DISCOURSE RELATIONS AND AFFECTIVE CONTENT
IN THE EXPRESSION OF OPINION IN TEXTS

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Abstract

The purpose of this paper is to determine the influence that the interaction of discourse structure expressed by discourse relations (Mann & Thompson 1988) and affective lexical items classified as Attitude (Martin & White 2005) have on the overall opinion in texts. We focus on the eight most frequent discourse relations in our data which we extracted from two corpora: the Simon Fraser University Review Corpus (Taboada 2008) and the Penn Discourse Treebank 2.0 (Prasad et al. 2008). The results show that "No change" of opinion polarity is the most frequent type of polarity that occurs with the analyzed discourse relations.

Keywords: discourse relations, opinion, Attitude, Appraisal Theory, polarity of opinion

1. Problem characterization

In the following examples (1)-(3), the effect of the evaluation (attitude of the author) is shaped by the presence of the affective content in combination with a discourse relation, or a nonveridical operator[1]: a concessive discourse relation in (1), a conditional relation in (2) and a modal verb in (3).

   (1) **although** he can capture *great dramatic* moments, he doesn't give anyone the idea on what type of film this should be. (Trnavac & Taboada 2012: 305)
   (2) *Fun* is *good*, **but** only if you know when to stop. (Trnavac & Taboada 2012: 305)
   (3) He is a *good* student. / He *could* be a *good* student.

   The concessive discourse relation marked by the concessive marker in sentence (1) downtones the positive opinion word *great* in the subordinate clause. Comparably, the conditional marker in (2) and the modal verb in (3) restrict the positive meaning of the opinion words *fun* and *good*. In this paper we explore the idea, previously discussed in Polanyi & Zaenen (2006), Taboada et al. (2011) and Trnavac & Taboada (2012), that apart from lexical choice of the writer which is the most salient clue about the attitude, the organization of the text also contributes information relevant to assessing attitude. We focus on the role that different types of discourse relations together with their nucleus-

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[1] Veridical operators express certainty and an individual's commitment to the truth of a proposition, whereas nonveridical expressions express uncertainty and lack of commitment (Giannakidou 1995, Zwarts 1995).

satellite structures (Mann & Thompson 1988, Taboada & Mann 2006) have on the affective content of opinion words. This paper presents a pilot corpus study performed on the eight most frequent discourse relations that are collected from two corpora: Simon Fraser University Review Corpus (Taboada 2008) and Penn Discourse Treebank 2.0 (Prasad et al. 2008). We automatically extract words expressing evaluation from these eight relations and analyze how a particular relation influences the initial polarity of extracted words.

In section 2 we present some recent research on the interaction between discourse structure and evaluation in text. In section 3 we briefly introduce Appraisal Theory (Martin & White 2005) and characterize the affective lexicon that we use in our analysis. Section 4 describes Rhetorical Structure Theory (Mann & Thompson 1988, Taboada & Mann 2006) as a theory of coherence that provides a list of relations for this study. Section 5 presents corpora and software used in the analysis, corpus annotation and the corpus study that we perform, as well as a discussion of the results of our study. In section 6, we provide conclusion on the interaction between discourse relations and opinion words based on 8 types of discourse relations. We also describe our future research in this domain.

2. Previous research

The area of research that analyzes a relation between discourse structure and attitudinal value of opinion words is relatively new. Polanyi and Zaenen (2006) argue that the approach that takes into consideration only individual lexical items as signals of the sentiment in texts is incomplete. They describe how the base attitudinal valence of a lexical item can be modified by some contextual shifters such as negatives, intensifiers, presuppositional items, connectors and discourse structure. There are two basic discourse relations of interest to them in this work: lists and elaborations[2]. The authors discuss examples similar to (4) in which the positive evaluation in *terrific*, which appears in the nucleus[3] of an Elaboration relation, is reinforced by the elaborations in the satellite.

(4) John is a **terrific** athlete. Last week he walked 25 miles on Tuesday. Wednesday he walked another 25 miles. Every weekend he hikes at least 50 miles a day.

Taboada et al. (2011) propose a word-based method for extracting sentiment from text that relies on the most relevant parts of a text. The method predicts that opinion words found in the nuclei (more important parts) of a document are more significant for the overall sentiment, whereas opinion words found in the satellites (less important parts)

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[2] According to Polanyi & Zaenen (2006: 4), some discourse constituents" are linked to other constituents in a list in which each constituent encodes a similar relationship to some more general concepts and some other constituents give more detailed information of some sort about material encoded in constituents preceding them in the linear organization of the text".

[3] According to the Rhetorical Structure Theory (Mann & Thompson 1988), nuclei are considered to be central parts of discourse relations, while satellites are classified as less important parts of discourse relations.

only potentially interfere with the overall sentiment. Heerschop et al. (2011) have used an RST discourse parser in order to calculate semantic orientation at the document level by weighting the nuclei more heavily. The authors hypothesize that there is a possible hierarchy in relations – the satellites of some relations may contribute more to the overall sentiment than others. Asher et al. (2008, 2009) in their preliminary work on discourse structure and opinion of the document, propose that Result relations strengthen the polarity of the opinion in the second argument, while Continue relations strengthen the polarity of the common opinion, and Contrast relations may strengthen or weaken the polarity of opinion expressions. Chardon et al. (2013), using Segmented Discourse Representation Theory measure the effect of discourse structure when assessing the overall opinion of a document and analyze to what extent these effects depend on the corpus genre. Trnavac & Taboada (2012) examine how two types of RST-like rhetorical relations (conditional and concessive) contribute to the expression of Appraisal (Martin and White 2005) in movie and book reviews. The authors show that concessive and conditional rhetorical relations mostly modify (downtone and intensify) the polarity of the entire sentence, while nonveridical markers (modals, negation, intensional verbs, etc.), lead to changes in the polarity at the local level, in the clause in which they occur.

In this paper we focus on eight discourse relations and analyze the way they influence the polarity of the opinion words within the nucleus-satellite structures. In the next section we present Appraisal Theory and delineate the lexicon that is the focus of this work.

3. Appraisal Theory

Appraisal belongs to the tradition of systemic-functional analysis started by Halliday (Halliday 1985, Halliday & Matthiessen 2004), and has been developed mostly in Australia by Jim Martin, Peter White and colleagues (Martin 2000, Martin & White 2005, White 2003). Martin (2000) characterizes appraisal as the set of resources used to express emotions, judgements, and valuations, alongside resources for amplifying and engaging with those evaluations. He divides the Appraisal system into three sub-systems (see Fig. 1): Attitude, Engagement and Graduation. Attitude refers to the ability to express emotional, moral and aesthetic opinions, and is classified as Affect, Judgment and Appreciation. Martin is primarily concerned with the semantic categories of words (mostly adjectives), and not grammatical forms. Engagement refers to the ways in which speakers position themselves with respect to the positions that they are presenting by quoting, reporting, acknowledging other possibilities, affirming, etc. (Martin and White, 2005:36). The Graduation system is responsible for a speaker's ability to intensify or weaken the strength of the opinions they express. Fig. 1 summarizes the Appraisal systems.

Figure 1: The Appraisal system, with examples
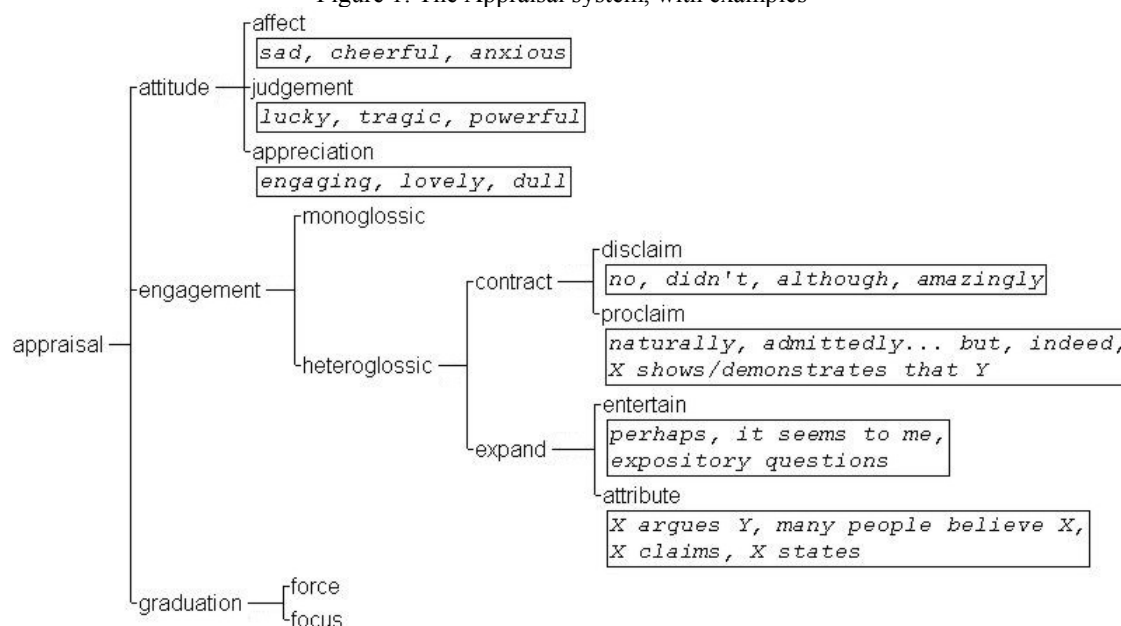
The focus of this study is the semantic continuum that is covered by Attitude, and includes emotional, moral and aesthetic opinions. In the following section we present a set of discourse relations within which these lexical resources occur in our analysis.


4. Coherence relations

In this study, we focus on the eight most frequent relations in our corpus. The set of relations that we analyze is based on Rhetorical Structure Theory (Mann & Thompson 1988, Taboada & Mann 2006), where two or more text spans are part of relations, such as Cause, Concession, Condition, Elaboration, etc. In most relations, clauses, but also entire sentences and paragraphs are linked as main and secondary parts. That linkage produces the effect of coherence in discourse. Central spans are marked as nuclei, while less central, or supporting spans, are marked as satellites (Matthiessen & Thompson 1988). Some of these relations will have an impact on the interpretation of evaluation in text. For instance, a Condition relation in certain cases can limit the extent of a positive evaluation. In example (5), cited from Trnavac and Taboada (2012:306), the positive evaluation (Appreciation, in Appraisal terms) is tempered by the condition that the reader has to be able to change their expectations about the author's typical style and previous books. This downtones the positive evaluation contained in *interesting*[4].

(5) It is an interesting book if you can look at it with out expecting the Grisham "law and order" style.

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[4] Examples from our corpus are reproduced verbatim, including typos and grammatical mistakes.

In this paper we concentrate on the following most frequent relations that are based on 5 files of movie reviews (437 sentiment words) from Simon Fraser University Review Corpus[5] (Taboada 2008). These are the following relations: Background, Cause, Circumstance, Concession, Contrast, Elaboration, Joint, and Purpose. Figure 2 shows a schematic representation of three RST relations, where the arrow indicates subordination, from a satellite to a nucleus.

Figure 2: Representation of discourse relations (Rhetorical Structure Theory)
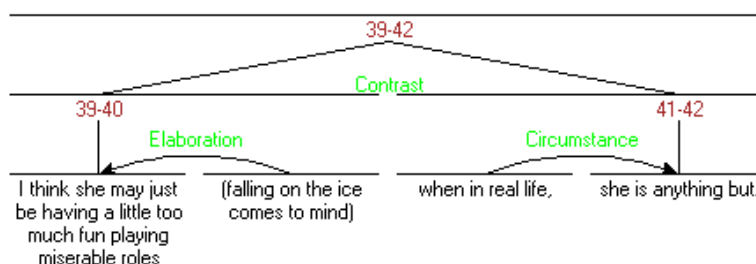
In the following section, we present our corpus analysis that should demonstrate how discourse relations interact with opinion words in texts.

5. Corpus study

5.1 Corpora and software

In this study we analyzed the discourse structure of texts from the Simon Fraser University Review Corpus (Taboada 2008) and the Penn Discourse Treebank (Prasad et al. 2008). The Simon Fraser University Review Corpus (Taboada 2008) contains 400 Epinion reviews of movies, books, music, hotels, and consumer products (cars, telephones, cookware and computers), for a total of 281,000 words. We did our pilot study on five negative movie reviews from the SFU Review Corpus (Taboada 2008) out of a total of 50 reviews in the movie part of the corpus with 25 positive and 25 negative reviews. The SFU Review corpus has been annotated with discourse relations manually based on Rhetorical Structure Theory[6]. We extracted 437 opinion words expressing evaluation from the SFU Review Corpus with SO-CAL, a calculator of semantic orientation for words, sentences and texts (Taboada et al., 2011). SO-CAL has hand-ranked dictionary for automatic analysis of evaluation in discourse based on 400 Epinion reviews (SFU Review Corpus). It includes 306 adjectives, 1068 nouns, 701 verbs, 587 adverbs, ranked on the scale from -5 to +5. The value for the full forms is chosen as a result of balance among different interpretations that the particular word has (Taboada et al. 2008).

Another corpus that we used is the Penn Discourse Treebank 2.0 (Prasad et al. 2008), a collection of Wall Street Journal articles with one million words. We extracted manually 439 opinion words from the PDTB corpus.

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[5] http://www.sfu.ca/_mtaboada/research/SFU_Review_Corpus.html
[6] Automatic discourse parsing is far from an achievable goal in computational linguistics. For a review on this topic see Marcu (2000).

The PDTB adopts a theory-neutral approach to the annotation. There is no commitment to what kinds of high-level structures may be created from the low level annotations of relations and their arguments. The PDTB also follows a lexically-grounded approach to the annotation of discourse relations (Webber et al. 2003). Discourse relations, when realized explicitly in the text, are annotated by marking the necessary lexical items, *discourse connectives,* that indicate the presence of a relation, thus supporting their automatic identification. Example (6) shows a result relation marked by the connective *as a result*.

(6) U.S. Trust, a 136-year-old institution that is one of the earliest high-net worth banks in the U.S., has faced intensifying competition from other firms that have established, and heavily promoted, private-banking business of their own. **As a result**, U.S. Trust's earnings have been hurt. [PDTB]

The Penn Discourse Treebank (PDTB) has annotated the argument structure, senses and attribution of discourse connectives and their arguments. The focus of our analysis in the PDTB corpus is related to two parameters: the annotated argument structure and senses. Discourse connectives, as markers of discourse and argument structure, in the PDTB include both explicit discourse connectives and implicit discourse connectives. In the latter case, annotation consists of inserting a connective expression that best conveys the inferred relation. The two arguments to a discourse connective are labelled Arg2, for the argument that appears in the clause that is syntactically bound to the connective (and corresponds to the satellite structure in the SFU Review Corpus), and Arg1, for the other argument (corresponds to the nucleus structure in the SFU Review Corpus). There are five types of senses: explicit, implicit, AltLex (a discourse relation is inferred), EntRel[7] (entity-based coherence), where no discourse relation can be inferred and where the second sentence only serves to provide some further description of an entity in the first sentence, and NoRel, where neither a discourse relation nor entity-based coherence can be inferred between the adjacent sentences. Explicit, implicit and AltLex senses have four major semantic classes: TEMPORAL, CONTINGENCY, COMPARISON and EXPANSION. For each class, a second level of types is defined to further refine the semantics of the class levels. As for attribution of discourse connectives and their arguments, it relates to ascribing beliefs and assertions expressed in text to the agent(s) holding or making them. For our analysis, attribution is not a relevant parameter.

In the next subsection, we describe the annotation procedure that we performed on our data.

5.2 Corpus annotation

Since this is a pilot study, the corpus annotation was performed by one annotator on 876 opinion words (437 opinion words from SFU Review Corpus and 439 opinion words

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[7] The following sentence provides an example of the EntRel sense type: *Mr. Milgrim succeeds David Berman, who resigned last month* (Prasad et al. 2008: 23).

from Penn Discourse Treebank 2.0). Opinion words were automatically extracted from the SFU Review Corpus by the SO-CAL system which assigned their polarity (Taboada et al. 2011). On the other hand, opinion words were manually extracted from the Penn Discourse Treebank Corpus. Their value was assigned manually again based on the intuition of the annotator. The data was coded for the following five parameters:

a) Type of the relation (sense in the PDTB) in which the word occurs.
b) Its position within nucleus-satellite (Arg1/Arg2) structure.
c) Positive or negative polarity of the word.
d) Word class.
e) Polarity formed between the two parts of a relation (two arguments of a sense).

The annotator classified all opinion words within four polarity types: reversal, intensifier, downtoning and no change of polarity. We illustrate different polarity types with the following examples from the Penn Discourse Treebank and the SFU Review Corpus:

Conjunction[8] (with intensification as discourse relation polarity).
    (7) [Arg1] We're talking about years ago before anyone heard of asbestos having any **questionable** properties. [Arg 2] (Besides), there is no asbestos in our products now. [PDTB]

EntRel[9] (no change of polarity at the level of the discourse relation).
    (8) [Arg1] No matter who owns PS of New Hampshire, after it emerges from **bankruptcy** proceedings its rates will be among the **highest** in the nations. [Arg2] That **attracts** attention. [PDTB]

Contrast (reversal as discourse relation polarity).
    (9) [Arg1] Separately, the Federal Energy Regulatory Commission **turned down** for now a request by Northeast seeking **approval** of **its possible** purchase of PS of New Hampshire. [Arg2] Nevertheless, it would refile its request and still **hopes** for an expedited review by the FERC. [PDTB]

Concessive (downtoning as discourse relation polarity)
    (10) "Mona Lisa Smile" is a really a film for fans of Julia Roberts although many fans would feel it could've been much better in the end. [SFU Review Corpus]

As for the difference between a reversal, on the one side, and downtoning/intensification, on the other side, the annotator coded a relation in which two units of a relation have opposite meaning as a reversal of polarity[10], and downtoning/intensification was coded in cases when the opinion word(s) from the nucleus (Arg1) was/were partially negated or intensified with the opinion words or discourse markers from the satellite (Arg2). The annotator also classified all opinion

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[8] The conjunction sense from the PDTB Corpus corresponds to a Joint discourse relation in Rhetorical Structure Theory.

[9] The EntRel sense from the PDTB Corpus corresponds to an Elaboration discourse relation in Rhetorical Structure Theory.

[10] The relation contains implicit negation between two units.

words based on two polarities: positive and negative. She disregarded all the words with neutral polarity and analyzed the following four word classes: nouns, adjectives, verbs and adverbs. She annotated opinion words with 18 discourse relations within the SFU Review Corpus and chose the eight most frequent relations (Background, Cause, Circumstance, Concession, Contrast, Elaboration, Joint, Purpose). 205 opinion words out of 437 words (47% words) were within those eight relations. In the PDTB Corpus, nine out of 18 types of senses correspond to the nine most frequent relations (Contrast, Concession, Cause-result, Conjunction, EntRel, Instantiation, Pragmatic cause, Restatement, Temporal). Out of the 439 opinion words, 430 (98%) were within those nine senses.

In the following subsection we present the results of our analysis.

5.3 Analysis and results

In Table 1 below, we show a number of opinion words that were analyzed within relations (senses). The table also illustrates the mapping between different relations from the SFU Review Corpus and senses from the Penn Discourse Treebank.

Table 1: Mapping of relations (SFU Corpus and PDTB)

Relation (SFU)	Number of words	Sense (PDTB)	Number of words
Background	16	Pragmatic cause	4
Cause	15	Cause-result	124
Circumstance	18	Temporal	25
Concession	47	Concession	41
Contrast	20	Contrast	24
Elaboration	29	EntRel	20
		Instantiation	13
		Restatement	10
Joint	53	Conjunction	144
Purpose	7	-	-
-	-	Temporal	25

The results of the analysis show that the most frequent relations in the movie portion of the SFU Review Corpus are Joint, Concession, and Elaboration. The most frequent senses in the Penn Discourse Treebank are Conjunction, EntRel, Instantiation, Restatement, and Cause. Now let us look at the separate results related to the distribution of opinion words within the nucleus-satellite structure of discourse relations/senses.

5.3.1 Results (SFU Review Corpus)

The following table shows the distribution of opinion words in the eight most frequent relations:

Table 2: Rhetorical relations with the nucleus-satellite structure and polarity of evaluation (SFU Corpus)

Relations (N/S)	Reversal	Downtoning	Intensification	No change
Background	4/1	1/0	0/2	6/3
Cause	-	1	1/2	8/3
Circumstance	3/0	-	-	8/7
Concession	18/17	3/1	1/0	3/4
Contrast	12/0	-	4/0	4/0
Elaboration	3/1	2/0	4/2	10/7
Joint	7/0	-	17/0	29/0
Purpose	-	-	-	4/3

The results show that "No change" is the most frequent type of polarity for all types of relations, with the exception of the Concessive and Contrast relations (reversed polarity). Sentiment words are more frequent in the nucleus of Background, Cause and Elaboration relations, while in Contrast and Joint, the structure consists of the nuclei by default. Since "No change" is the most frequent type of polarity, nuclei in the above relations are the most frequent with "No change" polarity. Intensification and downtoning are less frequent than "No change" polarity, while intensification is the most dominant with Joint relation. All the above relations are conceptualized as *Lists* (Polanyi and Zaenen 2006), which can be characterized as discourse constituents that are linked to others in a list in which each constituent encodes a similar relationship (no change of polarity). Even Elaboration, whose purpose is to provide more detailed information, occurs more frequently with "No Change" polarity than with the expected "Intensification" (since Elaboration may be expected to reinforce the affective effects of the sentiment from the preceding unit).

The results from the Penn Discourse Treebank show similar tendencies.

5.3.2 Results (PDTB Corpus)

As with the SFU Corpus, "No Change" of polarity is the most frequent type of phenomenon, while reversal is dominant with Contrast and Concessive senses.

Table 3: Senses with the Arg1-Arg2 structure and polarity of evaluation (PDTB)

Senses (Arg1/Arg2)	Reversal	Downtoning	Intensification	No change
Contrast	12/10	-	-	2/0
Concession	12/10	-	-	4/15
Cause-result	8/4	-	-	60/52
Conjunction	15/6	-	27/20	40/36
Instantiation	-	-	2/1	8/2
EntRel				10/10
Pragmatic cause				3/1
Restatement			1/1	8/0
Temporal	4/1	-	2/1	8/9

Sentiment words in the nuclei are the most frequent with Concession, Conjunction, Instantiation, Pragmatic cause and Restatement. Conjunction (Joint) is the only relation which shows a significantly higher number of examples with "Intensification" type of polarity in comparison to the other senses. It is also the most frequent sense among the other nine senses. All senses behave as a *List* type of relation (similar to the examples of relations from the SFU Review Corpus).

6. Conclusion and future research

This pilot study shows that the most frequent type of polarity is "No Change" of polarity for eight relations/nine senses. The aim of future research is to classify existing types of discourse relations in their interaction with Attitude. We plan to extend our corpus analysis to all RST-like relations and show statistical tendencies for attraction between polarity types, types of relations and positive/negative opinion (Appraisal) words.

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