding was repeated, and the initial coding was carefully refined. Check-coding revealed a few boundary cases regarding the categories of counter-claim and rebuttal. These cases were resolved by scrutinizing the content of the message in the context of the sub-thread constitutive of an individual argument pattern. The refining of the coding was continued until there were no anomalies.

To answer research question 2 dealing with the frequency of various argument patterns, the data were scrutinized by means of descriptive statistics. Most importantly, the percentage distributions were calculated for the argument patterns per 100 Q&A threads, as well as for the diverse elements of argument per argument pattern. Second, to answer research questions 1 and 3, qualitative content analysis was conducted. The constant comparative method was used to capture the variety of articulations of the elements of argument and the ways in which they appeared as constituents of various argument patterns (Lincoln & Guba, 1985, pp. 339-344). As the qualitative data appeared to be saturated enough, it was possible to draw sufficiently coherent and credible picture of the nature of argument patterns in the Q&A forum.

Since the contributors to Yahoo! Answers are expected to be well aware of the fact that their messages will become publicly available on a social Q&A site, no attempts were made to contact the askers and answerers to obtain permission for the use of their messages in the present study. Asking permission would have been difficult in practice because the majority of the contributors appeared to be occasional users; they may not be motivated in answering for requests such as these. However, when using the illustrative extracts taken from messages, the anonymity of the contributors is carefully protected. Their nicknames are replaced by neutral identifiers such as Asker, Thread 12 or Answerer 6, Thread 97. Given the high number of Q&A threads discussing global warming, it is unlikely that such extracts could be associated with individual contributors.

## **Findings**

### *Quantitative overview of the argument patterns*

One hundred Q&A threads contained 1020 messages. Of them, 100 were questions posted by 95 individual askers and 920 answers provided by altogether 497 individual answerers. Thus, on average, a question attracted 9 answers. The number of answers per question varied between 5 and 25. The answering activeness was distributed unevenly since 83% of the answerers provided only one answer, while 5.5% posted

two answers and 2.6% three answers. The share of most active answerers posting 10 or more answers was 2.6%. Overall, the uneven distribution of a few active contributors and a long tail of occasional participants is characteristic of the participation activeness in online forums such as discussion groups (Savolainen, 2011a; 2011b).

The participants presented altogether 259 initial claims, either in the context of questions or answers. Of the initial claims, 7% were formulated by the askers and 93% by the answerers. Of all initial claims, 80.3% were bolstered with grounds. Almost all counter-claims (96.7%) were presented by the answerers. Of all counter-claims, 60.3% were supported by grounds. Similarly, the majority of rebuttals were presented by the answerers (96.6%). Of all rebuttals, 95.5% were bolstered with grounds; this evidences that the participants were more active to provide grounds for rebuttals than for initial claims and counter-claims. Of the indications of support for claims, counter-claims or rebuttals, 90.5% were bolstered by grounds. Table 1 specifies the percentage distribution of the Grounds of diverse types and provides illustrative examples of them.

Type of Grounds	Personal beliefs (n = 256)	Facts (n = 132)	Opinions of other people (n = 21)	Emotive appeals (n = 10)	Number of mentions in total (n = 419)
Percentage	61.1	31.5	5.0	2.4	100.0
Examples	“The Earth has gone through climate change before in the past, i.e. the Ice Age. I believe Earth is just running its course” (Thread 91)	”Humans emit over 30 gigatons of CO2 on an annual basis while the atmosphere is increasing by 2 ppm or approximately 15.8 gigatons annually”. Source: <a href="http://www.nature.com/ngeo/journal/v3/n1...">http://www.nature.com/ngeo/journal/v3/n1...</a> (Thread 40)	” So, he said that if he is right, that global warming can save us.” (Thread 65)	“That is just a little too far over the Stupid Line. You are a troll, right?” (Thread 2)	

TABLE 1. Distribution of Grounds used in argumentation.

The arguments were mainly supported by drawing on personal beliefs (61.1 %) and facts (31.5%), while opinions of other people (5%) and emotive appeals (2.4%) remained marginal in this regard.

Altogether 259 instances of unique argument patterns were identified. Thus, on average, there were 2-3 unique argument patterns per thread. The number of unique argument patterns per thread ranged from one to seven. As depicted in Figure 1 above, the argument patterns were further classified into four types on the basis of the combination of elements of argument. The majority of the instances of unique argument patterns (163 out of 259) that is, 62.9 % were failed openings consisting of the initial claim only. This suggests that in Q&A forums, the participants do not necessarily engage in argumentative debate to question or support the claims presented by others. Therefore, the messages often remain as a set of monologues. Of all instances of unique argument patterns, 15.1% were oppositional, 13.1% non-oppositional and 8.9% mixed in nature.

### *Qualitative features of the argument patterns*

#### Failed openings

Failed opening appeared to be the most frequent argument pattern. One out of five initial claims were presented by providing no grounds. We may take a couple of examples to illustrate initial claims of this kind.

Question presented by the Asker: “Do first graders generally know what global warming is?” (Thread 35)

There is not such a thing as global warming! (Answerer 11, Thread 35)

Question presented by the Asker: “I need help finding peer-reviewed articles on global warming.” (Thread 7)

Earth is not the only place experiencing global warming. (Answerer 4, Thread 7)

Since claims such as these are very general and fairly categorical, they do not provide a fertile ground for developing arguments for or against. Therefore, it is easy to ignore such claims and devote attention to more specific assertions. In most cases, however, the participants provided grounds of some kind to bolster their claims. To this end, they mostly drew on their personal beliefs.

Question presented by the Asker: “Given the Earth is warming, why is there this anomaly with ice size?” (Thread 2)

Overall, the ice caps have been reducing, the short increases are probably due to climatic forces such as the *La Nina* effect. As a non-scientist but avid reader this is my best take on the situation. (Answerer 9, Thread 2).

In a few cases, the initial claims were bolstered by drawing on facts.

Question presented by the Asker: “Does pollution affect climate change?” (Thread 12)

It is reasonable to assume that man-made greenhouse gases influence climatic change. However, 70 to 80% of all greenhouse gases are produced naturally so the impact of man-made GHGs (= greenhouse gases) is not known. (Answerer 4, Thread 12)

From the viewpoint of assessing the credibility of the answers, initial claims presented without grounds are most problematic because the asker (or the reader) of a Q&A thread encounters difficulties in trying to put such claims in a meaningful context. Initial claims bolstered by facts or personal beliefs are potentially more useful since they provide concrete points which can be used while judging the credibility of an answer. Nevertheless, many of the initial claims with grounds remained monologues. This may be simply due to that none of the participants became sufficiently interested to comment on an initial claim. We may also speculate that in the case of fact-based grounds, a participant may not feel him- or herself sufficiently competent to argue for or against the statistical data, for example, that "70 to 80% of all greenhouse gases are produced naturally" (as proposed by Answerer 4 above).

#### Non-oppositional argument patterns

About 13% of argument patterns were non-oppositional in nature. The major characteristic of non-oppositional argument pattern is that other participants indicate support for the initial claim by agreeing with it. In most cases, the non-oppositional argument patterns were short, and they typically entailed 1-2 indications of support. All initial claims constitutive of non-oppositional argument patterns were presented by the answerers. Of these claims, 88% were bolstered by grounds of some type. Of the supporting indications, 82% were backed by grounds. To illustrate the nature of non-oppositional patterns, we may take first an example of the cases in which both the initial claim and the indication of support were presented without ground.

Question presented by the Asker: "What are some examples of global warming?" (Thread 67)

Initial claim:

Sea ice in the Arctic Ocean is thinning. Massive Antarctic ice sheets have collapsed into the sea with alarming rapidity. (Answerer 6, Thread 67)

Support:

Ice-burbs are melting on the both poles. Sea level is increasing. (Answerer 11, Thread 67)

In the above example, the argument pattern is very short. The commentator (Answerer 11) agrees with the initial claim presented by Answerer 6 by rephrasing her statement. From the viewpoint of the asker, argument patterns such as these may result in the judgment of the former message as credible because the latter message confirms the former. On the other hand, the credibility of the answer may be weakened by the fact that the participants provided no explicit grounds to bolster their statements; they just agreed on this issue. In most cases, however, both the initial claims and indications of support were bolstered by referring to facts, personal beliefs or the opinions presented by other participants.

Question presented by the Asker: “How many is 97% of climate scientists?” (Thread 47)

Initial claim:

In 2010, the National Academy of Sciences conducted research amongst the 1372 most published climate scientists and concluded that...“(i) 97–98% of the climate researchers most actively publishing in the field support the tenets of ACC (= Anthropogenic Climate Change) outlined by the Intergovernmental Panel on Climate Change, and (ii) the relative climate expertise and scientific prominence of the researchers unconvinced of ACC are substantially below that of the convinced researchers.” PNAS-2010-Anderegg-1003187107.pdf (Answerer 1, Thread 47)

Support:

X actually answered your question correctly and received 5 thumbs up for answering a question correctly. (Answerer 8, Thread 47)

In the above example, the presenter of the initial claim (Answerer 1) draws on the facts published in a survey report. To strengthen the credibility of the initial claim about the distribution of views among climate scientists, a hyperlink is provided to the original document for a more detailed study. Answerer 8 strongly supports the claim presented by Answerer 1. In addition, he evaluates positively the overall quality of her answer by referring to 5 votes received from the readers of the thread.

Often, however, non-oppositional argument patterns were based on the presentation of opinionated views rather than facts.

Question presented by the Asker: “Why are humans significant agents of climate change?” (Thread 64)

Initial claim:

Humans are not significant agents of climate change, that is just propaganda. While it is true the globe has warmed somewhat over the last several decades, none of it is human caused. There is nothing people are currently doing that significantly impacts the climate. You might find that hard to believe, watch these videos and you will see it istrue: The Great Global Warming Swindle <http://www.youtube.com/watch?v=YaTJJCPYhIk> (Answerer 6, Thread 64)

Support:

There is no substantial proof that man has more than a minor effect, if any. The climate models used have too many "undetermined" variables filled in with "guesstimates"! (Answerer 7, Thread 64)

The initial claim is strongly grounded on the personal belief that global warming is “just propaganda”. The claim is supported by a hyperlink to a YouTube video. This strengthens the view that Answerer 6 is not alone with his opinion. Answerer 7 agrees with the above view by casting doubt on the credibility of climate models. From the perspective of the asker, the credibility of answers such as these may be difficult to assess because they are not questioned from an alternative viewpoint. Overall, the

above findings support the results of Sampson and Clark (2007, p. 268) focusing on students discourse episodes. The non-oppositional discussions appeared to be relatively unsophisticated. Students were liable to accept what is written in the claim and moved onward.

### Oppositional argument patterns

Of all instances of unique argument patterns, about 15% were oppositional in nature. As a whole, these patterns contained somewhat more argumentative elements than non-oppositional ones, even though usually no more than 2 or 3 elements; the highest number of elements was 10. Of the initial claims, the majority (74.3%) was bolstered by grounds of some type. Further, of the counter-claims, two out of three were supported by grounds of some kind. Finally, about 88% of the rebuttals were supported by personal beliefs, facts or grounds of other kinds. Thus, the participants devoted particular attention to the strengthening of the rebuttals.

In the simplest form, an oppositional argument pattern consists of an initial claim plus a counter-claim. In most cases, the claims of both types were supported by personal beliefs or facts.

Question presented by the Asker: “Help my climate change paper.” (Thread 16)

Initial claim:

Climate change has become a worldwide issue and has affected Canada in many different ways. It has affected the average temperature, the amount of precipitation we face, and of course it has impacted the animals which reside in our country. (Asker, Thread 16)

Counter-claim:

Ignore all. The climate change does not exist and it is propaganda. (Answerer 1, Thread 16)

In the above example, the asker presents an initial claim by drawing on her beliefs about the changes of average temperature and the amount of precipitation. The counter-claim presented by Answerer 1 denies the existence of climate change. The counter-claim is grounded by drawing on the belief that the discourse about climate change is ideologically biased. Due to the generality of grounds such as these, the oppositional argument pattern remains very short. The participants just present the opposite views and the discussion is not continued.

The oppositional argument patterns were longer if they included both counter-claims and one or more rebuttals.

Question presented by the Asker: “Why is there such hostility from most staunch believers of anthropogenic global warming (AGW)”? (Thread 55)

Initial claim:

It seems now that anybody who disagrees with the AGW hypothesis is a liar. (Asker, Thread 55)



Counter-claim:

It is not a hypothesis. It is a scientific theory. (Answerer 5, Thread 55)

Rebuttal-1:

Well, for one, calling AGW a "hypothesis" is a little silly, don't you think? Meant evoke petty arguments rather than promote rational discussion? (Answerer 6, Thread 55)

Rebuttal-2:

You start by saying "It seems now that anybody who disagrees with the AGW hypothesis is a liar." Why in the world do you believe this? It is certainly not the way I feel, and I don't think it is the way most people feel. The people I call liars are the ones I believe are lying - that has nothing to do with whether or not they believe in the science of AGW. I think many people on the denial side are not technically lying because they don't understand they are distorting the truth or misstating facts. (Answerer 8, Thread 55)

In the above argument pattern, all contributors bolster their statements by drawing on personal beliefs about whether anthropogenic global warming (AGW) is a hypothesis or a scientific theory. Statements such as "anybody who disagrees with AGW is a liar" are emotionally laden, referring to the ideological struggle between the "warmists" and "denialists". Even though the participants do not provide any facts to support their views, oppositional argument pattern may provide a richer and more credible source of information for the asker than non-oppositional pattern because the former identifies the conflicting viewpoints. The provision of rebuttals indicates that their presenters are aware of opposing views, and are not trying to ignore them. On the other hand, the presenters of rebuttals can make attempts to ground their alternative views by anticipating the objections that other participants may have.

In oppositional argument patterns, the order in which the argumentative elements are presented may vary. The initial claim can be questioned by presenting a rebuttal, while counter-claims indicating disagreement with the initial claim may appear later on as new participants send their comments. Thus, an oppositional argument pattern may become fairly complicated if there are a number of counter-claims and rebuttals. On the other hand, an oppositional argument pattern can provide a lot of detailed information if the participants make attempts to challenge the initial claim by means of counter-claims and rebuttals. Along with this process, the assumptions of the initial claim can be specified and the rebuttals may provide useful information that refines the picture of the issue at hand. This enables the comparison of alternative views, thus helping the asker to evaluate the credibility of the answers. On the other hand, the higher the number of counter-claims and rebuttals, the more difficult it is for the asker to evaluate the answers by creating a summary picture of their pros and cons. Thus, oppositional patterns exemplify particularly well the dilemma of whom to believe and whose evidence counts most? In fact, the asker may face the dilemma identified by Myerson and Rydin (1996, p. 216): "there seem to be all too many arguments for and against the assumptions of global warming and there may be no solution directly arising from such arguments. Diverse arguments may have so many rivals that they could not possibly say whether they have won or not".

## Mixed argument patterns

These patterns differ from the oppositional ones in that in addition to initial claims, counter-claims and rebuttals, they contain indications of support. Of all instances of unique argument patterns, about 9% were mixed in nature. These argument patterns typically contained 3-5 elements; the highest number of elements was 13. Of the counter-claims, 54.5% were bolstered by grounds of some kind. Furthermore, of the rebuttals, about 83% were supported by grounds of some type. Thus, similar to the oppositional argument patterns, the participants were more active in providing grounds for rebuttals than for counter-claims. Finally, of the indications of support, about 90% were bolstered by referring to personal beliefs, facts or grounds of other types. The following extract illustrates the nature of the mixed argument patterns.

Question presented by the Asker: "Is global warming real?" (Thread 75)

Initial claim:

It is normal that climate is changing? Absolutely

<http://www.noaanews.noaa.gov/stories2010...> We are causing it.

<http://c1.planetsave.com/files/2010/08/H...>

The ten warmest years in history are 2010, 2005, 2009, 2007, 2002, 1998, 2006, 2003, 2004 and 2001. <http://data.giss.nasa.gov/gistemp/> (Answerer 1, Thread 75)

Support-1:

No legitimate scientific body on the planet denies global warming exists. Says it all in my opinion. (Answerer 2, Thread 75)

Rebuttal-1:

As real as global cooling. Everything on this planet is cyclic in nature. As real as an Ice age, is the truth of global warming, one cannot be without the other. You cannot have a sunset without a sunrise. It is the Yin and Yang of our world, the light and darkness. There simply cannot be one without the other, the balance that is nature, if you choose to believe it or not. (Answerer 4, Thread 75)

Support-2:

Yep. We are causing it. Here are a few sources for more information

<http://www.skepticalscience.com/>

<http://aip.org/history/climate/summary.h...>

<http://www.epa.gov/climatechange/>

(Answerer 5, Thread 75)

Counter-claim-1:

No, global warming is very fake. It was created by all the power hungry people to create big money. (Answerer 8, Thread 75)

Counter-claim-2:

Absolutely not. It is basically just a whole bunch of Bologna. (Answerer 9, Thread 75)

Support-3:

Yes, that is why it is been hot hell the past couple of summers:) (Answerer 10, Thread 75)

Counter-claim-3:

No, it is just a bunch of money hungry people who make millions off of lying. (Answerer 13, Thread 75)

It is a characteristic of mixed argument pattern that the discourse easily becomes complicated because there may be a number of counter-claims and rebuttals, as well as indications of support for other elements of argument. The general tone of discussion is dependent on the extent to which the participants place emphasis on counter-claims and rebuttals versus indications of support, and the extent to which the indications of support concern the initial claim or the counter-claims and rebuttals. The above extract exemplifies a typical pattern in which the opinions are strongly divided and the elements of argument are bolstered by personal beliefs as well as facts. Similar to oppositional argument pattern, the asker is provided with conflicting answers. On the one hand, they shed light on the various sides of the issue at hand. On the other hand, the evaluation of the credibility of the answers can be easier because the indications of support with fact-based grounds in particular can provide additional evidence for the higher quality of an answer compared to its rivals.

## **Discussion**

Mainly drawing on Toulmin's (2003) model, the present study examined the ways in which argument patterns are structured in a social Q&A forum. Failed opening appeared to be the most frequent argument pattern (63% of all instances of unique argument patterns), followed by oppositional (15%), non-oppositional (13%) and mixed (9%) argument patterns. While providing grounds for their arguments, the participants mainly drew on their personal beliefs. In addition, facts were used as grounds quite frequently, while the role of the opinions of other people and emotive appeals remained marginal. Overall, the participants were more active to provide grounds for rebuttals and indications of support than for initial claims and counter-claims.

The finding that failed openings and non-oppositional patterns occupied a large share (altogether 76% of all instances of unique argument patterns) suggests that most Q&A discussions seem to be broad but not particularly deep. As a whole, the argument patterns appeared to be fairly unsophisticated. Failed openings and non-oppositional argument patterns offer only limited opportunities for the evaluation of the credibility of the answers because these patterns simply introduce the initial claims or indicate that some of the participants agree with them. On the other hand, the share of oppositional and mixed argument patterns (altogether 24%) is not insignificant. These patterns are more sophisticated and they provide better opportunities for the participants to evaluate the credibility of the answers. The presentation of counter-claims and rebuttals is an effective way to develop alternative answers to the asker's question. On the other hand, the evaluation of the credibility of the answers becomes more difficult along with the growing number of conflicting views suggested by opposing claims and rebuttals. The existence of mixed patterns can make the credibility judgment easier if the indications of support confirm the initial claim,

counter-claim or rebuttal by offering further evidence for or against competing answer candidates.

The empirical findings cannot be directly compared to the results of earlier Q&A studies because the study approach is novel. However, the findings provide confirm the results of studies discussing the features of credibility judgment in online forums. In an empirical investigation of online discussion groups Savolainen (2011a) demonstrated that the participants evaluate the quality of the message's information content and the credibility of the author by drawing on diverse criteria such as the factuality of information and the perceived expertise of the writer of a message. In an investigation focusing on the users of Yahoo! Answers Kim (2010) found that the fact criterion was used both positively and negatively; a factual assertion made in the answer to a discussion question positively impacted credibility judgment while a lack of fact-based information resulted in a negative judgment. The findings of the present study suggest that providing initial claims, counter-claims and rebuttals with fact-based grounds can be an effective strategy in the defense of one's arguments. On the other hand, similar to Gazan's (2006) and Kim's (2010) findings, the self-claimed expertise or merely drawing on one's personal beliefs may elicit more doubt, thus giving rise to counter-claims or rebuttals.

The comparison of the findings dealing with online discussion groups and Q&A sites is rendered difficult because the latter arenas are constrained by the setup of the architecture, which has a strict question and answer format. Q&A threads must start with a question, and the participants mainly interact by answering the question, not by addressing one another. Furthermore, one cannot answer more than once nor can one answer oneself, making it technically difficult to organize debates similar to online discussion groups (Adamic et al., 2008, p. 667). Another difference between Q&A sites and online discussion groups is that in the latter arenas, the debates are not necessarily concluded by binding decisions reached at the end of the process of exchange of arguments and criticisms (Lewinski, 2010, p. 90). Thus, no single person can be seen as an agent able to carry the burden of proof successfully from the confrontation to the point of coming to a reasonable conclusion, and thus to the point at which a difference of opinion is resolved (Lewinski, 2010, p. 103). In Q&A sites, however, it is expected that the question posed by an asker will be resolved, at least partially, even though the answer voted as best does not necessarily guarantee that a final solution to a problem has been found. On the other hand, Q&A discussions entailing oppositional and mixed argument patterns may remain open-ended, similar to debates taking place in online discussion groups.

## **Conclusion**

The main contribution of the present study is the empirical specification of the ways in which argument patterns are structured in Q&A discussions. The study also shows how various argument patterns provide opportunities to evaluate the credibility of answers available on Q&A sites. However, the findings of the present study are limited because issues such as global warming are inherently controversial, ideologically laden and often subject to opinionated debate. Kim (2010) draws attention to this fact in a study characterizing the credibility judgments among the users of Yahoo! Answers. The users felt that biased and hateful users tend to be abundant particularly in politics, religion, and global warming categories where

opinions are particularly divided. Diverse argument patterns may be distributed differently in Q&A discussions focusing on less controversial topics such as hobbies. Since the present study focuses on Q&A threads available in Yahoo! Answers, caution should be taken in generalizing these results to other social Q&A sites.

There is a need to elaborate the study of argumentation practices by making use of alternative research approaches. This is reasonable because one of the limitations of Toulmin's (2003) model is that it takes a somewhat schematic approach to the specification of the elements of argument, as well as their relationships. As Crosswhite (2008, p. 170) rightly points out, Toulmin's model does not draw attention to the complexities of rhetorical situations in which argumentation takes places. To elaborate these issues, the ideas of rhetoric could be used in the analysis of argument patterns and argumentation process (Burke et al., 2007). Intriguing questions include, for example, what kind of rhetorical devices and strategies are used in the defense of counter-claims and rebuttals in Q&A discussions? Further, how effective is the use of diverse rhetorical devices in the defense of arguments? Relevant topics of further research also include the analysis of the features of successful versus unsuccessful argument strategies. This issue may be examined by focusing on the selections of "best answers" chosen by the askers or the participants. Such investigations would also contribute to the studies of answer quality in Q&A forums. Finally, the above questions could also be addressed in comparative studies examining the ways in which argument patterns are structured on Q&A sites and discussion groups. It is evident that comparative studies such as these would also shed light on the ways in which the credibility of messages can be evaluated in online forums.

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