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ABSTRACT

The representation and classification of the structure of natural arguments has been one of the most important aspects of Aristotelian and medieval dialectical and rhetorical theories. This traditional approach is represented nowadays in models of argumentation schemes. The purpose of this article is to show how arguments are characterized by a complex combination of two levels of abstraction, namely, semantic relations and types of reasoning, and to provide an effective and comprehensive classification system for this matrix of semantic and quasilogical connections. To this purpose, we propose a dichotomous criterion of classification, transcending both levels of abstraction and representing not what an argument is but how it is understood and interpreted. The schemes are grouped according to an end-means criterion, which is strictly bound to the ontological structure of the conclusion and the premises. On this view, a scheme can be selected according to the intended or reconstructed purpose of an argument and the possible strategies that can be used to achieve it.

KEYWORDS: argumentation, classification, types of reasoning, interpretation, textual analysis, pragmatics, argumentation schemes

Argumentation schemes have become an important topic in argumentation theory. Schemes have been developed as stereotypical patterns of inference, abstract structures representing the material (semantic) relation and logical relation between the premises and a conclusion in an argument. They are based on a richer semantic system than the formal representations used in logic, and for this reason they can mirror both necessary

and defeasible relations between concepts. They can be regarded as the modern interpretation and reconsideration of the ancient *loci*, that is, maxims of inference (Walton, Reed, and Macagno 2008; Rigotti 2009). Thanks to their explanatory and analytical effectiveness the schemes have been applied to different fields, ranging from education to law and artificial intelligence.

Many authors in the last fifty years have proposed different sets and classifications of schemes, trying to provide exhaustive lists from which more generic categories grouping different types of argument patterns can be abstracted.[1] By contrast, Frans van Eemeren and Rob Grootendorst (2004) have proposed a top-down approach, distinguishing three generic types of schemes, under which different subtypes can be classified. All these theories concerning argumentation schemes raise crucial problems concerning the criteria used for the distinctions and abstractions made, which ultimately are mirrored in the fundamental issue of what the structure and nature of an argumentation scheme is. These apparently purely philosophical questions are becoming increasingly important for practical purposes. How can we teach, use, and implement the schemes if there is not a commonly accepted set of criteria for distinguishing between them?

The purpose of this article is to tackle the problem of classifying the schemes, starting from the analysis of their nature and structure. We identify the different components of natural patterns of arguments, paying particular attention to the quasilogical and the semantic levels. We draw on our description of natural arguments to show the shortcomings of the existing classifications and to propose a new model aimed at providing a dichotomous system based on the pragmatic purpose of an argument, considered as a move (speech act) in a dialogue.

CLASSIFYING THE SCHEMES

Arguments are reasons given to support a conclusion that is potentially controversial or less acceptable or accepted than the premises (Aristotle, *Topics* 100a25–26; 104b1–18). They are based on *endoxa*, that is, commonly accepted propositions (such as "man is a rational animal") and principles of inference that can be absolutely valid (such as "what the definition is said of, the *definiendum* is said of as well") or defeasible and commonly shared (such as "what experts say within their field of expertise should be considered as true"). Argumentation schemes represent the formalization of the most commonly used principles of argumentative inferences,

combining material links (relations between concepts) with different types of reasoning, or, as Aristotle put it, "species of dialectical arguments," such as induction and deduction(*Topics* 150a11). This representation of natural arguments is extremely useful for both producing and analyzing arguments, as it provides criteria for constructing arguments and counterarguments and assessing their strength. For these reasons, the interest in the practical applications of argumentation schemes is growing in different fields, including education, law, and computing. Schemes can be used as instruments of textual analysis, allowing one to reconstruct the structure of an argumentative text (which can be a legal document, a medical conversation, or a political speech), and evaluate the reasonableness and the force of the arguments used. The use of the schemes crucially depends on the principles used to differentiate them, which in turn constitute the criteria for choosing them.

Schemes and Their Implementation

Schemes are increasingly being recognized, applied and studied in computational domains like artificial intelligence and multiagent systems, and are being used to improve the reasoning capabilities of artificial agents. Schemes are being incorporated into software tools for argument mapping, such as Araucaria and Carneades.[2] A technology for argument mining of legal texts drawing on a corpus of legal arguments from texts of the European Court of Human Rights has opened opportunities for applying artificial intelligence to text mining in a way that could be used to identify and collect arguments of known types, like argument from expert opinion.[3] The practical usefulness of an automated tool that could search through legal databases and pick out all the arguments of a certain type is not hard to imagine. Such a tool could be enhanced by argument visualization tools (Reed, Walton, and Macagno 2007) that could be applied to argumentative texts, yielding analyses of arguments that would display schemes in the structure.

In education the interest in argumentation and the patterns for representing natural arguments is growing.[4] The argumentation schemes illustrated in *Argumentation Schemes for Presumptive Reasoning* (Walton 1996) and *Argumentation Schemes* (Walton, Reed, and Macagno 2008) have been applied to science education in an effort to improve the quality of students' arguments, retrieve the implicit premises of those arguments, and assess and rebut their reasoning in a systematic fashion.[5]

However, a crucial problem arising out of the use of schemes in education is their differentiation.[6] Students often fail to understand the differences between various types of arguments, and recent developments in education tend to conflate the schemes instead of providing criteria for classifying or distinguishing between them (Kim, Anthony, and Blades 2012).

It appears from the current implementations of these theoretical instruments that one of the crucial issues on which their future practical development depends is their classification. For all the possible future uses of schemes, from education to computing, from textual interpretation to legal analyses, clear and effective criteria for distinguishing one scheme from another or a class of schemes from another are needed.

Schemes and Classifications

In argumentation theory different models of argumentation schemes have been advanced, together with their own specific classification criteria. The theories of argumentation (or argument) schemes face a twofold challenge. On the one hand, the schemes need to represent the patterns of arguments that are commonly used in ordinary conversation and in different contexts in order to provide criteria for describing and evaluating them. For this reason, schemes need to be specific enough to highlight the different grounds on which a conclusion can be drawn from the premises. This was the goal of the proposal put forward in *Argumentation Schemes* (Walton, Reed, and Macagno 2008), in which more than sixty schemes were analyzed. However, using a large number of schemes leads to the risk of developing a theoretical model that is hard to use, for both the purposes of identifying and assessing the structure of natural arguments and for finding and producing complete and strong arguments. The balance between specificity and effectiveness in a theory of argumentation schemes can be achieved by providing criteria of classification, allowing one to identify the most adequate scheme by proceeding from few generic classes to the most specific ones, until the pattern is identified. Three theories are particularly relevant for understanding the principles that have been applied for distinguishing and classifying arguments in categories: Arthur Hastings's theory, Manfred Kienpointner's approach, and the pragma-dialectical account.

Hastings improves Toulmin's argumentation model by distinguishing different types of warrants and grouping them in three categories based on the material link between premises and conclusion. The first class includes reasoning based on verbal and semantic relations, the second one schemes

grounded on causal connections, and the third one arguments that support either verbal or causal conclusions. Hastings's classification (1963, 139) is given in table 1.

Kienpointner in *Alltagslogik* provides a different method for classifying his sixty context-independent argument schemes. He divides them in three main groups according to their relation with a rule or generalization (*endoxon*). Argument schemes may be based on rules taken for granted, they may establish new rules by means of induction, or they may illustrate or use new rules by means of examples, analogy, or authority. Kienpointner then differentiates rule-based arguments based on their material relation (classification, comparison, opposition, or causality) and distinguishes the descriptive and normative variants and the distinct logical forms of all schemes (modus ponens, modus tollens, disjunctive syllogism, etc.). The classification is represented in table 2 (Kienpointner 1992, 246).

It can be seen that in this classification the schemes are first distinguished according to an extremely generic principle (inductive vs. deductive or other types of reasoning) and that then such categories are specified further in terms of material relations.

The pragma-dialectical system of classification of schemes is based on three main types (van Eemeren and Grootendorst 1992, 94–102).[7] The first

Verbal reasoning	Causal reasoning	Verbal or causal reasoning
1. Argument from Example 2. Argument from Criteria to a Verbal Classification 3. Argument from Definition	4. Argument from Sign 5. Argument from Cause 6. Argument from Circumstantial Evidence	7. Argument from Comparison 8. Argument from Analogy 9. Argument from Testimony

TABLE 1. Hastings Classification of Schemes

Argument schemes using rules				Argument schemes establishing rules	Argument schemes using or establishing rules
Classification Schemes	*Comparison Schemes*	*Opposition Schemes*	*Causal Schemes*		
a) Definition b) Genus-species c) Whole-Part	a) Similarity b) Resemblance c) Difference d) *A maiore* e) *A minore*	a) Contradictory b) Contrary c) Relative d) Incompatible	a) Cause b) Effect c) Reasons d) Consequence e) Means f) End	Inductive argumentation from example	1. Illustrative argumentation from example 2. Argumentation from analogy 3. Argumentation from authority

TABLE 2. Kienpointner's Classification of Schemes

one, called "symptomatic argumentation," represents type of argumentation in which the speaker tries to convince his interlocutor "by pointing out that something is symptomatic of something else," meaning that what is stated in the argument is concomitant with what is stated in the standpoint, as the former is a sign or symptom of the latter. The second scheme is based on similarities, on an analogy between what is stated in the argument and what is stated in the standpoint. Finally, the third type of argumentation scheme is the instrumental one, in which the argument and the conclusion are linked by a relation of causality. No formal model or necessary conditions of the notion of causality is offered to support the account given of the structure of this scheme. For this reason, the scope of its applicability to cases appears to be quite broad, depending on what notion of causality is intended. These three schemes are the generic categories under which other arguments are classified (van Eemeren and Grootendorst 1992, 97). For instance, arguments based on inherent qualities or a characteristic part of an entity or from authority are regarded as belonging to the relations of concomitance (symptomatic), while arguments pointing out the consequences of an action or based on the means-end relationship are considered as subclasses of causal arguments. The classification criteria for these schemes correspond to the ways the standpoint is defended and to the critical questions associated with each argument pattern (Garssen 2001, 91). For instance, in symptomatic argumentation the premise points out a characteristic of what is mentioned in the standpoint that is presented as typical thereof. In analogical arguments the similarities between what is already accepted (expressed in the premises) and what is potentially controversial (what is stated in the conclusion) are brought to light. In causal argumentation an event mentioned in the premise is presented as the cause of what is mentioned in the standpoint. This system of classification is grounded on three categories that represent respectively a material relation (causal arguments), a specific type of reasoning (analogy), and a class of arguments, symptomatic arguments, which includes mostly abductive arguments but also other patterns based on effect-cause or concomitance relations.

These various classification systems are based on distinct criteria and lay out different categories of schemes. One of the crucial characteristics of argumentation schemes that these models of classification identify is the distinction between material relations (classification, causality) and types of reasoning (induction, abduction). In the following sections we analyze in detail these two levels characterizing the schemes, which can be taken into consideration in order to elaborate new criteria for dividing up the

argumentation patterns. The goal is to propose a model aimed at meeting both the needs of *specificity* and *effectiveness*. In particular, this ideal model would be based on dichotomies. In this fashion the analyst could both reason from similarities (comparing the existing argument with patterns of arguments) and from alternatives (by excluding the most inadequate choice). Moreover, for the purpose of finding and producing arguments, a system of classification needs to proceed from the speaker's communicative intentions, which can be further specified by taking into account the means to achieve them.

TYPES OF ARGUMENT AND TYPES OF REASONING

In the dialectical tradition, general topics represent abstract patterns of inference based on the semantical-ontological structure of language (such as *loci* from definition, opposition, etc.) and the structure of reality (causes and consequences). Cicero, however, distinguishes some *loci* in this category that, on his view, are principally used by dialecticians. Such topics, named *loci* from antecedents, consequents, and incompatibles, represent patterns of reasoning based only on the meaning of the connector of the hypothetical premise (if . . . then). For instance, if such a premise holds and the antecedent is affirmed, the consequent follows necessarily (topic from antecedents) (Cicero, *Topica* 53:1–25). These *loci* seem to be aimed at establishing commitments based on past commitments. In other words, instead of increasing the audience's acceptability of a viewpoint based on the presumed acceptability of the content of the premises in a rhetorical situation, such topics elicit the opponent's acceptance of a conclusion in a dialectical setting. They can be regarded as rules of commitment. In the twelfth century, the notion of forms of inference was developed into a reduction of all topical inferences to syllogisms. In the thirteenth century, categorical syllogisms were analyzed as proceeding from topics from the whole to the part, called *dici de omni* and *dici de nullo*. These topics were grounded not in the meaning of the propositions, but only on the quantifiers: every A is B; every B is C; therefore, every A is C (Green-Pedersen 1984, 256).

This ancient treatment of the topics and the so-called consequences can shed some light on the relation between natural arguments, classes of generic maxim propositions (*loci*), and formal patterns of argument. Formal patterns of argument are characterized by a very abstract ontology, which takes into account only the meaning of few expressions such as quantifiers or connectors. The maxims, on the other hand, are grounded on a much richer ontology, which takes into account a wide range of commonly accepted

connections between concepts and events, such as causal or definitional relations. These classifications and formalizations can be regarded as levels of abstraction, gathering under more generic principles different but somehow similar arguments, which can be necessarily or defeasibly valid. In particular, the rules governing the different types of syllogism (such as modus ponens) constitute the highest level of abstraction. Searle puts it very clearly (2001, 19):

> It would be more accurate to say that the rule of *modus ponens* gets its validity from the fact that it expresses a pattern of an infinite number of inferences that are independently valid. The actual argument does not get its validity from any external source: if it is valid, it can be valid only because the premises entail the conclusion. Because the meanings of the words themselves are sufficient to guarantee the validity of the inference, we can formalize a pattern that describes an infinite number of such inferences. But the inference does not derive its validity from the pattern. The so-called rule of *modus ponens* is just a statement of a pattern of an infinite number of such independently valid inferences.

However, if we analyze the structure of many arguments that are normally considered to be acceptable and reasonable, we will see that abstract rules different from the ones of deduction apply (Blair 2007). Reasoning from example or from sign, for instance, cannot be analyzed using deductive rules of inference such as modus ponens or modus tollens (Godden 2005).

The first hint of the possibility of having different high-level types of argument pattern can be found in Aristotle. In the *Rhetoric* (1357b12–23), he distinguishes between argument from example and enthymeme, showing a correspondence between the former and induction and between the latter and deduction. Moreover, he underscores a crucial difference in reasoning from signs, differentiating between proper (or infallible) signs and improper (or defeasible) ones. Aristotle advocates the view that that only proper signs can be put in a syllogistic form, while examples need to be analyzed as forms of induction, and an improper sign cannot be traced back to either type of reasoning. It represents a form of reasoning called by Peirce "abduction," indicating a type of reasoning stemming from a major premise, which we can represent as $p \rightarrow q$, and a minor premise q, which represents the consequent of the conditional. It is a kind of syllogism in which the conclusion and the minor premise are switched, which is also called retroduction or reasoning from best explanation.[8] Building on the Aristotelian account, we can

Type of reasoning (abstraction II)	Deductive axioms	Induction	Abduction
Type of argument (abstraction I)	Argument from definition, genus...	Argument from example	Argument from (improper) signs
	Argument from cause to effect	...	...
	Argument from expert opinion		
	...		

TABLE 3. Types of Argument and Types of Reasoning

distinguish the level of the *type of argument*, that is, a common pattern of premises supporting a conclusion based on a specific semantic (or topical or material) relation (that we call abstraction 1), from the level of the *type of reasoning*, or rather the kinds of "logical" reasoning and their axioms (which we call abstraction 2). We represent the two levels of abstraction of the topics in table 3.

This classification, however, can cause several problems. The Latin and medieval account of *loci* is not focused on the relationship between the first and the second level of abstraction but only on the characteristics of classes of argument distinguished by some generic common features. Modern theories of argumentation schemes inherited this combination of levels of abstraction in defining the types of argument. While this criterion can be extremely helpful for rapidly identifying common characteristics in arguments that are frequently used, it can lead to problems when it comes to classifying the schemes or evaluating them. In order to contribute to the classification process, in the following sections we try to show how the relations between the two levels of abstraction are extremely complex and how they relate to each other.

IMPERFECT BRIDGES

The distinction between the two levels of abstraction can be helpful for understanding the structure of argumentation schemes. As we have noted, argumentation schemes can be considered representations of common inferences, providing an abstract pattern that shows the material (or semantic) link between the concepts used in the premise and the conclusion and the prototypical (most common) rule of reasoning on which the inference is based. Consider for instance, the following scheme, the argument from cause to effect (Walton, Reed, and Macagno 2008, 168):

Major premise	Generally, if A occurs, then B will (might) occur.
Minor premise	In this case, A occurs (might occur).
Conclusion	Therefore in this case, B will (might) occur.

TABLE 4. Argumentation Scheme 1

This scheme proceeds from a generic relation (more specifically a causal one) between two events. This argument structure, as it is presented, can be classified at a second level of abstraction as defeasibly deductive and in particular as a scheme based on defeasible modus ponens. On this view, the semantic (topical), first-level relation is combined with a specific logical, second-level one. However, not only do argumentation schemes provide a generic major premise (the *maxima propositio*, or topic) from which a conclusion can be drawn, but they specify the (second-level) rule representing the passage from the premises to the conclusion. The aforementioned combination between the first and the second level of abstraction can only mirror one of the possible ways in which the conclusion is drawn from the major premise. The actual relationship is much more complex.

For instance, different arguments based on the classic Aristotelian causal link between "having fever" and "breathing fast" can be found:

1. He had fever. (*Fever* causes breathing fast). Therefore, he (must have) breathed fast.
2. He did not breathe fast. (Fever causes *breathing fast*). Therefore, he had no fever.
3. He is breathing fast. (*Only* fever causes breathing fast). Therefore, he has fever.
4. He is breathing fast. (Fever causes *breathing fast*). Therefore, he might have fever.
5. He has no fever. (*Fever* causes breathing fast). Therefore, he may be not breathing fast.

These cases illustrate five different ways to draw a conclusion from a causal principle, or rather causal major premise in a scheme. In (1) the rule of defeasible modus ponens applies, while in (2) the logical pattern is the defeasible modus tollens. In (3) the causal principle is different, as the sufficient and the necessary conditions are inverted; for this reason the affirmation of the consequent can be reconstructed as a modus ponens. In (4), however, the conclusion

is drawn from the same causal principle by affirming the consequent. This type of reasoning, which leads to the possibility that the state of affairs represented in the conclusion may be true, is commonly referred to as abductive (or retroductive) reasoning (Peirce 1992, 140–41). The last argument (5) can be rephrased by contraposition as "Not breathing fast is caused by having no fever," and the conclusion would follow abductively (it would be a kind of negative abduction).

There are types of argument in which the semantic (material) relation is left implicit, and it does not need to be reconstructed in order to provide the complete logical structure of the argument. While in the arguments we have just considered the major premise is simply tacit, in inductive and analogical reasoning it is implicit, as it is reconstructed a posteriori. In the first case, the maxim proposition (or the causal principle in this case) can be drawn by example, or rather by an operation inductive in nature (the Aristotelian reasoning from example; see *Rhetoric* 1357a14–16). For instance, it is possible to reason as follows: "You may have fever. When I had fever, *I* was breathing fast, and you are breathing fast." Here the causal principle is implicit, inductively abstracted from the specific past case and then applied to the case at issue. Similarly, the same causal maxim can also be implicit in analogical reasoning, which can be considered as a form of reasoning, distinct from induction and deduction, consisting in abstracting a generic category or relation from two similar cases.[9] An example of an analogy-based causal argument would be "You may have fever. When cows have fever, they breathe fast, and you are breathing fast." In this argument, the semantic causal relation is drawn analogically from two similar cases (the fast breathing of cows and human beings).

Other crucial argumentation schemes can be analyzed according to the distinction between the semantical-ontological ground and the type of reasoning. For instance, a similar analysis can also be applied to schemes grounded on the material relation (which can be considered from cause) between the quality of the source (expertise or authority) and the quality of his or her statement (acceptability). A different, more complex analysis needs to be made for the argument from verbal classification, which has been represented as follows (Walton, Reed, and Macagno 2008, 319):

Major premise	If some particular thing *a* can be classified as falling under verbal category *C*, then *a* has property *F* (in virtue of such a classification).
Minor premise	*a* can be classified as falling under verbal category *C*.
Conclusion	*a* has property *F*.

TABLE 5. Argumentation Scheme 2

Classification broadly understood as the use of a particular word to denote a fragment of reality (Walton and Macagno 2010) can be based on different definitional or quasidefinitional material relations, which hide deeper forms of reasoning. The convertibility of the *definiens* and *definiendum* is a semantic (or rather metasemantic) relation, and for this reason it depends on the nature of the specific definition. Victorinus in his *Liber de definitionibus* listed several types of different definitions, of which the most important ones are the essential definition, the definition by parts, etymology, description, illustration, and metaphor. Some of these definitions (by genus difference, essential property, or etymology) establish a two-way relationship, while others (such as definition by parts) only a univocal one (Macagno and Walton 2014, chap. 3). Metaphorical definitions express an analogy between two different entities (Macagno and Walton 2009, 173), while definitions by illustration provide an example from which it is possible to attribute the classification inductively.

Some argumentation schemes do not feature only one step of reasoning but instead involve a chain of argumentation and for this reason are complex. The most representative category of complex schemes is that for the argument from consequences (if a state of affairs is good/bad, it should/should not be brought about), which is based on the relationship between classification of an entity as good or bad according to some values (argument from classification) and the relationship between value judgment and action (argument from values, based on the premise that if a value V is good/bad, the agent is committed to goal G).[10] Emotional arguments are variants of this complex pattern, where an emotion (fear or pity, or rather compassion) supports an argumentative passage from evaluation to commitment.

Analysis of the most common pattern of arguments shows how arguments can be grounded on different types of topical relations and can be characterized by different logical patterns. Argumentation schemes are imperfect abstractions, possible bridges between the first and the second level of abstraction. The two levels do not match, as conclusions can be drawn deductively, abductively, inductively, or analogically from the same semantic link. Argumentation schemes provide the generic and abstract pattern of the *prototypical* causal or classificatory, inductive, or analogical arguments, without considering that arguments from classification can proceed abductively, and reasoning from example can be used to classify an entity or support the reliability of a claim based on its source's expertise. There can be various combinations between semantic relations, types of reasoning, and rules of inference (such as modus ponens, modus tollens, positive and negative abduction), which are not accounted for by an approach

aimed at classifying schemes according to either purely semantic or logical criteria. By drawing the distinction between the two levels of abstraction, it is possible to analyze them separately and classify the schemes showing the possible interrelations between the semantic relations and logical rules.

CLASSIFYING THE SCHEMES

Argumentation schemes can be characterized by various semantic (or topical) relations, and the conclusion can follow from the premises in virtue of distinct types of reasoning (abductive, deductive, inductive) and logical rules of inference. The combinations between these levels result in a variety of possible schemes similar in content or logical form. Moreover, some schemes are characterized by a structure involving the combination of two or more schemes. How should we classify this variety of argument patterns? As we have suggested, a system of classification based on dichotomies could be extremely effective, especially in cases of uncertainty. The crucial problem is to identify the criteria that can be used to articulate the schemes in alternatives.

A classification based on the semantic link can provide an instrument for understanding why the premise can support the conclusion. However, the semantic link can be the same for arguments aimed at different types of conclusions or the same type of conclusion can be supported by different semantic relations. For instance, causal relations can constitute the core of practical arguments, and at the same time arguments from sign (and not only the ones based on definition) can be aimed at classifying an entity. A classification based uniquely on the semantic content would blur these fundamental differences. For this reason the ontological (semantic) criterion needs to be integrated within a more generic pattern, which we call end-means, that is, a system based on the purpose of an argumentative move and the possible means that are or can be used to achieve it.

Argumentation Schemes and Argument Purposes

Schemes can be considered instruments for both interpreting a dialogical move and the reasoning underlying it, as well as for building arguments and discourse moves. For this reason, a system of classification that starts from the communicative purpose of an argument could be extremely effective for bringing to light the most basic distinctions. From the point of view of the reconstruction and interpretation of a move, the analysis of an inference

presupposes a previous understanding of both the structure of the scheme and the purpose (and, therefore, the "pragmatic" meaning) of the argument and the components thereof.[11] For example, an argument can be aimed at classifying a state of affairs, support the existence of a state of affairs, provide reasons in favor of a value judgment, or influence a decision-making process.

This generic principle can be used for drawing a first distinction between the types of argumentation schemes. The purpose of an argumentation move limits and defines the possible types of argument that can be used to achieve it. As a matter of fact, not all the semantic (material) relations that are at the basis of the schemes can support all the possible conclusions or purposes of an argument. For instance, definitional schemes are aimed at supporting the classification of an entity or state of affairs, and for this reason they are unlikely to lead to the prediction or retrodiction of an event. Similarly, reasoning from consequences can be used to establish the desirability of a course of action but cannot lead reasonably to the truth or falsity (or acceptability) of a proposition. On this perspective, the analysis of the pragmatic meaning of an argument provides a criterion for restricting the possible choices. However, the idea of argument purpose is ambiguous, as it can refer to the goal of the discourse move to be analyzed (the "meaning" of one's speech act) or the goal that the speaker wants to achieve by means of an argument. If we adopt the view of the speaker as a producer of arguments, we need to find the possible alternatives the speaker can choose between in order to achieve his or her goal. For this reason, the generic communicative purpose can place before the speaker different means to achieve it. The criterion of classification thus becomes an inter-relation between the pragmatic goal of an argument and the means used.

The second differentiation concerns the strategies directly connected with the purpose of the move. As mentioned before, the first distinction is a pragmatic one, which depends on most generic nature of the subject matter, that is, a course of action or a state of affairs. This alternative leads to a first choice of the instruments that the speaker can avail himself of.

When the goal is to establish the desirability of performing a certain action, the speaker can support his or her conclusion internally by evaluating its consequences or the means to achieve a certain goal. In the first case, a course of action can be judged as desirable or undesirable because of the positive or negative effects that can result from it. In the second case, the reasoning proceeds from the goal to the possible productive or necessary means to bring it about (Von Wright 1963, 161). The external patterns

of argument can support courses of action in two ways. On the one hand, the authority can correspond to the (social) role of the source needed for recommending or imposing a choice ("You shall do it because I told you to!"). On the other hand, a course of action can be pursued based on popular practice ("We should buy a bigger car. Everyone drives big cars here!").

When the purpose is to support a judgment on a state of affairs, the speaker is also faced with the same alternative, that is, the choice between external and internal arguments. In the first case, unlike with arguments used to make a decision, the relevant quality of the source is not the authority of the speaker or of a group of people (which is connected with the consequences of not complying with orders/conforming to common behavioral expectations) but their superior knowledge. This group of arguments includes schemes from expert opinion, popular opinion, and the position to know. The quality of the source can be also used for "destructive" purposes to undercut an argument (ad hominem arguments) and show that a source is not reliable for information, and therefore the conclusion itself should be considered doubtful. The arguments used to provide internal grounds for a judgment on a state of affairs can be divided according to the nature of the predicate that is to be attributed. The most basic differentiation can be traced between the arguments used (1) to support a (factual or evaluative) judgment on an entity or a state of affairs or (2) to establish the existence of a state of affairs (the occurrence of an event or the existence of an entity in the present, past, or future).

In (1), the reasoning can be divided in two types. On the one hand, reasoning from classification can be grounded on descriptive (definitional) features, which support the attribution of a categorization (Bob is a man; Tom is a cat). On the other hand, an entity or a state of affairs can be evaluated, namely, a value judgment is attributed. This type of classification is grounded on values, or rather hierarchies of values, and depends not on a shared definition of a concept but rather on what is commonly considered to be "good" or "bad." Also the reasoning underlying the attribution of evaluative predicates, such as "to be a criminal," can be considered as part of this group of arguments. These patterns are based on signs of an internal disposition of character, which in its turn is evaluated. Therefore, this group of classificatory and evaluative arguments includes the schemes from verbal classification, from sign, from composition, and from division.

In (2), the arguments supporting a prediction or a retrodiction can be used either to establish whether a fact or event has occurred, or to predict whether it will occur. When the event is a future one, the speaker needs to

mostly rely on possible cause-effect relations; in knowing certain causes, he or she may draw from them the most likely effects. The reasoning will be different when the speaker intends to support a judgment as to the existence of an entity or the occurrence of an event in the past (retrodiction). He or she will reason from the possible signs, that is, he or she will take into account the possible effects of an event or the existence of an entity and reconstruct the possible efficient or material causes thereof. The distinctions we have outlined can be summarized in the tree represented in figure 1.

In this classification, schemes are grouped according to the interplay between two criteria, the purpose of an argument and the means of achieving it. This model can be used both for analyzing arguments and for producing them. In the first case, the tree represents the possible intentions of the speaker, that is, the communicative goal that his or her move is aimed at accomplishing. The interpretation of his or her intentions starts from the most generic purpose, to make a decision or to advance a judgment on a state of affairs. The possible interpretations are then made more specific, so that the analyst can reconstruct the possible communicative goal by reasoning from alternatives and retrieve the possible argumentation scheme used. In the second case, this system of classification provides alternative strategies, from the more generic to the more specific ones, to achieve a specific communicative purpose. Here the nature of the viewpoint opens up specific argumentative means to support it, which in turn can be determined by the characteristics of the conclusion.

The pragmatic purpose of an argumentative move is strictly bound to the ontological structure of the subject matter of the claim. In other words, the communicative purpose and the strategies used (or to be used) to achieve it can be partially identified by taking into consideration the nature of the viewpoint. The speaker or the analyst can choose the scheme according to the generic goal of the communicative act (to support a decision or to ground a judgment concerning a state of affairs). The speaker's communicative intention can be then further specified by detailing the most generic strategy chosen to provide a basis for the acceptability of the conclusion, whether by pointing out some properties of the subject matter or by appealing to an external source. In the first case, the means used to achieve the goal are again determined by the nature of the subject matter. In particular, the crucial distinction is between the classification and the prediction (retrodiction) of an entity or state of affairs. This distinction leads to a further specification of the nature of the viewpoint that the speaker intends to back with his argument (is the event a future or a past one? is the
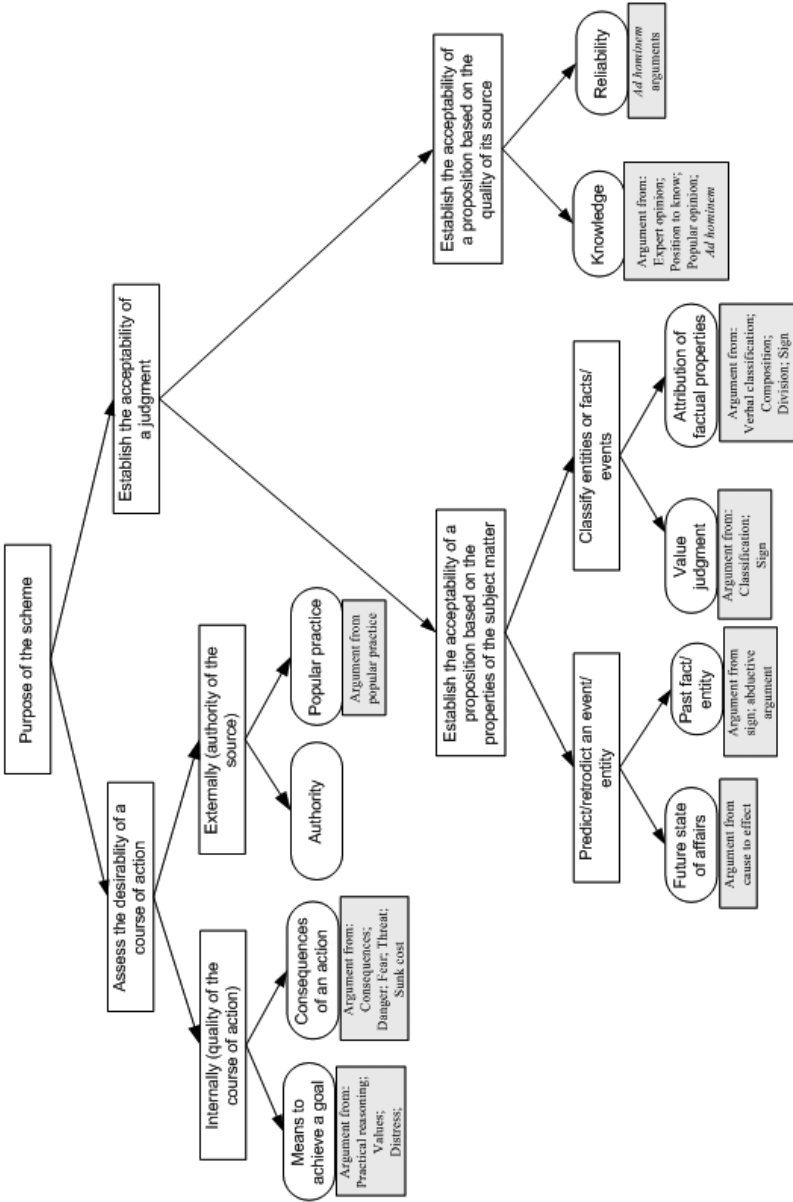
FIG. 1.   An End-Means Classification of Argumentation Schemes

classification a value judgment or does it consist in the attribution of factual properties?), which in turn leads to the specific means that can be used to achieve his or her purpose. In case of decision making, the argumentation schemes are classified according to the same interrelation between the goal and the generic strategies to achieve them. Within the internal arguments, it is possible to distinguish between the decision to support a course of action by taking into account is consequences or the means to achieve it. External arguments are characterized by a lower complexity of the inter-relation between the purpose and the means used to achieve it. In this case, the choice of backing the conclusion by appealing to the opinion of a source can be made more specific by distinguishing between the kinds of sources (experts or the majority of people) and the nature of the support (knowledge or reliability). These generic categories of schemes can serve to group the various argumentation schemes that a speaker might use to back a conclusion or that an analyst might draw on to reconstruct the speaker's intention.

As we have noted, argumentation schemes are imperfect and provide complex bridges between topical relations and logical rules of inference. A more complete picture of these distinctions needs to take into account how argumentation schemes are placed within the matrix between seman-tic and logical relations. To this purpose, the two levels of abstraction need to be further specified and analyzed.

The semantic relation characterizing a scheme can be "shaped" accord-ing to different types of reasoning (understood as the categories belonging to the second level of abstraction). For instance, the desirability of a course of action can be assessed internally by taking into consideration the means for achieving a goal. However, this pattern of reasoning can be stronger or weaker depending on whether there is only one or several alternatives. Depending on the paradigm of the possible means, the reasoning will be deductive or abductive, resulting in a conclusion less or more defeasible. The same principle applies to the other semantic relations, such as causal relations or classification, which can proceed by induction, deduction, abduction, or analogy.

For instance, the desirability of a course of action can be established by considering the consequences or the means to a goal. In the first case, the rea-soning will proceed from the intended positive effect to its productive cause (abduction) or from the undesired effect to the negation of its cause (modus tollens). If the purpose is to assess the means to achieve a goal, the speaker will reason abductively from the effect to the means or deductively in case the

cause is also necessary. External arguments in this case proceed deductively, from an order or a common practice to the action. The acceptability of a judgment on a future action can be supported by a causal relation proceeding deductively, inductively (*x* happened in the past, therefore it can happen in the future), or analogically (*x* happened in a similar situation before). Judgments on the occurrence of past events can backed up by similar deductive, analogical, and inductive (from similar past events) reasoning. The attribution of causal properties and value judgments can be grounded on different types of definition or definitional premises, which can lead to different types of reasoning, as we have mentioned. Last, arguments based on a knowledgeable source can proceed deductively (if an expert says that *x* is true, *x* is true; expert *x* says that *x* is true; therefore *x* is true), inductively (what *x* said in the past was true, so what he says now is true as well), abductively (*x* said that *p* was true, and it was true; therefore, he is an expert) or analogically (this medicine student was right when gave his opinion on my broken bone; therefore, this engineering student is right when he says that the bridge will collapse soon). The arguments aimed at undermining an argument from sources (ad hominem arguments) or aimed at supporting the unacceptability of a judgment based on the quality of the source combine defeasibly deductive patterns (*x* is unreliable; therefore he will not tell the truth) with abductive ones (*x* behaved badly, therefore he should not be trusted). In figure 2 we represent how the different semantic relations can be shaped differently according to the distinct types of reasoning.

This classification of schemes shows a strict interdependence between the ontological-semantic structure of the standpoint, the possible arguments that can be used, and the types of reasoning. The analysis of the possible kinds of definitional propositions illustrates how, depending on the nature of the definition or classificatory premise used, the types of reasoning are different. This relationship is also crucial for causal arguments, or rather arguments that are grounded on a distinct species of causes. By analyzing in detail the semantic link, such as the types of causes, it is possible to better assess the reasonableness of an argument, or rather how it is possible for a given premise to support a conclusion. For instance, by determining the type of causal relations between action and character and character and action it is possible to assess the strength of a value judgment and its defeasibility conditions. In the first case, it is necessary to consider the goal and the occurrences of specific good or bad actions in order to establish the final cause of the agent (which determines his or her disposition to act, or rather character), while in the second case the habit efficiently influences
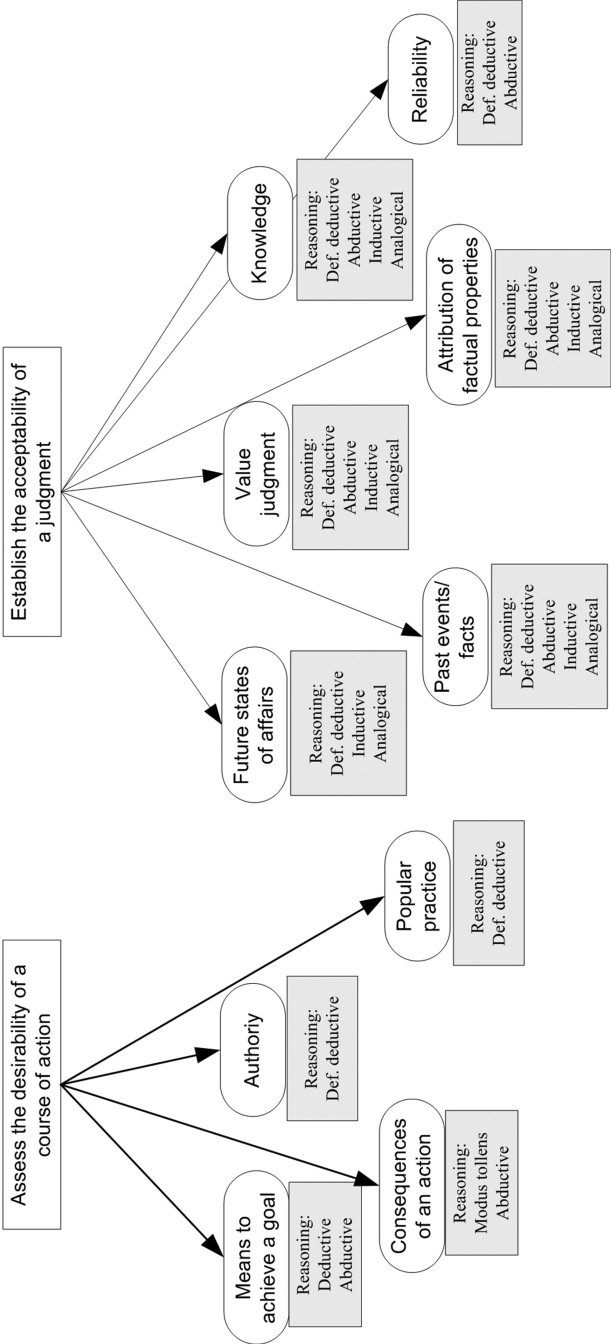
FIG. 2. Types of Reasoning and Semantic Relations

the agent's future actions.[12] This type of analysis can be carried out on the semantic relations on which the predication and retrodiction of events is based. On the one hand, predictions can be made by taking into account causal laws or weaker and defeasible causal generalizations. For instance, a future event can be predicted because its efficient cause has occurred, such as in case of earthquakes. In other cases, such as weather forecasts, the material cause (the presence of clouds) is fundamental. Actions can be predicted also based on the intention of the agent, such as with diplomatic decisions. Clearly causal laws are not the only means we use for drawing predictions on future events. Speakers also draw on weaker forms of relations between events, that is, co-occurrences and "mechanisms" (Elster 1999, chap. 1), which we group under the label of "causal generalizations" that frequently occur. Such relations are only possible explanations of what frequently happens and cannot be considered as causal laws. For instance, we expect a supermarket to be open at a certain hour because it was open at that time previously in the past; we expect an aggressive behavior from a wounded or scared animal, even though other possible responses may be triggered by the same circumstance. On the other hand, the same causal laws and generalizations can support the reconstruction of past events. Evidence of a past event or entity can be found in its effects, which were caused efficiently, materially or teleologically, or in the results of mechanisms and co-occurrences. In figure 3 we represent the possible structure of one of the distinctions set out in the figures 1 and 2. The semantic link is analyzed according to the types of causes or relations.
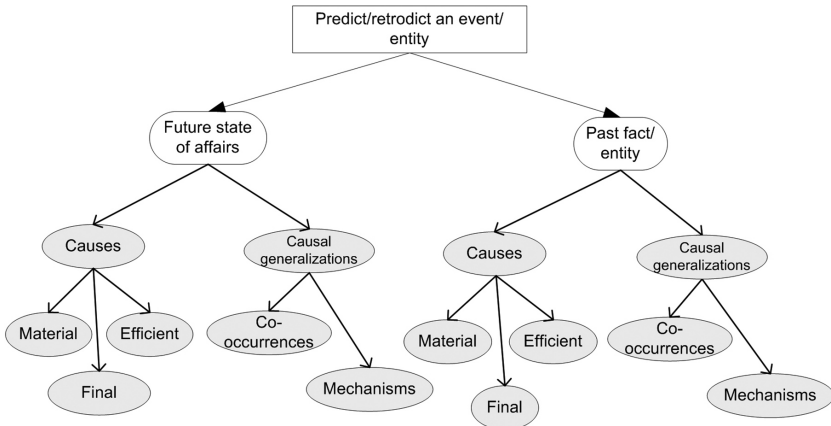

FIG. 3. Semantic Relations and Argument Purposes

To summarize the classificatory system we have proposed, we need to distinguish between the levels of abstraction and the principle of classification. The criterion used to dichotomously organize the argument patterns is based on the communicative goal of an argument and the possible strategies for achieving it. From an analytical perspective, this end-means structure corresponds to the specification of the communicative intention of the speaker, and for this reason it can be considered a detailed analysis of the argument's purpose or its pragmatic meaning. This classificatory criterion is purely communicative (even though it is essentially related to the ontological structure of the conclusion and the premises) and does not overlap with the two levels of abstraction, which are focused on the formal structure and the ontological nature of the arguments. The tree of argument purposes can therefore be further analyzed according to the two levels of abstraction, representing the strength of an argument, or rather the logical connection between premises and conclusion (level of abstraction 2), and its reasonableness, or rather the acceptability of the material relation between premises and conclusion (level of abstraction 1). Generic argument purposes organize the schemes, which in their turn can be examined according to distinct material links (definition, cause, co-occurrence, and so forth) and the different rules of reasoning.

Argumentation Schemes and Argument Reconstruction

As we have noted, the proposed criterion of classification can be used for both producing and analyzing arguments. In particular, in the case of analysis, the classification system represents a specification of the communicative purpose of the argument, which can be used as an instrument for restricting its possible interpretations. On this perspective, a discourse move can be interpreted starting from its most generic goal, namely, whether it is aimed at making a decision or supporting a judgment on a state of affairs. By selecting the alternative means that can be used to achieve the general goal, the possible interpretations of the move are narrowed down until a specific scheme is selected. In this way, the system of classification permits the reconstruction of the specific pragmatic meaning of the move.

The relationship between the purpose of a move, the means used to achieve it, and the interpretation becomes clear if we reconstruct the reasoning underlying the retrieval of the implicit premises in an argument. In order to retrieve what is left unsaid in an argument, it is necessary to understand its communicative goal and, more precisely, the specific

communicative intention of the speaker, which includes both the effect that he or she wants to achieve on the dialogical situation (alter particular commitments of the parties) and instruments that he or she uses to achieve this goal. Consider the following arguments:

1. (A) Our operations do not involve the presence of U.S. ground troops. (B) Our operations are not "hostilities."
2. (A) Bob is violent. (B) He punched his brother.

In these cases, the connectors between the two sequences in both examples express a relation of "motivation" (sequence x expresses a reason to believe sequence y) (Rigotti and Rocci 2006).[13] This relation can be represented by the linguistic connective "therefore" in (1), and "as" in (2), depending on the order between the motivated and the motivating state of affairs. In (1) the purpose of the first sequence (A) is to support the attribution of the predicate "to be hostilities" to "our operations," which corresponds to the goal of determining the acceptability of a proposition. For this reason, the purpose can be presumed to be the classification of a state of affairs. Moreover, (A) supports such a classification by describing the characteristics of the subject of the predication ("our operations"). The purpose of the first sequence can thus be said to provide an internal justification, which in this case is based on a definitional (or more generically classificatory) principle aimed at the attribution of the predicate "to be hostilities" in the second sequence (Kempson 1975, 109–10). Based on the purpose of the conclusion and the premise (A and B), it is possible to reconstruct the material link and retrieve the pattern of argument. We can represent the structure of the argument as shown in figure 4.

The purpose of the conclusion indicates the function of the relation between the two sequences, which is further specified by replacing the variables with the information provided in the first sequence. Similarly, in (2) the purpose of the conclusion (A) is to attribute a quality to the subject. However, in this case the second sequence, motivating the first one, describes a particular action carried out by the subject. For this reason, the specific relation is a sign: (B) provides a possible effect of a stable disposition indicated in (A).

This linguistic and pragmatic account of the purpose (or pragmatic meaning) of a speech act (or dialogue move) allows one to link the patterns of reasoning to their communicative dimension. In this perspective, the meaning of a move corresponds to the purpose of the argument. In turn, the goal of the argument can be used as an instrument for understanding the structure of the argument itself and consequently for reconstructing its

THEREFORE
A is a reason for B

A. (Our operations do not involve the presence of U.S. ground troops).

B. (Our operations are not hostilities).

A is a reason for B.
A is a definition of B.

B. Our operations are not hostilities.

Level 1

A. Our operations do not involve the presence of ground troops.

A is a definitional principle of 'to be hostilities.'

Level 2

'To involve the presence of ground troops' is a definitional principle of 'to be hostilities.'
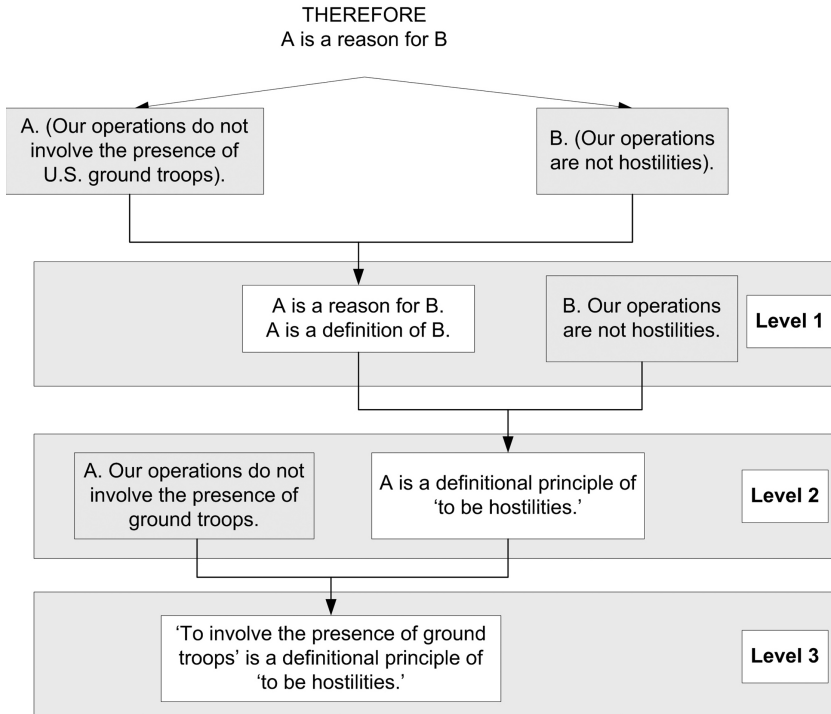
Level 3

FIG. 4. Purpose and Argument Structure

implicit components. For this reason, a classification based on the function of a type of argument is useful for both recognizing the schemes and identifying their patterns. The different categories of conclusions (established according to their generic purpose) are supported by different semantic relations (causal, classification, and so on), and this connection needs to be framed by different logical patterns (defeasible modus ponens, abductive processes, induction, etc.).

CONCLUSION

Argumentation schemes can be regarded as the modern development of an ancient idea. They are the result of a combination of two levels of abstraction, two different ways of looking at the complex reality of natural arguments. Semantic, or topical, relations represent a criterion for classifying the arguments based on the content of their major premise. The types of reasoning take into consideration the form of the argument, how a premise

can support a conclusion based on the relation between the antecedent and consequent, or the quantification of the predicates in the premises and conclusion. These two levels do not overlap, but the possible combinations between them are extremely complex. This general framework raises a crucial question: is it possible to identify a criterion for organizing this complex matrix of semantic and logical connections? Providing an instrument that combines the two levels in a coherent way would make the identification of common structures of reasoning easier and would allow one to evaluate natural arguments based on the rules of the two levels of abstraction.

A possible answer can be found starting from the idea of what an argumentation scheme is. Within the conceptual frame of levels of abstraction, argumentation schemes can be thought of as imperfect bridges between different conceptual levels. They are forms of abstraction, yet the ground from which they abstract is not made of the *possible* arguments but of the *most fundamental* ones for everyday conversational argumentation. For this reason, they mirror prototypical ways of reasoning, and this simplification in the object of inquiry makes them at the same time incomplete abstractions yet extremely useful and effective instruments. How can we combine the effectiveness of prototypes with the specificity and complexity of the combinations between material and logical relations? One possibility is to find a way of organizing them that transcends both levels of abstraction and of representing not what an argument is but why it is used and how it can be understood and interpreted. In this fashion, a classification system can mirror the actual practices of using and reconstructing arguments.

The most generic principle of the classification we have proposed is the purpose of a dialogical move. The fundamental dialogical characteristic of arguments is that they are acts used for a communicative goal, which can be further made more specific by taking into account the possible argumentative strategies that can be used to achieve it. Thus the dialogical purpose consisting in defending a judgment on state of affairs or the desirability of a course of action can be accomplished through internal or external arguments, depending on the decision to take into account the subject matter or not. The classes of arguments that can be used, and especially the internal ones, are strictly related to the ontological structure of the viewpoint that is to be supported. Depending on whether that viewpoint represents a prediction or the attribution of properties to a state of affairs, the argumentative instruments will be different. The ontological structure of the viewpoint excludes certain classes of arguments, narrowing down the possible choices.

This approach results in a tree of possible goals and means, a dichotomous structure that leads the speaker or the analyst to identify the

most suitable argumentation scheme. This tree of goals and means can be combined with the analysis of the semantic and logical levels of abstraction, which can bring to light the criteria for assessing the reasonableness and the strength of a specific argument.

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NOTES

1. See, for example, Hastings 1963, Perelman and Olbrechts-Tyteca 1969, Kienpointner 1992a and 1992b, Walton 1996, Grennan 1997, and Walton, Reed, and Macagno 2008.

2. Araucaria can be downloaded from http://araucaria.computing.dundee.ac.uk/doku.php; Carneades can be downloaded from http://carneades.github.com.

3. See Mochales Palau and Moens 2009 and 2011.

4. See Rapanta, Garcia-Mila, and Gilabert 2013, Kim, Anthony, and Blades 2012, and Song and Ferretti 2013.

5. See Macagno and Konstantinidou 2013.

6. See Nussbaum 2011, Duschl 2008, and Kim, Anthony, and Blades 2012.

7. See also Hitchcock and Wagemans 2011.

8. See Greenland 1998, 545, Poole 1988, and Josephson and Josephson 1996, 15.

9. On analogical reasoning, see Juthe 2005, Macagno and Walton 2009, Macagno 2014, and Macagno and Zavatta 2014.

10. On the argument from values, see Walton, Reed, and Macagno 2008, 321.

11. See the notion of congruity in Rigotti 2005.

12. See Thomas Aquinas, *Summa theologiae* 25, 1a2ae, 71a3; see also 51a2.

13. On connectors, or coherence relations, see Asher and Lascarides 2003, chap. 7.

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