Information and argument structures in Sociology research abstracts

Abstract
In a research abstract, information and arguments have to be organized and presented in a way that helps the reader to understand the research study and to be persuaded of the research arguments. This study analyzes the information and argument structures of 33 sociology research abstracts, focusing on 13 abstracts reporting investigative studies. The types and sequences of argument claims were analyzed, as well as the conceptual structure of each argument claim. Two semantic frames – the research-relation frame and the comparison frame – were applied to analyze the types of information provided, as well as how the semantic frames were progressively filled along the argument chain in the abstracts.

1. Introduction
Research papers typically contain an abstract with an organization structure that is a variation of the well-known IMRaD format: introduction, method, results and discussion/conclusion/contribution (Sollaci & Pereira 2004). Content-wise, an abstract provides an overview of the research study, including the research objectives and often an outline of the research method and results. A good abstract will also make an argument for why the research objective is worth investigating (e.g. by pointing out a research gap), and will justify the validity of the research results and the significance/contribution of the study. The information content and arguments have to be expressed textually in a way that helps the reader understand the information provided, and be persuaded of both the explicit and implicit arguments put forward.

This study analyzes the information and argument structure of sociology research abstracts. An argument can be divided into the argument claim (e.g. that a research objective is well-founded and worth investigating) and supporting argument (e.g. a research gap). The argument structure of a text (e.g. abstract) is the pattern of argument claims and supporting arguments represented in the text. This study first identifies the types of argument claims found in sociology research abstracts, and then analyzes the sequences of argument claims (referred to as argument chains) to identify argument chain patterns.

Information structure in this paper refers to the conceptual structure of argument claims and supporting arguments. An argument contains several pieces of information that are linked together. The argument claim often has a complex structure: for example, a research result may specify that a concept A causes another concept B in a particular context. The information structure can be represented as patterns of concepts and relations, represented graphically as a network of nodes (concepts) and edges (relations). This study makes use of the idea of semantic frames from frame semantic
theory (Fillmore 1976) to represent common information structures or patterns. The basic assumption of frame semantic theory is that the meaning of a word is embedded in and understood within a set of related concepts representing the essential knowledge related to a particular type of event or situation. The set of related concepts can be represented as a semantic frame specifying the expected relations/roles/slots and the types of concepts that can fill those roles.

In this study, we developed a few semantic frames to represent common situations represented in a research text, the types of information that are expected in the text, and the roles the pieces of information play in the situation. This paper focuses on two important and prevalent semantic frames found in research papers:

- the research-relation frame represents a relation (e.g. cause-effect relation) between two concepts, as well as the types of information that are relevant to the relationship, including the modality (i.e. true, false, probable, etc.), the size of the relation, and the evidence for the relationship. The Research-relation frame is often found in those sentences outlining the objectives and results of research.
- the comparison frame represents comparisons between two or more concepts, as well as the result of the comparison. It is often used to compare attributes of concepts and research outcomes in sentences outlining research objectives and results.

2. Literature review

The concept of argument in academic writing has been defined in different ways. It has been characterized as a main idea referred to as a “claim” or “thesis statement” supported by evidence (The Writing Center, University of North Carolina at Chapel Hill, n.d.). Some arguments are obvious and easily recognized by the reader because they “make a direct claim based on or drawn from evidence” (Lunsford & Ruszkiewicz, 2016, p. 5). Other arguments are indirect and need to be inferred from the surrounding text, knowledge of the text genre (in this case, research abstract), and even the content domain (sociology research).

A commonly used argument model in the field of academic writing and genre studies is Toulmin’s (2003) model of argumentation, which indicates that the argument claim may have qualifiers and rebuttals, and the supporting argument includes the data or evidence, the warrant (that authorizes the inference step from the data to the claim), and backing (which provides support for the warrant).

Although Toulmin’s (2003) model has been used to analyze and evaluate the argument structure in various educational contexts, several scholars (e.g. Wingate 2012) have noted that it can only model micro-level argument instances instead of macro-level argument structures. Toulmin, Rieke and Janik (1984, p. 14) referred to
we refer to as the **argument structure**.

We also analyzed the conceptual structure of each argument at the micro-level using the research-relation frame and the comparison frame to identify the types of information represented in each argument. Ou, Khoo and Goh (2007) have previously analyzed the conceptual structure of research objective sentences in sociology dissertation abstracts. The research-relation frame in this study is an extension of their variable-based framework. In addition, we analyzed how the instantiated research-relation frame evolves along the argument chain—that is, how each argument along the chain adds new pieces of information to the research-relation frame, or modifies the existing information.

3. Methodology

The data for this study were abstracts taken from 33 journal articles published in eight sociology journals with high impact factor listed in InCites Journal Citation Reports. Our preliminary analysis indicated that different types of research have different argument and information structures. In our sample of 33 articles, we identified six types of research: historical analysis, descriptive study, development study, evaluation study, identification study, and investigative study. Due to space constraints, this paper reports only our analysis of 13 abstracts that describe investigative studies, which make up 39% of the sample. We define an investigative study as research that aims to investigate a relation (*i.e.* cause-effect, association, or co-occurrence) between two concepts/entities, often by carrying out a survey or experiment.

Having previously developed three semantic frames in a preliminary study (Cheng, Khoo and Kathpalia, 2017), we herein describe and illustrate two of them, namely the *research-relation* and *comparison* frames, using an example abstract given in Table 1. This abstract (with the last two sentences left out) is part of a journal article reporting an investigative study to identify causal relations between two entities – embedded social media in hotels.
Table 1: Example abstract and chain of argument claims found

<table>
<thead>
<tr>
<th>Sentences in the example abstract</th>
<th>Argument claims</th>
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| [Support] Considering the strong [Research-relation] influence of social media on internet users, [Claim] it is important to understand its role for hotel businesses, particularly the online aspect of lodging operations. | Argument 1: Claim – Topic Centrality  
**Information structure:**  
[social media] –influence-> [internet users].  
[hotel websites] –attr-> [social media]. |
| [Claim] Although several social media studies have been done, very few studies have focused on travelers’ needs and the specific gratifications they seek when using embedded social media channels on hotel websites, and how those channels would [Research-relation] influence their purchasing behavior. | Argument 2: Claim – Research gap  
**Information structure:**  
[Internet users: travelers] –attr-> [gratifications]  
–attr-> [purchasing behavior]. |
| [Claim] The main purpose of the current research is to examine the effectiveness of embedded social media channels on hotel websites and their [Research-relation] influence on traveler behavior. | Argument 3: Claim – Objective/question  
**Information structure:**  
[affects]  
–cause-> [social media] <-attr- [hotel website]  
–effect-> [Internet users: travelers] |
| [Claim] Applying the uses and gratifications (U&G) approach, we examined [Research-relation] relationships among traveler gratifications, satisfaction, and purchase intentions by [Comparison] comparing user experience with hotel websites that used embedded social media channels to those without embedded social media channels. | Argument 4: Claim – Objective/question (narrower)  
**Information structure:**  
[travelers]  
–attr-> [gratifications]  
–attr-> [satisfaction]  
–attr-> [purchase intentions]  
[comparison]  
–cause-> [hotel website] –attr-> [social media]  
–effect-> [hotel website] –attr-> [NO social media] |
| [Claim] The results indicated that travelers exposed to the hotel website with embedded social media channels had [Comparison] higher levels of perceived informativeness, perceived enjoyment, and perceived social interaction that directly [Research-relation] influenced traveler satisfaction. | Argument 5: Claim – Result  
**Information structure:**  
[cause-effect]  
–cause-> [hotel website] –attr-> [social media]  
–effect-> [perceived informativeness, enjoyment, social interaction]  
–size-> [higher]  
[perceived informativeness] –affects-> [traveler satisfaction] |
| [Claim] In the context of embedded social media channels, the gratification factors, such as perceived enjoyment and perceived social interaction, directly [Research-relation] influenced traveler satisfaction and purchase intentions, and indirectly [Research-relation] influenced purchase intentions through traveler satisfaction. | Argument 6: Claim – Result (narrower)  
**Information structure:**  
[perceived enjoyment, social interaction]  
–affects->[traveler satisfaction, purchase intentions]  
[perceived enjoyment, social interaction]  
–affects-> [traveler satisfaction] –affects-> [purchase intentions] |

websites and traveler satisfaction. The first column lists the sentences in the abstract, and the second column indicates the types of argument claims represented in the sentences.

Figure 1 illustrates an instantiated research-relation semantic frame, showing the information structure of a particular research-relation specified in the example abstract of Table 1. Most investigative studies seek to identify specific relations (e.g. cause-effect and association) between important research concepts or entities. We refer to all these as research relations. The research-relation concept is linked by the relations concept1 and concept2 to two related concepts. In Figure 1, concept1 has been specialized to a more specific relation, cause. Concept2 is specialized to effect. Each concept may have one or more attributes and aspects. In Figure 1, attributes of the research-relation concept include size, and a direct or indirect relation. The instantiated research-relation frame shown graphically in Figure 1 represents the information structure of the abstract in Table 1.

4. Result

4.1. Analysis of argument chains

In a research paper, many types of arguments are made. In a preliminary study (Cheng et al. 2017), we identified eleven types of argument claims: centrality (or importance) of the topic, general statement (generalization), research gap, research issue/problem, research idea/approach, objective/question, hypothesis, method, result, development of something new, and contribution. We also identified ten types of supporting arguments.

We analyzed the argument chains found in the abstracts. For the example abstract from Table 1, the chain of argument claims is listed in the second column, and summarized as follows:

Topic centrality → Research issue/gap → Objective/question – Objective/question (narrower) → Result – Result (narrower)

This represents a fairly complete argument chain. From our analysis, we derived the following comprehensive argument chain for research abstracts:

General statement → Topic centrality → Established knowledge (from previous studies) → Research gap → Objective/question → Method → Result → Contribution/Recommendation

We shall refer to this as the full research argument chain. However, few abstracts use the complete argument pattern, most following a sub-sequence of the pattern. In the 13 abstracts in question, the objective/question and the result appear very frequently, in 12 (92%) and 11 abstracts (85%), respectively, while contribution is present about half of the time, in 6 abstracts (46%).
In 4 of the abstracts (31%), the objective/question is followed by one, or more, narrower objectives/questions. 5 abstracts (38%) show that a given result may also be followed by a narrower or more specific result. It is well-known that a research gap/problem/issue is an important argument and justification for carrying out research. We found that only 5 abstracts (38%) pointed out a research gap/problem/issue.

Overall, the abstracts follow the sequence of argument claims specified above, with one exception. One abstract asserts the centrality of the topic after the objective/question statement, probably to highlight the importance of the objective.

4.2. Analysis of information structure in the arguments

We analyzed the overall information structure of each abstract, by identifying the pieces of information in the text that fill different elements/roles in the research-relation and comparison frames, illustrated in Figure 1. Overall, cause-effect and association relations are found in almost all abstracts reporting investigative studies. Context information is provided in 69% of the abstracts, and modality in 46%. Furthermore, all
the research-relation frames are linked to one or more comparison relations, typically comparing attributes or aspects of a concept, and comparing alternative research-relations (representing different outcomes in the study).

We also analyzed how the research-relation and comparison frame elements are progressively specified along the argument chain. We focused our analysis on the following frequent argument progressions:

- Case 1: Established knowledge or Topic centrality \(\rightarrow\) Research gap
- Case 2: Research gap or Topic centrality or Established knowledge \(\rightarrow\) Objective/question
- Case 3: Objective/question \(\rightarrow\) Result
- Case 4: Result \(\rightarrow\) Contribution or Recommendation

For Cases 1 to 3, the Research-relation frame for the supporting argument is usually underspecified, and the argument claim will then add more detailed or specific information. Looking at Case 2 in more detail, a research gap statement typically indicates either an unknown element in a research-relation frame, or a general concept that needs to be specialized with a narrower concept. So the research objective statement that follows the research gap statement often provides more detailed information by:

1. Specializing the research-relation, for example from association in the research gap to cause-effect in the research objective statement.
2. Specifying the cause and/or effect concept in more detail, for example specifying a subclass or an attribute of the cause concept that is the actual causal factor.
3. Specifying two or more subclasses of the cause and/or effect concept for comparison.
4. Specifying additional types of information as constraints on the study.
5. Alternative causal concepts or factors

An exception is the case of established knowledge from previous studies \(\rightarrow\) research gap or objective/question. The research gap and objective statement may seek to broaden the research-relation that was established in previous studies. Case 4 (Result \(\rightarrow\) Contribution or Recommendation) also usually involves broadening or generalizing the research-relation information.

5. Conclusion

We have analyzed the argument chains in 13 sociology research abstracts reporting investigative research studies, and derived a comprehensive chain of argument claims. Most abstracts use a sub-sequence of this chain. We also identified the most common argument claims, and alternatives to the common argument claim sequences. We also analyzed the information structure with the help of two semantic frames (research-relation frame and comparison frame) that specify the types of information that are expected to be represented in the abstract. We identified the most common types of
information found, and how the semantic frame elements are progressively filled or modified from a supporting argument to the argument claim.

This study will be extended to other types of research studies (e.g. qualitative descriptive studies and evaluation studies), and carried out on the other sections of the research paper (e.g. Introduction and Literature Review). The results of this study can be applied to the teaching of academic report writing as well as inform research in natural language processing, especially in automatic discourse analysis and summarization of research papers, and in argumentation mining.

References