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An ANALYSIS of ARGUMENT STRUCTURE in EXPERT and STUDENT PERSUASIVE WRITING

by

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Abstract

This study investigated differences among student writers at three grade levels (i.e., 6, 8, and 10), and between expert writers and students, in terms of (a) the extent to which argument structures were used in their persuasive texts, (b) the complexity of these argument structures (as measured by depth and elaboration), and (c) the use of general semantic structures and conjunctive ties to represent argument substructures. In addition, the study determined the predictive relationship between the holistic scores assigned to student texts and argument structure measures. To identify and analyze argument structure a model was developed that could account for the variability in structure observed across a range of persuasive writing situations. The model was a modified version of Toulmin's (1958) schematic, and its characteristics were defined using categories derived from a theory of semantic representation in discourse.

Results of the structural analyses indicated that (a) argument was the predominant organizational structure for expert and student writers, (b) over 80% of students produced elaborated arguments involving some form of opposition, (c) experts produced more arguments and more complex arguments than students, and (d) expert texts contained relatively higher frequencies for warrants, countered rebuttals, and modals, and student use of these argument substructures increased with grade level. The general semantic and linguistic analyses revealed the following patterns particular to experts: (a) the use of identification types of claims, (b) an increased use of modals and decreased use of opinions as marks of argumentation, and (c) an infrequent use of causal conjunctions to mark data structures. Results of a forward stepwise regression analysis revealed that argument structure complexity accounted for 40% of the variance associated with quality ratings assigned to students' texts. Two other variables were significant predictors: number of supporting structures and number of opposing structures.

The results were interpreted from a rhetorical perspective: the developmental and expertise-related patterns of performance associated with the use of particular argument substructures, and the representation of these substructures were seen as reflecting an awareness of and ability to manipulate one's audience--skills that are necessary to achieve the goals of persuasive discourse.

Résumé

Cette étude a examiné les différences entre des élèves à trois niveaux scolaires (i.e., 6ième, 8ième, et 10ième années) dans une activité de rédaction, et entre des experts et ces élèves selon (a) l'étendue d'l'utilisation des structures d'arguments dans leurs textes persuasifs, (b) la complexité de ces structures d'arguments (mesurée par la profondeur et l'élaboration des arguments), et (c) l'utilisation des structures sémantiques générales et des liens conjonctifs pour représenter les sous-structures d'arguments. En outre, l'étude a prédéterminé le rapport entre les résultats synthétique attribué aux textes des élèves et les mesures de structures d'arguments. Afin d'identifier et d'analyser les structures d'arguments, un modèle a été développé qui pourrait expliquer la variation dans la structure qui a été noté sur l'étendue des situations de rédaction persuasifs. Le modéle était une version modifiée du schématique de Toulmin (1958), et ses caractéristiques étaient définies en utilisant des catégories tirées d'une théorie de représentation sémantique en discours.

Les résultats des analyses structurelles ont démontré que (a) l'argument était la structure prédominante pour les experts et les élèves en rédaction, (b) plus de 80% des élèves ont produit des arguments elaborés impliquant une certaine forme d'opposition, (c) les experts ont produit plus d'arguments et plus d'arguments complexes que les élèves, et (d) les textes des experts contenaient des fréquences relativement plus élevées pour les attestations, les ripostes de réfutations, les modaux, et l'usage de ces sous-structures d'arguments par les élèves ont augmenté avec le niveau de scolarité. Les analyses sémantiques et linguistiques générales ont révelé des tendances particuliéres aux experts, soit: (a) l'utilisation des types d'identification en revendications, (b) une argumentation à l'usage de modaux et une baisse de l'expression d' opinions comme marques d'argumentation, et (c) un emploi infréquent de conjonction de cause pour marquer les structures de donnés. Les résultats d'une analyse de regression d'échélon avancée ont révélé que la complexité de la structure d'argument expliquait 40% de la variation associé à la qualité des évaluations attribuées aux textes des élèves. Deux autres variables étaient significatives dans cette explication: le nombre de structures de supports et le nombre de structures opposantes.

Les résultats ont été interpretés dans une perspective rhétorique: les tendances de compétences reliées au développement et à l'expertise étaient associées à l'utilisation de sous-structures d'arguments particuliers, et la représentation de ces sous-structures ont révélé une conscience, et une capacité à manipuler son audience--des habilités qui sont nécessaire pour réaliser les buts du discours persuasif.

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I. Introduction

Mastery of persuasive writing is important because it empowers students--it enables them to produce, evaluate, and act on the professional, ethical, and political discourse which is central to our democratic society (Hays & Brandt, 1992; Lauer, 1994; Lemke, 1988). Moreover, because persuasion presupposes argumentation, the persuasive essay can be viewed as a heuristic--as a tool for critical and analytical thinking, the production of knowledge (D'Angelo, 1975; Perelman, 1982; 1994), and the creation of meaning (Enos & Lauer, 1993). It is an ongoing concern for educators, then, that most students demonstrate either a minimal or unsatisfactory degree of competency in persuasive writing. A series of reports generated by the National Assessment of Educational Progress (NAEP) indicate that the majority of students across grades 4 through 12 are unable to produce an "adequate or better" persuasive essay (Applebee, Langer, Jenkins, Mullis, & Foertsch, 1990; Applebee, Langer, & Mullis, 1986; NAEP, 1980). Evaluative and descriptive studies by Cooper, Cherry, Copley, Fleischer, Pollard, and Startisky (1984), Hays, Brandt, and Chantry (1988), and Hays and Brandt (1992) have revealed that students continue to experience difficulties with persuasive writing beyond the high school years.

Attempts to understand and address the difficulties students demonstrate with persuasive writing generally involve one or more of the following approaches: (a) identifying those text features giving rise to raters' judgments in holistic scoring situations (Connor, 1990; Connor & Lauer, 1985; Crowhurst, 1980; Durst, Laine, Schulz, & Vilter, 1990; Knudson, 1992; McCulley, 1985), (b) determining the effects of modality (oral versus written), genre (e.g., argumentative, narrative, and expository), content knowledge, or audience on the quality of students' writing or their use of specific discourse structures (Crowhurst, 1987; Hays et al., 1988; Hays & Brandt, 1992; Hidi & Hildyard, 1983; McCutchen, 1986, 1987; Prater & Padia, 1983; Rubin & Piche, 1979), and (c) determining the effectiveness of various instructional strategies designed to improve student persuasive writing (Crowhurst, 1991; Knudson, 1991,1992; Matsuhashi & Gordon, 1985; Scardamalia, Bereiter, & Goelman, 1982; Scardamalia & Paris, 1985). Such research has revealed that poor performance on persuasive writing tasks is typified by (a) inadequate content (e.g., lack of sufficient support for a point of view or failure to elaborate arguments), (b) poor organization--associated with inadequate knowledge regarding argument structure, and (c) stylistic inappropriateness characterized by the use of informal language and immature connectors. Moreover, the above research that is concerned with experimental writing instructional programs has resulted in limited or partial success.

Although the results of these previous studies have proven insightful, research and analysis of persuasive writing have been impeded for the following four reasons. First, confusion exists as to the nature of the genre. As Connors (1981), Gage (1992), and Perelman (1994) have pointed out, initial classifications of written discourse led to not only the separation of persuasion from argumentation, but also its replacement by argumentation in composition instruction. Recently, theorists in the field of rhetoric have challenged the educational efficacy of this approach, and emphasized the need to classify discourse in terms of its function or intent (rather than its form or structure), and provide composition instruction according to this purposive classification scheme (Connors, 1981; Kinneavy, 1971; Lloyd-Jones, 1981). Despite this, many researchers not only continue to use the term "argumentative" either instead of or interchangeably with "persuasive" but also limit the scope of their structural analysis or instructional intervention to logically derived models of argument (Crowhurst, 1991; Knudson, 1992; McCann, 1989; Scardamalia & Paris, 1985). That is, they seek to evaluate, explain, or promote the use of specific argument substructures in students' written persuasive text without sufficient consideration of those factors motivating the use of such structures.

Second, information is needed on the semantic structures which are characteristic of persuasive discourse as well as the linguistic devices used to signal or represent these structures. Theoretical developments in the area of discourse processing suggest the internal structure of a text is multi-representational. It is generally described in terms of two dimensions or qualitatively different levels of representation, semantic and linguistic (Bracewell, Frederiksen, & Frederiksen, 1982; Clements, 1979). Methodological advances in discourse analysis have enabled researchers to begin to describe the structures representative of these levels as well as how they interact more precisely. For example, there is a general consensus that the semantic structure realized in text can be analyzed at two levels of detail, a propositional or micro-structural level, and a frame or macro-structural level (Frederiksen, 1986; Kintsch & van Dijk, 1978; van Dijk & Kintsch, 1983). In addition, there is general agreement that the surface or linguistic structure of a text can be described in terms of language devices such as cohesive ties, and topicalization (Grimes, 1975; Halliday, 1985; Halliday & Hasan, 1976). Finally, researchers have begun to explore the functional relationship between the underlying meaning or semantic structure and the surface level representation or linguistic structure of a text (Bracewell, 1986, 1987; Frederiksen, Donin-Frederiksen, & Bracewell, 1987; Witte, 1983a). A substantial body of literature exists involving the analysis and description of narrative (e.g., Beaugrande, 1980; Frederiksen et al., 1987; Kintsch, 1977) and expository (e.g., Britton & Black, 1985; Meyer, 1975) type texts in terms of their macro- and micro-structures. Such a detailed

semantic description, which provided a precise and explicit theoretical basis for developing models of narrative and expository writing and dealing with the variability in structure associated with these types of text, is lacking for persuasive text.

Third, researchers have yet to develop and utilize formalized and theoretically-based methodologies to identify the argument structures in written persuasive text. This tactic would increase the precision and reliability of coding procedures (Breuleux, 1987) and in doing so address the concern that many researchers have expressed regarding the low inter-rater reliability associated with coding complex or elaborate argument structures (Connor & Lauer, 1985; Crowhurst, 1991; Scardamalia et al., 1982). Moreover, an analysis of argument structure which was based on a theory of semantics in discourse would facilitate the development and refinement of a theory of persuasive writing (VanLehn, Brown, & Greeno, 1984).

Finally, there is a need to examine well-formed texts in order to describe the discourse structures and underlying factors involved in good persuasive writing. Hitherto, empirical investigations of good persuasive writing have been limited to determining those text features serving as predictors for the holistic scores assigned to student persuasive texts or identifying developmental trends in students' use of genre-specific structures. Alternative sources to student persuasive writing - such as texts produced by expert writers - need to be scrutinized in order to advance our understanding of the criteria for and the components of "effective" or "good" persuasive writing. Such information could be used to develop a reference model in studying instances of student writing (Frederiksen, Bracewell, Breuleux, & Renaud, 1990) and also contribute to a theory of persuasive writing.

This study attempts to build upon current understanding of the nature of persuasive writing by taking the following four steps. First, persuasive discourse is viewed from a rhetorical perspective, and as such refers to text which is produced in order to either obtain or increase the adherence of an audience to a particular thesis advanced by the writer/author. Such discourse pervades the professional, political, and ethical discourse of our Western, democratic society and includes not only those opinion essays and argumentative essays introduced in high school English courses but also most academic writing at the college level. Argumentation is considered to be a part of the rhetoric of persuasion--the means rather than the end. Hence, while the analysis of persuasive discourse proposed herein draws on models of argument structure, it is proposed that the variations associated with these structures are best explained within a rhetorical perspective. By focusing on the purposive, intentional aspect of such discourse it may be possible to obtain information that would best serve the development of instructional programs that really help students learn to write.

Second, while recognizing that types of argumentation (such as the rational, credible, and affective appeals proposed by Connor and Lauer, 1985) do contribute to a text's persuasiveness, this study focused on obtaining a detailed description of argument structure and an analysis of its function in meeting the goals of persuasive writing. A task analysis (Newell & Simon, 1972, chap.3; see also Ericsson & Simon, 1984) of the domain of informal argument was conducted to develop a model which could account for the variability in structure occurring across various instances of *persuasive* writing. The semantic properties of this model were identified and defined in terms of a general theory of semantics in discourse. This model served as a frame of reference in analyzing variations in the structure and function of arguments represented in the persuasive texts considered herein.

Third, the method of coding instances of argument structure in persuasive text was not only based on a well-defined model of argument structure but also followed analyses derived from a multi-level model of discourse processing. That is, identification and description of argument structures followed a series of linguistic, propositional, and frame structure analyses of the persuasive texts under investigation. Finally, in order to identify criteria for "good" persuasive writing, consideration was given to texts produced by expert writers, i.e., published professionals. The analyses of expert persuasive texts provided a frame of reference which was used in describing and interpreting the structural features characteristic of student persuasive writing.

II. Literature Review

This literature review is divided into three sections. The first section comprises a task analysis of the domain of informal argument. Recently proposed theories and models of informal or practical argument are reviewed in order to develop and define a model of argument that would account for the structural variations that might be encountered across various instances of persuasive writing. The second section involves consideration of recent developments in discourse processing theory and related methods of discourse analysis. The purpose of this section is to provide a background for the theoretical and methodological approaches characterizing the current study, i.e., developing a model of argument by formalizing the semantic properties of practical argument and using this model as a basis for text analysis. The final section considers recent studies involving the evaluation or description of student persuasive writing. The purpose of this section is to review the contribution of these studies to current knowledge regarding the factors underlying good persuasive writing and the difficulties students experience with persuasive writing tasks.

II.1. Theories and models of argument

The objectives of the following discussion are (a) to identify the semantic properties of informal argument structures and (b) to indicate the sort of linguistic representations that must be considered in order to analyze and describe such structures in written persuasive texts. Meeting these objectives requires consideration of current theoretical perspectives on everyday argumentation and recently proposed models of informal argument as well as research on practical reasoning in natural language texts.

In general, theorists view argument as a particular type of discourse. Some, like Thomas (1986) use the term *argument* to describe any discourse having a certain logical structure, i.e., discourse in which some statement is given as a reason for some conclusion. Given this broad definition, argumentative discourse refers both to discourse designed to explain (i.e., to make clear or tell why a particular state of affairs or occurrence exists or happens) and discourse designed to justify (i.e., to give grounds, evidence or reasons of any sort in order to convince or persuade others as to the truth of a claim or assertion). However, a number of theorists recognize more explicitly that the purpose as well as the structure of the discourse are defining features of argument. For example, Toulmin (1958) and Toulmin, Rieke, and Janik (1979) restrict application of the term *argument* to discourse involving a justification process, while those proposing audience-

centered theories of argument place even greater emphasis on the purpose or communicative goal of the discourse (Kummer, 1972; Perelman, 1982; Perelman & Olbrechts-Tyteca, 1969; Rieke & Sillars, 1975; Willard, 1989). Although Rieke and Sillars (1975) have distinguished between persuasion and argument on the basis of their classical rhetorical features (i.e., persuasion relying on ethos and pathos and argument drawing upon logic), others have pointed out that persuasive writing does in fact draw upon the form or structure of argument (Connor, 1990; Connor & Lauer, 1985; Matsuhashi & Gordon, 1985; McCann, 1989; Perelman, 1982, 1994). All these perspectives, however, are consistent to some extent with the recent shift from formal to practical reasoning in both the study and teaching of logic and have implications for establishing methods and criteria to describe and evaluate practical arguments.

II.1.1. Formal argument

The structure of arguments associated with formal logic will first be considered briefly in order to provide a contrastive background for the discussion pertaining to the definition and representation of practical argument--issues which are of interest in the present study.

The study of formal logic involves the study of formal reasoning processes (i.e., deduction and induction) and the logical structures which reflect and require these processes as well as the development and study of formal logistic systems and their properties (e.g., predicate calculus). In general, formal arguments are described in terms of three components (i.e., a major premise, a minor premise, and a conclusion) and the logical relationships which exist between these components. The logical relationships define the structure of formal arguments and in natural language are indicated by certain key "logical terms" (i.e., words like "all", "some", "or", "not", "if-then"). The meanings carried by these terms can be represented by special symbols in formal or mathematical rule-based systems such as propositional or quantificational calculus (Johnson-Laird, 1983). These systems, then, constitute various artificial languages for the formalization and modeling of the inferential processes associated with formal logic.

The traditional or Aristotelian approach to argument advocates that formal logic presents a model of good reasoning--one which humans should aspire to. However, since the 1950's the dominance of this perspective in the study and teaching of logic has been challenged on at least two accounts, its relevance and its efficacy (Blair & Johnson, 1989). First, since there was considerable evidence to indicate that humans do not follow the rules of formal logic when reasoning, it appeared both relevant and necessary to focus on practical rather than formal reasoning. Second, and relatedly, there was concern that students taught to analyze and evaluate arguments in formal logic or to use formal

representational systems such as predicate calculus would not acquire the necessary skills for dealing with arguments arising in everyday life (i.e., those characteristic of political, professional, and social discourse). Such concerns motivated an increased and continued interest in understanding the nature of practical argument (Govier, 1988; Perelman & Olbrechts-Tyteca, 1969; Toulmin, 1958) as well as a proliferation of textbooks focusing on teaching students the methods and standards for analyzing, evaluating, and more recently, constructing arguments in natural language (e.g., Beardsley, 1966; Johnson & Blair, 1983; Kahane, 1984; Rieke & Sillars, 1975; Scriven, 1976; Thomas, 1986; Toulmin et al., 1979).

II.1.2. Practical argument

Within the field of practical argument disagreements exist regarding the nature and extent of the relationship between formal logic and everyday reasoning (i.e., what place formal logic holds in an account of human reasoning processes) and consequently whether or not students need to understand the principles and structures of formal argument in order to improve their reasoning skills and ability to deal with everyday arguments. As pointed out by Rieke and Sillars (1975), the existence of fallacies in everyday arguments is sufficient to indicate that human reasoning does not always follow the course of formal logic. Such findings support the skeptical view held by many as to the value of teaching formal logic in order to interpret and criticize practical arguments (Johnson & Blair, 1989; Scriven, 1976). However, psychological research (Henle, 1962; Stewart, 1961) as well as recent analyses of arguments in natural language texts (Govier, 1988; Thomas, 1986) show that some natural arguments do exemplify logically valid forms. That is, it appears human reasoning processes can be similar to those inferential processes formal logic attempts to describe. Such research supports the notion that understanding the basic concepts of deductive entailment, which are central to formal logic, is extremely important for the correct interpretation and criticism of arguments (Cederblom & Paulsen, 1986; Govier, 1988). Consistent with this perspective, Kaufer & Neuwirth (1983) have suggested that expert arguers combine logical and probabilistic or informal reasoning in practice and thus formal logic can contribute to an effective heuristic for the composition of argument.

Despite ongoing debates as to the role of formal logic in practical argument there seems to be some general agreement that certain features distinguish practical argument from formal logic. These features, which are concerned with the underlying or semantic structure of practical argument and the representation of this structure in natural language text, can be described as follows.

First, in terms of the underlying structure of argument, it is widely recognized that most everyday reasoning has a conditional, as opposed to universal, aspect (Rieke & Sillars, 1975; Toulmin, 1958; Toulmin et al., 1979). And in fact, Aristotle referred to this probabilistic nature of practical arguments in his *Rhetoric* (trans. 1954). How to account for this aspect in describing and evaluating the structure of arguments is an issue which has been addressed at length by the philosopher Stephen Toulmin (1958). Second, and relatedly, recent theoretical developments indicate that the structure of practical arguments can be more complex than that associated with formal arguments. For example, in addition to its conditional aspect, structures representative of everyday argumentation must be able to account for chains of reasoning or embedded arguments, as well as counter-arguments and their supporting structures (Beardsley, 1966; Kopperschmidt, 1985; Rieke & Sillars, 1975; Stratman, 1982; Thomas, 1986). Third, in terms of the linguistic representation of arguments, as has been pointed out by many theorists, the essential components or defining features of an argument are not necessarily made explicit in practical arguments. For example, the argument may take the form of an enthymeme in which the major premise (warrant) is not present in the text but is replaced by a mutual and implicit understanding between the speaker (or arguer) and audience. Alternatively, the conclusion may be left to the audience to infer (Rieke & Sillars, 1975; Thomas, 1986; Toulmin, 1958). Finally, the fourth feature, like the third, also draws attention to problems associated with identifying the underlying structure of arguments represented in natural language. Researchers have pointed out that not only are practical arguments more complex structurally than formal arguments but that the logical or conditional relationships defining the structure of the argument may be carried by the meaning or content of the actual words or be signaled by various language forms other than the limited number of logical terms associated with formal argument (Beardsley, 1966; O'Conner, 1989; Thomas, 1986). These issues concerning the nature or defining structure of argument and its linguistic or surface representation are central to the current analysis of argument structure in written persuasive text and are discussed in greater detail in the following sections.

II.1.2.1. Toulmin's model of practical argument

The model of practical argument most frequently referred to by instructors, rhetoricians, and researchers is that developed by Toulmin (1958). Basically, Toulmin proposed that (a) an argument consisted of an assertion, which was seen as contentious, and the reasons stated or implied in support of this assertion and (b) the primary function of argument was one of justification. The model of a basic argument was represented graphically by Toulmin (1958) (see Figure 1) and the elements of this model were defined

as follows: The CLAIM is an initial or concluding assertion which is disputable (i.e., of questionable or contentious validity). The DATA refers to the evidence or grounds on which the claim is based. The WARRANT provides the basis for, or authorizes, the relationship between data and claim (Toulmin, 1958, p. 97-99).

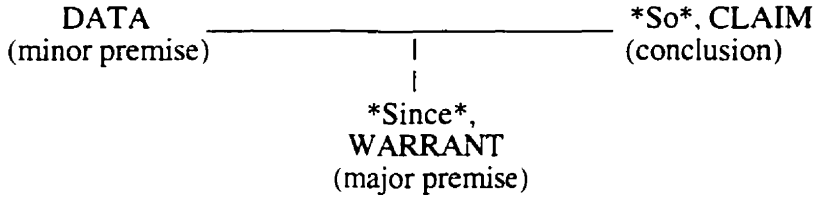

Figure 1. Toulmin's schematic for a basic informal argument

Toulmin's model of a basic argument structure appears to be consistent with the form or structure underlying formal as well as informal logic, i.e., the DATA constitute the minor premise, the WARRANT is the major premise, and the CLAIM is the conclusion. However, based on his analysis of practical argument, Toulmin concluded that argumentation and formal logic are not equivalent in that people do not necessarily follow the laws of formal logic when they argue. First, he pointed out that unlike logical reasoning, everyday argumentation involves reasoning about the probable and not about the deductively certain; there is generally some sort of qualification as to the degree of certainty and strength associated with a particular argument. To account for this probabilistic or "human" aspect of logical reasoning, Toulmin introduced two additional elements to his model, qualifiers and reservations. The QUALIFIER makes explicit the degree of certainty associated with a particular claim and takes the form of a modal (e.g., a modal phrase or a modal verb). The RESERVATION, elsewhere referred to as a rebuttal (Toulmin et al., 1979) specifies conditions which might defeat or rebut the warranted conclusion (i.e., circumstances under which the general authority of the warrant would not apply).

In addition to the conditional aspect, Toulmin (1958) proposed that practical argument differed from formal logic with respect to the representation and function of the major premise or warrant. This difference resulted in further modifications to his model as well as to his approach to the evaluation of argument. In his analysis of practical argument Toulmin pointed out that warrants are often implicit (i.e., either not represented in the text at all or implied by virtue of facts, authorities and the like which are present in the text), although in controversial arguments, these implicit warrants may be challenged and thus may not only be made explicit but also defended. The result of these observations from a structural point of view was the inclusion of an additional element, BACKING, which

referred to facts, authorities, and the like used to support or justify the warrant, to the model expressing the structure of argument. The resulting more complex form of the argument as presented diagramatically by Toulmin (1958, p. 101) is shown in Figure 2.

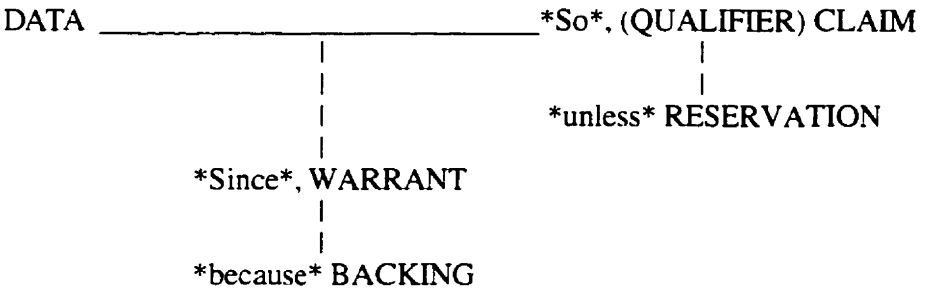

Figure 2. Toulmin's schematic for an elaborated informal argument.

Toulmin's challenge to the traditional view of formal logic had ramifications for the evaluation as well as the structure of argument. In contrast to the assessment of formal arguments--which was based on the notions that validity (a) was a characteristic of form or structure and (b) could be determined without reference to the content or substance of an argument--Toulmin claimed that evaluation was field-dependent. Specifically, he proposed that (a) arguments of the form Data, Backing, Conclusion could no longer be formally valid and that assessment of such arguments should be based on consideration of the proof (i.e., reasons or backing advanced for supporting a conclusion or establishing a warrant) and (b) the standards set to determine whether the proof was sufficient cause for an arguer to state his conclusion with a given degree of certainty varied according to the specific domain of knowledge and/or social context involved in the argument.

II.1.2.2. Modifications to Toulmin's model of argument

Other contemporary theorists generally agree that the minimum structural requirements of an argument are an assertion and reasons stated or implied (i.e., the claim - reason complex) and have likewise acknowledged its probabilistic nature. That is, there appears to be some consensus that Toulmin's schematic captures the essential characteristics of argument that are common to everyday discourse and that of specialized fields, e.g., theological, legal, scientific, mathematical, and literary (Rieke & Sillars, 1975; Thomas, 1986; Toulmin, et al., 1979). However, recent descriptions of argument, which are empirically-based (i.e., based on analyses of arguments taken from instances of persuasive writing) as opposed to the hypothetical approach taken by Toulmin, suggest that (a) additional elements be considered in defining the semantic or underlying structure of practical argument and (b) identification of these structures may require determining the

function of certain linguistic devices and structures. These structural modifications and representational issues have implications for the development of writing instruction programs and methods for evaluating and describing students' persuasive texts which have hitherto relied on Toulmin's model of argument (Conner, 1990; Knudson, 1992, 1993; Kneupper, 1978; Matsuhashi & Gordon, 1985; McCann, 1989; Scardamalia & Paris, 1985; Stratman, 1982).

Reviews of recent major works in the area of human reasoning and argument reveal that at least four structural additions to Toulmin's model need to be considered. First, Rieke and Sillars (1975) provide example analyses of natural language texts showing that the DATA or reasons offered in support of a CLAIM may be supported in turn by specific examples, facts, authorities and the like, in much the same way that Toulmin's unstated or stated WARRANT may be supported by BACKING. Hence, these researchers modified Toulmin's model by adding a component termed SUPPORT to the DATA.

Second, recent research focusing either on the role of argument in decision- or policy-making processes or on audience-centered activity in persuasive writing, indicate that a theory of argumentation must take into account how speakers or writers acknowledge and respond to a point of view different from their own (Hays et al., 1988; Hays & Brandt, 1992; Kopperschmidt, 1985; Rieke & Sillars, 1975; Thomas, 1986; Willard, 1989). This research points to the need to incorporate OPPOSING STRUCTURES beyond the RESERVATION element introduced in Toulmin's model of argument--those involving opposition or competing arguments in the form of counter-claims or alternative solutions to problems as well as their supporting data structures.

Third, research suggests that the conditional aspect of human argument is not limited to QUALIFIERS (i.e., modals) and RESERVATIONS. That is, arguers often attach conditional information to their claims which is of an enabling nature, i.e., specifying the particular circumstances under which a claim holds (Kneupper, 1978; Rieke & Sillars, 1975; Stein & Miller, 1993; Thomas, 1986). Stein and Miller (1993) have shown that such conditions and circumstances which serve to constrain the nature of an argument influence arguers' decisions to support a particular position. This conditional information appears to function as a qualification but the exact nature of its relationship to the QUALIFIER element described by Toulmin is yet to be understood (e.g., whether this conditional information is an elaboration of the modal qualifier or has a separate, independent function).

Finally, researchers examining extended arguments in natural language text have reported the presence of argument chains or EMBEDDED ARGUMENTS. For example, data may be used to establish a claim that also functions as a reason for a subsequent claim,

which in turn may be the final conclusion of an argument or another intermediate conclusion, and so on. This sort of structure or reasoning process is dealt with by Beardsley (1966) and Thomas (1986) who used tree diagrams to represent the relationship between reasons and claims (i.e., to indicate the direction of reasoning) as well as by Rieke and Sillars (1975) who used a modified version of Toulmin's model as the basis of their argument analysis. Rieke and Sillars (1975) also illustrated that argument chains can be found underlying warrants (i.e., data supports a claim which functions as SUPPORT or BACKING for a WARRANT). In effect, this particular type of embedded argument seems to capture the warrant-establishing procedure Toulmin (1958) refers to.

II.1.5. Language representation in argument

Many contemporary instructional textbooks in logic and argument deal with the language of argumentation from a traditional rhetorical perspective by describing and providing examples of various linguistic strategies (i.e., word choice, sentence structure, figures of speech, types of argument) which are employed in practical argument (Beardsley, 1966; Perelman & Olbrechts-Tyteca, 1969; Rieke & Sillars, 1975; Toulmin et al., 1979). In addition, some textbooks give particular attention to the difficulties that arise in analyzing and identifying the structure of arguments presented in natural language (Beardsley, 1966; Thomas, 1986). In contrast to the structure of formal arguments which is defined and represented in the surface structure by certain logical terms, practical argument structures are a semantic phenomenon and may be signaled by various linguistic forms or depend upon the meaning or content of the words involved.

In attempting to address the problem of identifying practical argument structures reliably and accurately, many instructional textbooks provide lists of those words and phrases typically used to signal a logical or semantic relationship between two statements in a text. For example, words and phrases such as "as indicated by", "since", "because", "in view of the fact" indicate that the statement following them is a reason whereas those such as "consequently", "therefore", "demonstrates that", "leads me to believe that" indicate that the statement following them is a conclusion. Thomas (1986) also deals with the difficulties of identifying arguments in which the structure is not signaled by these "inference indicators" by proposing that the following two strategies be adopted in such instances. First, he suggests that the discourse be examined for modality in that modal words and phrases are sometimes used instead of (as well as in conjunction with) inference indicators to signal an argument. Second, he suggests that consideration be given to the content of the discourse statements involved to determine whether it is sufficient to justify a transfer of belief or acceptance between statements. This strategy requires the reader or

audience to draw upon their world or domain specific knowledge relevant to the argument and to employ the "Principle of Charity"[1].

In summary, the above review of recent research in argumentation suggests two directions for the development of theories of practical or persuasive argument. First, at the semantic level, certain structural modifications to Toulmin's (1958) model are required in order to account for the range and complexity of argument structures across various instances of persuasive and argumentative writing. Second, at the language level, consideration needs to be given to the linguistic devices and structures authors use to represent argument structures in such text.

II.2. Theories of discourse and methods of discourse analysis

The fact that theorists classify persuasion, or argument, as a special type of discourse suggests that researchers in the field of persuasive writing should be able to capitalize on the theoretical frameworks and methodological tactics developed in discourse processing. The purpose of the following discussion is to review current theories of discourse and methods of discourse analysis and indicate how they can be used to research and analyze persuasive writing.

In cognitive research there has been increased interest in discourse or text. For cognitive psychologists, discourse is of interest because it is viewed as a fundamental source of information about the cognitive architecture of humans (Frederiksen et al., 1990). Particular attention has been given to developing and defining formal structures to represent the semantic dimension of discourse (i.e., the information or knowledge contained in a text). These structures are hypotheses about the knowledge representations and cognitive processes that are required to generate and understand a text (Frederiksen, 1975; Grasser, 1981; Kintsch & van Dijk, 1978; Meyer, 1975). That is, natural language discourse is viewed as reflecting the knowledge of the writer or speaker, the purpose of communicating meaning through language, and the cognitive processes required to produce and comprehend knowledge and represent it as discourse.

Similarly, in linguistic research there has been an emerging focus on the meaning or semantics of discourse (i.e., text as language having a communicative intent; Beaugrande, 1980). In attempting to understand how and why a text means what it does, research and analysis in linguistics has focused on the following two resources in language for creating

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[1]The Principle of Charity requires that when reasoning is not clearly indicated in text but present, one should choose the analysis that results in the strongest possible reasoning. If, on the other hand, the only reasoning that could be attributed to the statements is illogical, then the discourse should be categorized as "nonreasoning".

text--cohesion and thematic organization (i.e., the syntactic organization of information presented in a text (Halliday, 1985).

In the following discussion, consideration will be given to those semantic structures and linguistic devices which have been used to study and understand such discourse processing activities as text production, comprehension, and translation. Reference is made to empirical studies in the area of text comprehension since many of the early developments in discourse theory and methodology were the result of research in this particular branch of discourse processing.

II.2.1. Semantic structure in discourse processing

Researchers in the area of discourse comprehension have argued that in order to examine the information a reader processes from text it is necessary to know the content or semantic structure realized in the text. These semantic structures represented in text have been related to semantic or knowledge representations in memory (Brewer, 1980; Frederiksen, 1975, 1986; Graesser, 1981; Kintsch & van Dijk, 1978; Meyer, 1975, 1985). Hence, not surprisingly, in characterizing the nature of these semantic structures, researchers have drawn upon general theories of knowledge representation and organization (e.g., Schank, 1975; Sowa, 1984). However, in selecting formalisms to define and represent these semantic structures researchers have been influenced by linguistic theories.

Propositional/micro-structures

In general, cognitive psychologists and text linguists recognize that the semantics underlying a text or discourse can be characterized structurally in terms of at least two levels--a detailed propositional level and a higher organizational level. Meyer (1975, 1985) has also proposed a third, or top-level structure which represents the overall organizing principle of a text. Taxonomies of the semantic structures comprising the detailed level (referred to as primary concepts, propositions, or micro-structures) have been outlined by Beaugrande (1980), Frederiksen (1975), and Kintsch (1974). These structures are described as basic conceptual units or chunks of information. The types of semantic categories described by Frederiksen (1975) for example, include case-frame types of relations associated with events, systems, and states, (e.g., agency, instrument, patient) as well as identity, algebraic, function, dependency, modality, and temporal property relations. Studies have indicated that the propositional content of a text interacts with the

knowledge possessed by the reader to influence comprehension (cf. Britton & Black, 1985; Graesser, 1981; Kintsch & van Dijk, 1978; Reder, 1980).

Frame/macro-structures

In general, greater emphasis has been placed on determining the role that higher level semantic structures (referred to as frames, conceptual networks, macro-structures, schemes, scripts, and story grammars) play in the comprehension process. Two perspectives have been taken in defining these structures. The genre-based approach is concerned with content or organizational structures that are associated with a particular mode of discourse (e.g., narrative, expository). The knowledge-based approach is concerned with identifying general conceptual structures that are used to organize world knowledge and are represented in a variety of genres. In both frameworks researchers have investigated the readers' knowledge and use of these larger organizational structures in comprehending text.

Genre-based approaches

The genre-based perspective is evident in recent work on text grammars and prototypical macro-structures. Text grammars are based on the assumption that a text, like a sentence, has a constituent structure. This structure is generated by applying the re-write rules of the grammar. Different types of text (i.e., genres) have different grammars (i.e., constituents). For example, Mandler (1978), Mandler and Johnson (1977), Rumelhart (1975), and Thorndyke (1977) have outlined text grammars which specify the constituents of a story. It is postulated that these story grammars account for a well-formed and coherent narrative and that the reader's knowledge and use of these grammars will be related to his comprehension and recall of narrative texts. To this effect, Stein and Glenn (1979) have shown that the development of children's story comprehension skills can be accounted for in terms of an adapted version of Rumelhart's story grammar.

Macro-structures are described as higher level structures forming an outline or summary of a text and are generated by rules which apply to a set of micro-structures (Kintsch & van Dijk, 1978; Meyer, 1975, 1985). Prototypical macro structures have been proposed for specific genres. For example, Kintsch (1977) has specified types of macro-structures associated with stories (i.e., exposition, complication, resolution, moral), and Meyer (1975, 1985) has delineated five types of macro-structures found in expository text (i.e., causation, collection, response, comparison, and description). It has been shown

that better readers are able to use these macro-structures to summarize and recall information presented in expository texts (Meyer, Brandt, & Bluth, 1981).

Knowledge-based approaches

Arguments have been raised against the genre-based approach to discourse analysis. For example, Levy (1979) has pointed out that text grammars are confined to a particular discourse type, and Bracewell et al. (1982) have suggested that story grammars do not account for the variation in semantic structure within a text type. Research results reported by Brewer and Lichenstein (1981), Bruce (1980), and Trabasso, Secco, and Van Den Broek (1984) indicate that rather than the genre-based approach, a knowledge-based approach may be more appropriate in conducting a semantic analysis of discourse.

Knowledge-based approaches to the analysis of semantic structure in text are motivated by the assumption that people construct summaries and comprehend text according to their understanding of what the world is like. For example, Morgan and Sellner (1980) argue that people understand stories according to the types of relations between events and facts in the real world (i.e., those of temporal order, causality, and motivation). Consistent with this perspective Brewer and Lichenstein (1981) and Bruce (1980) have shown that people use different criteria than that specified by story grammars to recall information from stories. Specifically, it is knowledge of plans, goals, and intentionality that guide recall and comprehension. Similarly, Trabasso et al. (1984) have indicated that it is the causal coherence of a story and the reader's understanding of causality that are prerequisite to understanding and constructing a representation of the story in memory.

Frederiksen (1986), Graesser, (1981), and Graesser and Goodman (1985) refer to general knowledge structures of the sort described by Brewer and Lichenstein (1981), Bruce (1980), and Trabasso et al. (1984) as frames or conceptual graph structures. A number of frames have been specified in detail by Frederiksen et al. (1990): (a) narrative frames, consisting of event-structures formed by temporal and causal relations, (b) procedural frames, consisting of procedural structures formed by goal, conditional, action, and decomposition relations, (c) descriptive frames consisting of various types of structures formed by attribute, spatial-locative, classification, and part-whole relations, (d) problem frames consisting of problem and problem solving structures, and (e) dialogue frames consisting of conversational structures formed by illocutionary events (i.e., speech-acts) and relations. Generally speaking, these frame structures appear to be consistent with the three types of conceptual graph structures proposed by Grasser and Goodman (1985), i.e., cause-oriented structures, goal-oriented structures, and static descriptive structures.

Like story grammars and macro-structures, frames organize the propositional content of a text to influence comprehension. However, it is proposed that these frame structures are not specific to a discourse type or genre but are combined to form the overall semantic organization of a text. For example, a story would consist of narrative, procedural, and descriptive frames. Research results are consistent with the notion that these general knowledge structures play a role in the comprehension of various texts. For example, Frederiksen and Breuleux (1990) have reported expertise-related differences in individuals' use of procedural frames to comprehend technical text, and Frederiksen (1988) has also shown that children demonstrate differential ability in using general organizational structures such as procedural and narrative frames to comprehend stories and expository texts.

The use of knowledge-based approaches to account for the role of semantic structure in comprehension represents an advance in the development of a psychological theory for discourse processing. That is, since the frames and conceptual networks proposed by Frederiksen (1986) and Trabasso et al. (1984) are assumed to have a one-to-one correspondence with organizational structures found in human memory, they have potential psychological validity. Miller (1985) suggests that for this reason they offer a distinct advantage over the genre-based systems proposed by Meyer (1975, 1985), for example. In further investigating the role of frames in discourse processing it is suggested that research needs to be conducted to determine how various frames are integrated to fulfill a particular discourse function or communicative goal. For example, similar to the functional relationship between Meyer's top level or rhetorical predicates and macro-structures for expository text, a particular frame type may both define the overall semantic organization of a text and be embedded within this top level structure (Grasser & Goodman, 1985).

II.2.2. Linguistic structure in discourse processing

Considerable research effort has been directed toward delineating the linguistic devices that are properties of text and examining how these surface-level structures contribute to text coherence and influence comprehension. Researchers have indicated that the principal surface structure through which the underlying semantic structure is represented in text is a sequence of clauses or sentences. Of particular interest, however, are the surface text patterns which serve to connect the text beyond the clause or sentence level. Two aspects of text structure at the surface level have been implicated in the overall organization of a text--cohesion as described by Halliday and Hasan (1976) and thematic organization or topicalization patterning as outlined by the functional sentence perspective (Danes, 1970; Grimes, 1975; Halliday, 1985).

Cohesive structure

According to Halliday and Hasan (1976) cohesion is that part of a language system which serves to distinguish text from a disconnected sequence of sentences. It is a property of text in that it signals semantic relations within sentences and more importantly, across sentences. Five types of cohesive relations have been identified in the English language: lexical, referential, substitution, ellipsis, and conjunction. What these categories have in common is the property of signaling that the interpretation or meaning of some element (i.e., lexical item) in the discourse is dependent upon that of another (Halliday, 1985; Halliday & Hasan, 1976).

Lexical cohesion depends on a continuity of lexical meaning through a text. It is effected by the author's choice of vocabulary and may take the form of word repetition, synonyms, general words (i.e., the names of superordinate members of major lexical sets) or a superordinate (i.e., the name for a more general class). Referential cohesion involves the use of certain lexical items (e.g., proforms, demonstratives, and comparatives) which have the property of reference; they make reference to something else for their interpretation. Cohesion is effected when that source of interpretation is an element of the text. Substitution is a type of cohesion that is effected by the replacement of one lexical item by another. Ellipsis involves the omission of a lexical item, something that is left unsaid but understood and is cohesive when the primary source of the presupposition is the text. Both substitution and ellipsis effect cohesion by form: a word or a structural feature is carried over text. Conjunction achieves cohesion by semantic connection. It is different from other cohesive relations in that the conjunctive elements are cohesive not in themselves but by virtue of their specific meanings--they relate other linguistic elements that occur in succession but are not related by other structural means. There are four major types of semantic relations represented as conjunctions--additive, adversative, causal, and temporal--and they are expressed in the text as lexical conjunctives, adverbs, and prepositional phrases (Halliday, 1985; Halliday & Hasan, 1976).

Thematic organization and topicalization structure

Functional sentence perspective linguists have stressed the contribution of sentence topic pattern to the overall discourse topic (or thematic organization). They have suggested that surface text structures or patterns can be determined on the basis of two distinctions: (a) the theme/rheme or topic/comment distinction and (b) the old/new information distinction. Halliday (1985) refers to the thematic structure of a clause or simple sentence

in terms of a theme, which consists of the first element, and rheme, which consists of the remainder. Others (Clements, 1979; Grimes, 1975) have analyzed the thematic structure using a slightly different approach, i.e., in terms of the topic, which consists of all elements occurring before the main verb, and a comment, which consists of the remainder. The theme/rheme or topic/comment structure interacts with the old/new distinction in that generally, the theme or topic carries information that is old (i.e., given previously in the text) while the rheme or comment contains information that is new.

Analyses of cohesion, old/new information, and sentence topic patterning have been used to identify three basic types of text patterns: (a) simple linear progression, (b) thematic progression with a continuous (or constant) theme, and (c) thematic progression with derived themes (or a hypertheme; Danes, 1970). Halliday (1985) has suggested that a particular patterning of themes (or topics) may be associated with a particular genre. For example, in narrative or descriptive texts the same participant may remain in theme or topic position (i.e., either the protagonist in the narrative or the object being described). In contrast, in texts involving logical argument it is more likely that the theme or topic of a clause is the rheme or comment of the preceding clause. The establishment of these thematic or topicalization patterns within a text is achieved through cohesive chains. For example, chains of pronominal reference would serve to maintain the protagonist in topic position in a narrative whereas conjunctive cohesive relations may link themes or topics in an expository text involving logical argument.

Researchers in text linguistics (Danes, 1970; Halliday, 1985; Witte, 1983a) have postulated that writers use patterns of topicalization to establish semantic relations between sentences, and hence analysis of the sentence themes or topics across a sequence of sentences can reveal the overall message or "gist" of a text. In fact, topicalization structures and thematical organizational patterns have been equated with the semantic outlines or macro-structures of text. Witte (1983a) for example, suggests that it would be possible to construct the macro proposition for a well-formed text based on an analysis of the topical structure without conducting the detailed semantic analysis outlined by Kintsch and van Dijk (1978). Studies investigating the function of linguistic structure with respect to comprehension suggest that surface text features such as cohesion, topicalization patterning, and the old/new distinction do affect the recall and inferencing of information from text (Clark, 1977; Clark & Haviland, 1977; Clements, 1979; Grasser, Hoffman, & Clark, 1980).

II.2.3. Multi-representational models of discourse production

Although much of the research on the role of semantic and linguistic structures in discourse processing has proceeded independently, in general theorists view these structures as subsystems or levels of a multi-level language system (Beaugrande, 1984; Clements, 1979; Flower & Hayes, 1984; Frederiksen et al., 1990; Halliday, 1985; Sowa, 1984; van Dijk & Kintsch, 1983). While much of the earlier research in the area of discourse processing focused on explaining and predicting text comprehension, researchers have recently been encouraged to use multi-level models of discourse representation as frameworks for developing theories of writing and discourse analysis systems as tools for investigating the knowledge representations and cognitive processes involved in text production (Bracewell & Breuleux, 1994; Bracewell et al., 1982; Frederiksen et al., 1987; Frederiksen et al., 1990; McCutchen, 1986, 1987; Witte & Cherry, 1986).

One of the most detailed models of discourse production is that proposed by Frederiksen et al. (1990). This model not only describes the sort of semantic and linguistic structures comprising a text but also outlines the processes which operate on each structure or serve to co-ordinate structures in order to fulfill a discourse function (i.e, communicate a particular message). The model defines the structure of discourse at three qualitatively different levels of representation: (a) conceptual networks, (b) propositional structures, and (c) surface level structures (i.e., topicalization patterns). The frames or conceptual networks provide the organizing principle or overall semantic organization for a text in that the goal of communication is to transmit understanding of one or more of these conceptual structures. They are not genre specific but are representative of general conceptual frameworks people use to organize their knowledge of the world (e.g., narratives, descriptions, and procedures). Propositional structures (e.g., states, events, algebraic relations, and logical dependency relations) as defined by Frederiksen (1975, 1986) provide the detailed semantic representation of frames. Topicalization patterns are of the sort proposed by Clements (1979), Halliday (1985), and Lautamatti (1987) and the component linguistic structures giving rise to these patterns are clauses and cohesive chains. The topicalization structure signals the meaning of a text by linking and placing appropriate emphasis and perspective on the underlying semantic structures.

Associated with each structure are a number of processes which are involved in text generation. Processes associated with conceptual networks include generating or retrieving frames, elaborating specific frames, and integrating various frame types as well as selecting and sequencing (i.e., topicalizing) information. Processes associated with propositional structures include generating or retrieving propositions consistent with the specified frame

structure, evaluating the coherence of the propositions, and segmenting propositions for encoding into language structures. Finally, processes associated with topicalization patterns include generating syntactic structures (i.e., clauses), selecting lexical units to achieve cohesive chaining, and evaluating whether the surface level pattern does in fact signal the intended meaning of the text.

Bracewell and Breuleux (1990) extended the Frederiksen et al. (1990) model of discourse production by specifying a pragmatic level of representation which encompasses the communicative goals and planning structures of the writer. This work brings together recent theoretical developments in writing research within problem solving and discourse processing perspectives. Specifically, consistent with the research reported by Flower and Hayes (1981, 1984), and Hayes and Flower (1980), it is suggested that writers define a writing task according to their knowledge of the situation (i.e., the audience, genre, content, and purpose) and based on this knowledge, they set objectives for the text which are specified in goals. The link between the task definition and the text itself can be found in the writer's planning structures which may be represented by a set of procedures outlining how goals may be met. These planning structures, as suggested by others (e.g., Burtis, Bereiter, Scardamalia, & Tetroe, 1983), act as control structures in text generation. They may be recovered from think aloud protocols when the task is defined by the writer (which occurs when the task is an ill-defined one such as writing a novel) or through an informal task analysis when the task is specified for the writer (e.g., a school writing assignment).

The results of a number of writing studies are consistent with the theoretical framework proposed by Frederiksen et al. (1990) and Bracewell and Breuleux (1990). The behaviors demonstrated by writers, and the texts they produce can be accounted for by the pragmatic, semantic, and linguistic structures specified in the stratified model of discourse processing. For example, Breuleux (1987) has identified the planning structures and goals of expert writers by conducting a procedural frame analysis of the writers' think-aloud protocols. Carey, Flower, Hayes, Shriver, and Haas (1989), and Bereiter, Burtis, and Scardamalia (1988) have indicated that the quality of writers' plans is related to the quality of the texts they produce. Evidence for the use of propositional structures comes from a study on children's oral production of stories (Frederiksen et al., 1987) as well as a study on the book reports written by elementary school children (DeRemer & Bracewell, 1989). These studies also demonstrated children's use of narrative, procedural, and descriptive frame structures in text production. In addition, Senecal and Crammond (1990) have reported that developmental and achievement-related differences in children's written narratives can be accounted for by variation in the complexity of procedural frames generated. Finally,

Bracewell (1986, 1987) and Frederiksen et al. (1987) have reported results indicating that students make use of topicalization patterns in signaling the narrative frame structures represented in their written texts, and Witte (1983b) has shown that the results of a topical structure analysis can be used to predict the writing quality of college students' essays.

II.2.4. Methods of discourse analysis

In general, methods of discourse analysis currently available have a direct correspondence to theories of discourse processing. That is, a discourse analysis system involves examining a text or discourse for the specific structure(s)--linguistic/surface, semantic, or pragmatic, for example--proposed in the discourse theory.

Analysis of semantic structure in discourse

Methods of discourse analysis directed at revealing the semantic or content structure of a text are generally based upon multi-level theories of discourse structure and formal representations or models of the levels of semantic structure which are represented in a text. For example, Kintsch and van Dijk (1978), and van Dijk and Kintsch (1983) have used a propositional notation to formally express the semantic structures of discourse at the micro- and macro-structural level. The basic composition rule for a proposition at any level is that it include a predicate or relational concept and one or more arguments which may be concepts or other embedded propositions. Predicates may be realized in the surface structure as verbs, adjectives, adverbs, and sentence connectives. Each predicate constrains the nature of the argument that it may take. The arguments of a proposition fulfill different semantic functions such as agent, object, and goal. The meaning of a text then, is represented by means of a structured list of propositions with the order of propositions being determined by the order of words in the text that correspond to the propositional predicates. To account for text comprehension, Kintsch (1988) and Kintsch and van Dijk (1978) have proposed a processing model that constructs a network of coherent propositions as it proceeds through the text. A discourse analysis system based on Kintsch and van Dijk's (1978) discourse theory would involve identifying the micro- and macro-propositions which comprise the coherent network. The propositions are either present in the text or the result of inferential processes drawing on prior knowledge. The resulting coherent network can be represented graphically in terms of the relationships between the levels of representation.

Beaugrande (1980), Frederiksen et al. (1990), and Graesser (1981) also advocate a multi-level theory of semantic representation. However, in order to meet the constraints associated with a knowledge-based perspective they have drawn on alternative notational

systems to model or formalize the semantic structures represented in discourse. The semantic structures proposed by Frederiksen (1975, 1986) are referred to as semantic networks, node-link structures in which the links are definitional or structural in that they define the relationship between nodes.

According to Woods (1973) semantic networks are ideal candidates for the role of internal semantic representations since they incorporate the notion of links connecting individual structures into a total structure. These semantic networks or structures may be formally expressed through systems of production rules referred to as representational languages or semantic grammars. The particular notation that Frederiksen has used to define the rules underlying propositional and frame structures is the Backus-Naur form (BNF; Backus, 1959; Naur, 1963). The BNF notation was originally devised to function as a linguistic grammar that defined legal strings for computer programming languages. A BNF semantic grammar defines a set of rewrite rules for generating and parsing semantic structures.

Using the BNF as a notational system to formally express discourse structures provides certain advantages to the researcher. First, the property of recursion in conjunction with the use of reference devices built into the grammar enables one to generate conceptual graphs which are models of associative semantic networks in memory (Sowa, 1984; Woods, 1973). That is, while application of a BNF grammar to a discourse results in a tree structure, the reference devices permit mapping among various tree structures so as to generate the conceptual network. Second, the optionality and iterative functions enable the pruning and elaboration of a tree structure and thus allow the researcher to account for variation in structures within and across texts. Third, the rewrite rules allow for increased degrees of precision in that structures can be decomposed or specified at levels of greater detail. Fourth, the co-ordination of various levels of representation (e.g., propositional and frame) can be expressed formally by specifying the mapping relations between objects at the different levels.

BNF grammars have been developed to represent the propositional structures proposed by Frederiksen (1975, 1986) and to describe various frame structures. The frame grammars specify the propositions or concepts as well as the legal relations linking these entities which define a particular frame. Application of the grammars to a discourse or text enables the researcher to generate a conceptual graph which is a model or formal expression of the underlying frame or semantic structure. To date grammars have been developed for narrative (Frederiksen et al., 1987) and procedural frames (Bracewell, 1989; Frederiksen & Breuleux, 1990) as well as for planning structures which are specialized versions of procedural frames (Breuleux, 1990). In addition, Senecal, Crammond, and Bracewell

(1991) have developed a methodology for analyzing discourse using a BNF Base Grammar which specifies the semantic links defining procedural, event, and descriptive frame structures as well as the semantic links that integrate these frames. The Base Grammar method of analysis enables the researcher to make comparisons across different instances of text production at a propositional or detailed level as well as at a higher level (i.e., general frames structures). Moreover, because the legal component-relation-component complexes have been specified within the grammar, it is also possible to identify the various sources of frame integration (Senecal & Crammond, 1990). As such, discourse analyses based on the BNF Base Grammar is a promising approach for investigating how basic frame structures are integrated within a particular mode of discourse or to meet the communicative goals of a discourse.

Linguistic analysis of discourse

Linguistic analyses generally involve considering syntactic dependency relations which represent the structure of text across sentences. For example, cohesion analysis involves examining a text for the various cohesive ties outlined in Halliday and Hasan's (1976) taxonomy. These cohesive ties are seen as linguistic devices which are used to create or signal a coherent structure in a text. Topical structure analysis as outlined by Clements (1979), Conner and Farmer (1990), Lautamatti (1987), and Witte (1983a) involves studying the semantic relationship between sentence topics and the discourse topic by considering the sequences of sentences and examining how sentence topics work through the text to progressively build meaning. Both cohesive structures analysis and topical structures analysis are based upon discourse theories which propose that the meaning or message of a text or discourse is created or signaled through specific linguistic devices or surface level structures in the text.

In sum, research and analyses of persuasive writing which are based on theories of discourse promise well for the advancement of current understanding of the field. The multi-level model of discourse processing suggests several possible approaches to persuasive writing research. It underlines the advantages of (a) describing the general semantic structures involved in persuasive text as well as their links with higher level structures reflecting informal arguments and (b) examining the relationship between these semantic structures and specific linguistic representations such as cohesion. In addition, the use of formalized systems of discourse analysis means that results can be not only systematically interpreted within a theoretical framework but also communicated clearly to a scientific community.

II.3. Research on persuasive writing

In the final section of this literature review consideration is given to studies which have contributed to our current understanding of persuasive writing by (a) identifying text features underlying the quality ratings assigned to student persuasive texts, (b) investigating the effect of factors such as age, genre, topic knowledge, and audience on students' use of specific discourse features or the quality of texts they produce, and (c) documenting the effects of various instructional programs designed to improve students' writing in this genre.

II.3.1. Predictive and quantitative descriptive studies of persuasive writing

Recently, a number of investigations have been conducted to determine those discourse features that can predict or explain the quality ratings assigned to students' persuasive texts. Such information is considered necessary to diagnose the specific strengths and weaknesses in students' compositions, to inform instructional practice, and to explore the issues of reliability and validity associated with traditional writing evaluation procedures such as holistic scoring (Connor & Lauer, 1985; Cooper et al., 1984; Huot, 1990).

The most frequently used type of discourse analysis applied to persuasive text is probably that based on the taxonomy of cohesive ties developed by Halliday and Hasan (1976). McCulley (1985) conducted such a linguistic analysis to investigate the explanatory and predictive power of cohesion in the persuasive essays produced by high school students for the NAEP (1980). He reported a significant relationship between four types of cohesive ties and NAEP primary trait quality ratings as well as between four categories of lexical cohesion and NAEP primary trait coherence scores. Conner and Lauer (1985) also reported that aspects of cohesion (e.g., lexical repetition) were correlated with both the holistic quality ratings and primary trait coherence ratings (based on Bamberg's (1984) scale) assigned to the persuasive texts produced by high school students. However, consonant with Witte and Faigley (1981) these researchers concluded that in view of the complexity of the relationship between cohesion and writing quality, type and frequencies of cohesive ties would not be useful measures for evaluating writing and other text features should be considered.

To this effect, Conner and Lauer (1985) conducted a preliminary investigation as to the relationships among various persuasive appeals (referred to as the rhetorical features of a persuasive text), holistic quality and coherence ratings, and cohesion measures. To achieve this a taxonomy of persuasive appeals was developed based on work by Perelman and Olbrechts-Tyteca (1969). The content analysis of students' texts involved segmenting texts

into thematic units or episodes (Black & Bower, 1979; van Dijk, 1982), classifying the unit as an affective, rational, or credibility type of appeal, and finally, rating the effectiveness of the appeal (i.e., positive or negative). Based on the patterns of significant inter-correlations which they found among the holistic rating scores and measures of these appeals, these researchers stressed the need for future investigations to adopt a multi-dimensional approach in accounting for variation in persuasive writing ability among high school students and to consider not only linguistic factors such as cohesion but also content and organization.

Durst et al. (1990) conducted a similar study but although using Connor and Lauer's (1985) taxonomy to consider types of persuasive appeals, other measures of linguistic and rhetorical skill (i.e., Bamberg's coherence scale (1984), spelling, sentence boundaries, agreement, and "five paragraph format") were not based on a theory of discourse and admittedly, interdependent. Durst et al. (1990) reported that the logical appeals variable was the most significant predictor of of the quality rating scores assigned to students' texts (accounting for 53% of the variance) and that the other significant predictor variables (number of words and coherence score) accounted for an additional 14%.

The study conducted by Conner (1990) represents a more serious attempt to take a comprehensive and theoretically-based approach to describe and evaluate high school students' persuasive writing. A battery of measures was developed to tap various aspects of text structure and these measures were then used as independent variables in a regression analysis with holistic writing score as the dependent variable. The independent variables included measures of (a) syntactical complexity based on a factor analysis of various syntactic and cohesive devices, (b) coherence based on a topical structure analysis as outlined by Connor and Farmer (1990), (c) types and effectiveness of persuasive appeals based on Conner and Lauer's (1985) work, and (d) a composite score derived from the quality ratings assigned to three argument components (i.e., claims, data, and warrants) drawn from Toulmin's (1958) model of argument. One problem reported with the analysis and rating of argument components was the low inter-rater reliability (ranging from .56 to .77). Nonetheless, of interest is the finding that the composite rating score based on students' use of Toulmin's argument components proved to be the most significant predictor of holistic rating scores. Specifically, the composite score accounted for 48% of the variance associated with the holistic scores where all significant variables accounted for 61% of the variance.

Results of other studies examining the extent to which the quality of specific argument elements predicted the overall quality of students' writing suggest that a more elaborated version of Toulmin's model be considered than that proposed by Connor (1990). In a

study of the rhetorical strategies used by native and non-native English speakers, Ferris (1994) found that not only did Connor's Toulmin composite score account for a significant portion of the variance (34%) associated with the holistic scores assigned to persuasive texts produced by college freshmen but that the variable counterarguments (defined as the recognition of opposition) was also significant predictor. Knudson (1992) reported that across three different persuasive writing samples, the quality ratings of claims and data accounted for 28 to 44% of the variance associated with holistic scores assigned to texts produced by 10th and 12th grade students, and, for two of these writing samples, the variable opposition was also a significant predictor. The variable warrant was a significant predictor for only one of these samples.

The most comprehensive descriptive study of student persuasive writing performance is that conducted by Cooper et al. (1984). These researchers analyzed the texts produced by college freshmen at the surface level for (a) errors associated with usage, punctuation, and spelling, (b) types and frequencies of cohesion, (c) clause length, and (d) types of syntactic constructions. At the rhetorical level texts were coded according to the types of arguments presented, and, based on Toulmin's (1958) model, types of argument elaborations. Of interest was how these text features might discriminate between the highest and lowest rated essays, and what they would reveal about the shortcomings of even the best writers. According to Cooper et al. (1984) it was at the top or rhetorical level of analysis that one could understand the nature of the problems underlying student persuasive writing. Although the more competent writers included more elaborative arguments, in general students' texts were characterized by a limited range of arguments, and an absence or minimal use of features considered important to persuasive writing (i.e., warrants, qualifiers, and reservations). These findings were not only viewed as evidence of students' minimal awareness of or adaptation to their audience, but also seen as reflecting a mode of thinking which discouraged the critical thinking essential to the production and evaluation of persuasive discourse.

Overall, results of previous descriptive/evaluative studies suggest the importance of the following research strategies in analyzing persuasive text: (a) using a theoretical framework to select measures, to interpret results, and to account for links between various systems of discourse analysis, (b) conducting an analysis of argument structure based on an elaborated version of Toulmin's model rather than a subset of argumentative elements, (c) using well defined methodologies to increase the reliability and accuracy of procedures for coding or rating the quality of argument structures, and (d) examining well-formed texts to extend current understanding of what constitutes good persuasive writing.

II.3.2. Descriptive and experimental studies involving persuasive writing

A number of researchers have contributed not only to our current knowledge of the nature of writing in general but also of persuasive writing in particular by manipulating factors such as age, genre, topic knowledge, audience, and mode of production and, by observing the effects on variables such as overall quality ratings, text length, types of cohesion, syntactic complexity, and the types or quality of genre-specific structures.

Many of the earlier descriptive and experimental writing studies focused on atheoretical variables such as text length or holistic scores assigned to texts. For example, Prater and Padia (1983) reported that persuasive texts were of a poorer quality than other types of text (expressive, explanatory) and shorter in length. Such results might support the notion that persuasive writing is difficult but do not tell us why it is so. Other researchers have attempted to delineate factors involved in the writing process by analyzing students' text for specific linguistic features and structures. For example, Crowhurst (1980) reported that students' argumentative texts with higher quality ratings were syntactically more complex than those with lower ratings while the reverse pattern was true for narrative texts. Crowhurst and Piche (1979) found that texts produced by students in the 6th and 10th Grades were syntactically more complex as a function of audience (e.g., argumentative texts directed to a teacher were more complex than those to a best friend) as well as discourse type (argumentative more complex than narrative). Pelligrini, Galda, and Rubin (1984) analyzed the persuasive texts produced by elementary-age students and noted variations in the use of cohesive ties as a function of mode, genre, and age. Crowhurst (1987) also reported variations in the types and frequencies of certain cohesive ties used in argumentative and narrative texts by 6th, 9th, and 12th grade students. However, the most interesting finding, according to Crowhurst (1987), was that for some types of cohesive ties similar mean scores could result from different writing behaviors. For example, use of lexical repetition could reflect either an immature repetitiveness in selection of lexical items or a tendency to elaborate and summarize arguments. What this interpretation seems to imply here is that in order to appreciate the significance of linguistic patterns represented in a text, it is necessary to move beyond the surface level features and consider the underlying semantic structure. In sum, Crowhurst's (1987) study is important not because of its findings regarding the use of specific cohesive ties but because it stresses the necessity of conducting a functional analysis of a texts' linguistic features (e.g., how a particular cohesive tie is used to represent a semantic or logical relation). Such an analysis depends upon a description of the semantics of the text.

Further advances in current understanding of the cognitive processes and structures involved in writing have resulted from such comprehensive studies. McCutchen (1986,

1987) and McCutchen and Perfetti (1982) used various content and linguistic systems of analyses to investigate the role of domain knowledge, discourse form, and modality in the development of writing ability and also adopted an integrated approach in interpreting the results of these analyses. For example, McCutchen (1987) compared the narrative and argumentative-type expository texts produced by students in the 4th, 6th, and 8th grades according to structural features derived from the following text analyses: (a) clausal analysis, (b) local coherence analysis, which involved determining connections at the surface level reflecting logical relations at the conceptual level, (c) linguistic analysis, which involved classifying the linguistic devices (i.e., cohesive ties) used to maintain local coherence, and (d) hierarchical analysis, which involved determining the depth of elaboration of the main points in a discourse according to a system derived from Voss, Greene, Post, and Penner's (1983) analysis of reasoning structures. Results indicated that (a) although narrative texts were longer, their depth of elaboration did not vary from the shorter argumentative texts and (b) students' argumentative texts contained proportionately more explicit ties (e.g., conjunctions and dependent clauses) while their narratives contained more inference ties (i.e., those based on the semantics of concepts presented in the text). This latter finding was seen as reflecting the nature of the genres--logical-causal structures which are characteristic of argument must be made explicit in the surface structure while the temporally and goal-related events characteristic of narratives are more easily inferred by the reader by virtue of their intrinsic relationship.

The studies conducted by McCutchen (1986, 1987) and McCutchen and Perfetti (1982) have theoretical and methodological implications for writing research in general. These researchers adopted an approach to text structure analysis which was not only comprehensive but also integrated. In addition, they attempted to make inferences from the results of their analyses to the cognitive structures and processes involved in text generation. In comparing structural features across genres researchers offered processing explanations for the difficulties students experience in producing argumentative text, and this processing account was not limited to a particular dimension of text representation but incorporated interactions between content and linguistic structures. A logical direction for future research to take would involve using a theory of discourse processing to determine the selection of text analysis systems and dependent measures as well as to interpret the results of these text analyses.

McCutchen's (1986, 1987) work represents theoretical and methodological advances in the study of writing in that it integrates the results of semantic and linguistic analyses. However, the semantic analysis was based on a hierarchical analysis of content which did not reveal qualitative differences between narrative and argumentative texts. The Voss et

al. (1983) model of human reasoning does not describe the semantic characteristics of elaborations found in narrative or argumentative texts. It is suggested that an analysis based on a theory of semantics in discourse could result in data that would provide more substance to the interpretation of findings regarding students' use of explicit and inferential ties in their narrative and persuasive discourse.

Other researchers have investigated the semantic differences in argument structures identified in students' persuasive texts as a function of age and audience. McCann (1989) and Knudson (1993) coded the persuasive texts produced by students in the 6th through 12th grade according to categories derived from Toulmin's model of informal argument and evaluated the quality of these structures. Developmental trends were evident in the use and quality of claims, warrants, and opposition structures. Concern was expressed regarding the generally weak performance of all students in the use of warrants and opposition in that these elements were described as being components of effective argument. However, why these elements are considered effective has best been conveyed by researchers who have adopted an audience-centered approach to persuasive text analysis.

Coirier and Golder (1993) and Golder and Coirier (1994) examined students' persuasive texts for specific structures indicative of the supporting (i.e., reasons) and negotiating (i.e., modals, counterarguments, evaluations, and propositions) processes they deem central to persuasive discourse. These researchers report that while students demonstrate the basic argumentative skills--the use of reasons to support a claim--in written persuasion at an early age (i.e., 10 years of age) the more sophisticated skills--the use of counterarguments and modals--seen as reflecting a concern for audience, appear later on in development (i.e., 13-14 years of age). Counterarguments are viewed as hallmarks of good persuasive discourse by many audience-centered theorists. These structures involve an examination of alternative views as well as an attempt to refute them and strengthen one's own position.

Support for the notion that the use of counterargument structures is influenced by the writer's representation of audience come from recent studies by Hays and Brandt (1992) and Hays et al. (1988), as well as earlier work by Clark and Delia (1976), O'Keefe and Delia (1979), and Rubin and Piche (1979). Overall, these researchers demonstrated that students (kindergarten through to college age) and experts use more counterarguments when their written persuasive texts are directed toward a hostile or unfamiliar audience. Clark and Delia (1976) and O'Keefe and Delia (1979) also cite data suggesting that (a) the use of these sophisticated persuasive strategies is related to a writer's ability to construct a complex and comprehensive representation of their audience and (b) the development of this ability is age-related. Rubin and Piche (1979) noted that experts, rather than focusing

exclusively on substantiating their claims, also appeared to consider the reader's value structures and to place their arguments in a broad historical and cultural context. These were viewed as strategies which might render their audience more receptive to arguments proposed. Although these researchers did not base their texts analysis on a model of argument, it appears that what they observed in expert texts was the use of warrants.

In sum, consonant with the implications of those studies discussed in II.3.1, results of the descriptive and experimental studies discussed herein emphasize the importance of considering the following research strategies in future investigations of persuasive writing: (a) the use of a multi-level model of discourse representation, i.e., one that incorporates both semantic and linguistic levels and the relationship between these levels, (b) the use of text analyses systems drawn from this multi-level model, and (c) the use of an elaborated version of Toulmin's model to analyze persuasive arguments--one that accounts for the types of structures seen as reflecting a concern for audience.

II.3.3. Instructional intervention studies focusing on persuasive writing

Finally, consideration is given to studies that have attempted to improve the quality of students' persuasive writing by implementing specific procedural strategies and instructional programs. Of particular interest is not the effectiveness of a given experimental treatment but how the results inform (a) current understanding of the factors involved in persuasive writing and (b) the direction that future research should take in analyzing persuasive text.

Scardamalia et al. (1982) used a strategy described as procedural facilitation to encourage students in grades 4 and 6 to generate longer and better argumentative texts. The effects of the procedural facilitation treatments, assessed by both atheoretical (i.e., text length and overall quality) and discourse variables (i.e., argument elements and text coherence), were that (a) the written mode of production resulted in a more coherent text than the oral mode, and this advantage was maintained after students added to their texts, (b) children's written texts were shorter than those dictated, (c) the same relative use of various argument elements was found across mode of production, with reasons and elaborations representing the most frequently used units, and (d) the relative use of elaborations and nonfunctional text units increased most when students were cued to add to their texts. Scardamalia et al. (1982), reported that attempts at a detailed analysis of argumentative text (e.g., coding embedded arguments) resulted in a drop in inter-rater reliability. These experimenters dealt with the problem by not conducting a detailed analysis and in doing so possibly failed to capture developmental or treatment related differences in the structural complexity of students' argumentative texts.

Matsuhashi and Gordon (1985) used a semantic analysis of persuasive texts as a means of studying the effects of three treatment sessions designed to encourage college students' revising activities. Text revisions were classified in terms of their function in an argument using categories derived from Toulmin's model (as defined by Rieke and Sillars; 1975). Matsuhashi and Gordon (1985) perceive these categories as comprising a discourse-specific taxonomy particular to argumentative/persuasive text. Frequencies calculated for these semantic categories revealed that regardless of the revising situation, students' additions to their texts primarily consisted of text units functioning as data (61%) and claims (28%). This study is viewed as important here because it raises the issue of how to treat variation in text structure. The experimenters noted that warrants, for example, were not always made explicit in an argumentative text and suggest the decision to use warrants depends upon situational factors (e.g., audience). The implication here is that in analyzing the internal structure of a discourse it is important not to treat variation simply as error; evaluations of student writing must take into account the pragmatic fit of a text, i.e., how well it meets the communicative demands set by the context.

Scardamalia and Paris (1985) used the semantic analysis of argumentative texts to investigate the role of genre-specific discourse knowledge in writing. Fourth and sixth grade students were assigned to one of three instructional treatments designed to ensure acquisition of explicit knowledge of the structural elements comprising an opinion essay. Similar to the analysis systems used by Matsuhashi and Gordon (1985) and Scardamalia et al. (1982), these structural units were derived from Toulmin's (1958) model of argument. Students' pre- and post-treatment essays were analyzed for structural elements (i.e., argument components) and use of structural markers (i.e., cohesive ties signaling the function of a particular semantic unit). Grade-related differences were reported for inclusion of particular structural elements (i.e., reasons, examples, and conclusions) and use of structural markers in post-treatment essays. Treatment-related differences were found for use of oppositions structures and non functional text units but not for measures of overall quality or coherence.

Crowhurst (1991) investigated the effects of providing 6th graders either instruction in persuasive writing which focused on specific structural elements (claims, data, and supporting ideas), or exposure to samples of persuasive text. Significant results were found in terms of improvements in writing quality, organization, use of elaborations, and text markers. The overall implications arising from Crowhurst's (1991) results are positive; the persuasive writing of 6th grade students can be improved by either instruction in writing or exposure to persuasive texts. However, little is known about the semantic characteristics of the elaborations (other than that students were neither encouraged to use

nor marked for using highly persuasive structures such as counterarguments) or the types of structural markers analyzed in students' texts. Moreover, since both overall writing quality and organization measures were holistic scores, the independence of these variables is questionable.

Other studies investigating the effectiveness of various instructional strategies on the persuasive writing of 4th, 6th, and 8th graders (Knudson, 1991) and 10th and 12th graders (Knudson, 1992) have not reported significant treatment effects. Improvements were not noted in either the overall quality of persuasive texts students produced or the quality ratings assigned to argument components derived from Toulmin's (1958) model. However, Knudson (1992) noted that regardless of treatment, students in grades 10 and 12 did make greater use of data and warrants in one of the three writing samples analyzed. This variation was seen as a reflection of students' prior knowledge about the topic rather than exposure to or opportunity to engage in persuasive writing.

Overall, results of studies investigating the effectiveness of instructional strategies to improve persuasive writing suggest that while instruction or practice in such writing can increase the use of specific structural elements, the overall quality of student persuasive writing does not generally improve. In a number of studies, little information is given as to the types of argument elaborations produced by students although those providing a more detailed description suggest these elements involve reasons and warrants (support for reasons). In terms of future research and analysis of persuasive discourse, these results point to the importance of (a) developing and using a detailed model of argument structure, (b) analyzing and interpreting linguistic features in relation to underlying semantic structures defining an argument, and (c) maximizing student performance by ensuring access to adequate topic knowledge.

Studies using text analyses systems to delineate factors associated with persuasive writing quality or investigate the writing process in general have proven informative with respect to persuasive writing research. Specifically, they have identified text structures which are correlated with writing quality scores or are affected by such factors as age, genre, modality, audience and topic knowledge. Moreover, researchers have begun to move toward a theoretical account of how these various linguistic and content structures interact as a function of the demands associated with persuasive writing. In view of such information researchers and educators can begin to appreciate the difficulties students experience in producing persuasive or argumentative text in cognitive processing terms. However, it is proposed that current understanding of such writing could be furthered by incorporating recent theoretical and methodological advances in the fields of argument and discourse into future investigations. Theoretically, what should be considered is the use of

(a) comprehensive and integrated theories of discourse production which will drive the selection of dependent variables and interpretation of findings, (b) a formalized model which clearly specifies the semantic characteristics of persuasive arguments, and (c) interpretation of results from a rhetorical or audience-centered perspective. Methodologically, what should be considered is the use of a principled coding scheme to analyze arguments represented in persuasive text which will (a) ensure a high degree of inter-rater reliability and (b) systematically account for the variability in structures and processes across particular instances of persuasive writing (Bracewell & Breuleux, 1990).

III. Rationale

The purpose of this study was to investigate the relationship between writers' use of argument structure and persuasive writing skill. The study was designed to (a) determine to what extent argument structures were present in written persuasive texts produced by four groups of writers: Experts, and 6th, 8th, and 10th Grade students; (b) describe differences among student writers at the three grade levels, and between experts and students, in the complexity of argument structures represented in their persuasive texts; (c) describe differences among student writers at the three grade levels, and between experts and students, in the general semantic structures and specific linguistic devices used to represent argument structures, and (d) determine the predictive relationship between the use and complexity of argument structure and the holistic quality rating scores assigned to the student persuasive texts.

Previous research conducted in the area of persuasive writing has generally taken either one or a combination of the following three approaches: (a) identifying the text features giving rise to the quality ratings of high school students' persuasive texts (Connor, 1990; Connor & Lauer, 1985; Cooper et al., 1984; Durst et al., 1990; Knudson, 1992; McCulley, 1985); (b) describing differences in students' persuasive texts as a function of age, genre, topic knowledge, modality, or audience (Coirier & Golder, 1993; Crowhurst, 1987; Crowhurst & Piche, 1979; Golder & Coirier, 1994; Hays et al., 1988; Hays & Brandt, 1992; McCann, 1989; McCutchen, 1986, 1987; Rubin & Piche, 1979); and (c) determining the effectiveness of experimental treatments and instructional strategies designed to improve the quality of persuasive writing produced by college, upper elementary, or high school students (Crowhurst, 1991; Knudson, 1991, 1992; Matsuhashi & Gordon, 1985; Scardamalia et al., 1982; Scardamalia & Paris, 1985). In describing and comparing students' argumentative and persuasive texts researchers have derived their dependent variables from text analyses systems based on (a) the taxonomy of cohesive devices developed by Halliday and Hasan (1976), (b) syntactic constructions, and (c) models of human reasoning and argument such as those described by Voss et al. (1983) and Toulmin (1958).

Results of previous studies provide some evidence that the use of certain linguistic devices is related to differences in the quality of student persuasive writing (Connor & Lauer, 1985; McCulley, 1985) and that the frequency with which students employ such devices does vary as a function of grade and type of discourse (Crowhurst, 1987; McCutchen, 1986, 1987; Pellegrini et al., 1984). However, researchers have also pointed

out that it would be far more pertinent to conduct a functional analysis of linguistic features found in persuasive text--one that is based on the relationship between specific linguistic features of a text and the underlying conceptual structure (Crowhurst, 1987; Witte & Faigley, 1981). Such an analysis requires a description of the semantics of persuasive text.

McCutchen (1986, 1987) has attempted to integrate the results of linguistic and organizational analyses conducted on the narrative and argumentative texts produced by students in grades 4, 6, and 8. However, the method of organizational analysis, while describing the hierarchical structure of text, did not provide a detailed description of the texts' semantics, i.e., the types of elaborative structures. The results of a number of studies indicate that Toulmin's (1958) model of informal argument best captures the type of organizational or higher level semantic structures that are associated with persuasive writing. For example, Connor (1990), Ferris (1994), and Knudson (1992) reported that the quality ratings of key elements taken from Toulmin's model of informal argument were the most significant predictors of the holistic writing scores assigned to high school and college students' persuasive texts. McCann (1989) has reported developmental differences in students' knowledge and use of these same elements in their written argumentative texts. And finally, researchers (Knudson, 1992; Matsuhashi & Gordon, 1985; Scardamalia et al., 1982; Scardamalia & Paris, 1985) designing and testing instructional programs based on Toulmin's (1958) model of informal argument have reported improvements in students' writing in terms of an increase in the use of specific argumentative elements.

Existing research, then, indicates that persuasive writing skill is related to the use and quality of specific structural elements derived from Toulmin's (1958) model of informal argument. However, the exact nature of this relationship remains unclear. Researchers have yet to provide a comprehensive account of how and why variations in the complexity of argument structures may be linked to the quality of a persuasive text for the following three reasons. First, many researchers using Toulmin's model as a basis for semantic analysis have focused on a subset of argument elements (e.g., claims, data, and warrants). Results of studies conducted by researchers taking an audience-centered perspective indicate that additional elements, such as modals and counterarguments, should be considered (Ferris, 1994; Golder & Coirier, 1994; Hays & Brandt, 1992). Second, researchers have yet to consider how argument functions as a unit in persuasive discourse; thus little is known as to how the use of embedded arguments is related to persuasive writing skill. Third, many researchers have not interpreted the results of argument structure analyses within a rhetorical framework, i.e., in terms of how a particular substructure serves the goal(s) of persuasive discourse.

In summary, consideration of previous research in the area of persuasive writing suggests that future attempts to build upon existing knowledge involve the following strategies: First, the analysis of argument should be based on a model that can deal with the range of argument structures that maybe encountered in persuasive texts. Second, the argument structure itself, in addition to the elements of an argument, should be treated as a basic unit of analysis. Third, the analysis of argument structure in persuasive discourse should follow theoretically based systems of text analysis, i.e., systems derived from a theory of discourse representation that accounts for the various structures and features characterizing a text as well as the functional relationships among these structures and features. And fourth, researchers should attempt to understand and explain the results of argument structure analyses within a rhetorical framework.

In order to treat argument as a basic unit of analysis and to ensure that the scope of this unit was sufficiently comprehensive, it was necessary to set up an intermediate objective for this study--the development of a general model of informal argument. Meeting this objective involved the following steps: (a) conducting a task analysis (Newell & Simon, 1972, chap. 3; see also Ericsson & Simon, 1984) to determine the structural characteristics of informal argument, (b) using a formal language to express the structure of argument as revealed by the task analysis, and (c) defining this argument structure in terms of general semantic categories derived from theories of semantic representation in discourse.

In the current study the argument structure examined was based on Toulmin's (1958) model of informal argument. Not only have the results of previous studies (Conner, 1985; Connor & Lauer, 1990; Knudson, 1992; McCann, 1989; Scardamalia & Paris, 1985) indicated the efficacy of this model in investigating the nature of persuasive writing, but the model is grounded in a theory of human argument and is adaptive to the various domains and purposes of mainstream argumentative discourse, including that of persuasion, due to its field-independence quality (Toulmin, 1958). Despite the proven strengths of this model a task analysis of informal argument was conducted in order to determine if and in what way Toulmin's schematic would need to be elaborated so as to allow one to deal with the variability in argument structures in persuasion. In addition to Toulmin's work, this task analysis involved considering various models and coding schemes which have been used to analyze the structure of argument in discourse (Hays et al., 1988; Hays & Brandt, 1992; Knuepper, 1978; Kopperschmidt, 1985; Rieke & Janik, 1975; Thomas, 1986; Toulmin et al., 1979). The task analysis permitted specification of the possible substructures and relational links defining an argument structure, as well as the semantic characteristics of these substructures and their status within the argument structure (i.e., whether they were necessary or optional). The overall or general model served as a reference against which to

compare not only the use but also the characteristics of the argument structures associated with each of the four groups of writers participating in the current study.

The use of a formal language or set of rules to represent the model of informal argument which was developed from the task analysis, and the definition of elements of argument in terms of categories drawn from a general theory of semantic representation in discourse, were procedures which were conducted in order to (a) make the semantic categories and rules characterizing argument theory more explicit and (b) provide a principled basis for the development of a coding scheme for the analysis of argument in discourse. That is, by mapping the relationships between the structure of argument and the semantic categories derived from a more detailed level of representation, it was possible to develop a coding scheme which involved specifying criteria for recognizing instances of argument structure in text in terms of specific configurations of propositional and frame structures. This mapping procedure, along with the specification of the roles that particular linguistic devices play in signaling argument structure in the written text, resulted in a coding scheme which not only had a theoretical base but also permitted argument structures to be identified and described with increased precision.[2]

The theory of semantic representation in discourse used to define argument structure is part of Frederiksen et al.'s (1990) multi-representational or stratified model of discourse. Consistent with other recently proposed multi-level models (Beaugrande, 1980, 1984; Flower & Hayes, 1984; van Dijk & Kintsch, 1983), these researchers propose that, independent of task and/or situation, discourse is represented and hence can be described at a number of qualitatively different levels. Frederiksen et al. (1990) specified three of these levels--(a) conceptual networks or frames, (b) propositional structures, and (c) surface level structures and features (e.g., topicalization patterns and cohesive ties)--and also indicated how these various structures might be developed and co-ordinated in order to fulfill a particular discourse function. For the current study, the stratified model provided a theoretical framework in which to examine the functional relationships among specific linguistic devices and semantic structures in the persuasive texts under consideration--semantic structures refering here not only to general structures such as propositions and frames but also to argument structure, which can be considered a type of specialized frame.

The methodologies used to identify the general semantic and linguistic structures in the expert and student persuasive texts are presented in Sections IV.2.2.1. and IV.2.2.2. The development of a model of informal argument and of a methodology to identify argument structures which are based on this model and represented in natural language text is

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[2]The rationale and procedures associated with this approach to discourse analysis have been articulated by Breuleux (1990) and Bracewell and Breuleux (1994).

outlined in Section IV.2.2.3. And finally, the mappings between each of the semantic and surface (linguistic) levels of discourse representation and that of argument are presented in Section IV.2.2.4. The text analyses were used to derive measures of (a) general semantic structures, (b) linguistic devices, (c) argument structures, and (d) the relationships among these discourse structures, in order to describe and compare the persuasive writing of experts and students in the 6th, 8th, and 10th grades.

IV. Methods

IV.1.Participants

Students: Participants in the study included 56 grade 6 students from two elementary schools within a small suburban school board, as well as 28 grade 8 students, and 27 grade 10 students from a suburban high school. The socio-economic background of both elementary and high school students was that of a combination of working and middle classes. According to the respective classroom and English teachers, the grade 6 students had neither received formal instruction in argumentative and persuasive writing nor been required to produce argumentative or persuasive text, the grade 8 students had received little formal instruction in argumentative and persuasive writing but had been required to produce argumentative and persuasive type texts in their English class, and the grade 10 students had both received formal instruction in argumentative and persuasive writing and been required to produce argumentative and persuasive texts as part of their English course.

Experts: The Expert group consisted of seven professional writers who wrote argumentative or persuasive texts (e.g., editorials, critical reviews, or advertisements) for publication in various journals, magazines, and newspapers. The years of professional writing experience for these participants ranged from 3 to 18.

IV.2.Procedures

IV.2.1.Collection of text samples

Text sample I: All students and experts were required to produce an essay in response to a writing prompt consisting of (a) a written text which asks the writer to present and defend their opinion regarding the training of animals, and (b) a collage of black and white pictures depicting some of the ways that trained animals are used by humans (see Appendix A, p.133). The picture stimuli were included to ensure that all participants had access to a minimum amount of topic knowledge. This feature of the task stimulus was used to address the findings of Bereiter and Scardamalia (1982) who reported that children produce longer texts when they are prompted with cues which enable them to access topic knowledge. While such cues have a direct impact on the amount of text school age children produce, they do not account for text coherence (Bereiter & Scardamalia, 1982; McCutchen, 1986). The picture stimuli used in the present study did not contain verbal descriptions of either the pictures or the possible relational links among the pictures. Thus, it can be argued that the pictures served to maximize performance only in the sense that they gave students "something to write about".

Task administration: All participants were presented with the same persuasive writing assignment on the topic of training animals (see Appendix A, p. 133). However, it should be noted that variations in the writing situation--between the 6th grade students and the older (8th & 10th grade) students and between the students and experts--might have resulted in differences in writers' perceptions of the task, and hence, their performance. The writing task was presented to the grade 6 students as part of an annual board-wide assessment of student literacy skills. The assessment battery generally consists of standardized spelling and reading comprehension tests and a narrative writing assignment. The persuasive text samples used in the present study were produced by students in the first year that a persuasive writing task was incorporated into the assessment battery. All literacy assessment tasks were administered to grade 6 classes by the homeroom teacher during two sessions, each session lasting approximately one hour.

The same writing assignment sheet was presented to a class of grade 8 students (n = 28) and a class of grade 10 students (n = 27) by their English teachers as being a part of their regular English curriculum. Although the 8th and 10th grade students were aware that their texts would be graded, it is possible that this assessment situation was not considered to be as formal as that in which the 6th grade students produced their texts. According to classroom teachers, the grade 8 class consisted primarily of "Average" students while the grade 10 class consisted primarily of "High" and "Average" students.

At all grade levels a printed assignment sheet consisting of the written prompt and picture stimuli (see Appendix A, p. 133) was distributed to each student. The homeroom or English teacher read the written prompt aloud to the class, instructed the students to read the assignment over to themselves, and suggested that they use the pictures to help them think about what they might want to write. Constraints were not placed on either time spent on the task or length of the essays, and in general students spent 30-50 minutes completing the assignment.

Experts were given the same assignment sheet as the students and asked to generate a text in response to the writing prompt. However, the task was administered to experts on an individual basis and in their customary work environments. The investigator also informed experts as to the general purpose of the study, advised them that the task and topic were selected so as to be appropriate for a range of writers, and suggested that they write this particular text for a general audience. All experts agreed to participate in a think-aloud procedure while composing. This procedure was used to obtain additional information that is to be considered in a subsequent study concerning the control structures involved in persuasive writing. All experts were paid an honorarium for participating in the present study.

Although no constraints were placed regarding the length of text produced or time on task, experts were told how long students took to complete the task. The actual length of time that experts spent on this task ranged from 20 minutes to one and one-half hours. All but one expert emphasized that they would generally spend time in a subsequent writing session revising the text for publication, and one expert indicated that the text he produced would not even be considered a first draft but a "collection of his ideas" on the topic. All experts indicated that usually they would spend some time researching the topic in order to be able to use facts and authorities in creating their arguments rather than just opinions.

Rating and selection of student texts: In order to obtain a measure of persuasive writing ability, the quality of each student text was assessed by two independent raters. The raters were high school English teachers who, in addition to the assessment activities associated with the high school English curriculum, had participated as judges of student essays produced as part of the annual English tests which are administered on a provincial wide basis. For the purposes of the present study the raters were asked to assign a holistic score to each text, using a scale of 1 - 5, based on how well they thought the text met the demands of a persuasive writing task relative to other texts produced by students at the same grade level. These two scores were added to produce an overall quality rating score. The interrater reliability calculated using a Pearson product-moment correlation was .73. Subsequent to scoring, 12 texts from each grade level inclusive of high, average and low writing quality were selected for the detailed semantic and lingusitic analyses conducted in the present study.

Text sample II: In order to obtain additional information regarding the use of argument structure in argumentative and persuasive writing, a second sample of this type of writing was obtained from each expert writer, and from 6 of the 12 Grade 10 students whose animal training texts had been selected for furthur analyses.[3] These second texts were analyzed for argument structure and the results used to check the models of persuasive writing developed for the Expert and 10th Grade groups. For experts participating in the study, the additional sample of their persuasive writing was a text which they viewed as being representative of their work assignments. For the students, the additional sample was a persuasive text that they produced in their English classroom as part of an assessment of their writing skills. No constraints were placed regarding the topic or length of this second sample although students were presented with a number of current issues and told that they could chose one of these topics to write on if they so wished.

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[3]Only six second samples of persuasive texts were used from grade 10 texts due to the limited instances of student persuasive writing, and constraints regarding the availability of these instances to the researcher.

IV.2.2. Text analysis procedures:

All original texts selected for use in the proposed study were transcribed using a word processor and then analyzed for (a) general semantic structures, (b) clauses, (c) conjunctive ties, and (d) argument structures. Results of these analyses formed a data base which permitted both empirical and qualitative approaches to be taken in investigating the relationship between argument structure and good persuasive writing.

IV.2.2.1. Analysis of semantic structure

The analysis of semantic structures in expert and student persuasive texts was based on a recently developed model of semantic structure in discourse (Senecal et al., 1991) which is consistent with a number of general theories of discourse representation (cf. Beaugrande, 1980; Frederiksen, 1975, 1986; Graesser, 1981). As was discussed in Section II.2.1., these theories postulate that the conceptual representation of a text or discourse can be specified at two levels, the propositional or micro-structural level and the frame or macro-structural level. Propositions denote events and states or qualify aspects of other propositions (Graesser, 1981). Analysis of a text at the propositional level allows for coding this type of semantic information which is either explicitly stated or can be directly derived from the semantic content of the explicitly stated propositions. Frames or macro-structures denote global structures that are used to organize knowledge of the world (e.g., the specific organization of propositions into structures capturing purposive, goal-oriented activities). This higher level of analysis permits the coding of pragmatic inferences--semantic content that is not explicitly stated but can be inferred based on an understanding of both the general conceptual structures or schemas which are used to organize world knowledge--and the rules and conventions governing conversation or speech acts (Graesser, 1981). In contrast to representational theories that are limited to specific types of discourse (e.g., story grammars, see Rumelhart, 1975); these general theories of representation provide symbolic systems capable of assigning conceptual representations to a diversity of texts (i.e., texts differing in terms of modality and genre).

In the present study the identification of semantic structure in the persuasive texts followed the Integrated Frame Analysis (IFA) methodology developed by Senecal et al. (1991). The IFA is based on a model of semantic representation which describes natural language text in terms of three basic frame structures: (a) goal-directed, intentional event structures; (b) cause-oriented, non-volitional event structures; and (c) static, descriptive structures. In addition, the model indicates what the defining features of each of these structures are and how the structures can be combined or integrated in discourse. These

semantic structures have been formally represented by a set of rules written in BNF notation (Senecal et al., 1991). This set of BNF rules, termed the Base Grammar, specifies the three types of frames in terms of basic semantic units, referred to as components, their constituent relations, and possible inter-unit relational links. The components include (a) volitional actions, which are termed PROCEDURES; (b) non-volitional actions, which are termed EVENTS; and (c) internal and external states, which are termed DESCRIPTIONS. The constituent relations represent those semantic characteristics which define the unit as being a procedure, event, or description and may be either required or optional. For example, PROCEDURES are marked by (a) agency, operation, and outcome (goal) relations which are required and (b) conditional, patient, purpose, and instrumental relations which are optional. Inter-unit (i.e., inter-component) relational links include embedded constituent relations (achieved through a type of transformation operation) and various types of temporal and decomposition relations.

Procedural, event, and descriptive frame structures can be described by referring to the Base Grammar since all legal links within and between component types (i.e., legal component-relation-component complexes) are specified. This grammar represents a principled approach to the analysis of the semantic structure underlying discourse since its rules can be used to generate a set of semantic categories which form the basis of a coding system. The Integrated Frame Analysis (IFA) Handbook (Senecal et al., 1991) provides operational definitions of these categories as well as examples taken from written texts. Like other discourse analysis systems based on a general theory of representation (e.g., Frederiksen, 1975, 1986; Graesser, 1981), the results of an IFA provide a data base that can be used to describe and compare the semantic representations of texts produced by various writers across different contexts.

The Base Grammar provides a more coarse-grained analysis of semantic structures in discourse than that associated with Frederiksen's (1975, 1986) theory of propositional representations in natural language. However, the coding system outlined in the IFA Handbook is linked to the more detailed approach in that the terminal nodes (e.g., the constituent structures associated with a component) either map directly onto propositional structures or can be "unpacked" (i.e., the rules rewritten) to describe constituent structures more thoroughly at the propositional level. For example, the PROPERTY.REL rule, which links general descriptive information to a constituent, can be rewritten to specify the various identifying relations (e.g., category, locative, part, attribute...) that have been proposed by Frederiksen (1975, 1986) as part of the semantic and logically derived information encoded at the propositional level. These identifying relations and their corresponding structures can be unpacked further to included propositional structures that

represent degree and quantity information. In sum, the fact that the coding system associated with the Base Grammar is linked to Frederiksen's more detailed approach to the analysis of semantic structure in discourse means that there exists a principled basis for modifying the coarser-grained analysis system as may be required in order to address a particular research question.

In the present study a revised and elaborated version of the Senecal et al. (1991) Base Grammar was used to obtain a detailed description of the semantic and logical structures comprising expert and student persuasive texts. This modified version differs from the original in the following ways: (a) certain relational rules were rewritten (i.e., semantic categories unpacked) to provide the theoretical basis necessary to describe the semantics of the key or defining aspects of informal argument, (b) constituent structures were specified in terms of basic cognitive units (i.e., objects, actions, attributes),[4] and (c) non-structural rules were amended to facilitate the actual encoding and recording of structures. The unpacking of the semantic categories in question was actually at two levels, propositional and frame. At the propositional level, Frederiksen's (1975, 1986) theory of semantic and logical representations in natural language provided the basis for a breakdown of the both REALIZED/UNREALIZED and DESCRIPTOR rules of the Base Grammar. Specifically: (a) The STATUS.REL rule was rewritten to specify modality, truth value, and tense information which are derived logical relations qualifying propositions; and (b) the PROPERTY.REL rule was rewritten to allow for detailed specification of descriptive information by incorporating the semantic and logically derived categories covered by Frederiksen's (1975, 1986) propositional identifying relations (e.g., category, is.a, part, is.a.part, attribute, location, temporal, duration, theme). In addition, the RATIONALE.REL rule was subsumed into the CONDITION.REL rule and this rule itself was then rewritten so as to permit categorization of causal-conditional and adversative-conditional relations. However, this categorization was based on the logico-semantic distinctions described by Halliday (1985) rather than the logically derived distinctions associated with Frederiksen's (1975) work. At the frame level, Frederiksen's (1986) and Frederiksen et al.'s (1990) description of frame types, as well as Meyer's (1985) description of macro-structures, provided the theoretical basis for the breakdown of the DECOMPOSITION.REL rule. Specifically, the DECOMPOSITION.REL rule was

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[4]The basic cognitive units here are actually the concepts which are a part of the propositional structures associated with Frederiksen's (1975, 1986) theory of semantic representation in discourse. A proposition may consist of a simple concept-relation-concept triple or the more complex concept-relation-proposition and proposition-relation-proposition triples where concepts are objects, actions, or properties (e.g., attributes, locations) and relations are case relations (e.g. agency) or logical relations (e.g. condition, category).

rewritten to allow for categorization of subgoal and elaborative links which exist at the frame level.

The modified Base Grammar, henceforth referred to as Base Grammar 2.0, is given in Appendix C (p. 161), and an annotated version, which includes operational definitions of categories and examples of these semantic categories taken from written persuasive texts, is presented in Appendix B (p. 134). Each text was analyzed and coded according to the semantic categories derived from the Base Grammar 2.0. Briefly, the analysis procedure involved (a) segmenting the texts into components, (b) classifying the components as PROCEDURES, EVENTS, INTERNAL.STATES or EXTERNAL.STATES, (c) identifying and recording component constituent structures, (d) identifying and recording the qualifying information associated with each component, and (e) identifying and recording the inter-component relations.

To test the reliability of the semantic analysis a second researcher independently coded a random sample of the persuasive texts examined in this study. The percentage of agreement between coders was calculated for components (91%) and inter-component relations (86%).[5]

The data base resulting from the semantic analysis was used to (a) facilitate recognition of instances of argument structures and (b) investigate group differences in the general semantic representations underlying the argument structures presented in the expert and student persuasive texts under consideration in this study. These procedures depended upon specifying the mapping relationships between general semantic categories derived from the semantic structures described in Base Grammar 2.0, and argument categories derived from the argument structure described in the Argument Grammar. These mapping relationships are outlined in Section IV.2.2.4. and detailed in Appendix E (p. 167).

IV.2.2.2 Linguistic analysis

Two types of linguistic analyses were conducted in this study, structural and non-structural. The structural analysis involved identifying clause complexes (Winograd, 1983) and the non-structural analysis involved identifying and describing a type of cohesive tie referred to as conjunction (Halliday, 1985; Halliday & Hasan, 1976).

Clause analysis

The structural or clause analysis procedure was based upon Winograd's (1983) description of clause types. Sentences were analyzed for clausal segments with a segment

[5]Percentage of agreement is not reported for the coding of contituents since once components were categorized the identification of constituents was highly constrained and predictable.

defined as being one of the following: (a) a major clause, (b) a type of secondary clause referred to as a bound adjunct, and (c) a major or bound adjunct clause which is part of a report noun group (i.e., embedded in a cognitive or conversational act). In addition, it was noted whether major types of clauses were interdependent (Halliday, 1985).

Conjunctive analysis

The analysis of conjunction was based upon Halliday (1985) and Halliday and Hasan's (1976) work on cohesion. These researchers describe cohesion as a non-structural linguistic resource for constructing discourse, i.e., for coding the semantic structure of a text in the surface. In general, four ways of creating cohesion in discourse have been proposed: reference, ellipsis and substitution, conjunction, and lexical organization (which includes collocation and repetition). In the present study the analysis of cohesive relations was limited to conjunction since this involves the type of logico-semantic relations which are central to arguments. According to Halliday (1985) conjunctive cohesive relations are essentially the same kind of semantic relations as those which obtain between clauses in an expanded clause complex, the difference being that the relationship is not necessarily realized in the structure of the clause complex but is made explicit through the use of conjunctive expressions. Grammatically, these expressions appear to be of two types: (a) conjunctive adjuncts which include adverbial groups and prepositional phrases (e.g., *for example, for that reason, on the other hand*), and (b) conjunctions (e.g., *because, but, yet...*). The conjunctive analysis conducted in the present study involved categorizing all instances of conjunctive ties in each persuasive text based on Halliday's (1985) taxonomy of conjunction.

The clausal and cohesive tie analyses resulted in a data base which was used to (a) facilitate the coding of argument structures and (b) investigate writers' use of conjunction as a means of signaling the structure of arguments in their persuasive texts. These procedures depended upon specifying the mapping relationships between specific conjunctive ties and the defining links of the argument structure described in the Argument Grammar. The mapping relationships are presented in Section IV.2.2.5 and Appendix F (p. 174).

IV.2.2.3. Analysis of argument structure

Before conducting an analysis of argument structure in the expert and student persuasive texts it was necessary to develop a general model of informal argument and then a methodology for identifying instances of such argument structures in discourse.

Model of informal argument

The development of a detailed model of informal argument involved two steps: First, a task analysis was conducted to identify the essential structural elements of argument. Second, a formal notational system or representational language was used to express the argument structure identified

The task analysis was based on the review of prominent theories and models in informal argument which was presented in Section II.1.2. The analysis indicated that a modified version of Toulmin's (1958) schematic would allow one to deal with the range of complexity characterizing argument structures found in written persuasive text. Generally, these modifications were of two types, elaborative and definitional. Elaborative modifications involved providing more detailed descriptions of the qualifying, supporting, and opposing elements comprising Toulmin's original model as well as adding a new substructure. To be more specific, the qualifying element (or Qualifier) in Toulmin's original model is represented in text by either a modal or modal adjunct and serves to indicate that there is a degree of uncertainty associated with the claim. In the current modified version, this qualifying information includes not only modality operators but also general and specific conditions which are necessary for the claim to be applicable. The Backing element in Toulmin's original model was linked to the Warrant whereas in the current model and consistent with later work by Toulmin et al. (1979), a Backing element also functions as a support structure for the Data element. The opposing element, referred to as the Reservation in the original model, was expanded in the current model so as to include not only the arguer's acquiesence of conditions or circumstances under which the claim would not hold, but also instances of the arguer's (a) *rebuttal* of potential threats to the claim and (b) *recognition* of possible alternative solutions. And finally, the claim element was elaborated in the current model so as to deal with the arguer's use of "subclaims" or "subarguments" (i.e., the incorporation of claims or arguments involving specific cases or circumstances into argument structures centered around more general claims).

The definitional modifications to Toulmin's (1958) model involved indicating (a) the status of argument elements in terms of whether they were required (necessary) or optional and (b) the structural status of each element, i.e., whether the structure could be represented as a basic cognitive unit (i.e., object or attribute), a component (i.e., semantic unit, see Appendix B, p. 134), a claim, or an argument. Consistent with recent work by Stein et al. (1996) and Stein and Miller (1993), the claim-data complex was understood to

comprise a *basic* argument structure and additional substructures, identified through the task analysis, were classified as being optional or *elaborative*. Specification of the structural status of each argument element was deemed crucial for the analysis of extended persuasive discourse which invariably consists of multiple, related arguments. This modification not only allows the researcher to treat embedded claims and arguments as a reflection of the depth or complexity of an argument but also to examine how embedded arguments are used in persuasive and argumentative discourse. Overall, both definitional modifications incorporated into the current model are seen as contributing to the field of argument analysis since they allow a principled approach to be taken in measuring the complexity of an argument structure (i.e., by determining the elaborations, depth, and types of semantic representations comprising the structure).

The formalized expression of this modified argument structure was based on recent methodological advances in modeling and analyzing the semantics of discourse. As discussed in Section II.2.4., a number of researchers have pointed out that the conceptual graph structure is a valid format for knowledge representation and is suited for a variety of representational tasks including the comprehension and production processes associated with discourse (Beaugrande, 1980; Frederiksen, 1975, 1986; Graesser, 1981). The particular notation or representational language used to express this formal model of argument was the BNF, a system which has been used by Bracewell (1989), Frederiksen (1986), Frederiksen et al. (1987), and Senecal et al. (1991) to specify general semantic structures found in discourse at the propositional or frame level, and by Breuleux (1990) to define specialized frame structures (e.g., plans). The general advantages afforded the researcher in using the BNF system to represent the semantic structures found in various texts have been discussed in Section II.2.4. This particular approach to modeling argument differed from Toulmin's (1958) schematic in that it not only permitted specification of the constituent structures of argument and the functional relationships among these constituents but also the arguer's use of embedded claims and arguments. In effect, this approach allowed the researcher to address the need to account for variability in both the scope and depth of argument structures in a principled fashion.

In addition to using the BNF system, reference was made to the general guidelines for devising a semantic network notation outlined by Woods (1973). As such, developing a BNF ARGUMENT GRAMMAR required specification of (a) the types of nodes and links that can be used, (b) the rules of combinations of links and nodes (syntax), and (c) the meanings of links and nodes.

In general, a BNF grammar consists of the symbols which designate the structures and relations and the basic notation or metasymbols which designate grammatical operations. The BNF metasymbols used in the ARGUMENT GRAMMAR are presented in Table 1.

Table 1

Metasymbols for BNF ARGUMENT GRAMMAR

"::="	designates "is rewritten as"
"space"	designates conjunction ("and")
" | "	designates disjunction ("or")
"{ }"	designates that a constituent is optional
"*"	designates that a constituent is iterative

Each BNF rule consists of three elements: (a) a head element which is the left-hand symbol, (b) a rewrite metasymbol "::=", and (c) rewrites of the head element (i.e., constituents) which are the right-hand symbols.

The structure of the ARGUMENT GRAMMAR follows Sowa's (1984) definition of a linear notation for conceptual graphs. Concept rules alternate with link rules to form concept-relation-concept (i.e., node-link-node) triples. One exception to the structure-relation alternation can be found in the relation-to-relation rule sequences that are used where a link rule expands into a disjunction. In this case the disjuncts qualify the type of initial relational link. ARGUMENT GRAMMAR concepts include (a) the top level or argument structure which is represented by the start symbol ARGUMENT and (b) the constituent structures of an argument which are represented by the intermediate nodes (i.e., CLAIM, JUSTIFICATION, and COUNTERED.REBUTTAL) and terminal nodes (e.g., ARGUMENTS, COMPONENTS, and OBJECTS[6]). ARGUMENT GRAMMAR links (indicated by the .REL extention to the symbol or rule name) include (a) constituent relations defining an argument (i.e., CLAIM.REL, JUSTIFICATION.REL, and OPPOSITION.REL) and (b) constituent relations defining the constituent structures of the

[6]Terminal nodes in the ARGUMENT GRAMMAR include the following semantic units: (a) basic cognitive units such as objects and attributes (Frederiksen, 1975); (b) modality operators, which modify the truth value of a component; (c) frame level structures such as COMPONENTS and INTERNAL.STATES, as defined by the BASE GRAMMAR 2.0 in Appendix C (p....); and (d) embedded CLAIM and ARGUMENT structures as defined by the ARGUMENT GRAMMAR.

argument (e.g., the ASSERTION.REL, CONTENTIOUS.REL, QUALIFICATION.REL, and SUBCLAIM.REL are definitional links for the CLAIM).

The terminal nodes of the ARGUMENT GRAMMAR either map directly onto categories derived from general theories of semantic representation in discourse or can be unpacked to provide a more detailed and explicit representation of the semantics underlying argument. This unpacking involves a mapping between general and specialized levels of semantic representation--a procedure described in Section IV.2.2.4. The BNF rules for the ARGUMENT GRAMMAR are presented in Appendix D (p. 164) and an annotated version of these rules is presented below. A graphic representation of the argument structure generated by the ARGUMENT GRAMMAR can be found in Figure 3.

BNF Rules for ARGUMENT GRAMMAR

The BNF rules of the ARGUMENT GRAMMAR as well as the meanings of the links and nodes or the semantics of the argument structure represents the model of practical argument. The top level or argument structure in the ARGUMENT GRAMMAR is defined by the following rules:

ARGUMENT ::= CLAIM.REL JUSTIFICATION.REL*
{OPPOSITION.REL}*

CLAIM.REL ::= CLAIM

JUSTIFICATION.REL ::= JUSTIFICATION

OPPOSITION.REL ::= REBUTTAL.REL |
ALTERNATIVE.SOLUTION.REL

The ARGUMENT rule defines a practical argument structure in terms of the following constituent relations: (a) a CLAIM.REL which is mandatory, (b) a JUSTIFICATION.REL which is mandatory and iterative, and (c) an OPPOSITION.REL which is optional and iterative, and is rewritten as a disjunction to specify two possible types of OPPOSITION links, a REBUTTAL.REL link and an ALTERNATIVE.SOLUTION.REL link. Each of the constituent relations rewrites to corresponding constituent structures of an argument; the CLAIM and JUSTIFICATION which are required, and the REBUTTAL and ALTERNATIVE.SOLUTION which are optional. The semantic structures representing the defining features of a CLAIM and JUSTIFICATION can be generated by application of the CLAIM and JUSTIFICATION rules.

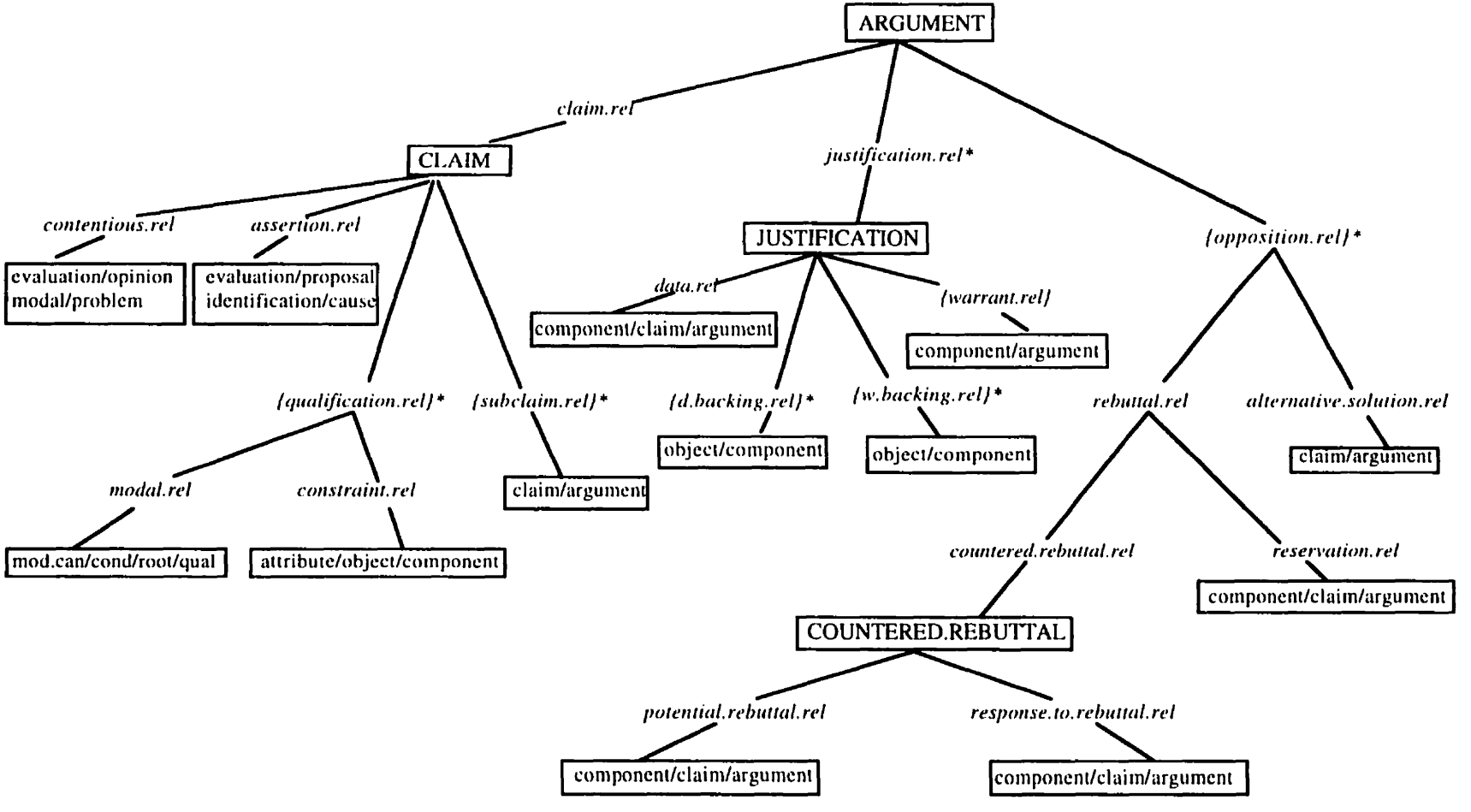

Figure 3. Graphic representation of argument structure
(* = iterative relation, { } = optional relation)

CLAIM ::= ASSERTION.REL CONTENTIOUS.REL* {QUALIFICATION.REL}* {SUBCLAIM.REL}*

A CLAIM is a mandatory constituent of any argument. It is a basic assertion advanced by the arguer which is of contentious truth value. In order for the claim to be accepted by the audience it must be demonstrated that it is well-founded, i.e., it must be justified. A claim that is not substantiated or clarified is a simple personal opinion rather than the opening move or conclusion in an argument. Generally, a claim is advanced to provide either an answer to a question or a solution to a perceived problem. It may be the final proposition in an argumentative discourse or an intermediate statement that serves as evidence for a subsequent claim in an argument. The CLAIM rule defines a CLAIM in terms of the following constituent relations: (a) an ASSERTION.REL rule which is mandatory, (b) a CONTENTIOUS.REL rule which is mandatory and iterative, (c) a QUALIFICATION.REL rule which is optional and iterative, and (d) a SUBCLAIM.REL rule which is optional and iterative.

ASSERTION.REL ::= COMPONENT

The ASSERTION.REL marks the statement serving as the problem solution or answer which is advanced by the arguer. Depending upon the type of question or problem posed, an assertion may take the form of a proposal or policy statement, an evaluation statement, an identification/definitional statement, or a causality/prediction statement (Ehninger & Brockriede, 1963; Fahnestock & Secor, 1983).

Examples:

- I think animals should be trained to help people.[7] (PROPOSAL)
- In my opinion it is a good thing to train animals. (EVALUATION)

CONTENTIOUS.REL ::= EVALUATION | INTERNAL.STATE | MOD.QUAL | PROBLEM.STATEMENT

The CONTENTIOUS.REL rule allows for generation of the structure(s) which signals that the truth value of the statement functioning as the assertion is contentious and open to dispute.[8] The logical equivalent of this contentious aspect is a qualified truth value in terms

[7]Underlined text represents an example of the argument element being described, and instances of text within asteriks are linguistic markers for the element.

[8] The CONTENTIOUS.REL rule serves to identify structures which signal that an assertion is a claim; unlike other ARGUMENT GRAMMAR rules, it does not mark a definitional or constituent structure.

of probability on the COMPONENT representing the assertion. This modal qualification places the truth value of the assertion either within the range or at the limits of the probability interval [0.0, 1.0]. That is, to say that an assertion is "probably" true indicates that there is a degree of uncertainty associated with its being so in comparison with the existence of possible alternatives. To say that an assertion is "definitely" true, or "definitely not" true places the truth value at the limits of the probability interval [0.0, 1.0] where 1.0 represents the complete exclusion of possible alternatives and 0.0 represents the complete exclusion of the assertion itself (White, 1975).[9]

The CONTENTIOUS.REL rule is iterative in order to account for the fact that an assertion may be marked as being probably true by more than one structure. The contentious aspect of a claim is always a function of the social context in which the problem, question or issue under consideration is advanced, and may also be signaled by any one or a combination of the following semantic structures present in the argumentative text: (a) the PROBLEM.STATEMENT which is a statement of the issue or problem under consideration and is generally represented by a COMPONENT marked by an INTERROGATIVE.OPERATOR, (b) EVALUATIONS which are COMPONENTS involving a personal or subjective assessment (i.e., judgment) of an OBJECT or COMPONENT, (c) OPINIONS which are represented by INTERNAL.STATES or CONDITIONS involving such concepts as thoughts, beliefs or opinions and hence like EVALUATIONS serve to personalize the assertion (i.e., make it subjective[10]), and (d) MOD.QUAL operators which are modal adjuncts indicating explicitly that the truth value of the view advanced in the assertion either has a degree of uncertainty associated with it or is at the limits of the probability interval.

Examples:

- Should animals be trained? (PROBLEM.STATEMENT)
- There's nothing wrong with animal training. (EVALUATION)
- In my opinion, animals should be trained. (OPINION)
- I think that animals should be trained. (OPINION)
- Training seeing eye-dogs is definitely a good thing for the blind. (MOD.QUAL).

Analysis of semantic structures marking a claim were specified in the grammar due to the pre-dominant role of the claim in an argument structure. That is, the claim is central to an argument structure in that other constituent structures obtain their identity by virtue of the fact that they stand in either a direct (e.g. data) or an indirect (e.g. backing) relationship with the claim.

[9]Assertions qualified by modal operators that place their truth value at the limits of the probability interval [0.0, 1.0] are viewed as contentious since it is the presence of the modal qualifier which indicates that what is stated in the assertion is not yet an established fact but based on evidence available to the arguer/speaker; the modal qualifier would not be used in circumstances where the statement was an established fact.

[10]The personalization of an assertion places its truth value within the probability interval [0.0, 1.0] by limiting its universality to the arguer.

(EVALUATION)

• ...by and large I think such training to be above criticism. (MOD.QUAL), (OPINION), (EVALUATION)

QUALIFICATION.REL ::= MODAL.REL | CONSTRAINT.REL

MODAL.REL ::= MOD.CAN | MOD.COND | MOD.QUAL | MOD.ROOT

CONSTRAINT.REL ::= ATTRIBUTE | OBJECT | COMPONENT

The QUALIFICATION.REL link defines structures which serve to qualify the universal applicability of the CLAIM. The QUALIFICATION.REL rule is iterative to allow for the possibility of more than one QUALIFICATION being involved in an argument and is rewritten to a disjunction to specify the type of qualifying information presented. A MODAL.REL marks propositional semantic structures (i.e., MOD.QUAL, MOD.CAN, MOD.COND, MOD.ROOT) which specify the degree of certainty (i.e., probability, possibility, conditionality, or necessity) with which a claim is advanced. For example, as Toulmin (1958) points out, in a situation where the available information points unequivocally to one particular solution or conclusion (which is not usually the case other than for fields such as science and mathematics), then the arguer may indicate this by marking the assertion with a MOD.ROOT operator, i.e., say that a conclusion "must be the case" or that it is necessarily so under the circumstances. In other fields, such as aesthetics, the answers to questions are a matter of opinion or taste; that is, in light of the data, more than one solution may be possible and acceptable. In this situation, the arguer decides on a particular solution in which he has more confidence and may present a guarded or qualified claim or conclusion by including a MOD.QUAL operator in the assertion.[11] In the surface structure, these modal operators include adverbs and adverbial phrases such as *perhaps*, *possibly*, *probably*, and *It is probable that*, as well as auxiliary verbs such as *might*, *should*, *could have*, and *must*.

Examples:

• And yet, that is perhaps the only significant question when we ask whether humans are superior to other animals.

• More importantly, good people probably train animals decently, humanely.

[11] Certain semantic structures acting as MOD.QUAL operators serve two functions in an argument structure: (a) to mark that an assertion is contentious and (b) to indicate that the assertion is a guarded or qualified one (i.e., the arguer is hedging with respect to the claim).

The CONSTRAINT.REL rule marks structures (i.e., COMPONENTs, OBJECTs, ATTRIBUTEs) that function as presuppositions. Such structures serve to constrain the applicability or validity of the claim by specifying the particular circumstances under which the claim would apply (i.e., would be true). In this situation the arguer presents the claim or conclusion conditionally, indicating that the solution advanced in the claim would be the true only if certain (i.e., enabling) conditions applied.

Examples:

- It's fine to train animals *if* there is no cruelty, undue pain or restriction involved.
- I think it is okay to train animals *but only* to a certain extent.
- I think it is alright [*sic*] to train *certain* animals.

SUBCLAIM.REL = CLAIM | ARGUMENT

The SUBCLAIM.REL rule marks a structure which functions as a secondary or minor claim. The rule is iterative in order to allow for the possibility of there being more than one SUBCLAIM. The SUBCLAIM is semantically linked to a major or top level CLAIM by an equivalence relation with respect to the basic assertion advanced, as well as a part and/or exemplification relation. That is, relative to the major CLAIM, the scope of a SUBCLAIM is limited by the arguer's inclusion of one or more of the following structures: (a) a QUALIFICATION, (b) a RESERVATION, (c) a degree attribute, and (d) a specific instance of the general case stated in the major assertion. In effect then, the universality of the SUBCLAIM'S applicability is limited to a greater degree than the major CLAIM. SUBCLAIM structures in the ARGUMENT GRAMMAR are represented by CLAIMS and ARGUMENTS. This latter form occurs when the SUBCLAIM is justified within the text itself (i.e., is an embedded argument).

Examples:

- I think training animals isn't a nice thing to do to animals especially if you are training animals to do work. (opening statement = SUBCLAIM)... ...I don't think training animals is fair. (concluding statement = CLAIM)
- I think animal training is alright [*sic*] as long as the animal doesn't disagree. (CLAIM) To teach a dog to stop biting, stop barking, sit, roll over etc... is okay. (SUBCLAIM)

JUSTIFICATION ::= DATA.REL {WARRANT.REL} {D.BACKING.REL}* {W.BACKING.REL}*

A JUSTIFICATION is a mandatory constituent structure of any argument. It serves to justify or substantiate the claim advanced by the arguer. Definitional links include the

DATA.REL which marks the required consitutent structure of a JUSTIFICATION, the WARRANT.REL which marks an optional constituent structure, and the D.BACKING.REL and W.BACKING.REL which are iterative and mark optional constituent structures.

DATA.REL ::= COMPONENT | ARGUMENT | CLAIM

The DATA.REL rule marks a structure(s) which provides justification by way of evidence or grounds (i.e., DATA) for the CLAIM advanced. A DATA structure is a basic assertion or statement advanced by the arguer which is either certainly known to be true or accepted by the audience as being true. It generally takes the form of a fact or truth, although it may also involve a subjective, personal view or value judgment (i.e., a preference; Ehninger & Brockriede, 1963; Perelman & Oltrechts-Tyteca, 1969; Thomas, 1986). The type of information that is considered "acceptable grounds" for a particular claim depends upon the argument field (Toulmin, 1958; Toulmin et al., 1979) and the audience (Perelman, 1982, 1994). In the ARGUMENT GRAMMAR, DATA structures are represented by COMPONENTS, CLAIMS, or ARGUMENTS. This latter form occurs when the truth value of the statement forwarded as DATA is established or justified within the argumentative text itself (i.e., it is an embedded argument).

Examples:

- ...dogs are good for alot [*sic*] of things. They can be used as house pets, great friends, and can be put in shows. Dogs can be eyes for blind people. (COMPONENTS)
- I don't believe in criticizing that use *because* the blind need these trained animals. (CLAIM)

WARRANT.REL ::= COMPONENT | ARGUMENT

The WARRANT.REL rule marks an optional structure which serves to validate the supportive relationship between the CLAIM and the DATA. For the arguer, the WARRANT stands as general evidence which legitimizes the supportive relationship advanced between the CLAIM and DATA. For the audience, the WARRANT provides the means by which one reasons from the evidence to the claim--it authorizes or requires one to make an inference. Many kinds of general statements serve as WARRANTS; the exact nature of the WARRANT depends to some extent on the type or field of argument. For example, in law, the natural sciences, and mathematics, WARRANTS include legal and moral principles, laws of nature, and formulas. In fields such as medicine, aesthetics, and psychology, the WARRANTS employed in an argument are not easily articulated in the

form of explicit laws, rules or principles. Rather, certain "rules of thumb" or systematic patterns which provide ways of looking at data may function as WARRANTS (Toulmin, et al., 1979). Like assertions functioning as DATA in an argument, the assertion or statement functioning as a WARRANT must be either certainly known to be true or accepted by the audience as being true. However, WARRANTS may often be absent in an argument structure presented in a text as they are implicitly understood by both the arguer and the audience. When they are stated explicitly in the text, they may be either COMPONENTS, or embedded ARGUMENTS. This latter form occurs when there is a warrant-establishing argument embedded within the main argument.

Example:

- At the time, I found the story rather alarming. It seemed to me an almost ideological tract about curtailing our energies, harnessing them to a particular domestic task and situation, about civilization, which in the orthodoxy of the sixties (aspects of which still lurk in my mind) was a strait jacket binding the real nature of man. (COMPONENT)

D.BACKING.REL ::= OBJECT | COMPONENT

W.BACKING.REL ::= OBJECT | COMPONENT

The BACKING.REL rules indicates optional structures which the arguer might include to strengthen or support the statements advanced as DATA or WARRANTS. The rules are iterative since more than one instance of support might be advanced for a given DATA or WARRANT structure. Semantic structures functioning as support for DATA include specific examples and authorities. Those functioning as support for WARRANTS include explanations, and the background or context in which the statement is forwarded as well as examples and authorities. BACKING structures are represented in the ARGUMENT GRAMMAR as COMPONENTS and OBJECTS.

Examples:

- To be against animal training, in her view, is to be against the very notion of civilization. (BACKING WARRANT = OBJECT)
- I think training animals is fine because it could help you for things. *For an example*, people train dogs for blind people. (BACKING DATA = COMPONENT)

REBUTTAL.REL ::= RESERVATION.REL | COUNTERED.REBUTTAL.REL

RESERVATION.REL ::= COMPONENT | CLAIM

The REBUTTAL.REL rule marks structures which might be capable of defeating or refuting the warranted claim. The rule is written as a disjunct to allow specification as to how the arguer incorporates these potential rebuttals into the argument structure. The RESERVATION.REL rule marks structures which, like qualifications, serve to limit the universal applicability of the claim. However, while qualification structures represent circumstances which must necessarily be present for the claim to remain valid and applicable, reservation structures represent circumstances which must necessarily be absent. The arguer may incorporate such structures into an argument by explicitly stating not only the "disabling" conditions but also their implications (i.e., the negation of the claim) and may signal the role of these structures in opposing an argument by the use of conjunctive adjuncts such as *unless* and *but not if*, which represent negative conditional relationships. Alternatively, the arguer may represent reservation structures as conditions which challenge the claim and signal this relation with conjunctive adjuncts such as *but*, *however*, or *on the other hand*, which represent a contrastive type of adversative relationship. Reservation structures are represented in the ARGUMENT GRAMMAR as COMPONENTS, CLAIMS, and ARGUMENTS.

Examples:

- I think that training animals are good *unless* they are treated cruelly.
- If your animal gets treated the way I have explained above, animal training is okay, *but if* the animal is treated roughly animal training is one of the worst things you can put it through.
- Training guide dogs to guide people was a very good idea, for us. *But* think of how the animals feel.
- The humane training of animals for good purposes is all right; the training of animals for bad purposes is wrong.

COUNTERED.REBUTTAL.REL :: = COUNTERED.REBUTTAL

COUNTERED.REBUTTAL ::= POTENTIAL.REBUTTAL.REL RESPONSE.TO.REBUTTAL.REL

POTENTIAL.REBUTTAL.REL ::= COMPONENT | CLAIM | ARGUMENT

RESPONSE.TO.REBUTTAL.REL ::= COMPONENT | CLAIM | ARGUMENT

Unlike the reservation structures, which represent the arguer's acknowledgment and acceptance of those circumstances which would defeat the claim, the COUNTERED.REBUTTAL.REL rule marks a structure which represents the arguer's recognition but not acceptance of the force of the rebuttal. The COUNTERED.REBUTTAL rule defines a countered rebuttal in terms of two constituent relations, a POTENTIAL.REBUTTAL.REL and a RESPONSE.TO.REBUTTAL.REL. The POTENTIAL.REBUTTAL.REL marks a structure which challenges and could potentially refute a claim. The RESPONSE.TO.REBUTTAL.REL marks a structure which represents the arguer's attempt to counter the force of the potential rebuttal. In effect, by including a COUNTERED REBUTTAL structure, the arguer continues to present the claim as being acceptable and applicable even in light of circumstances which might refute it or undermine its force--it is a recognition but not an acceptance of the rebuttal. POTENTIAL REBUTTAL and RESPONSE.TO.REBUTTAL structures are represented in the Argument Grammar as COMPONENTS, CLAIMS and ARGUMENTS.

Examples:

- It may not help the dog (POTENTIAL.REBUTTAL = CLAIM) *but* it definitely helps the blind person. (RESPONSE.TO.REBUTTAL = CLAIM)
- Performing tricks is nice too.(CLAIM) All those people who say it isn't nice to teach animal tricks, (POTENTIAL.REBUTTAL = COMPONENT) you find them one day or the other watching the circus or an animal parade and enjoying it! (RESPONSE.TO.REBUTTAL = COMPONENT)

ALTERNATIVE.SOLUTION.REL ::= CLAIM | ARGUMENT

The ALTERNATIVE.SOLUTION.REL marks a structure which is an alternative possible solution or answer to the problem statement or question which is under consideration. It may or may not be accompanied by supporting structures and is represented in the Argument Grammar by CLAIMS and ARGUMENTS.

Examples:

- Some wholly reject such training,(ALTERNATIVE.SOLUTION.1) others reject all objections. (ALTERNATIVE.SOLUTION.2) I would propose a middle way with various criteria. (CLAIM)
- Overall, I think animals should not be trained because it interferes with their way of living. (CLAIM) But you may think differently. (ALTERNATIVE.SOLUTION)

Developing a methodology for coding argument structures in natural language texts

Given the general model of informal argument, the analysis of argument structures in the expert and student persuasive texts involved identifying the presence of specific elements derived from this model. Specifically, the structural analysis of argument was conducted using four tactics which are dependent upon (a) the nature of the BNF rules comprising the ARGUMENT GRAMMAR and (b) the extension of the ARGUMENT GRAMMAR to include a number of non-structural rules. These methodological strategies, which were developed by Breuleux (1990), can be described in the following ways:

First, by defining and representing practical argument using a semantic grammar it was possible to adopt a theoretically-based and hence principled approach to conducting a structural analysis of argument in persuasive text.

Second, by writing the grammar in BNF notation it was possible to develop and use a flexible system of argument analysis, i.e., one which could account for structural variations across particular instances of persuasive writing. This flexibility was achieved in two ways: one was simply by capitalizing on the properties of BNF rules and metasymbols, and the other was by extending the ARGUMENT GRAMMAR. The flexibility inherent in the BNF is achieved by (a) its recursive property which allows multiple argument "tree" structures to be described, (b) the optionality metasymbol which permits the operations of "pruning" and elaboration to be conducted in constructing argument trees, and (c) the iteration metasymbol which also allows for elaboration of these trees. For example, the semantic tree representing an argument is pruned when optional constituent structures such as warrant or reservation are not present in the text and elaborated when such structures are included. The semantic network is also elaborated when a claim is supported by more than one justification structure. The flexibility achieved by extending the ARGUMENT GRAMMAR involved including a TEXT.REL rule which permits specification of whether a required constituent structure (i.e., CLAIM or JUSTIFICATION) is stated explicitly (PRESENT) or implied (ELIDED) in the text, or if it is missing altogether (ABSENT).

Third, by extending the ARGUMENT GRAMMAR to include the EMBEDDED.REL, ID.REL, and LABEL.REL rules (which are non-structural), it was possible to (a) describe complex argument structures (i.e., those involving embedded arguments) and (b) record the text string (i.e., the verbal elements) through which a constituent argument structure was realized. The problem of representing the complex argument structure, which is realized in the text analyzed as a semantic network, was addressed by making use of both references devices such as the EMBEDDED.REL and ID.REL, and the recursion principle inherent in a BNF grammar. The ID.REL rule points to an index number for a particular

argument or constituent structure. The researcher can then map reference pointers in order to create links between branches of different argument tree structures and, ultimately, the argument chain(s) comprising the argument. The EMBEDDED.REL rule, which is optional and iterative, specifies embedded argument structures. That is, this relational rule allows for texts characterized by complex arguments which involve one argument (picked up through the T.ARGUMENT) taking on a component role in another argument (i.e., the embedded argument can be either an E.DATA, E.WARRANT, or E.REBUTTAL). It permits one to keep a record of the mappings between argument structures and the constituent structures they are transformed into in the "host" argument. The LABEL.REL rule, which is a rewrite of all terminal nodes in the grammar, rewrites to a STRING and permits recording of the actual text strings through which the underlying semantic structure was encoded.

Fourth, by extending the ARGUMENT GRAMMAR to include a MARKER rule as an optional rewrite of the following constituent relational rules: DATA.REL, CONSTRAINT.REL, WARRANT.REL, BACKING.REL, RESERVATION.REL, and REBUTTAL.REL, it was possible to record the writer's use of specific language devices, such as conjunctive ties, to signal an argument structure. The extended ARGUMENT GRAMMAR inclusive of non-structural rules is given in Appendix D (p. 164).

In addition to the above mentioned tactics made possible by developing and extending the model of informal argument, a final methodological approach adopted in the current study was that of identifying argument structures based on the presence in the text of (a) particular configurations of general semantic structures and (b) specific linguistic devices. This approach was made possible by specifying the mapping relationships between (a) semantic categories derived from the ARGUMENT GRAMMAR and the Base Grammar 2.0 and (b) the structural links of an argument (defined by the ARGUMENT GRAMMAR) and the conjunctive ties representing these links in the surface structure of a text. These mapping relationships are described in Sections IV.2.2.4 and IV.2.2.5. The use of such a coding procedure was considered important in view of the low inter-rater reliability reported in previous studies in which texts were analyzed in terms of discourse elements defined by Toulmin's model of informal argument (e.g., Connor & Lauer, 1985; Scardamalia et al., 1982).

While the mapping between levels of representation facilitated the coding of argument structures, other sources were used to guide decisions as to the categorization of text as a particular element in an informal argument structure. Specifically, categorization at times was based on the reader's ability to make inferences regarding the arguer's intention as to the function of a particular piece of text in an argument structure. These inferences were

based on (a) a general knowledge of reasoning structures and persuasive discourse forms which serve to set up expectations regarding contiguous text units that may not be linked explicitly by an "inference indicator" or conjunctive device,[12] (b) sources of cohesion beyond conjunction (such as the use of semi-colons and dashes), and (c) syntactical patterns within and between clause complexes.

In summary, analyzing the argument structures present in the persuasive texts under consideration in this study involved the following steps: (a) conducting a general semantic analysis based on rules specified in the Base Grammar 2.0; (b) identifying all conjunctive devices; (c) using the results of the analyses described in (a) and (b) to identify argument substructures (i.e., contentious markers, assertions, qualifications, and subclaims defining claims, data, warrants, backing for data or warrants defining justifications, and reservations, countered rebuttals, and alternative solutions defining opposing structures); (d) using the non-structural rules of the ARGUMENT GRAMMAR to track the arguer's use of embedded arguments and claims or structural markers; and (e) noting the basis for each decision regarding the coding of specific argument substructures.

To test the reliability of the argument analysis a second researcher was first familiarized briefly with the definitions and coding schemes, and then independently coded a sample of the persuasive texts examined in this study. The percentage of exact agreement was calculated for claims (74%), justifications (86%), qualifications (83%), opposition structures (75%), and overall coding (79%). Separate reliability measures were not estimated for each substructure due to the low frequencies associated with their use. It should be noted that the coding of expert text generally involved a higher incidence of disagreement between coders, and that most coding discrepancies involved text structures that needed to be "double-coded" (e.g., subclaims, and justifications represented as claims). The absence of explicit text structure markers was also associated with a drop in agreement between coders.

The analysis of argument structure resulted in a data base from which the following measures were derived: (a) number of argument structures per text,[13] (b) number of major arguments per text, (c) number of minor or embedded arguments per text, and (d) frequencies of different argument elements (i.e., claim, contentious marker, qualification,

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[12] In general, this approach is consistent with one advocated in a number of instructional texts focussing on the analysis of argument in discourse, i.e., the Principle of Charity, or the Co-operative Principle. Essentially, this principle states that when analyzing reasoning one should always analyze it in the way that interprets it as the strongest possible reasoning compatible with the inference indicators (i.e., conjunctions) in the discourse (Thomas, 1986).

[13] The minimal structural requirement of an argument was that it contain a claim-data complex.

subclaim, data, warrant, backing, reservation, potential rebuttal, response to rebuttal, alternative solution) per text.

IV.2.2.4. Mapping relationships between general semantic structures and argument structures

The purpose in identifying the mapping relationships between the general semantic structures described in the Base Grammar 2.0 and the argument structure described in the ARGUMENT GRAMMAR was threefold: (a) to facilitate the coding of argument structures represented in natural language text, (b) to identify any group-related differences pertaining to the use of general semantic structures to represent argument structures in persuasive text, and (c) to advance understanding of the semantic basis for those categories and rules that have traditionally been associated with informal argument.

The semantic categories specified by general theories of discourse representation can be used not only to provide a detailed description of the semantics underlying a particular text but also to define higher level structures that serve a specific function in discourse production or comprehension (Bracewell & Breuleux, 1991; van Dijk, 1977). Some of these structures are general to writing in that they can be found across genres or contexts (e.g., planning structures), whereas others are more typical of a particular genre or situation (e.g., narrative structures). Defining the semantic characteristics of these higher level structures in terms of the frame or propositional structures specified in a general theory of discourse representation has both theoretical and methodological implications. Theoretically it provides information about the semantic basis for the specific categories and rules characterizing the global structures associated with a discipline such as rhetoric, narrative or argument theory (van Dijk, 1977). Methodologically it enables the researcher to develop a more precise and reliable coding scheme in analyzing a text or discourse for a given control structure. This research tactic was developed by Breuleux (1988) and demonstrated in an investigation of planning by expert and sub-expert writers (Breuleux, 1990). Breuleux (1988) specified a model of planning using a semantic grammar and then defined the properties of planning structures in terms of their semantic characteristics at the propositional level of representation (Frederiksen, 1975). As such Breuleux not only provided a detailed analysis of the semantics of planning but his method of coding writers' planning structures as represented by statements in their think-aloud protocols was based on a formalized model and permitted a greater degree of precision than alternative methods of protocol analysis in writing research.

In the present study the argument structure specified in the BNF ARGUMENT GRAMMAR was defined in terms of a configuration of semantic categories derived from

the Base Grammar 2.0. In doing so it became evident that argument structures can be construed as specialized versions of basic procedural, event, and descriptive frame structures. The mapping between the key features of arguments and the Base Grammar 2.0 semantic categories is described below and also summarized in Appendix E (Tables 1 through 7, p. 167-173). Examples from written persuasive texts are also provided in the Appendix Tables for the purposes of clarification. It is important to note that the mapping relationships outlined here do not constitute an exhaustive list of the possible mappings between general semantic and argument levels of representation.

The basic frame structure through which an argument is realized depends on the content or topic of the argument as well as the how the arguer conceptualizes the claim. However, generally speaking, there appear to be four types of claims: (a) proposals or policy statements, (b) evaluations, (c) categorical propositions, and (c) cause-effect statements (Ehninger & Brockriede, 1963; Fahnestock & Secor, 1983). These claims can be defined in terms of a configuration of Base Grammar 2.0 semantic categories through a mapping relationship (see Table 1, Appendix E, p. 167). For example, a proposal or policy statement, which is a proposed course of action, is always a represented as a PROCEDURE, is marked by the FUTURE TENSE and a MOD.ROOT qualifier such as "should". In contrast, an evaluation involves a concept-attribute relation which in Base Grammar 2.0 notation may be represented by a DESCRIPTION comprised of a REFERENCE and an EXTERNAL.STATE characterized by a PSYCHOLOGICAL ATTRIBUTE or DEGREE marker.

The contentious nature of a particular assertion usually depends upon the social context. However, this particular aspect of a claim can also be signaled in the text through the use of one or a combination of particular semantic structures. For example, writers may indicate that an assertion is a personal opinion by placing a POSITIVE CONDITION.REL on the assertion (e.g., *In my opinion...)* or using an INTERNAL.STATE structure (e.g., *I think...*). In this latter instance the claim would be conceptualized as a DESCRIPTION with the assertion itself represented as an embedded D.THEME. The contentious aspect can also be revealed through the use of an evaluation represented by a PSYCHOLOGICAL ATTRIBUTE or DEGREE marker by virtue of these attributes requiring a personal, subjective judgement. Finally, the arguer may use a MODALITY marker indicating necessity, advisability, obligation, possibility, contingency, or probability.

The claim, like an opinion, is a questionable assertion. However, it differs from an opinion in that it is justified, or contended for, by the arguer (Toulmin, 1958). This justificatory aspect of an argument is evident in statements that function as data and warrants. In the Base Grammar 2.0 these statements are represented as components (i.e.,

PROCEDUREs, EVENTs, or DESCRIPTIONs) that are linked to the component functioning as the assertion by a REASON.CONDITION.REL. It appears that the WARRANT relationship that exists with other elements in an argument structure is one that cannot be defined by the Base Grammar 2.0. Instead, its recognition may depend upon other types of analyses. For example, a lexical analysis might be used for a warrant involving the a relationship between the generic or rule of thumb (e.g. *all*, *most*, *some* or*generally*) and the specific case (claim-data).

Those aspects of informal argument structures which are characteristic but not essential (i.e., are optional) were also defined in terms of Base Grammar 2.0 configurations. The qualification relation which serves to delineate the universal applicability of the claim is represented at the Base Grammar 2.0 level by (a) MODALITY markers, particularly MOD.QUAL or any combination of modality markers involving a QUAL, or (b) a POSITIVE CONDITION.REL.[14] A subclaim relation in an argument structure is represented at the Base Grammar level by a PART.REL, or an EXEMPLIFICATION.REL between the two components functioning as the claim and subclaim respectively.

The inclusion of support or backing for data and warrants in an argument may be represented at the general semantic level by (a) component structures (PROCEDURES, EVENTS, or DESCRIPTIONS) that are linked to the data or warrant component by two types of ELABORATION.RELs: an EXEMPLIFICATION.REL linking structures which are specific examples of the data, and a SPECIFICATION.REL linking all possible instances of the data, or (b) component or constituent structures that are linked to the data or warrant component by POSITIVE.CONDITION.RELs indicating authorities or sources on various matters being considered as data or warrants.

The reservation relation in an informal argument structure is represented at the Base Grammar level as either a NEGATIVE.CONDITIONAL.REL, which indicates circumstances which are "disabling", or an ADVERSATIVE.CONDITIONAL.REL, which marks contrastive or unexpected circumstances. These conditional relations may link either primary concepts or components to the component functioning as the assertion. The countered rebuttal structure in an informal argument is represented at the Base Grammar level by an ADVERSATIVE.CONDITIONAL.REL, which marks either a concessive or unexpected implication. This relational link exists between the component functioning as a potential rebuttal and the component functioning as a response to the rebuttal. For the

[14] It is of interest to note that a MOD.QUAL can be seen to serve two functions in persuasive discourse--the arguer can use a MOD.QUAL to limit the applicability of a claim and to signal that the assertion is a contentious one.

alternative solution structure, identification proceeds from an analysis at the lexical level rather than the propositional or frame level.

By examining the particular configurations of Base Grammar categories that writers used to represent their argument structures it was possible to obtain a number of frequency measures which were used to explore developmental trends in such factors as rhetorical skill and audience awareness in persuasive writing.

IV.2.2.5. Mapping relationships between argument relations and the cohesive ties signaling these relations

In the present study the correspondences between semantic relations defining an argument and conjunctive ties were described for the following two reasons: (a) to facilitate the accurate identification of argument structures in natural language text and (b) to identify variations in the use of linguistic devices.

Using a formalism to express a semantic model for practical argument facilitates coding of this structure in discourse since categories are defined precisely and are rule-based. In general, the reliability of this encoding depends upon both the researcher's intuitive understanding of semantics and the extent of inter-rater agreement as to how these semantic structures are realized in text (surface structure). However, the correspondence between semantic and surface text structures can be made explicit by defining the possible syntactic representations and surface markings for various semantic structures. Such detailed analyses, resulting in a mapping between semantic and surface levels of representation, have been conducted by Breuleux (1990) for planning structures. His objectives in conducting such a detailed analysis were to increase reliability in coding semantic structures represented in discourse and to obtain information necessary to develop automated systems for analyzing and generating natural language texts.

In the present study, specification of semantic to surface mappings was limited to linguistic features marking or making explicit the relational links of argument structures. Essentially, this involved focusing on the conjunctive ties which, according to Halliday (1985), are associated with the group of logico-semantic relations referred to as "expansion". For example, the type of expansion involved in a JUSTIFYING.REL is a causal-conditional (with cause being reason) enhancement. This expansion can be marked explicitly with a conjunction such as *because* within a hypotactic clause complex (with CLAIM being the dependent element and DATA the dominant element) or a conjunctive adjunct such as *For this reason...* between two clause complexes. This type of conjunctive adjunct is usually placed in thematic position in the sentence expressing the claim and the "this" functions as a referential tie referring to the entire data structure already presented in

the text. The type of expansion involved in a QUALIFICATION.REL is a positive conditional enhancement. This expansion can be marked explicitly with a conjunction such as *if* or *as long as* within a hypotactic clause complex (with claim being the dependent element and qualification the dominant element). A more detailed description of the mappings between linguistic devices and the structural relations of argument are provided in Appendix F (p. 174).

In addition to facilitating accurate coding of argument structure in discourse, defining the correspondence between the semantic and surface features of arguments enabled a functional analysis of the linguistic devices presented in participants' persuasive texts to be conducted. That is, it permitted an investigation of how writers use particular syntactic structures (i.e., type of clause or clause complex) or conjunctive ties to represent the semantic structure involved in their argument.

IV.3. Measures and analysis of data

IV.3.1. Use and extent of argument structure in persuasive text

The following measures were used to address the questions as to whether and to what extent participants in the student and expert writing groups represented argument structures in their persuasive texts: (a) number of texts in each group containing at least one argument structure, (b) total number of arguments per text, (c) density of argument structures in each text, and (d) proportion of text accounted for by argument structure(s). The first two measures directly followed the argument structure analysis conducted on text sample I. The density and proportionate measures were based on results obtained from conducting both clausal and argument structure analyses on text sample I. The clausal analysis yielded the total number of segments in a given text (where a segment refers to the clausal unit determined by the system of clausal analysis described in Section IV.2.2.2.). The argument structure analysis identified text which mapped onto either argument structures or substructures linked to argument structures. The density measure reflects the number of argument structures per clausal segment, and the proportionate measure the number of clausal segments mapping directly onto argument structures relative to the total number of clausal segments in the text. Clausal segments not linked to argument structures were categorized as being "non functional". Descriptive statistics for each group were calculated for (a) the total number of argument structures per text, (b) the density of argument structures, and (c) the proportion of text representing argument structure(s). An analysis of variance (ANOVA) was conducted on the number of arguments per text in order to identify any group-related differences in use of argument structure.

IV.3.2. Complexity of argument structure

As a means of describing the complexity of argument structures characterizing student and expert persuasive writing, a problem-space-behavior graph was constructed for each group of writers based on data obtained from the argument analyses conducted on text sample I. The problem-space approach to creating a schematic for the argument structure typical of each group of writers involved treating each element in the argument structure as a possible state which a given subject might visit. The number of writers in each group visiting a particular state at least once (i.e., having at least one instance of a particular argument element in their persuasive text) relative to the total number of writers in the group was determined and these proportions reflected in the schematic.

A second persuasive text was analyzed for argument structure for all experts and for a subgroup of the 10th Grade writers. Of interest were the proportion of writers in these two groups representing a particular argument substructure in their second text. These data were compared to those resulting from the analysis of the first text in order to obtain some idea as to how representative the problem-space-behavior graphs were for the Expert and 10th Grade groups.

In order to further examine the relationship between argument complexity and persuasive writing skill a more quantitative approach was taken by considering the following measures: (a) maximum depth of an argument structure and (b) maximum variety of substructures used to elaborate an argument structure. The depth measure obtained for each subject represents the *longest* argument chain presented in text sample I. An argument chain is created by having an embedded argument (i.e., an argument which takes on the role of a specific substructure in an argument), and in the Argument Grammar this embedding is possible through three major substructures: (a) subclaims, (b) justifications (i.e., data or warrants), and (c) oppositions (i.e., alternative solutions, reservations, and countered rebuttals). For example, the argument structure presented in Figure 4, which was produced by a 10th Grade student, has a depth of three since the top level argument (ARGUMENT.1) has a subclaim structure represented as an argument (ARGUMENT.2), and this embedded argument structure (ARGUMENT.2) also has a substructure (i.e., a countered rebuttal) represented as an argument (ARGUMENT.3).

The elaboration of an argument structure refers to the inclusion of substructures which are defined as being optional in the ARGUMENT GRAMMAR (i.e., subclaim, constraint, modal, warrant, backing, reservation, alternative solution, and countered rebuttal). The variety of elaboration measure obtained for each subject represents the maximum variety (how many different types) of optional substructures a subject incorporated into an argument structure. For example, the argument structure presented in Figure 5, which was

taken from a text produced by an 8th Grade student, has an elaboration measure of three. In order to test for group-related differences in complexity of argument structure a multivariate analysis of variance (MANOVA) was conducted using Group as the main factor, and maximum depth and maximum variety of elaborations of argument structure as the dependent variables.

Additional analyses of argument structure data obtained from text sample I were conducted in order to determine if group-related differences existed in those factors seen as contributing to the measures of argument complexity. First, the following measures were obtained to determine whether differences existed in how expert and student writers used argument structures: (a) total number of embedded arguments per text and (b) relative frequencies of subclaim, data, warrant, countered rebuttal, reservation, and alternative solution structures represented as embedded arguments (i.e., frequency of argument substructure represented as embedded argument/total number of embedded arguments per text). Descriptive statistics for these measures were calculated for each group, and a MANOVA conducted using the proportionate data as the dependent variables and Group as the main factor.

Second, the following measures were obtained to investigate whether differences existed in the extent to which expert and student writers used different argument structure elaborations: (a) number of elaborations per text, (b) variety of elaborations per text, and (c) relative frequencies of different types of elaborative substructures (i.e., frequency of elaborative substructure/total number of elaborations per text). Descriptive statistics for these measures were calculated for each group, and two MANOVAs conducted: the first MANOVA used number of elaborations and variety of elaborations as dependent measures and Group as the main factor to test for group-related differences in the use of elaborations, and the second MANOVA used the proportionate data as dependent variables and Group as the main factor to test for group-related differences in how extensively various elaborative structures were used.

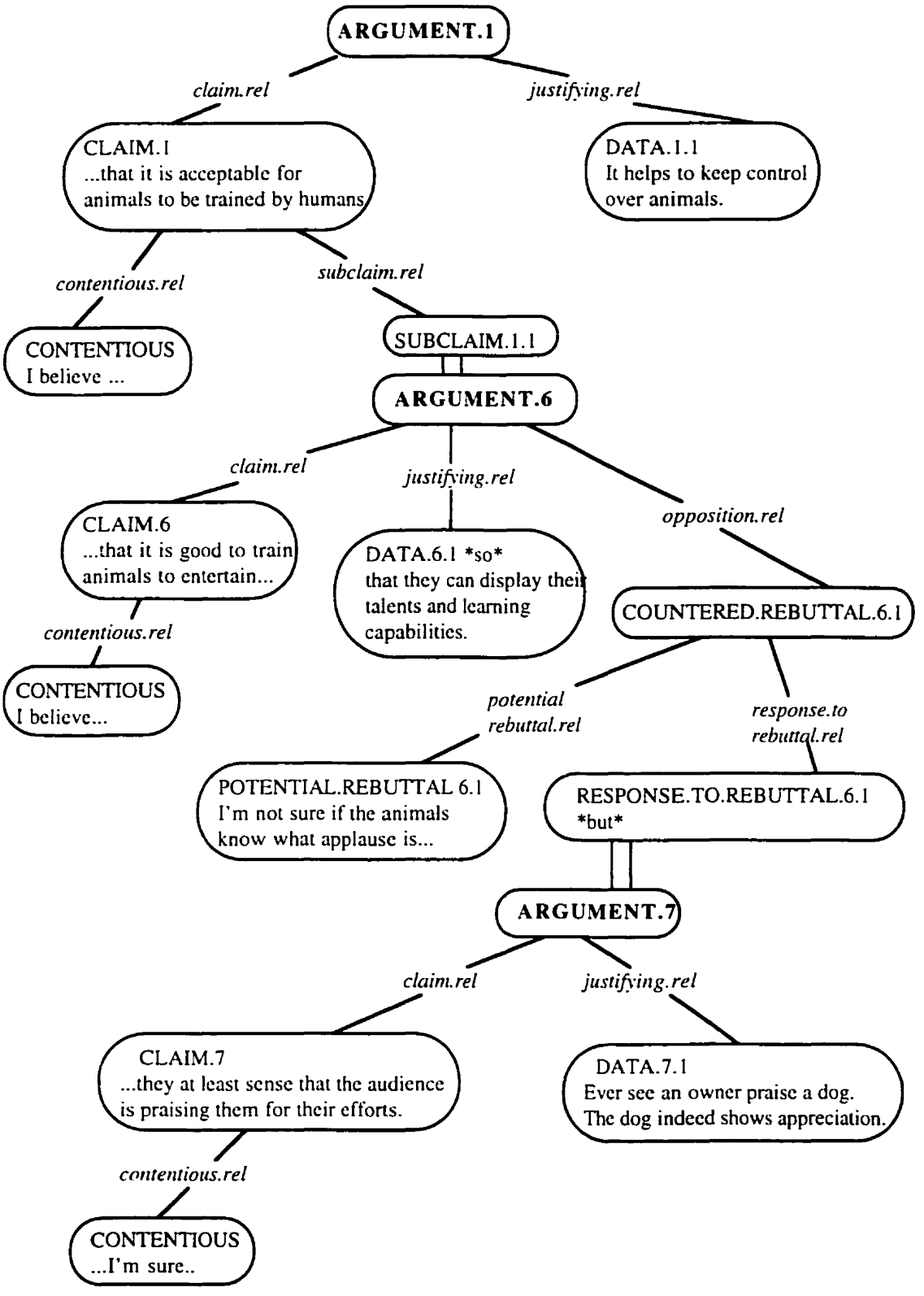

Figure 4. Argument structure with depth of three produced by 10th Grade student

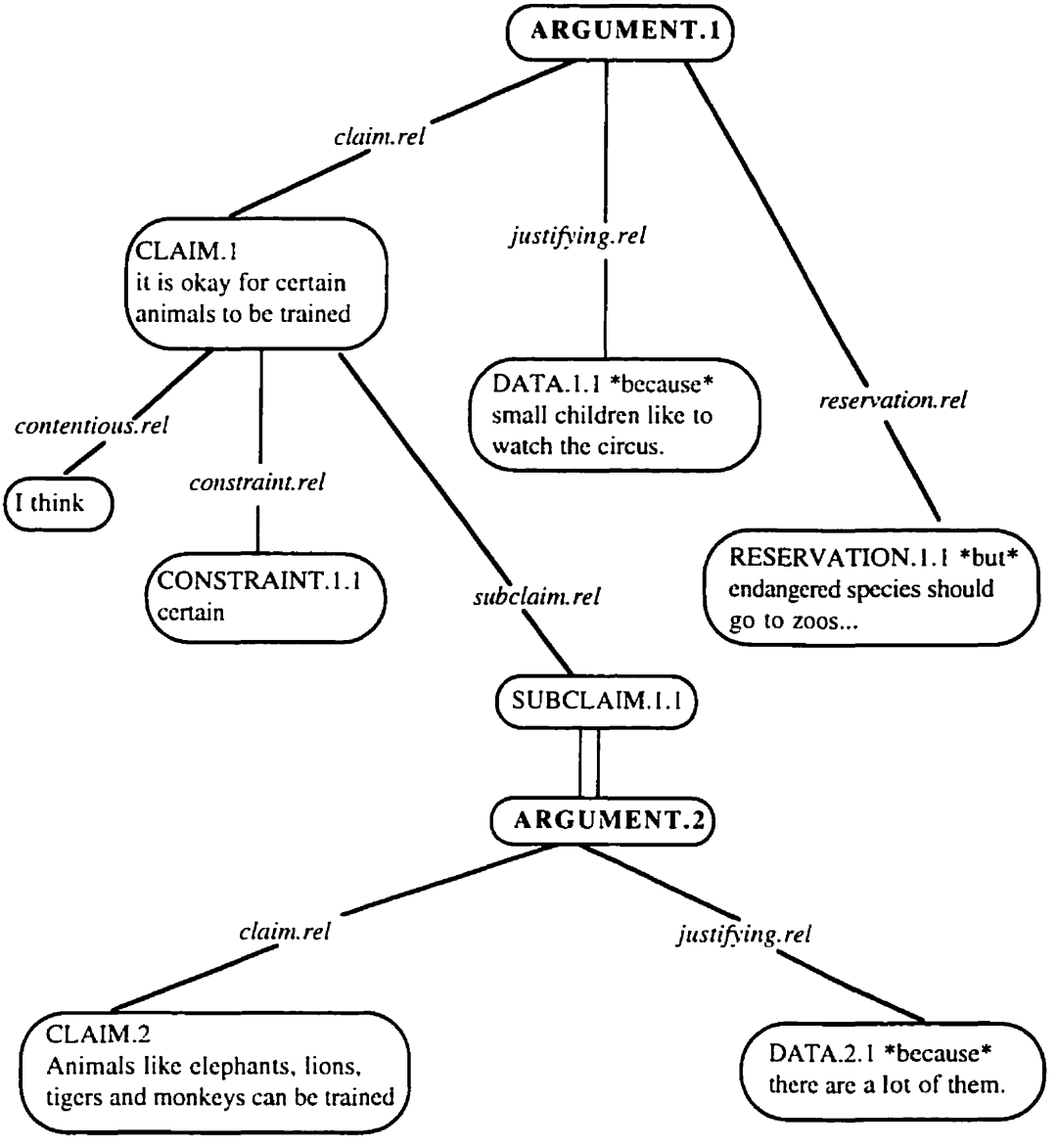

Figure 5. Argument structure with three different elaborations and a depth of two produced by an 8th Grade student

IV.3.3. Representation of argument structures

IV.3.3.1. Use of general semantic structures to represent argument structures

In order to determine whether differences existed among expert and student writers' uses of general semantic structures to represent argument structures, measures were derived from the mapping relationships between these two different levels of semantic representation. Using the results of the general semantic analysis and the argument analysis, frequency data were obtained for the types of general semantic structures underlying all claims, the contentious aspect of these claims, and also the subclaim, qualification, data, backing, reservation, and countered rebuttal structures (which are linked directly or indirectly to a claim).

IV.3.3.2. Use of linguistic devices and structures to represent argument structures

The following measures were obtained to determine whether differences existed among student and expert texts in terms of the types of conjunctive ties[15] used to represent argument substructures: (a) relative frequencies of additive and causal-conditional conjunctive ties associated with data, and constraint relations (i.e., frequency of conjunctive tie used to express particular argument relation/frequency of argument relation), (b) relative frequencies of additive and adversative ties used to represent reservation relations, (c) relative frequency of adversative ties used to represent countered rebuttal relation, and (d) relative frequencies of additive and causal-conditional ties used to represent backing and subclaim relations.

In order to identify differences in student and expert writers' uses of grammatical structures to represent argument substructures, the following measures were obtained: (a) relative frequencies of clause complexes and interdependent clauses used to represent reservation, countered rebuttal, and data structures and (b) proportion of clause complexes and interdependent clauses representing these structures that were linked by an explicit relational tie. Descriptive statistics for groups were calculated for these measures.

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[15] The types of conjunctive ties considered here were those which not only express a general semantic relation existing between clauses and/or clause complexes but also function to mark discourse specific relations (in this case argumentative) within a text.

IV.3.4. Persuasive writing ability and argument structure

In order to examine the predictive relationship between the quality of student persuasive writing and argument structure a multiple stepwise regression was carried out using the holistic quality rating scores as the dependent variable, and the following argument structure measures as the predictors: (a) level of argument structure model (i.e., number of different argument substructures included at least once in text sample I), (b) total number of data and backing structures combined per text, (c) total number of reservation and countered rebuttal structures combined per text, (d) number of modals per text, and (e) number of constraints per text.

V. Results

V.1. Use and extent of argument structure

Results of the argument structure analysis revealed that, with the exception of one grade six student and one grade eight student, all expert and student writers presented at least one argument structure (i.e., claim-data complex) in their persuasive texts. Moreover, as summarized in Table 1, argument structure(s) and substructures linked to argument structures accounted for all text produced by expert writers and almost all text produced by student writers. Non-functional segments produced by students tended to be opinion structures related to the issue of training animals but either unrelated or not linked by either semantic or syntactic relational links to the argument(s) presented in their persuasive text.

Table 2

Group Means and (Standard Deviations) for Use and Extent of Argument Structure

Group	*n*	Proportion of text accounted for by argument structure	# arguments per text	Density: Arguments per clausal segment
6th Grade	12	.90 (0.29)	2.50 (1.68)	.15 (.08)
8th Grade	12	.86 (0.28)	3.08 (1.68)	.12 (.07)
10th Grade	12	.97 (0.10)	3.50 (2.24)	.13 (.09)
Expert	7	1.00	11.57 (5.83)	.24 (.07)

The results of the ANOVA on number of argument structures per text revealed a significant group effect (F (3; 39) = 19.908, $p < .001$), and the subsequent planned comparison between students and experts (i.e., 6th Grade + 8th Grade + 10th Grade vs Experts) was also significant ($p < .001$). Tukey post hoc pairwise comparisons[16] indicated that the Expert group produced significantly more argument structures per text than any of the student groups ($p < .001$ for all three Expert vs student group comparisons). Although an increase with grade level was noted among student groups, when a trend analysis was conducted to test for a linear effect the resulting F statistic was not significant.

In order to determine whether or not the greater number of arguments produced by the Expert group was simply a function of text length an ANOVA was conducted using the

[16]All post hoc pairwise comparison results reported in this study are based on Tukey's HSD test.

density measure as the dependent variable and group as the main factor. The analysis yielded a significant F statistic for Group effect (i.e., $F(3; 39) = 3.631, p < .05$), and the planned comparison between student and expert groups (i.e., 6th Grade + 8th Grade + 10th Grade vs Experts) was also significant ($p < .01$). Post hoc comparisons yielded two significant differences--one between the 8th Grade group and the Experts ($p < .05$) and the other between the 10th Grade group and the Experts ($p < .05$). Overall, then, it appears that the experts used arguments more extensively than the student writers regardless of the length of their persuasive texts.

V.2. Complexity of argument structure

V.2.1. Models of argument structure for student and expert groups

The data used to create problem-space-behavior graphs or schematics for the models of argument representative of each group of writers is presented in Table 3. The criterion for inclusion of a particular argument substructure into a group model was the utilization of the structure in text sample I by at least one member of the group. Although few expert texts contained either backing or alternative solution structures, all but one expert text contained either a subclaim or reservation structure, and all expert texts contained at least one instance of each of the remaining substructures. This pattern of performance resulted in the most complex model of argument for the Expert group. The models produced for the 10th and 8th Grade groups are somewhat simpler in that they lack the backing for warrant structure, and the 6th Grade model is the least complex in that both warrant and backing for warrant structures are absent. The problem-space-behavior graphs used to represent the models are presented in Figures 6a - 6d.

A second text was analyzed for all experts participating in the study and for six of the twelve 10th Grade students. The purpose of this additional analysis was to determine to what extent the Expert and 10th Grade group models generated by the animal training texts (sample I) were representative of other instances of persuasive writing. The data presented in Table 4 indicates that overall the argument model developed for these groups can be considered an accurate representation of the structural complexity associated with their persuasive writing. However, there did appear to be a drop in student performance in that fewer writers represented constraints, qualifications, and countered rebuttals. In addition, fewer instances of various argument substructures were noted in student texts and an increase in nonfunctional segments. It is possible that this drop in performance was due to a lack of content knowledge. The second sample of persuasive texts produced by experts gave the impression of being far more substantive; they were longer and contained more substructures, particularly data and backing for data involving an authority.

Table 3

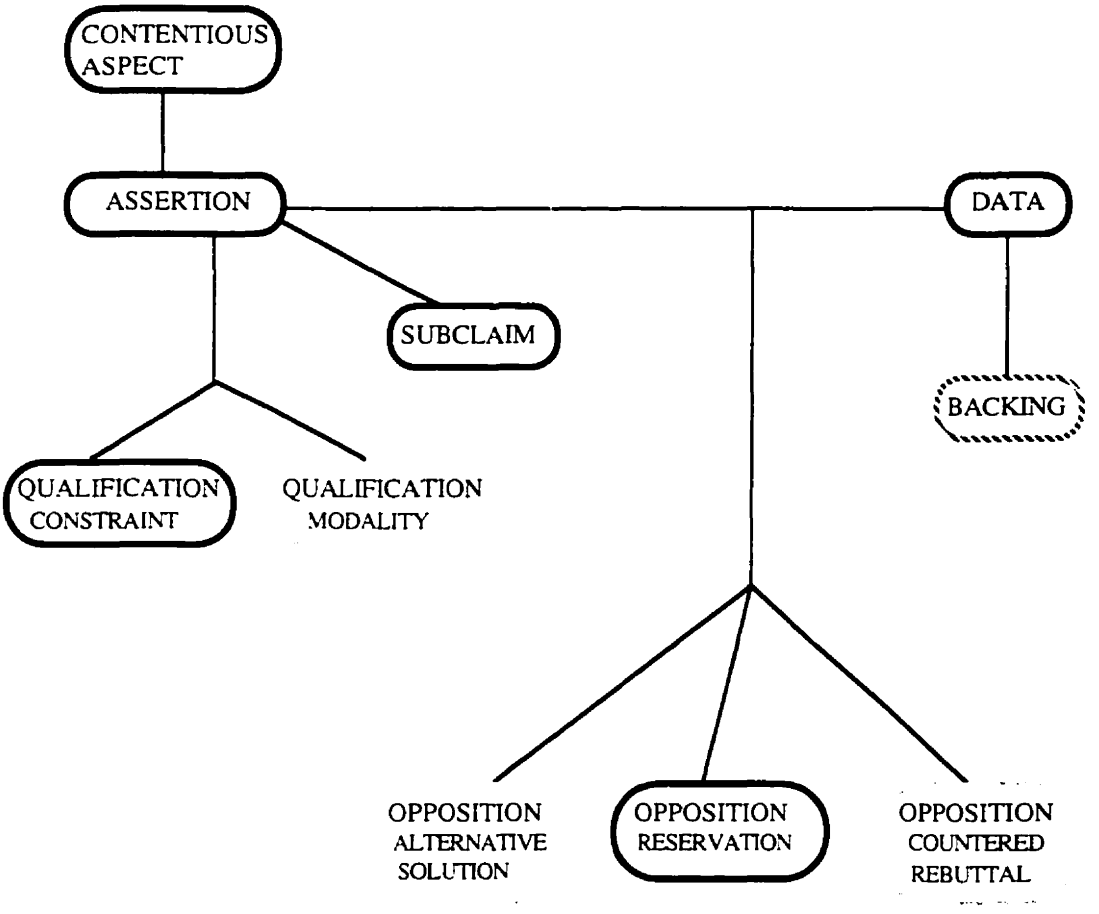
Proportion of Subjects in Each Group Representing Various Argument Substructures

	group			
Substructure	6th Grade (n = 12)	8th Grade (n = 12)	10th Grade (n = 12)	Expert (n = 7)
Contentious aspect	1.0	1.0	1.0	1.0
Claim	1.0	1.0	1.0	1.0
Constraint	0.75	0.83	0.75	1.0
Modal	0.25	0.17	0.58	1.0
Subclaim	0.83	0.92	0.92	0.86
Data	0.92	0.92	1.0	1.0
Backing (data)	0.42	0.50	0.42	0.29
Warrant	0.0	0.17	0.33	1.0
Backing (warrant)	0.00	0.00	0.00	0.29
Alternative solution	0.08	0.17	0.08	0.29
Reservation	0.75	0.83	0.25	0.86
Countered rebuttal	0.25	0.25	0.58	1.0

Table 4

Proportion of Subjects in Expert Group and 10th Grade Subgroup Representing Substructures in Persuasive Text Sample 2

	group	
Substructure	10th Grade ($n = 6$)	Expert ($n = 7$)
Contentious aspect	1.0	1.0
Claim	1.0	1.0
Constraint	.50	.71
Modal	.67	1.0
Subclaim	.50	.86
Data	1.0	1.0
Backing (data)	.50	1.0
Warrant	.17	.86
Backing (warrant)	.00	.14
Alternative solution	.00	.14
Reservation	.50	1.0
Countered rebuttal	.50	.86



Key

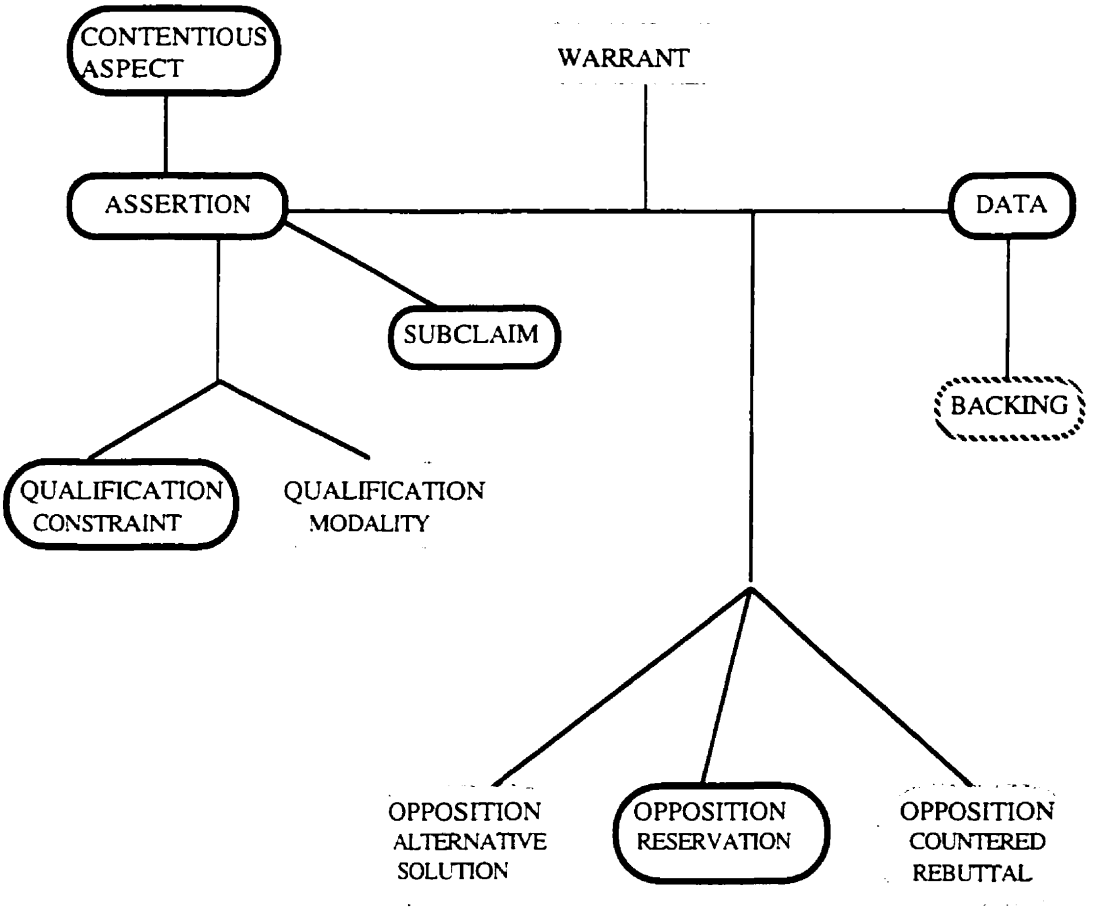
≤ 0.25 participants

0.26 < ≤ 0.50 participants

0.51 < ≤ 1.0 participants

(proportion of writers demonstrating use of particular structure is indicated by density of line)

Figure 6a. Model of argument structure for 6th Grade students participating in study.



Key

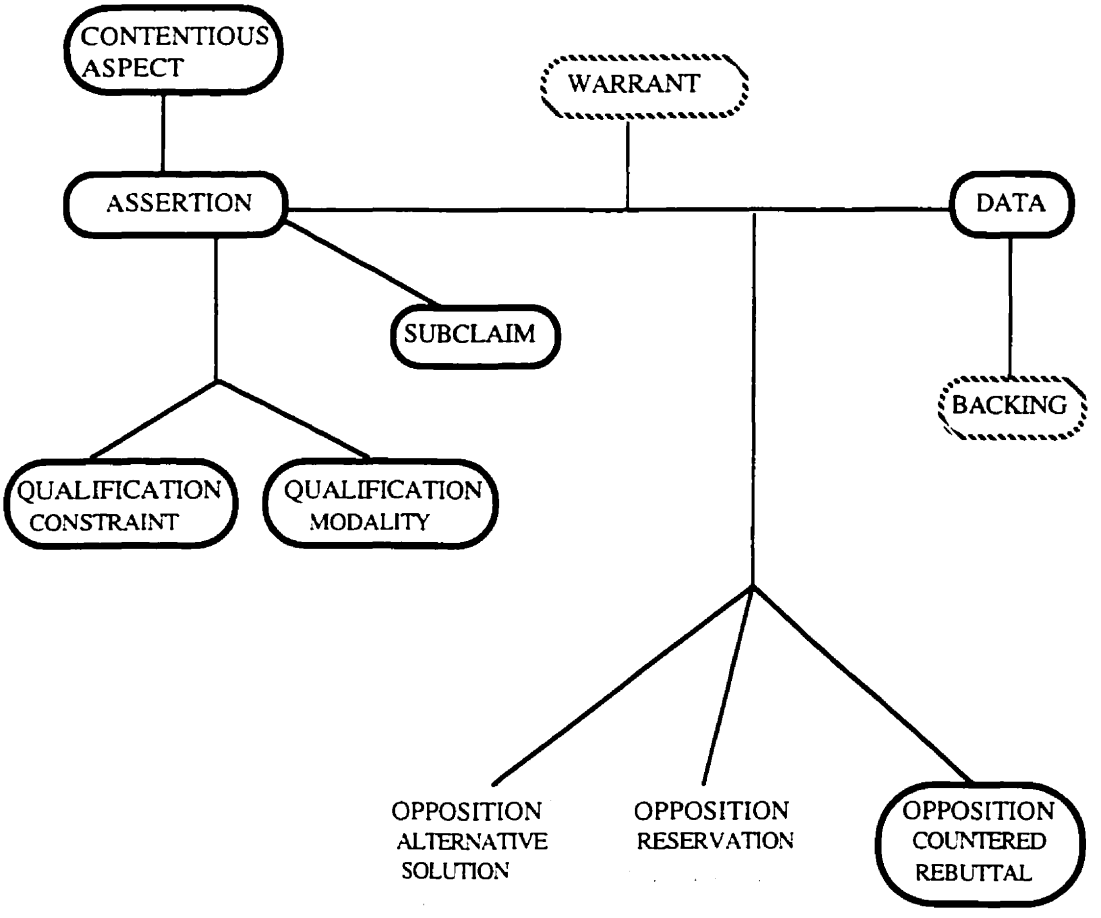
≤ 0.25 participants

0.26 < ..... ≤ 0.50 participants

0.51 < ——— ≤ 1.0 participants

(proportion of writers demonstrating use of particular structure is indicated by density of line)

Figure 6b. Model of argument structure for 8th Grade students participating in study.



Key

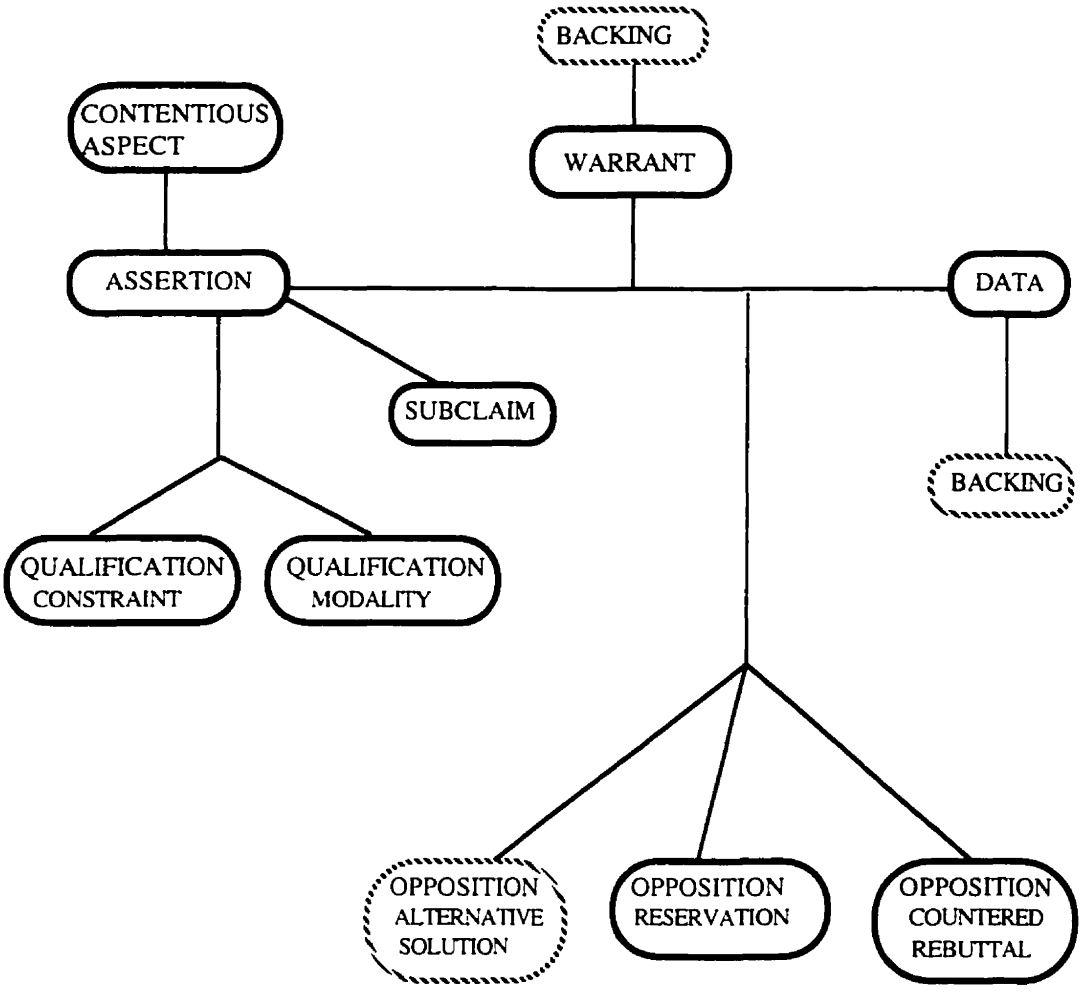
≤ 0.25 participants

0.26 < ≤ 0.50 participants

0.51 < ≤ 1.0 participants

(proportion of writers demonstrating use of particular structure is indicated by density of line)

Figure 6c. Model of argument structure for 10th Grade students participating in study.



Key

≤ 0.25 participants

0.26 < ..... ≤ 0.50 participants

0.51 < ——— ≤ 1.0 participants

(proportion of writers demonstrating use of particular structure is indicated by density of line)

Figure 6d. Model of argument structure for Expert writers participating in study.

V.2.2. Depth and elaboration of argument structure

The group means and standard deviations for the two measures of argument structure complexity are presented in Table 5. The multivariate analysis revealed a significant group effect, and the subsequent univariate tests yielded significant *F* values for both measures of argument complexity (i.e., maximum depth of argument structure and maximum variety of elaborative substructures). The results of multivariate and univariate tests are presented in Table 6.

Table 5

Group Means and (Standard Deviations) for Complexity of Argument Structure Variables

Group	*n*	Maximum depth of argument structure	Maximum variety of elaborations linked to argument structure
6th Grade	12	1.75 (1.06)	1.50 (0.91)
8th Grade	12	1.83 (0.94)	2.33 (0.99)
10th Grade	12	1.92 (0.67)	2.17 (1.19)
Expert	7	4.14 (1.57)	3.71 (1.31)

Table 6

Multivariate Analysis of Variance for Complexity of Argument Structure Measures

Multivariate *F*	5.375	($p < .001$)
Multivariate *df*	6; 76	
Univariate *F* Statistics		
Depth of argument structure	9.799	($p < .001$)
Elaboration of argument structure	6.085	($p < .01$)
Univariate *df*	3; 39	

To test predictions regarding the relationship between the complexity of argument structure and the development of persuasive writing skills a set of planned comparisons was conducted. Results were as follows:

Depth of argument structure

No significant differences were found for either one of the two comparisons between student groups (i.e., i) 6th Grade vs 8th Grade, and ii) 6th + 8th Grade vs 10th Grade) for the depth of argument structure measure. However, a significant difference ($p < .001$) was found for the comparison between student and expert groups (i.e., 6th + 8th + 10th Grade vs Experts). Post hoc pairwise comparisons revealed that the Expert group's performance was significantly higher than that of the 6th Grade ($p < .001$), 8th Grade ($p < .01$), and 10th Grade ($p < .001$). Grade-related increases in performance were observed among the student groups although a trend analysis conducted to test for a linear effect did not yield a significant result.

Elaboration of argument structure

No significant differences were found for either one of the two comparisons between student groups (i.e., i) 6th Grade vs 8th Grade, and ii) 6th + 8th Grade vs 10th Grade) for the variety of elaboration measure but a significant difference ($p < .01$) was found for the comparison between student and expert groups (i.e., 6th + 8th + 10th Grade vs Experts). Post hoc pairwise comparisons revealed significant differences between the 6th Grade and the Expert groups ($p < .01$) and between the 10th Grade and Expert groups ($p < .05$). The trend analysis conducted to test for a linear effect among student groups did not result in a significant F statistic.

V.2.3. Role of argument structures in persuasive texts

The following measures were obtained in order to investigate how student and expert writers used embedded argument structures in their persuasive texts: (a) total number of embedded arguments[17] per text and (b) relative frequencies of the different constituent roles in argument or opinion structures that these embedded arguments assumed (e.g., number of data structures represented as arguments/total number of embedded arguments per text). Descriptive statistics for these measures are given in Table 7, and the results of the MANOVA conducted on the proportionate data are presented in Table 8.

[17]Arguments that were embedded in either argument or opinion (i.e., an unjustified claim) structures were considered in this analysis.

Table 7

Group Means and (Standard Deviations) for Use of Argument Structures

Arguments	Group			
	6th Grade (n = 12)	8th Grade (n = 12)	10th Grade (n = 12)	Expert (n = 7)
Embedded/text	1.67 (1.30)	1.92 (1.78)	2.25 (2.18)	10.00 (6.61)
Proportionate data	(n = 10)	(n = 10)	(n = 9)	(n = 7)
Subclaim	.23 (.38)	.49 (.45)	.62 (.40)	.20 (.18)
Data	.10 (.18)	.07 (.14)	.34 (.42)	.25 (.15)
Warrant	.00	.00	.00	.13 (.14)
Countered rebuttal	.03 (.08)	.00	.02 (.06)	.29 (.16)
Reservation	.58 (.48)	.45 (.48)	.02 (.07)	.12 (.11)
Alternative solution	.03 (.08)	.00	.00	.01 (.04)

The group means show a gradual increase with grade level in the total number of embedded arguments in persuasive text and a notable increase in performance on this measure for the Expert group, and these results are entirely consistent with those for *total* number of arguments produced per text. The MANOVA for the proportionate data revealed a significant group effect, and the subsequent univariate analyses yielded significant F values for warrant, countered rebuttal, and reservation measures.

Overall, the statistics for the proportionate data suggest there are group specific patterns associated with the use of embedded arguments in argument and opinion structures. The 6th and 8th Grade groups show somewhat similar patterns with most embedded arguments accounted for by subclaim and reservation structures, a few accounted for by data structures, and little or none by countered rebuttals, alternative solutions, or warrants. This similarity is supported by the univariate analysis results, and the post hoc comparison findings which show no significant differences between these groups on any measure. The 10th Grade group differs from the lower grade level groups in that a larger proportion of arguments are accounted for by data structures (although this is not a significant difference), and very few arguments are accounted for by reservation structures (the post hoc test was significant for the comparison between the 6th and 10th Grade groups ($p <$ .05) but not for that comparison between the 8th and 10th Grade groups).

Table 8

Multivariate Analysis of Variance for Role of Embedded Arguments Measures (Proportionate Data)

Multivariate *F*	8.369	($p < .001$)
Multivariate *df*	18; 76	
Univariate *F* Statistics		
Subclaims	2.578	($p = .071$)
Data	2.329	($p = .093$)
Warrant	8.188	($p < .001$)
Countered rebuttal	20.167	($p < .001$)
Reservation	4.781	($p < .01$)
Alternative solution	0.704	($p = .557$)
Univariate *df*	3; 32	

The pattern associated with the Expert group resembles the student groups in that embedded arguments are generally not accounted for by alternative solution structures but are to a notable extent accounted for by subclaim and data structures; the univariate results for these measures indicated no significant group effect. In contrast to the student groups, however, it appears that the greatest proportion of embedded arguments produced by the Expert group can be accounted for by countered rebuttal structures and a notable proportion by warrant structures. This observation is supported not only by the Univariate results but also by the post hoc comparison tests which show significant differences between the Expert group and each of the student groups on both countered rebuttal and warrant measures (i.e., $p < .01$ for all such pairwise comparisons).

V.2.4. Use of elaborations in persuasive text

Descriptive statistics for each group of writers on measures reflecting the use of elaborative structures in persuasive text are presented in Table 9. These measures include (a) total number of elaborations linked to argument or opinion structures per text, (b) variety of elaborations per text, and (c) relative frequencies of different elaborative

structures per text (i.e., frequency of elaborative structure/total number of elaborations per text).

The MANOVA conducted to test for group differences in use of elaborations revealed a significant main effect, and the univariate *F* statistics were significant for both dependent measures: total number, and variety of elaborative structures associated with the argument or opinion structures used in text sample I. The multivariate and univariate test results are given in Table 10. The planned comparison between the Expert group and all three student groups (i.e., 6th + 8th + 10th Grade groups vs Expert group) was also significant ($p <$ .001 for both measures). A drop in performance by the 10th Grade relative to the 6th and 8th Grade groups on the number of elaborations produced per text measure was noted and a grade-related increase among student groups on the variety of elaborative structures per text measure. A trend analysis testing for a linear effect on this latter measure did not yield a significant *F* value.

Table 9

Group Means and (Standard Deviations) for Use of Elaborations

	Group			
Elaborations	6th Grade (n = 12)	8th Grade (n = 12)	10th Grade (n = 12)	Expert (n = 7)
Total per text	9.25 (5.45)	9.67 (3.23)	8.83 (4.15)	30.43 (13.43)
Variety per text	3.50 (1.51)	3.75 (0.66)	3.92 (1.00)	6.71 (1.11)
Proportionate data				
Subclaims	.23 (.15)	.25 (.15)	.23 (.15)	.11 (.08)
Constraints	.33 (.23)	.32 (.20)	.30 (.24)	.20 (.08)
Modals	.03 (.05)	.03 (.06)	.07 (.09)	.26 (.08)
Warrants	0	.04 (.10)	.04 (.08)	.13 (.09)
Backings	.16 (.29)	.17 (.20)	.18 (.24)	.03 (.05)
Reservations	.23 (.23)	.16 (.11)	.03 (.05)	.10 (.07)
Alternative solutions	.01 (.02)	.01 (.03)	.01 (.04)	.01 (.02)
Countered rebuttals	.03 (.05)	.05 (.09)	.15 (.15)	.15 (.12)

Table 10

Multivariate Analysis of Variance for Use of Elaborations Measures

Multivariate *F*	8.663	($p < .001$)
Multivariate *df*	6; 76	
Univariate *F* Statistics		
Total per text	19.988	($p < .001$)
Variety per text	14.619	($p < .001$)
Univariate *df*	3; 39	

The MANOVA conducted to test for group differences in the relative use of various elaborative argument substructures yielded a significant main effect for Group, and univariate *F* statistics were significant for the following dependent measures: relative use of modal, reservation, countered rebuttal, and warrant structures. The multivariate and univariate test results are given in Table 11. In order to determine group specific patterns regarding the relative use of various elaborative structures, consideration was given to the proportionate data presented in Table 9 and results of those post hoc comparisons which were conducted when warranted.

Consideration of the 6th and 8th Grade descriptive statistics reveals almost identical patterns of elaborative structure usage with the one exception being some evidence of the inclusion of warrant structures at the higher grade level--though this difference was not statistically significant. The proportionate data associated with 10th Grade group is similar to that reported for the 8th Grade group in most aspects but different from both 6th and 8th Grade groups in terms of (a) an increase in the relative use of countered rebuttal structures and (b) a decrease in the relative use of reservation structures. Results of post hoc comparisons involving the 6th and 10th Grade groups support this finding ($p < .01$ for reservations and $p < .05$ for countered rebuttals), although the comparisons involving the 8th and 10th Grade groups did not reach a statistically significant level.

The pattern of elaborative structure usage shown by the Expert group reveals similarities with the 10th Grade group for relative use of countered rebuttal structures, and with the 6th and 8th Grade groups for relative use of reservation structures. The Expert group differs from all student groups by virtue of the higher relative frequencies associated

with the warrant and modal structures. These findings are supported by post hoc comparisons involving the Expert and each of student groups on the modal measure ($p < .001$ for all comparisons), and by the comparison between the Expert group and the 6th Grade group on the warrant measure ($p < .05$). Additional differences noted between the Expert group and the student groups were the lower relative frequencies associated with the backing, subclaim, and constraint structures. These differences, however, were not statistically significant.

Table 11

Multivariate Analysis of Variance for Use of Elaborations (Proportionate Data)

Multivariate *F*	3.651	($p < .001$)
Multivariate *df*	24; 93	
Univariate *F* Statistics		
Subclaims	1.535	$p = .221$
Constraints	0.679	$p = .570$
Modals	19.906	$p < .001$
Warrants	4.121	$p < .05$
Backings	0.665	$p = .578$
Reservations	4.419	$p < .01$
Alternative solutions	0.043	$p = .998$
Countered rebuttals	4.312	$p < .01$
Univariate *df*	3; 39	

In summary, descriptive and multivariate statistics indicate that for the student groups (a) there exist similarities with respect to both the total number and the number of different types of elaborative structures used in their persuasive texts, and (b) the use of elaborations appears to involve four different structures: subclaims, constraints, backings, and reservations for the 6th and 8th Grade groups, and subclaims, constraints, backings, and countered rebuttals for the 10th grade group. In contrast, the Expert group data reflects the use of a greater variety of elaborative structures and indicates that the total number of

elaborations presented is largely accounted for by six different elaborative subtypes: subclaims, constraints, modals, warrants, reservations, and countered rebuttals.

V.3. Representation of argument structures

V.3.1. Representation of claim structures

In order to identify group-related differences in types of claims that writers used in their persuasive texts, the following measures were obtained: (a) total number of claims per text and (b) relative frequencies of different claim types. The classification of claims was based on the mapping relationships between claim structures and general semantic structures described in Table 1, Appendix E (p. 167).

Analysis of claim structures in text sample I and the general semantic structures used to represent these claims revealed that in general, although experts produced considerably more claims than student writers, all four groups of writers favored the use of evaluations above other types of claim structures. Moreover, with the exception of one 6th Grade student, all participants included an evaluation at least once in their persuasive text. Evaluations are defined in Base Grammar 2.0 terms as descriptive frame structures involving either a degree or ordered relation or a psychological attribute. Almost all other claims produced by students were represented as proposals, which are procedural frame structures requiring a modality operator marking qualified necessity (e.g., the auxiliary verbs *should*, *ought*) and tense marked as future. Some variability among student groups was noted in terms of the proportion data--texts produced by students in the 8th Grade group contained a higher proportion of proposal claims. This pattern was reflected in the number of students including at least one proposal in their texts. That is, 54% of students in each of the 6th and 10th Grade groups included proposals as compared to 92% of 8th Grade students. A few students (i.e., 25% in each group) did produce causality/predictive claims, which involve event or procedural frame structures, while none included identification/definition claims. In contrast, while proposals were the least frequently produced types of claims found in expert texts, all types of claims were represented at least once in most expert texts (i.e., all expert texts contained evaluations, 71% contained proposals, 86% contained identification/definitions, and 86% contained causality/predictive claims). The results of the analysis of claims and the mapping relationships between claim structures and general semantic structures defining different claim types are presented in Table 12.

Table 12

Group Means and (Standard Deviations) for Claims and Representation of Claims

Claims	Group			
	6th Grade (n = 12)	8th Grade (n = 12)	10th Grade (n = 12)	Expert (n = 7)
Claims per text	6.17 (2.69)	7.08 (3.45)	7.17 (3.19)	20.0 (4.87)
Relative frequencies				
Evaluations	.72 (.29)	.54 (.23)	.76 (.19)	.71 (.14)
Proposals	.23 (.27)	.41 (.21)	.19 (.21)	.08 (.08)
Identification/ definition	0	0	0	.12 (.10)
Causal/predictive	.06 (.11)	.04 (.07)	.05 (.09)	.09 (.07)

V.3.2. General semantic structures marking contentious aspect of claims

A claim is a basic assertion that has a disputable truth value. Various semantic relations acting as modal operators can mark the truth value of an assertion as being qualified, and for the reader or audience, this qualification may signal that the assertion is contentious and hence a claim. In order to identify any group-related differences in the representation of this contentious aspect, relative frequencies were obtained for the various types of semantic relations that might function to mark an assertion as having a qualified truth value. Semantic relations serving as contentious markers are specified in Table 2, Appendix E (p. 168). It is relevant to note here that each claim may be marked by one or a combination of these relations. The means and standard deviations for groups for the proportions of total claims in text sample I which are marked as being contentious by a particular relation are given in Table 13.

Consideration of the results reveals that for all groups the type of modal qualification associated with a majority of claims presented followed the use of either a psychological attribute relation or an ordered attribute relation. These types of semantic relations, which define an evaluation, can be viewed as contentious since they involve a subjective, personal judgement.

Table 13

Group Means and (Standard Deviations) for Representation of the Contentious Aspect of Claims

Proportion of claims marked by semantic relation	Group 6th Grade (n =12)	8th Grade (n =12)	10th Grade (n =12)	Expert (n =7)
Psychological attribute rel	.72 (.29)	.54 (.23)	.76 (.19)	.71 (.14)
Interrogative operator rel	.04 (.11)	.16 (.20)	0	.14 (.15)
Opinion	.52 (.28)	.50 (.26)	.48 (.26)	.19 (.21)
internal.state rel	.48 (.29)	.30 (.13)	.41 (.28)	.12 (.14)
positive.condition rel	.05 (.08)	.20 (.18)	.07 (.12)	.06 (.11)
Modality.rel	.26 (.26)	.48 (.24)	.29 (.21)	.49 (.20)
should	.23 (.27)	.41 (.21)	.19 (.21)	.08 (.08)
"other" modals	.06 (.12)	.04 (.10)	.11 (.13)	.40 (.15)

Note: This category includes claims modalized by positive conditional relations involving opinions as well as reference relations involving opinions due to the relatively low occurrence of these relations.

For student groups, the second most frequently observed type of modal operator associated with claims were semantic relations indicating that the assertion was an opinion. In general, this type of modal operator is represented by one of three different semantic relations: (a) an internal state relation such as *I think...*, (b) a positive-conditional relation such as *In my opinion...*, and (c) a reference relation such as *My opinion is ...* Writers in all groups made relatively greater use of the internal state relation in presenting their claims as opinions. However, compared to claims presented in the student persuasive texts, few expert claims were marked as being opinions and this difference appears to be accounted for by the lower relative frequency observed with respect to the use of internal state relations. Moreover, while all texts produced by students in the 6th, 8th, and 10th Grade groups contained at least one opinion marker, only 57% of the expert texts contained any semantic relation marking a claim as being an opinion.

Problem statements (which are considered modal qualifiers in that they involve an interrogative operator) were not found in any 10th Grade texts, and in only 17% of 6th Grade texts. On the other hand, the proportion of problem statements observed in the 8th Grade texts appears to be similar to that observed in the expert texts. However, it is also

relevant to note that (a) all experts used a problem statement at least once as compared to 67% of 8th Grade participants and (b) while students typically used problem statements to restate or reword the question presented in the task (e.g., *Is training animals right or wrong?, Should animals be trained?*), experts tended to redefine the problem or issue (e.g., *Is there a connection between animal training and educating children?*)

The modal category refers to those modal operators which are linked to a semantic structure only by a modality relation.[18] It includes auxiliary verbs such as *could, might, should*, adverbs such as *probably, generally, perhaps*, and adverbial phrases such as *It is probable, It is perfectly evident.*. In terms of overall use, the Expert and 8th Grade groups performed at a similar level and appeared to make greater use of modals to qualify their claims than either the 6th or 10th Grade groups. However, in this study the modal *should*, when used in a proposal type claim, was analyzed separately from other auxilary verbs or adverbial phrases used to modify assertions functioning as claims. Assertions described as proposals require the use of the modal *should* by definition whereas other modals are not an inherent part of any type of claim. Without adopting this convention it was possible that the statistical means reported for the student groups would be artificially inflated due to the higher proportion of proposals in their persuasive texts compared to that reported for the Expert group; important group-related differences in the use of modals would be masked. Consequently, in Table 12, statistics are given for the proportion of claims marked by the modal *should*, as well as for the proportion of claims marked by "other" modals. These statistics show, that as expected, the use of modals to qualify assertions presented in student persuasive texts is largely accounted for by the modal *should*. In contrast, the expert texts contained a considerably higher frequency of "other" modals which served to mark assertions as being contentious.

V.3.3. Representation of subclaim structures

Subclaim structures can be represented by two types of general semantic links: (a) a part relation which occurs when the subclaim has a basic assertion equivalent to that of the claim and a qualification or reservation which limits its applicability relative to the claim and b) an exemplification relation which occurs when the subclaim is a specific instance of the more general case stated in the top level claim (see Table 3, Appendix E, p. 169, for examples). Means and standard deviations for each group for the total number of subclaims in text sample I and the relative frequencies of the two types of subclaim representations are given in Table 14. Consideration of the data indicates that although the

[18]Other semantic relations serving as modal operators have a dual nature; they are relations which not only define a semantic component in terms of its constituent structure but also modalize its truth value.

three groups of student writers performed at a similar level in terms of the total number of subclaims produced, the 6th and 10th Grade writers tended to produce relatively more subclaims involving a part relation than an exemplification relation whereas this pattern was reversed for the 8th Grade writers. The expert writers produced more subclaims than the student writers and made relatively equal use of part and exemplification relations to generate these structures.

Table 14

Group Means and (Standard Deviations) for Representation of Subclaims

	Group			
	6th Grade (n =12)	8th Grade (n =12)	10th Grade (n =12)	Expert (n =7)
Subclaims per text	2.25 (2.14)	2.25 (1.66)	2.17 (1.90)	3.71 (2.40)
Relative frequencies	(n = 10)	(n = 11)	(n = 11)	(n = 6)
Part relation	.73 (.45)	.24 (.39)	.81 (.36)	.45 (.40)
Exemplification relation	.27	.76	.19	.55

V.3.4. Representation of qualification structures

The Argument Grammar specifies two types of qualification structures on claims: modals and constraints. There is a one-to-one correspondence between modal relations functioning as qualifications for a claim and those placed in the "other modals" category marking the contentious aspect of a claim. These modal relations are viewed as having a dual role--for the audience they signal that an assertion is contentious and hence a claim, for the arguer they are a means whereby the scope of the claim can be limited (i.e., a *hedge* placed on the claim). Other semantic relations which may function to mark a claim as contentious (e.g., psychological attribute relation, internal state relation) are also modal operators but are not viewed as claim qualifications here since there is reason to believe that they would not have been used intentionally to limit the universality of the claim. For example, both the modal *should* and a psychological attribute can be seen as essential rather than optional in that they define particular types of claims.

Analysis of constraint representation was based on the mapping relationships described in Table 4, Appendix E (p. 170), and involved considering three type of general semantic relations: (a) an indefinite attribute relation (i.e., a logical quantifier), (b) a local positive

conditional relation, and (c) an embedded positive conditional relation. Descriptive statistics for groups were calculated for (a) total number of modals, (b) total number of constraints, and (c) the relative frequencies of the three types of general semantic structures representing a constraint structure, and are given in Table 15.

Table 15

Group Means and (Standard Deviations) for Representation of Qualification Structures

	Group			
	6th Grade (n =12)	8th Grade (n =12)	10th Grade (n =12)	Expert (n =7)
Modals total	.5 (1.0)	.33 (.65)	.75 (.75)	8.00 (4.08)
Constraints total	3.5 (2.68)	3.33 (2.84)	2.17 (1.64)	6.57 (4.50)
Relative frequencies for constraints	(n = 9)	(n = 10)	(n = 9)	(n = 7)
Indefinite.attribute	.49 (.33)	.34 (.22)	.20 (.26)	.43 (.35)
Positive local condition	.11 (.14)	.19 (.24)	.17 (.35)	.34 (.36)
Positive embedded condition	.41 (.31)	.48 (.35)	.63 (.42)	.23 (.37)

The group means indicate that (a) expert writers used more modals and constraints than the student writers and (b) expert writers used more modals than constraints in their persuasive texts whereas the reverse pattern was observed for all student groups.

V.3.5. Representation of data and backing structures

In order to examine group related differences in the representation of justification structures, consideration was given to data and backing structures and the general semantic relations representing these structures. Table 16 gives the group means and standard deviations for the following measures: (a) total number of backing structures per text, (b) total number of data structures per text, and (c) relative frequencies for representation of data as facts (i.e., an assertion having an absolute or known truth value) and values (i.e., a modalized assertion). As indicated in Table 5, Appendix E (p. 171), data structures can be represented at the general semantic level as either reason-conditional relations or marked purpose-conditional relations. With few exceptions, (3% of responses in the 8th and 10th Grade groups and 2% of responses in the Expert group) all data structures were

represented as reason-conditional relations. Group variability was observed in terms of representing data structures as facts or values--experts were less likely than students to present data structures as facts.

Descriptive statistics for groups presented in Table 16 suggests a developmental trend in number of backing structures used by student groups and a decrease in expert group. As outlined in Table 6, Appendix E (p. 172), backing structures can be represented using one of two semantic relations, an exemplification relation or a positive conditional relation. Analysis of backing structures in text sample I revealed that all student responses and 50% of expert responses were represented as exemplification relations. The remaining 50% of expert responses were represented as positive-conditional relations which occurs when either a source or an authority is cited in support of data.

Table 16

Group Means and (Standard Deviations) for Representation of Backing and Data Structures

	Group			
	6th Grade (n =12)	8th Grade (n =12)	10th Grade (n =12)	Expert (n =7)
Total backing	.83 (1.19)	1.50 (1.88)	1.83 (3.74)	1.14 (1.77)
Total data	3.33 (2.31)	5.08 (2.88)	6.67 (3.37)	13.00 (4.73)
Relative frequencies for data	(n = 11)	(n = 11)	(n = 12)	(n = 7)
Facts	.41 (.39)	.67 (.35)	.53 (.34)	.20 (.19)
Values	.59	.33	.48	.80

V.3.6. Representation of opposition structures

The representation of two types of argument opposition structures were investigated in the present study, reservations and countered rebuttals. The mapping relationships between these structures and general semantic relations as given in Table 7, Appendix E (p. 173), specify that a reservation can be represented as either a negative-conditional relation or an adversative-conditional relation of the contrastive type and that while a countered rebuttal is also represented as an adversative-conditional relation it is of either the concessive or denied implication types. Table 17 contains the group means and standard deviations for the following measures derived from the semantic and argument analyses of

text sample I: (a) total number of reservations, (b) total number of countered rebuttals, (c) relative frequencies of negative-conditional relations and contrastive-adversative-conditional relations representing reservations, and (d) relative frequencies of concessive-adversative and denied implication-adversative-conditional relations representing countered rebuttals.

Texts produced by writers in the 6th and 8th Grade groups contained more reservations than those produced by writers in the 10th Grade group. In terms of representation, texts produced by students in the 6th Grade group contained more reservations represented by adversative-conditional relations than by negative-conditional relations whereas expert and 8th Grade texts contained a relatively even distribution of these two types of semantic relations used to represent reservations. Reservations contained in texts produced by students in the 10th Grade group, although few, tended to be represented by negative-conditional relations.

Table 17

Group Means and (Standard Deviations) for Representation of Opposition Structures

	Group			
	6th Grade (n =12)	8th Grade (n =12)	10th Grade (n =12)	Expert (n =7)
Total reservations	1.92 (1.73)	1.50 (.91)	.25 (.45)	4.00 (2.65)
Relative frequencies	(n = 9)	(n = 10)	(n = 3)	(n = 6)
Negative-conditional relation	.35 (.34)	.50 (.41)	.67 (.58)	.45 (.22)
Contrastive-adv. cond. rel.	.65	.50	.33	.55
Total countered rebuttals	.33 (.65)	.42 (.79)	1.17 (1.19)	3.29 (1.25)
Relative frequencies	(n = 3)	(n = 3)	(n = 7)	(n = 7)
Concessive-adv. cond. rel.	.67 (.58)	.83 (.29)	.86 (.38)	.62 (.28)
Denied implication-adv. cond. rel	.33	.17	.14	.38

For all groups, countered rebuttals were most often represented by a concessive-adversative-conditional relation, although overall experts did produce an almost comparable number of countered rebuttals represented as denied implication-adversative-conditional relations. Only one countered rebuttal response in each of the student groups was

represented as a denied implication whereas 43% of all expert responses were represented by denied implications.

V.3.7. Representation of argument structure using conjunctive ties

The descriptive statistics for groups reported in Table 18 provide an overview of the relative use of conjunctive ties to express certain semantic relations which define an argument structure. With the exception of those additive ties used to represent constraint, backing, and data relational links,[19] the conjunctive ties considered here are explicit discourse-relational ties. The analysis was based on the mapping relationships given in Appendix F (p. 174).

Table 18

Group Means and (Standard Deviations) for Use of Explicit-Relational Conjunctive Ties to Represent Argument Relations(Proportionate Data)

Argument relation represented (type of conjunction)	Group 6th Grade	8th Grade	10th Grade	Expert
Subclaim (exemplification)	.50 (.44) (*n*=3)	.48 (.36) (*n*=9)	.17 (.29) (*n*=3)	.43 (.40) (*n*=5)
Constraint (causal-conditional)	.67 (.52) (*n*=6)	.68 (.40) (*n*=8)	.72 (.30) (*n*=7)	.33 (.33) (*n*=4)
Constraint (additive)	.08 (.20)	.11 (.21)	.18 (.20)	.11 (.19)
Data (causal-conditional)	.39 (.40) (*n*=11)	.28 (.23) (*n*=11)	.09 (.10) (*n*=12)	.10 (.10) (*n*=7)
Data (additive)	.02 (.08)	.14 (.15)	.18 (.21)	.09 (.10)
Backing (exemplification)	.47 (.51) (*n*=5)	.46 (.37) (*n*=8)	.33 (.38) (*n*=6)	.00 (*n*=4)
Backing (additive)	.13 (.30)	.29 (.26)	.15 (.21)	.00
Reservation (adversative)	.69 (.35) (*n*=9)	.55 (.37) (*n*=10)	.67 (.58) (*n*=3)	.66 (.25) (*n*=7)
Reservation (additive)	.08 (.18)	.20 (.35)	.33 (.58)	.04 (.07)
Countered rebuttal (adversative)	.50 (.71) (*n*=3)	1.00 (n=3)	.810 (.33) (*n*=7)	.76 (.31) (*n*=7)

Note: The subclaim relation refers only to subclaims represented by exemplification relations, and the constraint relation refers only to constraints represented by embedded positive-conditional relations
n = number of participants demonstrating use of argument relation in persuasive text sample I

[19]All additive ties used to represent constraint and backing relations, and many of the ties used to represent data relations followed the used of a discourse specific relational tie, i.e., occurred when the arguer provided more than one instance of a structure contiguously.

Overall, the 6th and 8th Grade groups showed a similar pattern of performance with the one exception being the use of an adversative tie to signal a countered rebuttal relation. On this measure the data reported suggest 6th Grade writers used an adversative tie to mark a countered rebuttal less frequently than the 8th Grade writers. While only one of the four countered rebuttal responses found in the 6th Grade texts was marked with an adversative tie, all such responses contained in 8th Grade texts were marked and most in the 10th Grade and Expert texts. In the absence of the adversative tie, identification of a countered rebuttal structure depended on a lexical analysis.

The 10th Grade data is notable for the relatively low frequencies associated with the use of relational ties to mark subclaims, data, and backing structures. In fact, in this regard, the proportional data reported for the 10th Grade group resembles that for the Expert group. The expert writers also made less frequent use of causal-conditional ties to mark constraint relations. An ANOVA was conducted on the relative frequencies of causal-conditional ties to represent data structures and yielded a significant F value (F (3; 37) = 3.538, $p < .05$). Post hoc comparisons revealed that the 10th Grade texts contained significantly fewer instances of these discourse specific ties than the 6th Grade texts ($p < .05$).[20]

In addition to group-related differences, the data reported in Table 18 reflects a structural effect in that for all groups explicit discourse ties were used most frequently to mark reservations and countered rebuttals (and to a lesser extent constraint relations) and least frequently to mark data structures.

V.3.8. Representation of argument structures using interdependent clauses and clause complexes

The descriptive statistics for groups given in Table 19 provide information regarding the syntactic representation of data structures. The interdependent clause category includes those representations of data structures that are within the same clause complex as the claim--through either a hypotactic or paratactic relation. Comparisons of group means suggest that the 10th Grade texts contained proportionately fewer instances of this type of syntactic representation than 6th Grade, 8th Grade, or Expert texts. An ANOVA carried out on the interdependent clause measure with Group as the main factor yielded a significant F value (F (3; 37) = 3.186, $p = .035$). Post hoc pairwise comparisons showed that the 8th Grade texts contained a significantly higher proportion of data structures represented as interdependent clauses than the 10th Grade texts ($p < .05$).

[20]Multivariate analyses were not conducted on the proportionate data for use of other conjunctive ties due to the combination of small group size and differences in group size associated with most measures.

Consideration was also given to writers' use of conjunctive ties to mark a data structure represented as an interdependent clause. The group means indicate that the experts were less likely than the students to utilize conjunctive ties to express a data relation represented within a clause complex. Closer examination of these types of claim-data constructions revealed that experts often used semicolons or dashes to signal the data relation. Only two instances (one found in an 8th Grade and the other in a 10th Grade text) indicated that this strategy was used at all by student writers.

Table 19

Group Means and (Standard Deviations) for Use of Interdependent Clauses and Clause Complexes to Represent Data Structures

	Group			
Type of clause structure (proportionate data)	6th Grade (n =11)	8th Grade (n =11)	10th Grade (n =12)	Expert (n =7)
Interdependent clause	.33 (.38)	.43 (.33)	.09 (.16)	.35 (.15)
proportion marked	1.00 (n = 7)	.87 (.33) (n = 9)	.77 (.44) (n = 5)	.46 (.31) (n = 7)
Adjacent clause complex	.40 (.39)	.26 (.35)	.38 (.28)	.34 (.15)
proportion marked	.18 (.31) (n = 7)	.17 (.41) (n = 6)	.05 (.15) (n =11)	.07 (.13) (n = 7)
Remote clause complex	.26 (.30)	.30 (.26)	.50 (.28)	.28 (.13)
proportion marked	.11 (.27) (n = 6)	.13 (.22) (n =9)	.24 (.25) (n= 11)	.11 (.20) (n = 7)

All groups presented the greatest proportion of data structures using independent clause complexes and these clause complexes were either adjacent to (immediately following) or remote from (more than one clause complex away) the clause complex representing the claim. MANOVA using proportion of adjacent and remote clause complex as dependent measures and Group as the main factor yielded a significant F value (F (6; 72) = 2.494, $p <$ .05). Univariate results showed a significant group effect for the proportion of data structures represented in remote clause complexes (F (3; 37) = 3.191, $p < .05$), and post hoc pairwise comparisons revealed that the 10th Grade texts contained a significantly higher proportion of data structures represented in remote clause complexes than the 6th Grade texts ($p < .05$). In general, conjunctive ties were used less frequently by all groups to mark data structures represented in either adjacent or remote clause complexes than

interdependent clauses. Significant differences were not found among groups on measures of the proportion of data in independent clause complexes marked by a conjunctive tie.

V.4. Prediction of quality rating scores for student texts using argument-structure variables

A stepwise multiple regression analysis was conducted to determine the extent to which the use and complexity of argument structure would predict the holistic scores assigned to student texts. The correlation matrix presented in Table 20 includes those variables used in the regression analysis as well as the following two variables: (a) total number of arguments per text and (b) text length (assessed by determining word frequency). The *model level* variable was included in the regression analysis as it was seen as representative of a text's structural complexity. The *support* variable, which comprised total number of data and backing for data structures, was included as these are not only essential to argument but are also the types of structures that are emphasized in any formal instruction in persuasive writing. The *opposition* variable, which comprised total number of reservations and countered rebuttals per text, was included as recent theoretical and empirical work (Cooper et al., 1984; Golder & Coirier, 1994; Hays et al., 1992; Perelman, 1982, 1994) indicates that the ability to deal with opposition is central to good persuasive writing. Total number of *modals* was tested as a predictor variable as it appears to be linked to expertise in persuasive writing and the total number of *constraints* variable was included in the regression analysis in order to determine if raters recognized this type of elaboration as a component of good persuasive writing.

Total number of arguments was not included in the analysis as it was shown to be highly correlated with supporting structures. However, it is relevant to note that the predictive relationship between number of arguments and holistic scores was positive but not significant. Text length was not included in the regression analysis as it does not have any theoretical bearings on the questions of interest in this study. Text length was highly correlated with all variables and this is hardly surprising. A text which was more complex or had a greater number of substructures would almost invariably be longer.

In the forward stepwise regression the variable with the highest partial correlation with *quality rating* was entered first, and in subsequent steps the variable with the highest partial correlation after the preceding variable was entered into the equation was selected. The results of the regression analysis are shown in Table 21--the predictor variables are shown under *Step* in the order they were entered into the equation, followed by the *F at entry* and the level of *significance* associated with the entry of each variable, the multiple correlation

coefficient R, the squared multiple correlation coefficient R^2, and the *overall F* associated with each model.

Table 20

Correlation Matrix for Argument Structure and Text Variables

	length	arguments	constraints	modals	opposition	support	model
arguments	.40*						
constraints	-.01	.04					
modals	.47**	.55***	-.25				
opposition	.10	-.10	.43*	-.12			
support	.70***	.58***	-.28	.59***	-.31		
model level	.62***	.45**	.17	.43**	.32	.38*	
quality rating	.75***	.32	-.04	.47**	.26	.54***	.63***

* = p <.05. ** = p < .01. *** = p < .001
n = 36

As shown in Table 21, the squared multiple correlation indicates that the most powerful predictor of the quality rating scores assigned to student persuasive texts was the level of the argument structure *model.* For each subject this measure represented the number of different argument substructures (out of a possible 12 as listed in Table 3) contained in text sample I. The regression analysis shows that by itself, this variable accounted for 40% of the variation in the holistic scores. Two other independent variables contributed significantly to the prediction equation, the number of *supporting* structures per text and the number of *opposition* structures per text. Together these measures explained an additional 17% of the variation in the dependent variable. The remaining two independent measures explained minute and insignificant portions of the variance associated with the holistic scores. Hence, the overall or final equation consisted of the first three variables entered: *model level, support,* and *opposition.* All three of these variables remained significant when in the prediction equation together.

Table 21

Results of Multiple Stepwise Regression

Step	*F at entry*	*significance*	*multiple R*	R^2	*Overall F*
1. Model	22.324	.000	.63	.40	22.324
2. Support	7.185	.011	.71	.50	16.185
3. Opposition	4.814	.036	.75	.57	14.088
4. Modals	0.517	.478	.76	.58	10.631
5. Constraints	0.396	.534	.76	.58	8.344

VI. Discussion

The results of the present study constitute an important source of information regarding the functional or *rhetorical* relationship between argument structure and good persuasive writing. In a general sense, rhetoric is concerned with those means which are under the control of the author and represented in the text, to an end which is the potential and possible responses by an audience (Gage, 1992). For persuasive discourse this end is one of convincing an audience to have a certain belief or to undertake a certain course of action. The performance patterns associated with student and expert writers' uses of elaborative argument structures in their persuasive writing are indicative of certain rhetorical skills underlying the production of "good" persuasive text and of important developmental changes occurring with respect to these skills.

VI.1 Centrality of argument structure in persuasive writing

That argument is intrinsic to persuasive discourse is a point which is not only intuitive but has also been developed at great lengths theoretically (Perelman & Olbrechts-Tyteca, 1969; Perelman, 1982; 1994). Empirical investigations regarding the extent and nature of this intrinsic relationship, however, have been limited. Little has been revealed as to how argument structure as an entity is related to "good or effective" persuasive discourse. A credible amount of research reports data to the effect that high quality ratings of specific argument substructures (i.e., claims, data, opposition, or warrants) found in student persuasive texts are predictive of good persuasive writing (Connor, 1990; Connor & Lauer, 1985; Knudson, 1992, 1993; McCann, 1989). The present study sought to further understanding of the relationship between argument and persuasive writing by (a) treating argument structure as the unit of analysis, (b) specifying how argument chains could be created, (c) adopting a descriptive rather than evaluative approach, and (d) analyzing expert as well as student texts (thereby permitting a benchmark to be established as to what might constitute good persuasive writing).

Results following this approach clearly indicate that argument structure is the predominant organizational framework in both student and expert persuasive writing; it functions as a type of rhetorical superstructure. Consistent with studies investigating students' uses of claims and supporting structures (Coirier & Golder, 1993; Scardamalia & Paris, 1985) the present study also demonstrated that the ability to produce a basic argument (i.e., defined by the minimal requirements of a claim + reason) is acquired at a relatively early age (i.e., at least by the 6th grade). In effect, argument structures were found in all Expert and 10th Grade persuasive texts and in all but one 8th Grade and one

6th Grade text. Second, each persuasive text produced by an expert could be accounted for entirely by categories derived from the Argument Grammar, and approximately 85 to 95% of every student persuasive text could be described in terms of these same categories.

The notion that argument structure contributes to the production of good persuasive text is further supported by findings that (a) even after differences in text length are accounted for, experts produced significantly more arguments than students and (b) student persuasive texts with a greater number of argument structures tended to have higher quality ratings (holistic scores). Some insight can be gained as to how and why the frequency of argument structures is related to good persuasive writing by considering the qualitative and quantitative differences associated with expert and student use of argument chains (assessed by embedded argument measures). The 6th and 8th Grade students demonstrated a similar pattern of performance in that almost all argument chains found in their texts involved either subclaims or reservations. Argument chains found in persuasive texts produced by 10th Grade students involved subclaims primarily but also a substantial number of data structures. Finally, those produced by experts, while more variable in their make up, clearly involved countered rebuttals more than any other substructure, although data and subclaims were also involved fairly frequently.

From a rhetorical perspective, the overall frequency of embedded arguments in a persuasive text is seen as important because it reflects the number of argument chains--complex structures which can serve to strengthen the major claim. In practical, everyday argument or persuasive discourse, which generally consists of modalized propositions, using an argument to represent data may be considered a particularly effective strategy in attempting to gain the audience's adherence to the overall or major claim. Presenting an argument in the countered rebuttal position also seems a strategic move. This particular structure comprises an attempt to support a top level claim as well as refute the opposition, and an argument rather than a claim is seen as being far more effective in achieving this end. This interpretation as to the strategic use of arguments to represent countered rebuttals and data structures is supported by the experts' performance. There is also evidence that this ability develops with age in that the Grade 10 students made greater use of argument chains involving data structures than did their younger counterparts. It was noted that writers in all groups made use of argument chains involving subclaims. This type of argument chain may reflect a strategic decision by the writer (i.e., to get the audience to accept a more restricted claim rather than or before the major claim), or it may be a result of the writer's attempt to include specific data (i.e., that involving concrete, familiar examples). Of interest is the finding that younger students clearly favor argument chains involving reservations. Although including a reservation may serve to make the claim more

acceptable to the audience (i.e., by taking into account exceptions), the justification of this inclusion (which is reflected in the embedded argument) may be evidence of some inner deliberation or dialectical activity rather than an acknowledgment of and a concession to the audience's concerns.

VI.2 Argument structure complexity and persuasive writing

Mastery of the skills underlying the production of a basic argument appears to be a necessary prerequisite for good persuasive writing. Further understanding of the nature of the "good" persuasive writing was provided by the structural complexity analyses. The structural complexity of an argument is measured in terms of the number and type of optional or elaborative substructures the author includes above the basic argumentative structure.

The notion that overall complexity of argument structure is linked to good persuasive writing is supported by the data summarized in Table 6 and the problem-space-behavior graphs constructed for each group of writers. First, as expected, the most complex model of argument structure was that based on the Expert group performance for text sample I. This was true in terms of both the number of possible elements included and the percentage of writers in the group demonstrating use of a particular substructure. The models generated for the student groups, although surprisingly sophisticated, were relatively less complex on both counts. Second, the *model level* variable was the most significant predictor of the holistic scores assigned to student persuasive texts. This variable, which is a measure of complexity of argument structure,[21] accounted for approximately 40% of the variance noted among student texts with respect to quality ratings--more than that accounted for by either the number of argument structures or the total number of supporting structures.

Insight as to how and why the complexity of an argument structure may be related to good persuasive writing followed by first focusing on the notable developmental and expertise related differences associated with (a) the percentages of writers in each group representing specific substructures and (b) the relative frequencies with which these structures were used and, then, by interpreting these differences from a rhetorical perspective. Using this perspective required a shift from the more logically derived approach to practical argument, which is typified in Toulmin's (1958) work, to an audience-centered one such as that associated with Perelman and Olbrechts-Tyteca (1969)

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[21] The model level variable is seen as a reflection of complexity in that while all students had claim and contentious aspect elements and all but two had data elements (i.e., the required elements), considerable variation was present in terms of the inclusion of different elaborative structures. Thus, it can be said that it is the variation in elaboration which would account for variation in the model level measure.

and Perelman (1982; 1994). The shift in perspective was facilitated in part by identifying the areas of overlap between the coding categories derived from the Argument Grammar and those categories comprising coding systems used to identify evidence of audience-centered activity in persuasive text (Coirier & Golder, 1993; Golder & Coirier, 1994; Hays et al., 1988).

Variation was noted across student and expert groups with respect to the use of most elaborative substructures. However, of particular interest were the increases across student groups in the percentages of writers using warrants, countered rebuttals, and modals and the finding that all expert writers used each of these structures at least once in their persuasive texts. These structures constitute the focus of the following discussion.

VI.2.1 The rhetorical significance of warrants in persuasive text

The presence of warrants in persuasive text can be seen as evidence of the author's engaging in a type of audience-centered activity which involves recognizing the need to explain or justify the link made between the data and claim. More than this, however, the inclusion of warrants is seen as a powerful rhetorical strategy: it involves establishing mutually agreed upon premises, beliefs and feelings, or a shared context with the audience, which in effect allow the writer to gain rapport with the audience and render the latter more receptive to the claims and arguments proposed (Berthoff & Stephens, 1988). That it represents an attempt to draw the audience into the author's perspective is illustrated by the use of the first person plural *we* and *our* by experts.

The absence of warrant structures in student persuasive texts at the Grade 6 level and the slight increase in occurrence found at the higher grade levels are results that are consistent with those reported by McCann (1989). The overall minimal use of warrants relative to claim and data structures, a pattern which persists even for older students (i.e., the 10th Grade group), confirms findings of studies conducted by Connor (1990), Cooper et al. (1984), and Knudson, (1992, 1993). That the inclusion of warrant structures is associated with good persuasive writing is evidenced by expert performance in the current study. However, it is also important to note that experts did not use warrants in every argument structure presented within their persuasive texts. This is consistent with Toulmin's (1958) observation that it is not always necessary to state a warrant explicitly in informal argument and with Aristotle's warning in his discussion of the enthymeme that to state a warrant which is obvious can be considered a strategic weakness in that it renders the argument "boring" (Rieke & Sillars, 1975). So what are we to make of the students' performances? One explanation is that they did not include warrants because it simply was not necessary (i.e., the type of data/claim links they presented did not require a warrant to

be stated explicitly). For example, few people would question the link between claim and data in the following argument, taken from a Grade 8 text.

> *I think training animals is fine* {claim} *because it could help you for things.* {data} *For an example, people train dogs for blind people.* {backing}

Hence the infrequent use of warrants by students may not reflect a weakness in structure as Cooper et al. (1984) suggest but may instead point to a tendency to favor arguments based upon a mutual or general understanding with the audience as to underlying context or principles.

A second explanation for students' minimal use of warrants concerns their possible failure to recognize when one is needed (Matsuhashi, 1985). For example, a warrant was not included in the argument presented below (taken from a 10th Grade text) although it might be considered useful since the existence of mutual agreement between author and audience as to the principle underlying the justifying link is questionable.

> *I think it is okay for certain animals to be trained* {claim} *because small children like to watch the circus.* {data}

The failure to recognize when a warrant needs to be stated explicitly in the text may indicate that the author is not sufficiently aware of the audience's needs or background (i.e., the author has not formed a sufficient representation of the audience) to make this decision. Likely, the rare occurrence of warrant structures in student texts follows from a combination of these two factors: (a) the use of commonly agreed upon or less sophisticated arguments and (b) a difficulty recognizing when warrant structures would be necessary or rhetorically advantageous. To follow this train of thought, it can be said that experts use warrants more extensively since they generate more sophisticated arguments and are better able to determine when this substructure is warranted. In sum, while there is evidence that the use of warrants in persuasive discourse increases with age and expertise, a systematic investigation is needed to determine the factors underlying the use of these structures by students and experts.

VI.2.2. The rhetorical significance of modals

Toulmin (1958) has pointed out that the modal is an important if not defining characteristic of informal argument in that it deals with the probabilistic nature of practical, everyday argument--something that sets it apart from formal logic. From a rhetorical perspective, the inclusion of modals can be seen as an effective strategy in persuasion

because it limits the claim only in a general, noncommittal way and at the same time weakens or softens a claim, thereby making it more palatable to the audience.

To date, few empirical studies have included an analysis of modal use in persuasive text. The structural analysis conducted in the current study treats the modal as one of two types of qualifications that can be placed on the claim. The constraint, which is the other type of qualification, limits the scope of the claim in a specific manner. Results presented in Tables 6 and 9 indicate that it is a structure which is used widely by students and experts alike. Although the constraint could be viewed as an attempt by the author to accommodate the concerns of the audience, such activity is not clearly evident in the text. The modal, which is an expression of the degree of certainty associated with a statement, can be said to limit the scope of the claim in a general sense. According to Golder & Coirier (1994), modals found in argumentative or persuasive texts can be viewed as evidence of the negotiation process, the means beyond the supporting process by which the writer attempts to alter the representations of the audience. These researchers report that the percentage of children using modals in argumentative writing gradually increased from less than 10% (ages 10 -11 years) to approximately 40% (ages 15 - 16 years). The present study reported that there was a notable increase in the percentage of students using at least one modal between the 8th and 10th Grade (i.e., from 25% to 58%), although there was little difference across grades with respect to how frequently modals were used relative to other elaborative structures. In contrast, all experts used modals at least once and used modals more frequently than any other form of elaboration. Overall, the expert data is interpreted in support of the idea that the ability to use modals in persuasive writing is an important rhetorical skill, and the student data indicates that there is an important developmental change occurring with respect to this skill between the 8th and 10th Grade.

VI.2.3. The rhetorical significance of opposition structures

The very purpose of persuasive writing points to the necessity of considering those views of the audience which either challenge or are simply an alternative to the thesis being advanced. The Argument Grammar enables three coding categories to be constructed as a means of assessing whether and how a writer deals with these opposing or alternative views in persuasive text: (a) alternative solutions, (b) reservations, and (c) countered rebuttals. Rhetorically speaking, an alternative solution may be considered the weakest form in that it involves only the recognition or acknowledgment of opposition. This particular structure was used rarely by student and expert writers alike. Reservation structures, which involve recognition and acceptance of conditions which would defeat a claim, could be viewed as potential evidence of rhetorical activity. It is possible that they

are the result of some concession on the author's side to the audience's concerns. However, as with constraints, text analysis alone cannot serve to reveal whether this involves a consideration of audience apart from "self". However, the use of countered rebuttals is generally accepted as strong evidence of audience-centered activity. Moreover, it is a highly effective rhetorical strategy (Golder & Coirier, 1994, Hays et al., 1988) because it involves not only identifying but also refuting the opposition, with the end result of strengthening one's own position.

Most experts used a reservation structure and all used a countered rebuttal structure at least once in their persuasive texts. This finding supports the notion that these opposition structures are associated with good persuasive writing. However, a somewhat unexpected finding was that over 80% of writers in each of the three student groups included at least one instance of either a reservation or a countered rebuttal structure. This stands in contrast to reports stated in previous studies of relatively few students in the 4th through 12th grades including structures which reflect either the recognition of opposition or a response to opposition (Knudson, 1992, 1993; McCann, 1989; Scardamalia & Paris, 1985). Moreover, Cooper et al. (1984) reported that only 16% of students at the college freshman level participating in their study took into account an opposing point of view when writing persuasive text.

Although the majority of student texts in the present study showed evidence that opposing points of view had been considered, variation was noted in how this opposition was dealt with. While few students (25%) in Grades 6 and 8 used a countered rebuttal structure and most (75 to 83%) used at least one reservation structure, the reverse pattern of performance was true for students in Grade 10, only a few of whom (25%) used reservations and more than half of whom used countered rebuttals. The developmental pattern observed with respect to the use of countered rebuttals is somewhat similar to that reported in Golder and Coirier's (1994) study which focused on the negotiation processes in argumentative writing. These researchers found that less than 20% of 11-12 year-olds used counter arguments in their argumentative texts as opposed to more than 70% for the 13-14 and 15-16 year-olds. Unlike the present study, a notable increase in the number of students using at least one counter argument occurred between the ages of 11-12 and 13-14 years; in the present study, this increase appears later on (i.e., between the 8th and 10th Grade which is approximately between the ages of 14 and 16 years) and is paralleled by an increase of similar magnitude in the use of modals. Overall, this pattern is indicative of some developmental shift occurring with respect to certain rhetorical abilities associated with persuasive writing--those which involve a concern for audience.

VI.2.4. Socio-cognitive functioning and audience-centered activity

The expert group performance on measures concerning the use of warrants, countered rebuttals, and modals supports the notion that these structures have rhetorical significance in persuasive writing. In addition to noting superior expert performance, changes across grade level were noted in students' performance on these same measures. There was a developmental shift occurring between the 8th and 10th Grades with respect to the use of countered rebuttals and modals and a more gradual increase with grade level in the use of warrants. Two possible explanations are offered here for these patterns. First, the superior performance of 10th Grade participants might be a result of curriculum. That is, since students in grade 10 have received formal instruction in writing argumentative essays, they should be more able than their younger counterparts to produce complex argument structures in their persuasive texts. However, it is unlikely that this factor would adequately account for the increase in use of structures such as countered rebuttals, modals, and warrants, since students do not generally receive instruction as to their inclusion. The emphasis tends to be on stating one's position and providing adequate supporting structures. For example, an interview between the researcher and the 10th Grade English teacher revealed that instruction focused on teaching students to clearly state their opinion in an opening paragraph, to provide reasons for their opinion in subsequent paragraphs as well as to include additional support or elaborate on these reasons, and to provide a summary or concluding statement or paragraph. It is also relevant to note here that many intervention studies designed to improve persuasive writing performance fail to include in their instructional content one or more of warrants, modals, or countered rebuttals (Crowhurst, 1991; Knudson, 1992, 1993; Scardamalia & Paris, 1985).

The second and generally favored explanation for the grade-related increase in the use of structures reflective of audience-centered activity concerns the development of socio-cognitive skills (Clark & Delia, 1976; O'Keefe & Delia, 1979; Golder & Coirier, 1994; Hays et al., 1992). Implementation of audience-adapted persuasive strategies (i.e., the inclusion of warrants, countered rebuttals, or modals) requires the ability to represent the characteristics and perspective of the listener or audience. A number of researchers cite evidence indicating that these perspective-taking and psycho-social decentering abilities are aspects of socio-cognitive functioning and development. Flavell, Botkin, Fry, Wright, and Jarvis (1968) have shown that children's ability to decenter (take another's perspective) is age-dependent. Case (1985) reports data showing that the ability to deal with a verbally presented social problem from another's perspective is not fully mastered until between the ages of 13 - 15 years. Kroll (1979) concluded that the difficulty young children had in providing an explanation of a game was related to their ability to construct an adequate

representation of their audience. Clark and Delia and their associates have conducted extensive studies exploring the links between social-cognitive ability, age, and the use of persuasive strategies. For example, Clark and Delia (1976) and O'Keefe and Delia (1979) demonstrated that the ability to anticipate a target audience's reasons for refusing to comply to a persuasive request and then refute those reasons in writing was related not only to age but also the ability to form comprehensive and accurate representations of the audience. Stein, Bernas, Calicchia, and Wright (1996) and Stein and Miller (1993) have shown that when questioned, children as young as seven years are able to produce support and explanations for views opposing their own position. These researchers suggest that students do not include such information spontaneously in their arguments as they would view such a step as being in conflict with their own goals and intentions (i.e., that of maintaining their own position and beliefs). This research offers a possible explanation for results of earlier work showing children's difficulties decentering and role-taking.

Additional research suggests that factors such as the cognitive demands particular to persuasive writing and the availability of topic knowledge should also be considered in accounting for variations in students inclusion of argumentative elements in their persuasive discourse. Bereiter and Scardamalia (1982) have suggested that the interactive nature characterizing everyday argument and persuasion, particularly for young children, as opposed to the essentially monologue nature of written persuasive discourse, may explain the difficulty students experience in persuasive writing situations. Another factor which influences student performance on writing tests is topic knowledge (Knudson, 1992; Langer, 1984; McCutchen, 1986) and this may account for the apparent discrepancy between the findings of this study and those of others (Cooper et al., 1984; Knudson, 199; 1993; McCann, 1989) with respect to the inclusion of opposition structures. In the present study, all students were ensured access to knowledge relevant to the task by way of the pictures included on the assignment sheet. In addition, it is believed that the availability of assignment sheets throughout the writing session may have facilitated production of text by serving as a memory or organizational aid to students.

VI.2.4 The rhetorical significance of supporting structures

Data structures were not treated as an aspect of structural complexity here since they are seen as part of the minimal requirements for an argument structure. In general, the rhetorical skills involved in providing supporting structures to convince the audience as to the merits of a claim appear to be acquired at an earlier age than the more sophisticated skills that have been linked to a higher degree of audience awareness (Clark & Delia, 1979; Golder & Coirier, 1994; Hays et al., 1988; Hays et al., 1992; O'Keefe & Delia, 1979).

Nonetheless, results of this study and others do suggest that the use of data structures is in some way a reflection of the rhetorical skills underlying the production of persuasive discourse. In the present study the total number of support structures (i.e., data and backing) increased with grade level and expertise, was significantly correlated with quality ratings of students texts (see Table 20), and accounted for a significant proportion of the variance associated with these scores beyond that accounted for by complexity (see Table 21). Previous studies (Connor, 1990; Knudson, 1992) have shown that the quality ratings of data are significant predictors of the holistic scores assigned to students' persuasive texts. While it is clear that the quantity and quality of data structures increase with age and are influenced by such factors as background or content knowledge, furthur research is necessary to determine how and to what extent these structures might reflect superior rhetorical skills.

VI.3. Rhetorical implications of variations in argument substructure representation

The analysis of argument structure served to contribute to current understanding of how argument--in its entirety and its parts--is related to specific rhetorical skills underlying the production of persuasive text. Additional information was obtained regarding the rhetoric of good persuasive writing by considering the general semantics characterizing various argument substructures and the representation at the surface level of relational links defining an argument structure. Of interest in the present discussion are the group related variations revealed with respect to (a) the representation of claims, (b) the representation of a claim's contentious aspect (i.e., semantic structures in text which mark a proposition or an assertion as being a claim), and (c) the use of causal conjunctions to signal justifying relations between claim and data structures.

VI.3.1. Representation of claims

Based on their underlying semantic structure (see Table 1, Appendix E, p. 167), claims were placed in one of four categories: evaluations, proposal/policy statements, causal/predictive statements, and identifications/definitions. Overall, the majority of claims produced by each group were evaluations and, with the exception of one grade 6 student, all participants included at least one evaluative statement in their text. For students, the second most frequently used type of claim was the proposal/policy statement. These results are at odds with those of Golder and Coirier (1994) who report only 35 to 45% of all 10-11 and 11-12 year olds and approximately 70% of all 13-14 and 15-16 year olds in their study used either one of these two types of constructions. However, this discrepancy may be accounted for by differences in task presentation. In this study students were asked

to respond to a value judgement concerning animal training while in the Golder and Coirier (1994) study students were asked to develop their own point of view on the topic of pollution. Overall, then, it appears that students are able to formulate the basic types of claims as competently as experts. However, information as to how these claims are used (i.e., whether and where they are embedded in an argument structure) may reveal links to development and expertise. For example, evaluative claims found in the data position might indicate a preference for affective appeals--those which appeal to the audience's values.

A finding of greater interest, from a rhetorical point of view, was that while most experts produced at least one identification/definition type of claim, this construction was not used at all by students. Perelman (1982, 1994) has pointed out that a definition functions as a rhetorical device in persuasive discourse when it aims not at clarifying the meaning of an idea but at stressing aspects that will produce the desired persuasive effect. That the experts in this study use definition in a rhetorical sense is exemplified in the following excerpt:

> *"...it is important to define our meanings at an early stage. "Use" is the meaningful employment of an animal for a specific and beneficial end; abuse is pure and thoughtless exploitation."*

The definitions were coded as claims since they are clearly personalized (although note that the writer uses the first person plural "*our*" as opposed to the singular, thereby attempting to establish definitions that are shared by the reader), and there is also an element of choice in the meanings presented. Although a high level of audience awareness is presupposed here, the ability to use this type of claim structure may depend more upon the acquisition of rhetorical skills that are particular to a high level of expertise in argumentative and persuasive writing than upon socio-cognitive functioning.

VI.3.2. Representation of contentious aspect

Four categories (see Table 2, Appendix E, p. 168) were used in the present study to code text structures signaling a claim's contentious aspect (i.e., what makes it argumentative). Two of these categories--evaluations and modals--have already been discussed in a different context. Suffice it to say that evaluations are the most frequently found mark of argumentation: from 54 to 76% of all claims across groups comprised an attribute involving a subjective or value judgement. However, the patterns of usage for modals, opinions, and problem statements can be interpreted as evidence of superior rhetorical skills associated with expertise in persuasive writing. Modals were used by experts extensively: 40% of all their claims were marked by modals as compared to only

11% of 10th grade claims and less than 10% of 6th and 8th grade claims. The reverse pattern was noted regarding the use of opinion markers: less than 20% of expert claims were marked as being the author's opinion, and only four experts used this structure while over 50% of all student claims were marked in this manner and all students used this structure at least once.

The above results support the notion that the students have difficulty "decentering" and presenting their claims in a form that would perhaps be more acceptable to the audience. The students' minimal use of modals (seen as an explicit statement as to the degree of certainty associated with an assertion) as a mark of argumentation is a finding that is complemented by Coirier and Golder's (1994) report that 10 to 16 year old students were less likely to judge a text as being argumentative if it contained an expression of degree of certainty. Together, these results support the notion that students have difficulty incorporating audience concerns into their arguments, particularly when to do so would seem to conflict with their own goals.

The extensive use of opinion markers characteristic of student performance may be viewed in a positive light by some researchers (Coirier & Golder, 1994; Hays et al., 1992) who code such structures as evidence of accountability and speaker endorsement. However, it is seen here as evidence of an "I" oriented discourse as opposed to the more "we" oriented one typical of experts. The presence of first person plural pronouns is viewed as evidence of the use of arguments based on a value system shared by the audience and/or an attempt to draw the audience into the claims and arguments presented. Either way the more "we" oriented discourse appears to reflect a rhetorical strategy associated with good persuasive writing. Further information regarding this interpretation might be forthcoming by conducting a lexical analysis involving a comparison of first person plural and singular pronouns in arguments.

Problem statements were absent in all 10th grade texts and rarely occurred in texts produced by the remaining groups. One qualitative difference noted between experts and students was that while the former tended to redefine the issue or problem at hand, the latter tended to restate or reword the problem statement comprising the assigned task. This use of problem statements by expert is seen as evidence of the knowledge-transforming activity which is characteristic of expert writing (Scardamalia & Bereiter, 1987).

VI.3.3. Representation of the justification relation

The data resulting from the analysis of conjunctions in persuasive text is qualitatively different from that reported in other studies (e.g., Crowhurst, 1991). Specifically, this data followed a functional approach which entailed (a) considering only those conjunctions

signaling semantic relations defining an argument structure and (b) interpreting performance patterns in terms of their rhetorical significance in persuasive discourse. The finding of particular interest was the developmental shift that occurred in the use of causal conjunctions to mark data structures: 30 to 40 % of data structures produced by 6th and 8th Grade writers were marked with a causal conjunctive (e.g., *because, for this reason*) as compared to approximately only 10% for Experts and 10th Grade writers. It is believed that the minimal use of causal conjunctions reflects a rhetorically superior strategy since by refraining from stating the obvious the author is in fact drawing the audience in by forcing them to make the connection. The observed decrease is explained by an increased reliance on argument structure to carry the relationship between claim and data. The 10th Grade performance on this measure may be due to formal instruction in the argumentative genre which would increase awareness of the basic argument structure. However, there is also reason to believe that the expert performance reflects a more deliberate implementation of a rhetorical strategy. For 10th Grade texts, the absence of causal conjunction generally occurred between contiguous sentences and rarely within a clause complex when it was most needed (i.e., when the justifying relation involved an interdependent clauses). In contrast, experts used a causal conjunction to signal justifying relation between interdependent clauses only 46% of the time, favoring instead the use of alternative, nonlexical markers such as a semi-colon or dash.

Overall, the detailed analyses of the representation of argument substructures and their relational links in persuasive text revealed expertise and developmental differences. The importance of these differences can be understood from a rhetorical perspective and the factors accounting for these differences can be undersood to involve specific discourse abilities as well as level of socio-cognitive functioning.

VII. Conclusions and Implications

Competent persuasive writing, by definition, must involve a concern for audience. What the present study serves to do is demonstrate how argument structure--as an entity and in terms of its specific substructures--reflects this concern. Audience-centered approaches to argumentation can account for the association between the use of certain argument structures and good or effective persuasive writing. However, researchers attempting to develop coding categories to tap evidence of audience-centered activity in written persuasive text either have not used systems based on models of argument structure (Golder & Coirier, 1994; Hays et al, 1988; Hays & Brandt, 1992) or have evaluated the quality of a limited number of argument elements (Connor, 1990). The multi-dimensional approach implemented in the present study involved using well-defined and co-ordinated systems of semantic and argument analysis. This resulted in a more comprehensive and objective assessment of the relationship between argument structure and audience-centered activity in persuasive writing.

The results of the text analyses conducted in the present study revealed important developmental and expertise-related patterns associated with the use and representation of argument structure in written persuasive text. First, argument structure was shown to function as a rhetorical super-structure in student and expert persuasive texts and to subsume the role of a number of argumentative elements (i.e., data, warrants, reservations, and countered rebuttals). It was suggested that arguments embedded in data and countered rebuttal slots would be particularly effective in meeting the goals of persuasion. Expert performance clearly supported this idea. Second, the relatively high frequency of warrants, countered rebuttals, and modals in expert texts supported the notion that these structures reflect specific rhetorical skills involving audience awareness and strategic adaptation to audience needs and concerns. The developmental increases across grade level for these same argument substructures support the notion that students' levels of socio-cognitive functioning--particularly that to do with perspective-taking ability--are functionally related to the quality and effectiveness of their persuasive texts. Finally, the detailed semantic analysis focusing on the representation of claims and their contentious aspect and the functional analysis of causal conjunctions provided additional information as to the nature of competent persuasive writing. The use of identification/definition types of claims, the increased use of modals and decreased use of opinions as marks of argumentation, and the infrequent use of causal conjunctions in expert persuasive writing are all findings consistent with the notion that experts implement rhetorical strategies involving attempts to manipulate

the audience and bring them to the point of accepting the thesis advanced. It is believed that development of these particular skills might be related to instruction or experience in persuasive forms of writing rather than level of socio-cognitive functioning.

The study has several important implications for instruction. First, teachers should ensure that students have the opportunity to write persuasive texts on topics for which they have a strong, well-developed knowledge base. It is well-known that background or domain knowledge serves to maximize performance in problem solving situations and persuasive writing is no exception (Langer, 1984; McCutchen, 1987).

Second, teachers should attempt to facilitate students' inclusion of rhetorically significant structures in their persuasive texts. This facilitation might be effected not only by providing students with specific information as to audience characteristics but also by manipulating the audience factor. Hays et al. (1988) have shown that students produce more counterarguments when writing for a hostile rather than friendly audience, and O'Keefe and Delia (1979) have shown that students tend to produce higher level persuasive structures when their texts are directed toward a stranger as opposed to a familiar person. Third, while formal instruction in persuasive writing generally involves familiarizing students with argument (discourse) elements (Knudson, 1992; Scardamalia & Paris, 1985), a more effective approach might involve teaching students the rhetorical significance or function of these elements in persuasive discourse (i.e., how and why they can achieve a desired effect on the audience).

Fourth, students should receive instruction in audience analysis. This might include such activities as identifying the intended audience, the position the audience might hold on the issue under consideration, and the strength of their commitment to this position. In addition, students could be given the opportunity to role-play (i.e., to act as audience), which could involve judging the persuasiveness of a text(s) or challenging the author(s). These types of activities could increase students' understanding of (a) the importance of considering the perspectives and knowledge of the audience in producing an effective persuasive text and (b) the features of a text(s) which they as audience found particularly "persuasive".

Fifth, teachers should consider evaluating students' persuasive texts on the basis of how convincing or "persuasive" they are. Although this might involve some consideration of the quality of specific structures (e.g., data), this aspect of evaluation could have some degree of objectivity (e.g., the use of an argument structure to represent a reason or a countered rebuttal might rate a higher score than that for the use of a simple claim). Moreover, while concern has been expressed about students' tendency to omit warrants (Cooper et al., 1984; Knudson, 1992), this should not necessarily be viewed as a negative

feature; teachers or raters need to determine if a warrant is needed or if the link between claim and data can in fact be easily inferred by the reader before evaluating the text on this point. In effect then, such an approach to the evaluation of persuasive writing would have to take into account the audience (which might be set by the teacher or the student) for whom the text is intended.

Several questions for further research also follow this study. First, information is needed as to the use and structure of argument in other situations involving persuasive and argumentative discourse (e.g., political and labor negotiations which may be "highly charged" and involve oral as well as written discourse). It is suggested that applying the current approach to argument analysis to various situations involving argumentative discourse may yield results which (a) further our understanding of the nature of such discourse and (b) indicate areas in which the current model of argument structure might need to be refined or developed.

Second, additional information is needed regarding the extent to which specific argument substructures reflect the author's concern for audience, particularly one that is opposing or "hostile". Warrants, constraints, and reservations would be a focus of interest since the inclusion of these structures in text cannot be viewed as strong or definitive evidence for any audience-centered activity other than when that audience consists of the "self". Such information may be retrieved through an analysis of think-aloud protocols collected while participants are writing. It may also be possible to manipulate the characteristics and knowledge of the audience and determine if this has an effect on the inclusion of one or more of these structures. Second, we need to investigate the factors determining the use of warrants by experts and students. For example, it would be of interest to know whether warrants are used only when a link is not obvious (i.e., either when the argument is not based on a mutually shared value system or when specific domain knowledge is required to appreciate the claim-data relationship) or if they are also used when it is possible to infer the link. Third, in order to explore the relationship between socio-cognitive functioning and use of structures reflecting audience awareness and adaptation, researchers need to use independent measures of arguers' levels of socio-cognitive functioning such as those implemented by Clark and Delia (1979). The results of the Hays et al. (1988) study are interesting in terms of the relationship between type of audience and use of counterargument structures. However, conclusions regarding the link between students' levels of socio-cognitive functioning and the audience-centered activity evidenced in their persuasive texts would benefit from greater support given that the researchers' measure of socio-cognitive functioning was derived from a rating scheme applied to the *texts* (i.e., the measures were not independent). Finally, little is known

about the relationship between audience representation and the quality or effectiveness of supporting structures used. Such understanding may follow an analysis of data content based, for example, on the taxonomy of appeals developed by Connor & Lauer (1985) that was complemented by descriptions of both the audience and domain. Theories of argumentation indicate that the strategical importance of a given appeal in a persuasive text is field-dependent when field is understood as encompassing both audience (Perelman, 1982, 1994) and knowledge domain (Toulmin, 1958).

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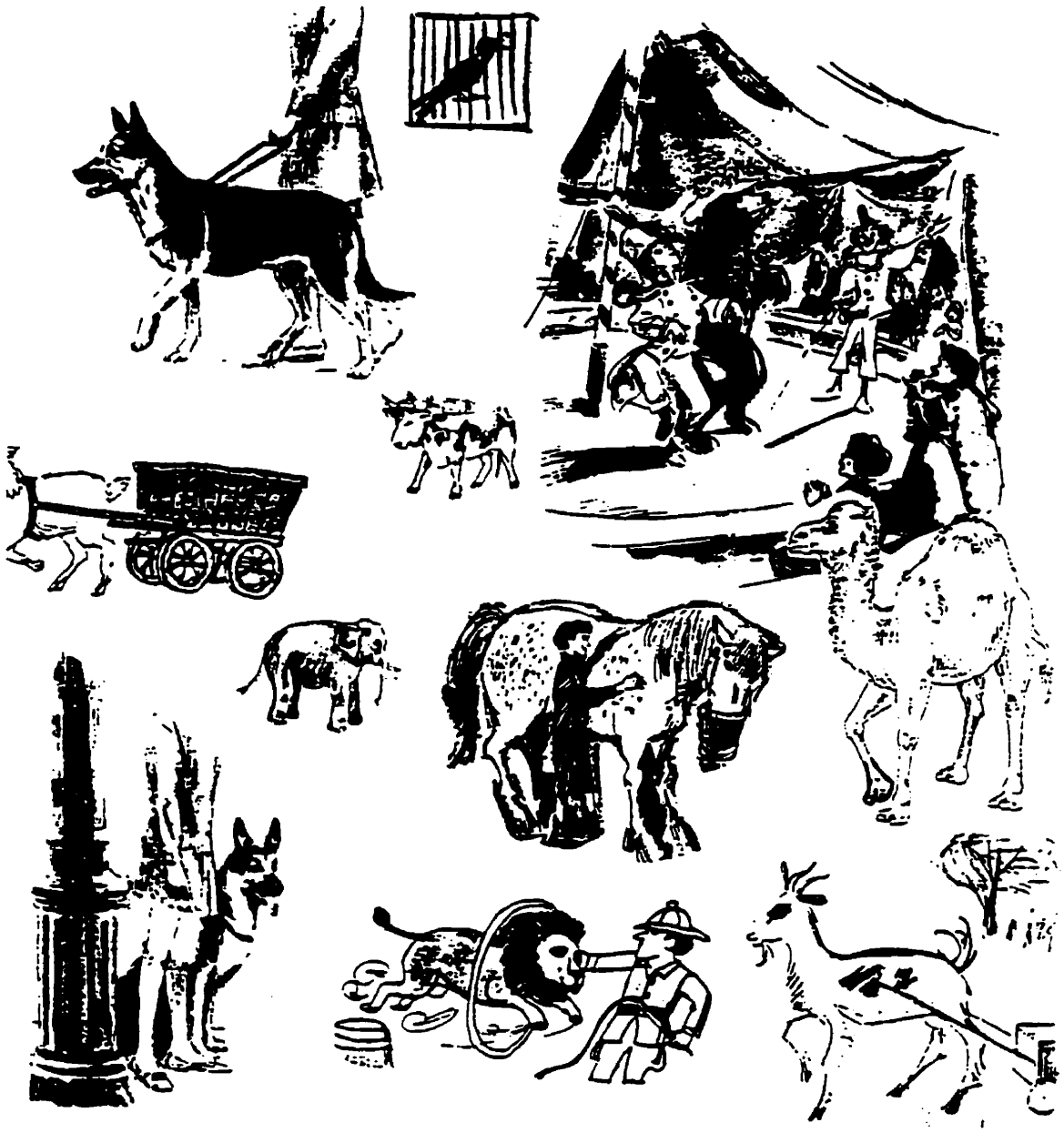
Appendix A

Task Assignment Sheet

Most animals can be trained by humans. Some are trained to perform jobs for people, and others are taught to perform special tricks in circuses and shows. Some people feel that training animals is fine; others do not think so. What do you think? Try to convince your readers that your opinions are right.



Appendix B

Base Grammar Version 2.0

Base Grammar 2.0 is a modified version of the Integrated Frame Grammar developed by Senecal et al. (1991). These grammars are sets of rules which provide a formal expression or model for semantic structures generally referred to as frames or macrostructures. The particular frames modeled are (a) volitional event structures, which capture purposive, intentional, and goal-directed actions and are termed PROCEDUREs; (b) non-volitional event structures, which capture many of the causal regularities in the physical world and are termed EVENTs; and (c) descriptive structures, which include state systems that exist in the social and/or physical world and are termed EXTERNAL.STATEs, and state systems that exist in the mind and are termed INTERNAL.STATEs. Base Grammar 2.0 differs from the Integrated Frame Grammar in that it includes rules which describe (a) the possible truth values that may be associated with semantic structures, (b) any modifications of this truth value (i.e., in terms of probability, possibility, necessity, and conditionality), (c) various types of conditional relations, and (d) various types of property relationships that may be found in state systems. The modifications were conducted by referring to Frederiksen's (1975, 1986) propositional system and Halliday's (1985) logico-semantic system which provide a more detailed description of various semantic representations existing in natural language. The reason for modifying the Integrated Frame Grammar was to develop a system which would permit a finer-grained analysis of the logical and semantic structures inherent in practical or informal arguments.

Consistent with previous work involving the use of representational languages or grammars to model semantic structures (e.g., Bracewell, 1989; Breuleux, 1990; Frederiksen, 1986), the notation used to express the representations of the procedural, event, and descriptive frame structures described above was the BNF system. The symbols designating the structures and relations involved in the BASE GRAMMAR 2.0 and the basic notation or metasymbols which designate grammatical operations on the symbols are presented below in Table 1.

Each BNF rule in the BASE GRAMMAR 2.0 consists of three elements: (a) a head element which is the left-hand symbol, (b) a rewrite metasymbol "::=", and (c) rewrites of the head element (i.e., constituents) which are the right-hand symbols.

Table 1

Metasymbols for BASE GRAMMAR 2.0

"::="	designates "is rewritten as"
"space"	designates conjunction ("and")
"repeat of left-hand symbol"	designates disjunction ("or") for relational rules and nonterminal nodes
" | "	designates disjunction ("or") for terminal nodes
"{ }"	designates that a constituent is optional
"*"	designates that a constituent is iterative

The structure of the grammar follows Sowa's (1984) definition of a linear notation for conceptual graphs. Concept rules alternate with link rules to form concept-relation-concept (i.e., node-link-node) triples. One exception to the structure-relation alternation can be found in the relation to relation rule sequences that are used where a link rule expands into a disjunction. In this case the disjuncts qualify the type of initial relational link.

BASE GRAMMAR 2.0 concepts include the following: (a) a frame structure, which is represented by the start symbol, FRAME; (b) component structures, which may be PROCEDUREs, EVENTs, or DESCRIPTIONs; and (c) constituent structures of these semantic component structures, which include OBJECTs, ACTIONs, ATTRIBUTEs,[1] and COMPONENTS. BASE GRAMMAR 2.0 links (indicated by the .REL extension to the symbol or rule name) include the following: (a) constituent relations, which indicate the hierarchical organization of a component structure (i.e., they define a higher level structure in terms of its constituent structures, e.g., a FRAME consists of PROCEDURE, EVENT, and/or DESCRIPTION components indicated by the COMPONENT.REL rule); (b) semantic relations, which indicate the various TEMPORAL, ELABORATION, and CONSTITUENT (i.e., embedded) links between component structures; (c) truth value relations, which indicate the status of a component in terms of absolute TRUTH VALUE, MODALITY, and TENSE; and (d) referential or identification relations which are indicated by an ID.REL rule. Constituent and semantic relations define frame structures. The ID.REL links point to an index number for a particular component structure to permit mapping between the components involved in a frame structure.

The analysis of a semantic component as defined by the set of BNF BASE GRAMMAR 2.0 rules results in the generation of a tree structure (i.e., the component's

*[1] Concepts are generally considered to be the primitives of cognitive representation i.e., the basic cognitive units or nodes of a semantic network (Anderson, 1980). In Frederiksen's (1986) description of propositional semantic networks, the following classes of concepts are specified: objects, actions, attributes, locations, times, durations, degrees, and numbers.

constituent structure). Although a text may consist of a single semantic component, in general, the semantic structure underlying a text is more complex; it consists of multiple, inter-related semantic components. The problem of representing such complex structures as a semantic network can be addressed in part by making use of the recursion principle inherent in a BNF grammar and reference devices such as the ID.REL. Specifically, the recursive property of a BNF grammar permits multiple components to be analyzed and the ID.REL allows for mapping of reference pointers resulting in the creation of links between branches of different tree structures or components and ultimately, the semantic network underlying the text.

The BNF BASE GRAMMAR 2.0 rules are presented below along with definitions for every semantic category (i.e., concepts and semantic links) that occurs in the grammar, and examples from natural language texts. Where possible, examples of these semantic categories have been drawn from the argumentative texts produced by students and experts participating in the current study.

BNF rules for Base Grammar 2.0 - Annotated

The top level structures of the BASE GRAMMAR 2.0 are represented by the following rules:

FRAME ::= COMPONENT.REL* {ROLE.REL}*

COMPONENT.REL ::= PROCEDURE

COMPONENT.REL ::= EVENT

COMPONENT.REL ::= DESCRIPTION

ROLE.REL ::= CONSTITUENT.REL

ROLE.REL ::= TEMPORAL.REL

ROLE.REL ::= ELABORATION.REL

The COMPONENT.REL rule, which is mandatory and iterative, allows for generation of the three basic semantic units which alone or in combination, comprise any frame structure. These basic semantic units, referred to as components, also correspond to three major types of frame structures. The knowledge structures comprising each of the basic semantic units can be generated through application of the PROCEDURE, EVENT, and DESCRIPTION rules respectively. The ROLE.REL rule allows for generation of the semantic links that can occur between the components (i.e., the rule allows for frame structures involving more that one component). ROLE.RELs include three basic types of

inter-component relations: (a) CONSTITUENT.RELations, which include all links involving an embedded component serving as a constituent structure, (b) TEMPORAL.RELations, and (c) ELABORATION.RELations. Each of these relations is further qualified through the disjunction operation achieved by rewriting the REL rules.(see p. 154-159).

PROCEDURE ::= ID.REL {TRUTH.VALUE.REL}* {MODALITY.REL}* {TENSE.REL} AGENCY.REL* OPERATION.REL GOAL.REL* {CONDITION.REL}* {INSTRUMENT.REL}* {PATIENT.REL}* {PURPOSE.REL}* {P.THEME.REL}*

ID.REL ::= STRING

All components (i.e., PROCEDUREs, EVENTs, and DESCRIPTIONs) are identified through the ID.REL rule which generates a text string (i.e., an index number). This index number can be used as a pointer for referencing the component being analyzed to other component structures. The link is not itself definitional but it allows semantic links to be made through the ROLE.REL rule.

PROCEDUREs are semantic components that comprehend *volitional* (i.e. goal-directed and intentional) event information. Definitional links include the AGENCY.REL, OPERATION.REL, and GOAL.REL links which mark required constituent structures, and the CONDITION.REL, INSTRUMENT.REL, PATIENT.REL, PURPOSE.REL, and P.THEME.REL links which indicate optional constituent structures.

TRUTH.VALUE.REL ::= NEGATIVE.OPERATOR | INTERROGATIVE.OPERATOR

The TRUTH.VALUE.REL rule is optional and iterative, and is applied either when a semantic relation does not exist or when its status (i.e., presence or absence) is under question. Consistent with Frederiksen's (1975) approach the convention or default adopted here is that a component consists of positive semantic relations (i.e., they exist and are present), and has a positive truth-value (i.e., it is true). If a particular semantic relation defining a component does not exist (i.e., is absent) then the truth value status of the component should ordinarily be considered false. However, applying a NEGATIVE.OPERATOR to the component (or semantic relation) enables one to maintain the "true" status of the component's truth value. By way of example, the statement "The ball is red." would consist of a false component if in fact the ball in question is blue. If a NEGATIVE OPERATOR, such "not", is applied to the component then the truth value of the resulting statement "The ball is not red." can be considered true. An

INTERROGATIVE OPERATOR is applied to a component when the truth value status of a semantic/constituent relation is under question. That is, if it is unknown whether a particular semantic relation is positive and true or negative and true the component must be marked by an INTERROGATIVE operator in order to remain true.

Examples:

- Animals learn to do what they are told to do. (POSITIVE - unmarked, default)
- In my opinion, animals should not be trained. (NEGATIVE)
- Animal trainers should never treat their animals cruelly. (NEGATIVE)
- What is the morality of animal training? (INTERROGATIVE)

MODALITY.REL ::= QUAL.OPERATOR | CAN.OPERATOR | COND.OPERATOR | ROOT.OPERATOR

The MODALITY.REL rule allows a component to be described in terms of any modification of its truth value. The rule is optional and iterative and when applied can specify that the asserted truth value of the component is modified according to either one or a combination of the following four modalities: (a) QUAL (probability), (b) CAN (possibility), (c) ROOT (necessity), and (d) COND (conditional). Modality operators include auxiliary verbs, adverbs, adverbial phrases, and as well as specific semantic structures which act as modal adjuncts [2]

The QUAL.OPERATOR option is selected when there is a degree of probability associated with a component, i.e., it indicates that the probability of the component's truth value is within the interval [0.0 - 1.0].

Examples:

- --*perhaps* that is sentimentalizing. (QUAL)
- *In most respects* it is difficult to talk about the animals... (QUAL)
- *I think* animals *should* be trained. (QUAL) (ROOT)
- *In my opinion*, it is wrong to train animals. (QUAL)
- ...although we *usually* have few memories of that time. (QUAL)
- I feel *reasonably confident* that... (QUAL)

The ROOT.OPERATOR option is selected when there is a necessary truth associated with a component, i.e., stated or unstated conditions exist that make a component or constituent a necessity.

Examples:

- Humans *ought not* to train animals. (ROOT) (NEG)
- And proper treatment would *have to* be defined,... (ROOT)
- He is *legally bound* to report the accident. (ROOT)
- *It is necessary* to train animals. (ROOT)
- *There is no need* to prove that to ourselves. (ROOT) (NEG)
- Some people *need* animals for companionship. (ROOT)

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[2] In the examples given the text structures signalling the modality of a component are placed within asteriks (*).

The CAN.OPERATOR option is selected when there exist conditions under which the component can actually be true (i.e., it stresses that the possibility actually exists). These conditions may or may not be stated explicitly.
Examples:
- ...that we *cannot* negotiate peace with them in a normal way,... (CAN) (NEG)
- ...we *can* because we possess the power to do so. (CAN)
- A dog *might be able* to use its eyes and guide the person who is blind. (QUAL) (CAN)

The COND.OPERATOR option is selected when the truth value of the component is conditionally dependent (i.e., contingent) on other components or propositions being true.
Examples:
- I *would* propose a middle way, with various criteria. (COND)
- *If *the animals are treated fairly then I think it is all right to train them. (COND)
- I *would* hate to be an animal locked in a cage. (COND)
- Blind people *would not be able* to cross streets *if* ... (COND) (NEG) (CAN)

TENSE.REL ::= PAST | PRESENT | FUTURE

The TENSE.REL rule allows for a component to be described in terms of its orientation in time (Frederiksen, 1975). This rule is optional and when applied specifies the temporal information localizing the time of the content of a component with respect to a point in time labelled present (i.e., PAST, PRESENT, or FUTURE). If no tense is specified then the truth value of the contents of a component is asserted without time constraints.
Examples:
- He is training the animal. (PRESENT)
- The debate over animal training has been brought to the forefront.... (PAST)
- In my opinion, animals should be trained. (FUTURE)
- One admires the talent of both the trainer and trainee. (time constraints not specified)

AGENCY.REL ::= OBJECT {DESCRIPTOR}*

An AGENCY.REL marks an animate OBJECT which is the immediate cause of an ACTION (i.e., is the AGENT). As such it is an OBJECT that is capable of volitional action (i.e., goal-directed and intentional acts).[3] The AGENT may be qualified by a DESCRIPTOR(s).
Examples:
- The people in the audience will laugh and enjoy themselves.
- A sheep dog works for a living by using its natural skills,
- Humans ought not to train animals.

OPERATION.REL ::= ACTION {DESCRIPTOR}*

[3] In the examples given, the text representing a PROCEDURAL, EVENT, or DESCRIPTIVE constituent structure is underlined and the text functioning as a marker for the structure is placed within asteriks.

An OPERATION.REL marks a ACTION that is volitional (i.e., is goal-directed and intentional).
Examples:
- The people in the audience will laugh and enjoy themselves.
- If you train a dog to sniff down crooks...
- A sheep dog works for a living by using its' natural skills,
- The training of animals for good purposes...

GOAL.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

A GOAL.REL marks an OBJECT or COMPONENT[4] (i.e., propositional state or event) as an outcome that is sought by an AGENT.
Examples:
- They can also be trained to find drugs and other things.
- A sheep dog works for a living by using its' natural skills,

CONDITION.REL ::= POSITIVE.CONDITION.REL | NEGATIVE CONDITION.REL | ADVERSATIVE.CONDITION.REL | REASON.CONDITION.REL

A procedural CONDITION.REL marks a structure that serves as a constraint on or a cause of an OPERATION. The CONDITION.REL rule is iterative in order to allow for the possibility of more than one CONDITION being involved in an operation, and it is rewritten as a disjunct so as to specify the type of CONDITION involved.

POSITIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

A POSITIVE.CONDITION.REL marks a structure which is necessary but not sufficient for the truth value status of the COMPONENT to remain true. POSITIVE CONDITIONs associated with PROCEDUREs are represented as OBJECTs, ATTRIBUTEs, or COMPONENTs.
Examples:
- You *must* not train them *with* a whip.
- ...that we *cannot* negotiate peace with them in a normal way.
- But endangered species *should* go to zoos...
- Animals *should only* be trained to help people.
- Animals should be trained *but only* to a certain extent.
- *If* animals like dogs are trained properly then they can help disabled people.

NEGATIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

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[4] Component structures functioning as constituent structures are embedded and this embedding is indexed through the CONSTITUENT.REL link which is rewritten as a disjunction to mark the various definitional links between the host and embedded components. Furthur examples for embedded constituent structures are given on p. 154-157.

A NEGATIVE.CONDITION.REL marks a structure which must be absent in order to ensure that the truth value status of the COMPONENT remains true. NEGATIVE CONDITIONs associated with PROCEDUREs are represented as OBJECTs, ATTRIBUTEs, or COMPONENTs.

Examples:

- ...because you can train them *without* hurting them.
- ...no one should hunt *except* for food.
- Animals should not be trained *unless* it is to help people.
- People should use animals *but not if* they abuse them.

ADVERSATIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

An ADVERSATIVE.CONDITION.REL marks a structure (i.e., an OBJECT or COMPONENT) which violates an expectation regarding a logical or causal-dependency relation between two structures. This violation may take the form of a denied implication, a contrast, or a concession.

Examples:

- Animals should not be trained *even if* it is to help people. (concessive)
- Animals like cats and dogs should be trained because they are used to it and depend on us. *However*, I think wild animals should be left in the wild. (contrast)
- Animals like dogs and horses have been trained for hundreds of years *but overall* I think that animals should not be trained because of the hurting and abuse. (denied implication)

REASON.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

A REASON.CONDITION.REL marks a structure which provides a causal explanation or rationale for the COMPONENT to which it is linked. REASON.CONDITIONs associated with PROCEDUREs are represented as OBJECTs or COMPONENTs.

Examples:

- The audience is praising them *for* their efforts.
- ...we can *because* we possess the power to do so.
- Animals should not be held in captivity; it is so cruel.
- People must train the animals with care, *so* they won't get hurt.

INSTRUMENT.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

An INSTRUMENT.REL marks an OBJECT(s) or COMPONENT(s) which functions as a tool used to achieve a goal (i.e., the tool through which an OPERATION was, is, or will be performed). The INSTRUMENT.REL rule is iterative to allow for the possibility that more than one structure functions as an INSTRUMENT for a given PROCEDURE.

Examples:

- ...man has demonstrated with pictures, then words,...
- To be sure, punishment is used in most kinds of animal training,...
- A sheep dog works for a living *by* using its' natural skills,

• Animal trainers rely on fear to force the animals to do what they want.

PATIENT.REL ::= ADJUNCT.PATIENT.REL

PATIENT.REL ::= ALTERED.PATIENT.REL

ADJUNCT.PATIENT.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

ALTERED.PATIENT.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

A procedural PATIENT.REL marks a structure (i.e., an OBJECT or COMPONENT) as the recipient of an OPERATION. The PATIENT.REL rule is iterative to allow for the possibility of more than one PATIENT being involved in an OPERATION and in order to qualify the type of PATIENT involved, the rule was rewritten as a disjunction. An ADJUNCT.PATIENT .REL marks an object which is a recipient incorporated into an OPERATION in order to achieve a change in an AGENT's state.

Examples:
- They flew the spacecraft right into the next galaxy!
- Then Witchie read the spellbook three more times.

An ALTERED.PATIENT .REL marks a structure (i.e., OBJECT or COMPONENT) that is altered (i.e., undergoes a change in state) by the AGENT's operation.

Examples:
- Dogs can also be trained to find drugs and other things.
- They even whip the animals just because they want to stop for awhile.

P.THEME.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

A P.THEME.REL marks an OBJECT or COMPONENT which is the thematic content or P.THEME of a speech act or cognitive process.

Examples:
- They want to be superior to animals while proclaiming the immorality of human power over animals.
- It is difficult to talk about the animals.
- You might argue that the animal could not survive today in the wild.
- Think of a dog.

PURPOSE.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

A PURPOSE.REL marks a structure (i.e., an OBJECT or COMPONENT) which is the AGENT's top level goal or purpose in carrying out an OPERATION. A structure functioning as a PURPOSE can be described as an intention whose agent is co-referential with the AGENT of the procedural OPERATION.[5]

Examples:

[5] A PURPOSE.REL is actually a type of conditional relation and is not written as a disjunct to the general condition rule as it marks a structure which is specific to PROCEDUREs.

- They took the animal backstage *so that* they could clean it up.
- But endangered species should go to zoos where they can be treated properly so hunters don't kill them.

DESCRIPTOR ::= PROPERTY.REL | ID.REL | QUANTIFICATION.REL

The DESCRIPTOR rule is optional and iterative and when applied results in qualification of the constituent structures for PROCEDUREs, EVENTs, and DESCRIPTIONs.[6] Structures functioning as DESCRIPTORs may be either "embedded" (i.e., COMPONENTs).or "local" (i.e., ATTRIBUTEs). The ID.REL rule, which is optional here, permits indexing of the component structure(s) that functions as a DESCRIPTOR(s).

Examples:
- If the trainer wants to teach a lion tricks, like leaping through a hoop,...
- ...we all have been creatures that could not speak.

Specification of the types of local descriptive structures that can be identified is possible through application of the PROPERTY.REL rule or the QUANTIFICATION.REL rule. The PROPERTY.REL rule marks a structure functioning as a characteristic quality of a constituent structure. It is a rewrite of the EXTERNAL.STATE and is itself rewritten as a disjunction in order to allow detailed categorization of the descriptive information which may be associated with a constituent structure. (See p. 149-152 for detailed descriptions and additional examples of DESCRIPTORs for various constituent structures.)

Examples:
- A sheep dog works for a living. (CATEGORY)
- Lots of animals are happy in zoos and circuses. (LOCATION)
- Small children like to watch those animals. (PHYSICAL)
- Man has trained animals since the beginning of time. (DURATION)
- I write this editorial on a Tuesday morning,... (TIME)
- ...because sometimes they can be treated badly. (PSYCHOLOGICAL)

QUANTIFICATION.REL ::= DEGREE.REL | NUMBER.REL | DEFINITE.REL | INDEFINITE.REL

DEGREE.REL ::= ATTRIBUTE

NUMBER.REL ::= ATTRIBUTE

DEFINITE.REL ::= ATTRIBUTE

INDEFINITE.REL ::= ATTRIBUTE

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[6] Examples of descriptors given here are for constituent structures associated with PROCEDUREs, EVENTs, and DESCRIPTIONs.

The QUANTIFICATION.REL marks a structure (i.e., an ATTRIBUTE) that serves to quantify a CONSTITUENT structure. The rule is written a disjunct in order to qualify the type of quantification relation. The DEGREE.REL is selected when a structure specifies the extent or amount for a non-countable concept.
Examples:
- Animals are not very smart.
- Training dogs and horses is perfectly normal.
- Various kinds of experimentation are much more dubious.
- ...that our communications are extremely limited.

The NUMBER.REL is selected when an attribute structure specifies the number of concepts (i.e., a count for objects, including the universal and null sets) in a concept set.
Examples:
- One elephant was badly hurt.
- ...others reject all objections.

The DEFINITE.REL is selected when an attributre structure specifies a particular concept or concepts from among a set of concepts.
Examples:
- The people in the audience will laugh,...
- However, physical reward and punishment are two of the few ways we have to communicate with animals.

The INDEFINITE.REL is selected when an attribute structure specifies a concept or concepts from among a set without specifying it or them uniquely.
Examples:
- Lots of animals are happy in zoos and circuses.
- It is alright to train some animals.
- ...although we usually have few memories of that time.

EVENT ::= ID.REL {TRUTH.VALUE.REL}* {MODALITY.REL}* {TENSE.REL} ORIGIN.REL* OCCURENCE.REL {CONDITION.REL}* {E.THEME.REL} {PATIENT.REL}*

EVENTs are semantic components that comprehend the nonvolitional (i.e., non-goal-directed) event information. EVENTs are comprised of constituent structures marked by the following definitional links: an ORIGIN.REL and OCCURENCE.REL which are required, and a PATIENT.REL and CONDITION.REL which are optional
ORIGIN.REL ::= OBJECT {DESCRIPTOR}*

An ORIGIN.REL marks a structure(s) (i.e., an OBJECT) which is the immediate cause or source of an OCCURENCE. The ACTION which represents the OCCURENCE is an inherent property of the OBJECT which is the ORIGIN.
Examples:
- A pet could make them happy.
- ...such things can and do give pleasure to a child.

- ...and punishment is bound to hurt.
- We must not be unduly influenced by a fad.
- We should continue to benefit from that help.
- Such circumstances are puzzling and distressing.

OCCURENCE.REL ::= ACTION {DESCRIPTOR}*

An OCCURENCE.REL marks an ACTION as being non-volitional (i.e., non-goal-directed and lacking intentionality).
Examples:
- The elderly are forgotten by society.
- After a couple of weeks the animals lose their natural instinct.
- A pet could make them happy.
- We have had fun watching them.
- These animals have taken the brunt of man's ways.

CONDITION.REL ::= POSITIVE.CONDITION.REL | NEGATIVE.CONDITION.REL | ADVERSATIVE.CONDITON.REL | REASON.CONDITION.REL

A CONDITION.REL associated with an EVENT marks a structure which functions as either a constraint on or a cause of an OCCURENCE. The CONDITION.REL rule is iterative in order to account for the possibility of there being more than one condition involved in an occurence, and is rewritten as a disjunct so as to specify the type of CONDITION involved.

POSITIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

A POSITIVE.CONDITION.REL marks a structure which is necessary but not sufficient for the truth value status of the COMPONENT to remain true. POSITIVE CONDITIONs associated with EVENTs are represented as OBJECTs, ATTRIBUTEs, or COMPONENTs.
Examples:
- We have had fun watching them.
- We should continue to benefit from that help.
- They have to perform the tricks perfectly before they get anything to eat.
- *If* you didn't train animals lots of terrible things could happen.

NEGATIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

A NEGATIVE.CONDITION.REL marks a structure which must be absent in order to ensure that the truth value status of the COMPONENT remains true. NEGATIVE CONDITIONs associated with EVENTs are represented as OBJECTs, ATTRIBUTEs, or COMPONENTs.

Examples:
- ...they could get lost *but not if* they had a seeing-eye dog.
- The horses become hot and tired *unless* they are given frequent rest.

ADVERSATIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

An ADVERSATIVE.CONDITION.REL marks a structure (i.e., an OBJECT, ATTRIBUTE, or COMPONENT) which violates an expectation regarding a logical or causal-dependency relation between two structures. This violation may take the form of a denied implication, a contrast, or a concession.
Examples:
- They may be fun to watch but think of how the animal feels. (concession)

REASON.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

A REASON.CONDITION.REL marks a structure which provides a causal explanation or rationale for the COMPONENT to which it is linked. REASON.CONDITIONs associated with EVENTs are represented as either OBJECTs or COMPONENTs
Examples:
- The dog could be hit by a car *because* it doesn't know not to run out onto the road.

E.THEME.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

An E.THEME.REL marks a structure which is the object of an ADJUNCT PATIENT's action.
Examples:
- It made me extremely angry to hear that.
- The elderly are forgotten by society.

PATIENT.REL ::= ADJUNCT.PATIENT.REL

PATIENT.REL ::= ALTERED PATIENT.REL

An EVENT PATIENT.REL marks a structure (i.e., OBJECT or COMPONENT) which is the recipient of a nonvolitional act. An ADJUNCT.PATIENT.REL is a recipient whose involvement in an OCCURENCE results in a change in the ORIGIN's state.
Examples:
- The elderly are forgotten by society.

An ALTERED PATIENT.REL marks an entity acted upon, and ALTERED by, the ORIGIN of the OCCURENCE.
Examples:
- The dog became excited.
- For instance, if you train a goat just to pull carts it would get tired.
- A pet could make them happy.

DESCRIPTION ::= ID.REL {TRUTH.VALUE.REL}* {MODALITY.REL}* {TENSE.REL} REFERENCE.REL STATE.REL

DESCRIPTIONs are semantic components which comprehend state information. The defining feature of a semantic structure classified as a DESCRIPTION is that the relationships among its constituents remain constant over time. The definitional links associated with DESCRIPTIONs include a REFERENCE.REL and a STATE.REL, which mark required constituent structures.

REFERENCE.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

A REFERENCE.REL marks the structure (i.e., OBJECT, or COMPONENT) to whom or which a given state applies.
Examples:
- Although not human, (ELIDED REFERENCE = animals) animals are still living things.
- I think that lots of animals are happy at zoos and at the circus.
- The question is sadly, rhetorical.
- It is alright to train certain animals.

STATE.REL ::= INTERNAL.STATE

STATE.REL ::= EXTERNAL.STATE

A STATE.REL marks structures which function as an attribute for the REFERENCE and may be either INTERNAL or EXTERNAL.

INTERNAL.STATE ::= MENTAL.REL D.THEME REL* {CONDITION.REL}*

INTERNAL STATEs include the knowledge, belief, or emotive state(s) of an animate OBJECT. INTERNAL.STATEs are comprised of constituent structures marked by the following definitional links: a MENTAL.RELation and a D.THEME.RELation which are required, and a CONDITION.RELation which is optional and iterative.

MENTAL.REL ::= ACTION {DESCRIPTOR}*

A MENTAL.REL marks a structure (i.e., a mental processive ACTION) which functions as the knowledge, belief, or emotive state (i.e., mentation) of an animate OBJECT.
Examples:
- They all wanted to go back home.
- I believe the last question to pose something of a dilemna...
- I imagine that a lion does enjoy jumping through a hoop.

- I think that training animals is wrong.
- For some reason, we seem to need to see animals performing in human-type ways.
- I would hate to be an animal locked in a cage.

D.THEME.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE {DESCRIPTOR}* | COMPONENT

A D.THEME.REL marks a structure (i.e., OBJECT, ATTRIBUTE, or COMPONENT) as being the content(s) or THEME of a mentation or INTERNAL.STATE.
Examples:
- I imagine that a lion does enjoy jumping through a hoop.
- I think that training animals is wrong.
- For some reason, we seem to need to see animals performing in human-type ways.

CONDITION.REL ::= POSITIVE.CONDITION.REL | NEGATIVE CONDITION.REL | ADVERSATIVE.CONDITION.REL | REASON.CONDITION.REL

A CONDITION.REL associated with an INTERNAL STATE marks a structure that serves as a constraint on or a cause of an animate OBJECT's knowledge, belief, or emotive state. The CONDITION.REL rule is iterative in order to allow for the possibility of more than one CONDITION being involved in an INTERNAL.STATE and it is rewritten as a disjunct so as to specify the type of CONDITION involved.

POSITIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

A POSITIVE.CONDITION.REL marks a structure which is necessary but not sufficient for the truth value status of the COMPONENT to remain true. POSITIVE CONDITIONs associated with INTERNAL.STATEs are represented as OBJECTs, ATTRIBUTEs, or COMPONENTs.
Examples:
- I think animals should be trained *if* it is for a good purpose.
- *The only time* I think it's good to train is *for* the blind and for at home...
- I think training animals to perform special things is O.K..
- I think it is okay for certain animals to be trained...

NEGATIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

A NEGATIVE.CONDITION.REL marks a structure which must be absent in order to ensure that the truth value status of the COMPONENT remains true. NEGATIVE CONDITIONs associated with INTERNAL.STATEs are represented as OBJECTs, ATTRIBUTEs, or COMPONENTs.
Examples:
- I think it is wrong to train animals *unless* it is to help the blind.

- In my opinion, it is okay to train animals to help people *but not if* it is for money or entertainment.

ADVERSATIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

An ADVERSATIVE.CONDITION.REL marks a structure (i.e., an OBJECT, ATTRIBUTE, or COMPONENT) which violates an expectation regarding a logical or causal-dependency relation between two structures. This violation may take the form of a denied implication, a contrast, or a concession.

Examples:

- I think that training animals are good *but* some are bad [*sic*]. (contrast)
- I don't think its all right to torture or cause them a great deal of pain for scientific purposes *but even* those animals are given many rights. (concession)

REASON.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

A REASON.CONDITION.REL marks a structure which is a causal explanation or rationale for the INTERNAL.STATE. REASON.CONDITIONs associated with INTERNAL.STATEs are represented as either OBJECTs or COMPONENTs.

Examples:

- I don't believe in criticizing that use *because* the blind need these trained animals.
- *For* some reason, we seem to need to see animals performing in human-type ways.

EXTERNAL.STATE ::= PROPERTY.REL {CONDITION.REL}*

EXTERNAL.STATEs include the physical and/or social attributes of an animate or inanimate OBJECT, an ACTION, or a COMPONENT. EXTERNAL.STATES are comprised of the constituent structures marked by the following definitional links: a PROPERTY.REL which is required, and a CONDITION.REL which is optional and iterative.

PROPERTY.REL ::= ALGEBRAIC.REL

PROPERTY.REL ::= ATTRIBUTE.REL

PROPERTY.REL ::= CATEGORY.REL

PROPERTY.REL ::= DURATION.REL

PROPERTY.REL ::= IDENTITY.REL

PROPERTY.REL ::= LOCATION.REL

PROPERTY.REL ::= PART.REL

PROPERTY.REL ::= THEME.REL

PROPERTY.REL ::= TIME.REL

The PROPERTY.REL rule rewrites to a disjunction to qualify the type of descriptive information comprising the EXTERNAL.STATE of a given REFERENCE.[7]

ALGEBRAIC.REL ::= PROXIMITY.REL | ORDER.REL | EQUIVALENCE.REL

An ALGEBRAIC.REL marks a structure (OBJECT, COMPONENT) that stands in a comparative relation with a REFERENCE or constituent structure. The rule is written as a disjunctive relation to qualify the type of comparison involved.

ORDER.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

The ORDER.REL marks a structure (OBJECT, COMPONENT) that differs in the value of a particular property which is linked to a REFERENCE or constituent and also indicates that there is specified order with respect to that difference.
Examples:
- Animals are *stronger* than humans.
- Training an animal is *better* than leaving it to die in the wild.
- Various kinds of experimentation are much *more* dubious. (elided)
- Animals are *cheaper* to buy and use than machines.
- The polar bear has *a thousand times* our strength.

PROXIMITY.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

The PROXIMITY.REL marks a structure (OBJECT, COMPONENT) that has a similar value with regards to a particular property linked to the REFERENCE or constituent.
Examples:
- Training an animal is *like* training a person for courses.
- They are *like* us.
- A hoop is much *like* a toy.
- *It's similar to* the argument that no one should hunt except for food.

EQUIVALENCE.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

The EQUIVALENCE.REL marks a structure (OBJECT, COMPONENT) that has an equal value with regards to a particular property linked to a REFERENCE or CONSTITUENT.
Examples:

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[7]The PROPERTY.REL rule is also a rewrite of the DESCRIPTOR rule which allows for specification of the local descriptive information associated with a constituent structure of a component. (i.e., The constituent structure would function as a REFERENCE if the information was represented as a component.)

- Animals have rights *just like* we do.
- To say that an animal is humiliated is to assume that an animal has feelings similar to a human.
- This is, of course, *contrary to* the propaganda of the animal rights extremists. (NEG) (EQUIVALENCE)
- There are bad and cruel animal trainers *just as* there are bad and cruel animals.
- ...that is, what animals have we also have.
- Animals are looked upon as those who fill in for humans.

ATTRIBUTE.REL ::=PSYCHOLOGICAL ATTRIBUTE.REL

ATTRIBUTE.REL ::=PHYSICAL ATTRIBUTE.REL

PSYCHOLOGICAL.ATTRIBUTE.REL ::=ATTRIBUTE {DESCRIPTOR}*

PHYSICAL.ATTRIBUTE.REL ::=ATTRIBUTE {DESCRIPTOR}* | COMPONENT

An ATTRIBUTE.REL marks a structure that functions as a ATTRIBUTE for an OBJECT or COMPONENT that is a REFERENCE. The rule is written as a disjunction in order to qualify the type of ATTRIBUTE involved. The PSYCHOLOGICAL.ATTRIBUTE.REL marks ATTRIBUTEs which are properties and characteristics that are either measured indirectly by some objective means or evaluated subjectively.

Examples:
- A lot of animals are stupid before you train them.
- It is wrong to train animals.
- The method of training animals is abusive.
- It is not acceptable to train animals in anyway, for any reason.

The PHYSICAL.ATTRIBUTE.REL marks ATTRIBUTEs which are properties and characteristics that are observable and directly measurable (i.e., objectively evaluated)

Examples:
- The newspaper said that the elephant had whip marks and bruises.
- When I see someone who is blind...
- ...that he has both the will and ability to use animals.
- We are able to ride and even jump on horses.

CATEGORY.REL ::= OBJECT {DESCRIPTOR}*

A CATEGORY.REL marks a structure represented by an OBJECT or set of OBJECTs which functions to classify the OBJECT or COMPONENT that is the REFERENCE.

Examples:
- Although not human, animals are still living things.
- The question is rhetorical.
- And we all have been creatures that could not speak.

DURATION.REL ::= ATTRIBUTE

A DURATION.REL marks a structure (an ATTRIBUTE) as the interval of time over which an OBJECT or COMPONENT are either in a particular state or involved in a particular action.

Examples:

- The water remained cold for the next three hours.
- The training sessions are three hours long.

IDENTITY.REL ::= ATTRIBUTE {DESCRIPTOR}* | OBJECT {DESCRIPTOR}* | COMPONENT

An IDENTIFICATION.REL marks a structure (an ATTRIBUTE, OBJECT, or COMPONENT) which has a one-to-one correspondance with the concept node functioning as the REFERENCE.

Examples:

- The key question in this matter is the way in which the animal is treated.
- My opinion is that animals should be trained.
- ...that cruelty and kindness are the sole criteria.
- Use and abuse are surely the key factors in this argument.
- ...abuse is pure and thoughtless exploitation.

LOCATION.REL ::= OBJECT {DESCRIPTOR}*

A LOCATION.REL marks a structure (an OBJECT) as a spatial location for an OBJECT, ACTION, or COMPONENT.

Examples:

- Also, the dogs have to stay in cold doghouses...
- Animals were on this earth for many years before humans were.
- Animals were meant to live in the wild.

PROPERTY.REL ::= PART.REL {DESCRIPTOR}*

A PART.REL marks a structure(s) (an OBJECT or COMPONENT) which stands in a part/whole relationship with the OBJECT or COMPONENT functioning as the REFERENCE.

Examples:

- A bird has wings.

RELATIONAL.REL ::=OBJECT {DESCRIPTOR}*

The RELATIONAL.REL rule marks an OBJECT that stands in some type of relationship to the OBJECT functioning as the REFERENCE. The relationships include those of kinship, marriage, entitlement, and ownership.

Examples:

- The blind have seeing-eye dogs to help them cross streets.
- Humans have the right to train animals.

THEME.REL ::= ATTRIBUTE {DESCRIPTOR}* | OBJECT {DESCRIPTOR}* | COMPONENT

A THEME.REL marks a structure (an ATTRIBUTE, OBJECT, COMPONENT) as the thematic content or THEME of an OBJECT or COMPONENT that is a REFERENCE.
Examples:
- The newspaper said that the elephant had whip marks and bruises.

TIME.REL ::= ATTRIBUTE

A TIME.REL marks a structure (an ATTRIBUTE) as the location in time for an OBJECT or COMPONENT that is functioning as a REFERENCE.
Examples:
- It is now three o'clock.

CONDITION.REL ::= POSITIVE.CONDITION.REL | NEGATIVE.CONDITION.REL | ADVERSATIVE.CONDITON.REL | REASON.CONDITION.REL

A CONDITION.REL associated with an EXTERNAL.STATE marks structures that function as either a constraint on or a cause of the physical or social attributes of an OBJECT or COMPONENT. The CONDITION.REL rule is iterative in order to account for the possibility of there being more than one condition involved in an EXTERNAL STATE and the rule is rewritten as a disjunct in order to specify the types of conditional relations involved.

POSITIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

A POSITIVE.CONDITION.REL marks a structure which is necessary but not sufficient for the truth value status of the EXTERNAL.STATE to remain true. POSITIVE CONDITIONs associated with EXTERNAL.STATEs are represented as OBJECTs, ATTRIBUTEs or COMPONENTs.
Examples:
- *If* we didn't have them life would be difficult for the blind.
- The spectacle of a bear dancing is highly unnatural--for the animal.
- That is alright,by me.
- It is alright to train certain animals.
- So in someways it's good to have animals trained, for blind people and people who can't carry heavy loads,...

NEGATIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

A NEGATIVE.CONDITION.REL marks a structure which must be absent in order to ensure that the truth value status of the EXTERNAL STATE remains true. NEGATIVE CONDITIONs associated with EXTERNAL.STATEs are represented as OBJECTs, ATTRIBUTEs, or COMPONENTs.

Examples:

- Training animals is a good thing *except* when the animals are mistreated.

ADVERSATIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

An ADVERSATIVE.CONDITION.REL marks a structure (i.e., an OBJECT, ATTRIBUTE, or COMPONENT) which violates an expectation regarding a logical or causal-dependency relation between two structures. This violation may take the form of a denied implication, a contrast, or a concession.

Examples:

- Training guide dogs to guide people was a very good idea, for us. *But* think of how the animals feel. (contrast)
- And we all have been creatures that cannot speak, *although* we usually have few memories of that time. (concession)
- *Even if* a thousand monkeys die peacefully to save one human life it is still worth it. (concession)
- Toilet training them is not bad *but* training them to do tricks for the circus should not be allowed....(contrast)
- So in someways it's good to have animals trained, for blind people and people who can't carry heavy loads, *but* in some ways it's bad to train animals because sometimes they can be treated badly. (contrast)

REASON.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE | COMPONENT

A REASON.CONDITION.REL marks a structure which is a causal explanation or rationale for the EXTERNAL STATE. REASON.CONDITIONs associated with EXTERNAL.STATEs are represented as OBJECTs or COMPONENTs.

Examples:

- In most respects it is difficult to talk about the animals *because* they cannot confirm or deny our suspicions.
- ... in some ways it's bad to train animals *because* sometimes they can be treated badly.

CONSTITUENT.REL ::= T.CONDITION.REL

CONSTITUENT.REL ::= T.DESCRIPTOR.REL

CONSTITUENT.REL ::= T.D.THEME.REL

CONSTITUENT.REL ::= T.E.THEME.REL

CONSTITUENT.REL ::= T.GOAL.REL

CONSTITUENT.REL ::= T.INSTRUMENT.REL

CONSTITUENT.REL ::= T.PATIENT.REL

CONSTITUENT.REL ::= T.PURPOSE.REL

CONSTITUENT.REL ::= T.REFERENCE.REL

The CONSTITUENT.REL rule allows for indexing of the semantic links which mark the embedding of a frame component (i.e., its assumption of the role of a constituent structure in another frame component). The embedding is made possible by a transformational operation. The CONSTITUENT.REL rule is rewritten as a disjunction so as to allow specification of the type of semantic relation between the embedded and host components.[8] Examples of embedded component structures have been given where relevant with descriptions of the constituent structures of PROCEDUREs, EVENTs, and DESCRIPTIONs. The additional examples provided below are for clarification.

T.CONDITION.REL ::= COMPONENT.1 COMPONENT.2

The T.CONDITION.REL rule marks the component structure (i.e., COMPONENT.1 which is a PROCEDURE, EVENT or DESCRIPTION) that is embedded or functions as a CONDITION and the component structure (i.e., COMPONENT.2 which is an EVENT, a PROCEDURE, or a DESCRIPTION[9]) that serves as the "host".[10]

Examples:

- It's fine to train animals *if* there is no cruelty, undue pain or restriction involved.
- Taken by themselves, questions of pleasure and pain might be misleading:
- Birds can be very entertaining *when* you train them to talk.
- They have to perform the tricks perfectly *before* they get anything to eat.
- I think training animals is wrong *because* *if* you make them do tricks for too long the animals might get tired.
- Animals should not be held in captivity; it is so cruel.
- People must train the animals with care, *so* they won't get hurt.

T.DESCRIPTOR.REL ::= COMPONENT 1 COMPONENT 2

A T.DESCRIPTOR.REL rule marks the component structure (i.e., COMPONENT.1 which is a PROCEDURE, EVENT, or DESCRIPTION) that is embedded or functions as a

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[8] Each of type of transformational relation can also be rewritten as a disjunction to specify the legal combinations of component types for the different semantic/constituent relations between the embedded and host components. The rules specifying these legal combinations are included in the set of BNF rules presented in the Integrated Frame Analysis Handbook (Senecal et al., 1991).

[9] For all inter-component relations, the text representing COMPONENT.2 is underlined in the examples given.

[10] For all TRANSFORMATIONAL.RELations, the component structures involved are indexed by the ID.REL which is a rewrite of both COMPONENT.1 and COMPONENT.2 rules.

DESCRIPTOR and the component structure (i.e., COMPONENT.2 which is a PROCEDURE, EVENT, or DESCRIPTOR) that serves as the "host"
Examples:
- When I see someone who is blind,
- The man who was wearing the top hat was training the animals with a whip.

T.D.THEME.REL ::= COMPONENT.1 COMPONENT.2

The T.D.THEME.REL rule marks the component structure (i.e., COMPONENT.1 which is a PROCEDURE, EVENT or DESCRIPTION) that is embedded or functions as an D.THEME and the component structure (i.e., COMPONENT.2 which is a DESCRIPTION) that serves as the "host".
Examples:
- I think that animals should be trained to help humans.
- I believe the last question to pose something of a dilemna...

T.E.THEME.REL ::= COMPONENT.1 COMPONENT.2

The T.E.THEME.REL rule marks the component structure (i.e., COMPONENT.1 which is a PROCEDURE, EVENT or DESCRIPTION) that is embedded or functions as an E.THEME and the component structure (i.e., COMPONENT.2 which is an EVENT) that serves as the "host".
Examples:
- They heard that the prime minister was going to resign.
- They saw how beautiful the planet was.

T.P.THEME.REL ::= COMPONENT.1 COMPONENT.2

The T.P.THEME.REL rule marks the component structure (i.e., COMPONENT.1 which is a PROCEDURE, EVENT or DESCRIPTION) that is embedded or functions as a P.THEME and the component structure (i.e., COMPONENT.2 which is a PROCEDURE) that serves as the "host".
Examples:
- ...think of how the animal feels.
- You might argue that the animal could not survive today in the wild.

T.GOAL.REL ::= COMPONENT.1 COMPONENT.2

The T.GOAL.REL rule marks the component structure (i.e., COMPONENT.1 which is a PROCEDURE, EVENT or DESCRIPTION) that is embedded or functions as a GOAL and the component structure (i.e., COMPONENT.2 which is a PROCEDURE) that serves as the "host".
Examples:
- They trained their dog to fetch the newspaper every morning.
- Some people train dogs to guard houses.

T.INSTRUMENT.REL ::= COMPONENT.1 COMPONENT.2

A T.INSTRUMENT.REL rule marks the component structure (i.e., COMPONENT.1 which is a PROCEDURE) that is embedded or functions as an INSTRUMENT and the component structure (i.e., COMPONENT.2 which is a PROCEDURE) that serves as the "host".

Examples:

- A sheep dog works for a living by using its natural skills.
- Animal trainers rely on fear to force the animals to do what they want.

T.PATIENT.REL ::= COMPONENT.1 COMPONENT.2

A T.PATIENT REL rule marks the component structure (i.e., COMPONENT.1 which is a PROCEDURE, EVENT or DESCRIPTION) that is embedded or functions as a PATIENT and the component structure (i.e., COMPONENT.2 which is a PROCEDURE or an EVENT) that serves as the "host".

Examples:

- It made me angry to hear that the animals had been abused.

T.PURPOSE.REL ::= COMPONENT.1 COMPONENT.2

A T.PURPOSE.REL rule marks the component structure (i.e., COMPONENT.1which is a PROCEDURE, EVENT or DESCRIPTION) that is embedded or functions as a PURPOSE and the component structure (i.e., COMPONENT.2 which is a PROCEDURE) that serves as the "host".

Examples:

- People train their dogs to obey so that they will not run out onto a road and be killed.

T.REFERENCE.REL ::= COMPONENT.1 COMPONENT.2

A T.REFERENCE.REL rule marks the component structure (i.e., COMPONENT.1 which is a PROCEDURE, EVENT or DESCRIPTION) that is embedded or functions as an E.THEME and the component structure (i.e., COMPONENT.2 which is a DESCRIPTION) that serves as the "host".

Examples:

- I think that to train an animal to help a blind person around is very good.
- It is alright to train certain animals.

TEMPORAL.REL ::= PRIOR.REL

TEMPORAL.REL ::= CONCURRENT.REL

TEMPORAL.REL ::= ELAPSED.REL

The TEMPORAL.REL rule, which represents a structural or semantic link in a frame, was rewritten to permit some degree of qualification as to the TEMPORAL.RELationship existing between two semantic components.

PRIOR.REL ::= COMPONENT.1 COMPONENT.2

The PRIOR.REL rule marks a temporal relation between two components involving an order in time (i.e., COMPONENT.1 takes place or exists PRIOR to COMPONENT.2).[11]
Examples:
- And sometimes they take the animals out of the wilderness where they live, *then* they train them.

CONCURRENT.REL ::= COMPONENT.1 COMPONENT.2

The CONCURRENT.REL rule marks a temporal relation between two components involving an equivalence in time (i.e., COMPONENT.1 takes place or exists at the same time as or CONCURRENT with COMPONENT.2).
Examples:
- All their equipment was bumping and smashing against the walls.
- ...a lion does enjoy jumping through a hoop.

ELAPSED.REL ::= COMPONENT.1 COMPONENT.2

The ELAPSED.REL rule marks a temporal relation between two components involving a difference in time (i.e., COMPONENT.2 takes place or exists after some specified time has ELAPSED from the point in time at which COMPONENT.1 takes place or exists).
Examples:
- ...then they train them. But *after a couple of weeks* the animals lose their Natural Instinct.
- They cleaned it up and took it backstage. *The next day* there was an article in the paper saying that inspectors found an elephant from the circus with a number of bruises and whip marks on its back.

ELABORATION.REL ::= EXEMPLIFICATION.REL*

ELABORATION.REL ::= SPECIFICATION.REL*

ELABORATION.REL ::= CLARIFICATION.REL*

ELABORATION.REL ::= DECOMPOSITION.REL*

The ELABORATION.REL rule, which represents a structural semantic link in a frame, was rewritten to qualify the type of ELABORATION RELation between two components.

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[11] For all TEMPORAL.RELations, the component structures involved are indexed by the ID.REL which is a rewrite of both COMPONENT.1 and COMPONENT.2 rules.

The ELABORATION.REL rule marks a structure(s) (COMPONENT.2) which provides additional detail relevant to the information presented in COMPONENT.1[12]

CLARIFICATION.REL ::= COMPONENT.1 COMPONENT.2

The CLARIFICATION.REL rule marks a component structure which clarifies by either restating in different words or stating in greater detail the information presented in COMPONENT 1.

Examples:

- ...since we are animals together with something else -- *that is*, what animals have, we also have, overlaid by our own human peculiarities.

EXEMPLIFICATION.REL ::= COMPONENT.1 COMPONENT.2

The EXEMPLIFICATION.REL rule marks a structure which illustrates by presenting one possible example of the more general case presented in COMPONENT.1.

Examples:

- Most of the time when someone trains an animal to do work they hurt it in some way. *For example*, lion trainers whip the lion to do what he or she wants the lion to do.
- I am for animal training in some ways, and against it in other ways, *for example*, if animals are trained to dispose of their droppings in a certain place, that is all right by me, but if animals are to attack people and perform circus stunts then that is what I consider cruelty.
- It is so mean when they take wild animals and put them in cages or in tanks. *For example* when they catch whales and put them in a big pool it is so mean.
- ...or makes it do dangerous things *like* jump through a fire ring,...

SPECIFICATION.REL ::= COMPONENT.1 COMPONENT.2

The SPECIFICATION.REL rule marks a structure which specifies by stating all possible cases or instances of COMPONENT.1.

Examples:

- If that owner knows how to treat him right; feed him well and let him rest when he's tired, I think that is okay.

DECOMPOSITION.REL ::= COMPONENT.1 COMPONENT.2

The DECOMPOSITION.REL rule serves to mark those structures which constitute the steps involved in a process. Thus, COMPONENT.2 is a subgoal that is set or a step that is performed in order to achieve the higher level goal which is specified in COMPONENT.1.

Examples:

- He fixed the cracks by putting earth in the holes and planting trees in the earth.

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[12] For all ELABORATION.RELations, the component structures involved are indexed by the ID.REL which is a rewrite of both COMPONENT.1 and COMPONENT.2 rules.

For purposes of conducting a discourse analysis based on the semantic categories defined in the Base Grammar 2.0, the grammar was extended by the following non-structural rules: (a) a TEXT.REL rule which rewrites to PRESENT and ELIDED options and permits specification of whether a concept is stated explicitly in the text or implied, (b) a LABEL.REL rule which rewrites to a STRING and permits recording of text strings representing a concept in the network, and (c) an ID.REL rule which also rewrites to a STRING and permits indexing of a component structure in the network. In general, all terminal nodes serve as the head elements for these "non-structural" or extensional rules. Two exceptions to the inclusion of these extensional rules are for nodes terminating TENSE.RELations and TRUTH.VALUE.RELations since the corresponding relational rules are rewritten to provide an exhaustive list of the possible terminal nodes.

The terminal nodes of the MODALITY.REL rule (i.e., QUAL, COND, CAN, ROOT) rewrite to the LABEL.REL rule which allows recording of the text string through which a particular modality is marked. The remaining terminal nodes in the Base Grammar 2.0 are OBJECTs, ACTIONs, ATTRIBUTEs, and COMPONENTs. OBJECT and ACTION nodes refer to the two classes of concepts defined by Frederiksen (1975) as well as to the optional identifying information (i.e., number, degree, measure) associated with these units. Attribute nodes refer to structures represented by terminal nodes of Frederiksen's (1975) set of identifying relations. These nodes can be unpacked to specify the particular attribute relational system (i.e., objects and relations among theses objects) which constitute the attribute structure, as well as any additional identifying information (i.e., degree, number, measure) which may optionally identify the attribute. The content of the OBJECT, ACTION, and ATTRIBUTE nodes in a given text can be recorded through the application of two extensional rules: (a) the TEXT.REL rule which allows specification of whether these concepts are PRESENT (i.e., stated explicitly) or ELIDED (i.e., not specified as a result of passive syntactic constructions) in the text, and (b) the LABEL.REL rule which as a rewrite of the PRESENT rule permits recording of the actual text string in which a semantic structure is represented. The COMPONENT, COMPONENT.1, and COMPONENT.2 nodes rewrite to an ID.REL in order to permit indexing of the component structures involved in an inter-component relation. This indexing enables the researcher to make structural links resulting in the integrated structure or semantic network underlying the text. The Base Grammar 2.0 inclusive of non-structural rules is given in Appendix C (p. 161).

Appendix C

Base Grammar Version 2.0 - BNF Rules

FRAME ::= ID.REL COMPONENT.REL* {ROLE.REL}*
COMPONENT.REL ::= PROCEDURE
COMPONENT.REL ::= EVENT
COMPONENT.REL ::= DESCRIPTION
ROLE.REL ::= CONSTITUENT.REL
ROLE.REL ::= TEMPORAL.REL
ROLE.REL ::= ELABORATION.REL
PROCEDURE ::= ID.REL {TRUTH.VALUE.REL}* {MODALITY.REL}*
{TENSE.REL} AGENCY.REL* OPERATION.REL GOAL.REL*
{CONDITION.REL}* {INSTRUMENT.REL}* {PATIENT.REL}* {PURPOSE.REL}*
{P.THEME.REL}*
TRUTH.VALUE.REL ::= NEGATIVE.OPERATOR
TRUTH.VALUE.REL ::= INTERROGATIVE.OPERATOR
MODALITY.REL ::= QUAL.OPERATOR
MODALITY.REL ::= CAN.OPERATOR
MODALITY.REL ::= COND.OPERATOR
MODALITY.REL ::= ROOT.OPERATOR
TENSE.REL ::= PAST
TENSE.REL ::= PRESENT
TENSE.REL ::= FUTURE
AGENCY.REL ::= OBJECT {DESCRIPTOR}*
OBJECT ::= TEXT.REL
DESCRIPTOR ::= ID.REL
DESCRIPTOR ::= QUANTIFICATION.REL
DESCRIPTOR ::= PROPERTY.REL
QUANTIFICATION.REL ::= DEGREE.REL
QUANTIFICATION.REL ::= NUMBER.REL
QUANTIFICATION.REL ::= DEFINITE.REL
QUANTIFICATION.REL ::= INDEFINITE.REL
DEGREE.REL ::= ATTRIBUTE
NUMBER.REL ::= ATTRIBUTE
DEFINITE.REL ::= ATTRIBUTE
INDEFINITE.REL ::= ATTRIBUTE
ATTRIBUTE ::= TEXT.REL
OPERATION.REL ::= ACTION {DESCRIPTOR}*
ACTION ::= TEXT.REL
GOAL.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
CONDITION.REL ::= POSITIVE.CONDITION.REL
CONDITION.REL ::= NEGATIVE CONDITION.REL
CONDITION.REL ::= ADVERSATIVE.CONDITION.REL
CONDITION.REL ::= REASON.CONDITION.REL
POSITIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE |
COMPONENT
NEGATIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | ATTRIBUTE |
COMPONENT
ADVERSATIVE.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
REASON.CONDITION.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT

INSTRUMENT.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
PATIENT.REL ::= ADJUNCT PATIENT.REL
PATIENT.REL ::= ALTERED PATIENT.REL
ADJUNCT PATIENT.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
ALTERED PATIENT.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
PURPOSE.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
P.THEME.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
EVENT ::= ID.REL {TRUTH.VALUE.REL}* {TENSE.REL} {MODALITY.REL}*
ORIGIN.REL* OCCURENCE.REL {CONDITION.REL}* {E.THEME.REL}*
{PATIENT.REL}*
ORIGIN.REL ::= OBJECT {DESCRIPTOR}*
OCCURENCE.REL ::= ACTION {DESCRIPTOR}*
E.THEME.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
DESCRIPTION ::= ID.REL {TRUTH.VALUE.REL}* {TENSE.REL}
{MODALITY.REL}*
REFERENCE.REL STATE.REL
REFERENCE.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
STATE.REL ::= INTERNAL.STATE
STATE.REL ::= EXTERNAL.STATE
INTERNAL.STATE ::= MENTAL.REL D.THEME.REL {CONDITION.REL}*
MENTAL.REL ::= ACTION {DESCRIPTOR}*
D.THEME.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
EXTERNAL.STATE ::= PROPERTY.REL {CONDITION.REL}*
PROPERTY.REL ::= ALGEBRAIC.REL
PROPERTY.REL ::= ATTRIBUTE.REL
PROPERTY.REL ::= CATEGORY.REL
PROPERTY.REL ::= DURATION.REL
PROPERTY.REL ::= IDENTITY.REL
PROPERTY.REL ::= LOCATIVE.REL
PROPERTY.REL ::= PART.REL
PROPERTY.REL ::= RELATIONAL.REL
PROPERTY.REL ::= THEME.REL
PROPERTY.REL ::= TIME.REL
ALGEBRAIC.REL ::= EQUIVALENCE.REL
ALGEBRAIC.REL ::= ORDER.REL
ALGEBRAIC.REL ::= PROXIMITY.REL
EQUIVALENCE.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
ORDER.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
PROXIMITY.REL ::= OBJECT {DESCRIPTOR}* | COMPONENT
ATTRIBUTE.REL ::= PHYSICAL.REL
ATTRIBUTE.REL ::= PSYCHOLOGICAL.REL
PHYSICAL.REL ::= ATTRIBUTE {DESCRIPTOR}* | OBJECT {DESCRIPTOR}* |
COMPONENT
PSYCHOLOGICAL.REL ::= ATTRIBUTE {DESCRIPTOR}*
CATEGORY.REL :: = ATTRIBUTE {DESCRIPTOR}* | OBJECT {DESCRIPTOR}*
DURATION.REL ::= ATTRIBUTE {DESCRIPTOR}*
IDENTITY.REL::= ATTRIBUTE {DESCRIPTOR}* | OBJECT {DESCRIPTOR}* |
COMPONENT
LOCATIVE.REL ::= OBJECT {DESCRIPTOR}*
PART.REL ::= ATTRIBUTE {DESCRIPTOR}* | OBJECT {DESCRIPTOR}* |
COMPONENT
THEME.REL ::= ATTRIBUTE {DESCRIPTOR}* | OBJECT {DESCRIPTOR}* |
COMPONENT
TIME.REL ::= ATTRIBUTE {DESCRIPTOR}*

CONSTITUENT.REL ::= T.CONDITION.REL
CONSTITUENT.REL ::= T.D.THEME.REL
CONSTITUENT.REL ::= T.E.THEME.REL
CONSTITUENT.REL ::= T.GOAL.REL
CONSTITUENT.REL ::= T.INSTRUMENT.REL
CONSTITUENT.REL ::= T.PATIENT.REL
CONSTITUENT.REL ::= T.PURPOSE.REL
CONSTITUENT.REL ::= T.P.THEME.REL
CONSTITUENT.REL ::= T.REFERENCE.REL
CONSTITUENT.REL ::= T.DESCRIPTOR.REL
T.CONDITION.REL ::= COMPONENT.1 COMPONENT.2
T.D.THEME.REL ::= COMPONENT.1 COMPONENT.2
T.E.THEME.REL ::= COMPONENT.1 COMPONENT.2
T.GOAL.REL ::= COMPONENT.1 COMPONENT.2
T.INSTRUMENT.REL ::= COMPONENT.1 COMPONENT.2
T.PATIENT.REL ::= COMPONENT.1 COMPONENT.2
T.PURPOSE.REL ::= COMPONENT.1 COMPONENT.2
T.P.THEME ::= COMPONENT.1 COMPONENT.2
T.REFERENCE.REL ::= COMPONENT.1 COMPONENT.2
T.DESCRIPTOR.REL ::= COMPONENT.1 COMPONENT.2
TEMPORAL.REL ::= CONCURRENT.REL
TEMPORAL.REL ::= ELAPSED.REL
TEMPORAL.REL ::= PRIOR.REL
CONCURRENT.REL ::= COMPONENT.1 COMPONENT.2
ELAPSED.REL ::= COMPONENT.1 COMPONENT.2
PRIOR.REL ::= COMPONENT.1 COMPONENT.2
ELABORATION.REL ::= CLARIFICATION.REL
ELABORATION.REL ::= DECOMPOSITION.REL
ELABORATION.REL ::= EXEMPLIFICATION.REL
ELABORATION.REL ::= SPECIFICATION.REL
CLARIFICATION.REL ::= COMPONENT.1 COMPONENT.2
DECOMPOSITION.REL ::= COMPONENT.1 COMPONENT.2
EXEMPLIFICATION.REL ::= COMPONENT.1 COMPONENT.2
SPECIFICATION.REL ::= COMPONENT.1 COMPONENT.2
TEXT.REL ::= TEXT
TEXT.REL ::= ELIDED
TEXT ::= LABEL.REL
COMPONENT ::= ID.REL
COMPONENT.1 ::= ID.REL
COMPONENT.2 ::= ID.REL
LABEL.REL ::= STRING
ID.REL ::= STRING

Appendix D

Argument Grammar - BNF Rules

ARGUMENT ::= CLAIM.REL JUSTIFICATION.REL* {OPPOSITION.REL}*
CLAIM.REL ::= CLAIM
CLAIM ::= ASSERTION.REL CONTENTIOUS.REL* {QUALIFICATION.REL}*
{SUBCLAIM.REL}*
ASSERTION.REL ::= COMPONENT
CONTENTIOUS.REL ::= PROBLEM.STATEMENT | MOD.QUAL | EVALUATION |
OPINION
QUALIFICATION.REL ::= MODAL.REL | CONSTRAINT.REL*
MODAL.REL ::= MOD.CAN | MOD.COND | MOD.QUAL | MOD.ROOT
CONSTRAINT.REL ::= ATTRIBUTE | OBJECT | COMPONENT
SUBCLAIM.REL ::= CLAIM | ARGUMENT
JUSTIFICATION.REL ::= DATA.REL* {D.BACKING.REL}* {WARRANT.REL}
{W.BACKING.REL}*
DATA.REL ::= COMPONENT | CLAIM | ARGUMENT
WARRANT.REL ::= COMPONENT | ARGUMENT
D.BACKING.REL ::= OBJECT | COMPONENT
W.BACKING.REL ::= OBJECT | COMPONENT
OPPOSITION.REL ::= REBUTTAL.REL | ALTERNATIVE.SOLUTION.REL
REBUTTAL.REL ::= RESERVATION.REL | COUNTER.REBUTTAL.REL
RESERVATION.REL ::= COMPONENT | CLAIM | ARGUMENT
COUNTER.REBUTTAL.REL ::= COUNTER.REBUTTAL
COUNTER.REBUTTAL ::= POTENTIAL.REBUTTAL.REL
RESPONSE.TO.REBUTTAL.REL
POTENTIAL.REBUTTAL.REL ::= COMPONENT | CLAIM | ARGUMENT
RESPONSE.TO.REBUTTAL.REL::= COMPONENT | CLAIM | ARGUMENT
ALTERNATIVE.SOLUTION.REL = CLAIM | ARGUMENT

Extended Argument Grammar - BNF Rules

ARGUMENT ::= CLAIM.REL JUSTIFICATION.REL* {OPPOSITION.REL}* ID.REL
{EMBEDDED.REL}*
CLAIM.REL ::= CLAIM
CLAIM ::= ASSERTION.REL CONTENTIOUS.REL* {QUALIFICATION.REL}*
{SUBCLAIM}* ID.REL TEXT.REL
ASSERTION.REL ::= COMPONENT
CONTENTIOUS.REL ::= PROBLEM.STATEMENT | MOD.QUAL | EVALUATION |
OPINION
QUALIFICATION.REL ::= MODAL.REL | CONSTRAINT.REL*
MODAL.REL ::= MOD.CAN | MOD.COND | MOD.QUAL | MOD.ROOT
CONSTRAINT.REL ::= ATTRIBUTE {MARKER} | OBJECT {MARKER} |
COMPONENT {MARKER}
SUBCLAIM.REL ::= CLAIM {MARKER} | ARGUMENT {MARKER}
JUSTIFICATION.REL ::= DATA.REL* {D.BACKING.REL}* {WARRANT.REL}
{W.BACKING.REL}* ID.REL TEXT.REL
DATA.REL ::= COMPONENT {MARKER} | CLAIM {MARKER} | ARGUMENT
{MARKER}
WARRANT.REL ::= COMPONENT {MARKER} | ARGUMENT {MARKER}
D.BACKING.REL ::= OBJECT {MARKER} | COMPONENT {MARKER}
W.BACKING.REL ::= OBJECT {MARKER} | COMPONENT {MARKER}
OPPOSITION.REL ::= REBUTTAL.REL | ALTERNATIVE.SOLUTION.REL ID.REL
REBUTTAL.REL ::= RESERVATION.REL ID.REL | COUNTER.REBUTTAL.REL
ID.REL
RESERVATION.REL ::= COMPONENT {MARKER} | CLAIM {MARKER} |
ARGUMENT {MARKER}
COUNTER.REBUTTAL.REL ::= COUNTER.REBUTTAL
COUNTER.REBUTTAL ::= POTENTIAL.REBUTTAL.REL
RESPONSE.TO.REBUTTAL.REL
POTENTIAL.REBUTTAL.REL ::= COMPONENT {MARKER} | CLAIM {MARKER} |
ARGUMENT {MARKER}
RESPONSE.TO.REBUTTAL.REL ::= COMPONENT {MARKER} | CLAIM
{MARKER} | ARGUMENT {MARKER}
ALTERNATIVE.SOLUTION.REL = CLAIM {MARKER} | ARGUMENT [MARKER}
COMPONENT ::= LABEL.REL
ATTRIBUTE ::= LABEL.REL
OBJECT ::= LABEL.REL
MARKER ::= LABEL.REL
MOD.QUAL ::= LABEL.REL
MOD.ROOT ::= LABEL.REL
MOD.CAN ::= LABEL.REL
MOD.COND ::= LABEL.REL
EVALUATION ::= LABEL.REL
OPINION ::= LABEL.REL
PROBLEM.STATEMENT ::= LABEL.REL
EMBEDDED.REL ::= T.ARGUMENT E.DATA | T.ARGUMENT E.WARRANT |
T.ARGUMENT E.RESERVATION | T.ARGUMENT E.POTENTIAL.REBUTTAL |
T.ARGUMENT E.RESPONSE.TO.REBUTTAL | T.ARGUMENT
E.ALTERNATIVE.SOLUTION | T.CLAIM E.DATA | T.CLAIM E.RESERVATION |
T.CLAIM E.POTENTIAL.REBUTTAL | T.CLAIM E.RESPONSE.TO.REBUTTAL |
T.CLAIM E.ALTERNATIVE.SOLUTION
T.ARGUMENT ::= ID.REL

T.CLAIM ::= ID.REL
E.DATA ::= ID.REL
E.WARRANT ::= ID.REL
E.RESERVATION ::= ID.REL
E.POTENTIAL.REBUTTAL ::= ID.REL
E.RESPONSE.TO.REBUTTAL ::= ID.REL
E.ALTERNATIVE.SOLUTION ::= ID.REL
ID.REL ::= STRING
LABEL.REL ::= STRING
TEXT.REL ::= PRESENT | ELIDED | ABSENT

Appendix E

Table 1

type of assertion (semantic characteristics)	semantic structure in terms of Base Grammar 2.0 categories (uppercase)	Examples
• Proposal / policy: proposed course of action which is advisable, preferred, or appropriate given the circumstances.	1) PROCEDURE; TENSE = FUTURE, MODALITY = ROOT-QUAL = should, ought	• I think animals should be trained. • Humans ought not to train animals.
• Evaluation: (a) value judgement indicated by a subjectively measured attribute or comparison, or	1) DESCRIPTION; EXTERNAL.STATE; PSYCHOLOGICAL.ATTRIBUTE or ORDERED.REL	• Training animals is wrong. • It is better to train animals than to let them do what they want.
(b) situational judgement regarding a course of action that was or was not taken.	2) PROCEDURE, EVENT, or DESCRIPTION with PSYCHOLOGICAL ATTRIBUTE as DESCRIPTOR on a constituent.	• That is a good idea. • I believe training animals is a good thing.
	3) PROCEDURE; TENSE = PAST MODALITY = ROOT-QUAL = should have, should not have	• Canada should not have sent troops to the Gulf War. • The UN should have permitted NATO air strikes on the Bosnian Serbs.
• Identification / Definition: reflects decision as to classification of an entity (i.e., an object or action)	1) DESCRIPTION; EXTERNAL.STATE; CATEGORY	• Perhaps it is a good idea to train animals... • Surely, the key question in this matter is the way in which the animal is trained.
	2) DESCRIPTION; EXTERNAL.STATE; IDENTIFICATION	• I am not saying that cruelty and kindness are the sole criteria, but they are necessary criteria.
• Cause - Effect: statement as to causality or a prediction of events	1) PROCEDURE, EVENT, or DESCRIPTION that has a specified causal-condition represented as an AGENT, SOURCE, or CONDITION	• If people don't train their animals the people will regret it. Because a lot of animals are stupid before you train them. This is my opinion about training animals. • The power failure was caused by a faulty hydro-electric system and not by a solar storm.

Table 2

contentious nature of claim (semantic characteristics)	Semantic structure in terms of Base Grammar 2.0 categories (uppercase)	Examples
• statement functioning as assertion is contentious and open to dispute		
• the assertion is a response to a question or problem statement	1) COMPONENT serving as a problem statement is marked by an INTERROGATIVE OPERATOR	• Should animals be trained? • What is the morality of animal training? • To train or not to train?
• there is a modal truth value in terms of probability associated with the assertion functioning as the claim. This modalization is achieved by i) personalizing the assertion; indicating that it is a belief, thought or opinion;	1) DESCRIPTION; INTERNAL.STATE; MENTATION = believe, think, feel, D.THEME = embedded COMPONENT = assertion	• I think animals should be trained
	2) DESCRIPTION; REFERENT = opinion, IDENTITY.REL marks COMPONENT that is an assertion	• My opinion is that animals should be trained.
	3) COMPONENT functioning as the assertion has a POSITIVE CONDITION which is an OBJECT = opinion	• In my opinion it is wrong to train animals.
ii) presenting an evaluative type assertion which requires a subjective judgement;	1) Evaluation as defined by Base Grammar categories in Table 1	• It is perfectly fine to train animals.
or iii) inserting a modal adjunct into the assertion and thereby indicating that the truth value of the assertion either lies within the range or is at the limits of the probability interval [0.0, 1.0].	1) assertion COMPONENT has MOD.QUAL.OPERATOR	• ...by and large, I think such training to be above criticism. • It is perfectly evident that such circumstances would be puzzling and distressing. • It might be OKay to train animals for our purposes

Table 3

qualification of assertion (semantic characteristics)	Semantic structure in terms of Base Grammar categories (uppercase)	Examples
• information which serves to qualify the assertion by limiting the universality of its applicability. This qualification is of two types: i) a modal adjunct affirming the possibility, contingency, or necessity of the assertion,	1) MOD.QUAL, MOD.CAN, MOD.ROOT, or MOD.COND. OPERATOR applied to the assertion COMPONENT	• Perhaps that is sentimentalizing. • It might be OKay to train animals for our purposes.
and ii) a constraint, indicating the general and/or particular circumstances under which the assertion would apply.	1) a constituent structure which has an INDEFINITE attribute and is linked to the assertion COMPONENT by a POSITIVE.CONDITION.REL	• Animals should be trained to a certain extent. • I think that certain animals should be trained. • Sometimes it is alright to train animals... • I would propose a middle way, with various criteria.
	2) an OBJECT or ATTRIBUTE which is linked to the assertion COMPONENT by a POSITIVE.CONDITION.REL	• Animals should be trained with care. • Animals should be trained humanely. • It is alright to train animals but only to a certain extent.
	3) a COMPONENT with a MOD.QUAL OPERATOR (i.e., is hypothetical) is linked by a POSITIVE.CONDITION.REL to the assertion COMPONENT	• It is alright to train animals if they are treated properly. • Taken by themselves, questions of pleasure and pain might be misleading... • Animals should be trained, or at least some animals. • I think you should only train animals when it is necessary and not for money. • I think it is acceptable to train animals for whatever reason or purpose as long as they are not mistreated or harmed in any way.
	4) a COMPONENT is linked by an ADVERSATIVE.CONDITION.REL[1] to the assertion COMPONENT	• Donkeys and small ponys should be trained to pull wagons but you should give them a frequent rest.

[1]Qualifications in an argument structure are represented as adversatives when the "enabling" circumstances are either seen or presented as being contrary to expectation. They may also be used rhetorically i.e., to emphasize importance of conditions

Table 4

subclaim (semantic characteristics)	Semantic characteristics in terms of Base Grammar 2.0 categories (uppercase)	Examples
• a minor claim which is more limited in its scope than the major claim. This limitation is due to either (a) the presence of qualifications and/or reservations which are not associated with the major claim	COMPONENT functioning as the assertion of a claim is linked by a PART.REL to the COMPONENT functioning as the assertion of the major claim	• I think training animals isn't a nice thing to do to the animals especially if you are training the animals to do work. I don't think training animals is fair.
or (b) a specific instance of the general case stated in the major claim is presented.	COMPONENT functioning as the assertion of a claim is linked by either an EXEMPLIFICATION.REL or a SPECIFICATION.REL to the COMPONENT functioning as the assertion for the major claim	• I am for animal training in some ways and against it in other ways, for example, if animals are trained to dispose of their droppings in a certain place, that is alright by me, but if animals are to attack people and perform circus stunts then that is what I consider cruelty.

Table 5

justification of claim[2]- data structures (semantic characteristics)	Semantic structure in terms of Base Grammar categories (uppercase)	Examples
• a fact (s) or value (s) which provides support or grounds for the claim. i) Facts are assertions which are known to be certainly true (i.e., events which have occured or states that exist)or which are generally accepted as being true.	1) COMPONENT with a positive (default) or NEGATIVE TRUTH.VALUE, is linked by a REASON.CONDITION.REL to the assertion COMPONENT	• Training animals is a good idea because it benefits both parties. • Animals should be trained because they can help people. • The only time I think it's good to train is for the blind and for at home at least you know that it's going to a good cause. • I don't believe in criticizing that use because the blind need these trained animals.
ii) Values are assertions which have a degree of uncertainty associated with their truth value (i.e., subjective, personal judgements, moral claims) and which may or may not be justified within the argumentative text (i.e., is a CLAIM or an ARGUMENT).	2) COMPONENT which is an assertion as described in Base Grammar categories in Tables 1 and 2, linked by a REASON. CONDITION.REL to another assertion COMPONENT	• I think it is wrong to train animals. The spectacle of a bear dancing, for instance, is highly unnatural and even humiliatin - for the animal.

[2] The WARRANT relationship that exists with other elements in an argument structure is one that cannot be defined by the Base Grammar 2.0. Instead, its recognition would depend upon a lexical analysis i.e., the relationship between the generic or rule of thumb (e.g. all/most/some/generally) and the specific case (claim/data).

Table 6

justification of claim - support for data (semantic characteristics)	Semantic structure in terms of Base Grammar 2.0 categories (uppercase)	Examples
• information that provides backing or support for the data by way of specific examples or instances as well as authorities on or sources of data.	1) a COMPONENT linked either by an EXEMPLIFICATION.REL,or a SPECIFICATION.REL to the COMPONENT functioning as the data structure	• Animals have many advantages when trained. Animals can help other people such as the blind. Training the animal can help it distinguish between good and bad.
	2) a COMPONENT linked by a POSITIVE.CONDITION.REL to the COMPONENT functioning as the data structure	• Animal training, according to Vicki Hearne (in her book *Adam's Task*) is like good pedagogy.
	3) local POSITIVE.CONDITION on the COMPONENT functioning as the data structure	• To be against animal training, in her view, is to be against the very notion of civilization.

Table 7

opposition to argument (semantic characteristics)	Semantic structure in terms of Base Grammar 2.0 categories (uppercase)	Examples
• An assertion or argument that opposes or challenges the claim in an argument.	1) COMPONENT linked by a NEGATIVE. CONDITION.REL to a COMPONENT functioning as the assertion of a claim structure	• I think it is alright to train animals unless they are treated cruelly. • However, the human purpose behind animal training and use is not always laudable.
• Reservation: limits the universal applicability of a claim by specifying the conditions or circumstances under which the general claim would not apply.	2) COMPONENT linked by a ADVERSATIVE.CONDITION.REL[3] to a COMPONENT functioning as the assertion of a claim structure	• Toilet training them is not bad but training them to do tricks for the circus .... should not be allowed.... • My conclusion is that I am not for training naturally wild animals like a tiger or an elephant, but in the case of a dog or cat I think it is OK. • So when it is necessary you should train them and when not you should not.
• Countered Rebuttal: acknowledgement of potential rebuttal and a refutation of its limiting effect on the range of the claim's applicability.	1) COMPONENT functioning as the potential rebuttal is linked by an ADVERSATIVE.CONDITION.REL[4] to the COMPONENT functioning as the counter or response to the rebuttal[5]	• Even if a thousand monkeys die to save one human life it is still worth it. • To be sure, punishment is used in most kinds of animal training, and punishment is bound to hurt, to be at least somewhat cruel. However, physical reward and punishment are two of the few ways we have to communicate with animals,...

[3] ADVERSATIVE.CONDITION.RELs that represent reservation structures are of the contrastive type and are marked by conjunctions such as *on the other hand.*, *however*, and *but.*

[4]ADVERSATIVE.CONDITION.RELs that represent countered rebuttal structures are of the concessive and denied implication type and are marked by conjunctions such as *even if, although, however*, and *but.*

[5] The component functioning as the counter or response to the potential rebuttal also serves as a subclaim, justification, or repeat of a major claim in an argument structure.

Appendix F

Correspondences Between Linguistic Devices (Hallliday,1985)
And Semantic Relations Defining An Argument Structure

semantic relation in argument structure	type of expansion (logico-semantic modification)	conjunctive device between clause complex	conjunctive device within clause complex
CONSTRAINT.REL	1) enhancement - causal-conditional condition: positive		if...then, if as long as
JUSTIFICATION.REL	1) enhancement - causal-conditional cause: reason	Therefore For this reason,	because, so for, since
BACKING.REL	1) elaboration - exemplification	For example, for instance Thus,	
RESERVATION.REL	1) enhancement - causal-conditional condition: negative	Otherwise,	otherwise, unless except if, when but not if
	2) extension - adversative	On the other hand, However,	but
POTENTIAL REBUTTAL.REL	1) enhancement - causal-conditional condition: concessive	Nevertheless	despite, yet even though, if, although
RESPONSE TO REBUTTAL.REL	1) extension - adversative	However,	but