ISSA Proceedings 2002 – Cases: Their Role In Informal Logic

1. Introduction
One aspect of informal logic is the attempt to apply logic to ordinary discourse. When attempting to do this, one needs to (a) recognize/determine that an argument is present and (b) be able to reconstruct the argument from the ordinary discourse. Doing both of these might be possible by inspection, e.g., you look and you know that there is an argument and what the argument is. Indeed, I believe that there are some simple cases or familiar situations in which this occurs. However, it seems equally clear that there are more complex cases in which neither the recognition nor the reconstruction can be accomplished by inspection. A review of texts shows that rules, guidelines, lists of indicators, lists of steps to be followed, flowcharts, and examples are all frequently deployed as techniques to assist the student to achieve the objectives of identification and reconstruction. These complex cases in which these tools are to be utilized are the interesting ones, both theoretically and pedagogically.

What are the situations encountered and how does one make the necessary determinations in these more complicated cases? What I want to do in this paper is to assess the nature of the two tasks listed above, discuss the roles of several of the tools just mentioned – rules and examples, and look at some ways of conceptualizing what is occurring.

2. Characterization of the Tasks and Processes in Informal Logic
The question of whether there is an argument (or arguments) in a passage is an existence question while the problem of what the argument is, if there is one, is an identification question. There are important distinctions between existence and identification questions, but nonetheless these two questions have important commonalities. In both cases the data available are going to be assessed to see if they satisfy the relevant criteria. Consequently, gaining an understanding of these tasks requires an analysis of:
a. the various sorts of criteria to be met;
b. the types of data and their characteristics; and

c. the variety of possible relationships between the evidence and the determination of whether the criteria are met.

2.1 Criteria

The classical conception is that a criterion specifies a set of features that are singly necessary and jointly sufficient. Although an instance must have all of the defining features, it is not precluded from having additional features. However, the defining ones are the only ones relevant to whether the criterion is met. If all of the defining features are present, classification succeeds; otherwise it fails.

There are numerous discussions in the philosophical literature about the difficulty of providing such a specification for all concepts. Alternative types of criteria which might be encountered include: sufficient conditions only; statistical rules; a list of necessary conditions which allows elimination in the absence of one them, but provides no sufficient conditions; guidelines or indicators with no specification of the circumstances under which they work although often relatively common exceptions are pointed out. Concepts for which instances may be characterized in a variety of ways and for which it is not possible to come up with a definition in terms of necessary and sufficient conditions are sometimes referred to as "polymorphic".

The most basic concept in argument identification is that of "argument". There appears to be no general agreement on the exact definition. But, at least among those dealing with rational argument theory, all include giving reasons in support of a claim as a necessary condition. It is at the next level – determining whether this or that should count as giving a reason where the situation becomes complex and the appropriate criteria to utilize less clear. My belief is that all theories of argumentation experience similar lack of clarity when the attempt is made to apply the theory to ordinary discourse.

2.2 The Evidence

The data itself can contribute to the complexity of the situation. A non-exhaustive list of some obvious examples include:

a. the evidence provided by a passage may be subject to multiple interpretations;

b. the evidence provided may underdetermine an answer in the sense that more than one answer may be consistent with the provided information; and

c. there is the possibility of conflicting data.

2.3 The Relationship

In making a determination if the criteria are met one considers reasons for and against. Initial assessments of how strong the reason is will be subject to change. For example, a “since” may initially be taken as a premise indicator. However, once the context makes clear that it is being utilized as a temporal adverb, the initial belief that the “since” indicates a reason both to suppose that there is an inference and that what follows is a candidate for being a premise or premises is rejected. Assessing whether the criteria are met is a both a process and a judgment. Consequently, the assessment can change over time. There are a variety of ways in which initially given reasons either can be eliminated, strengthened, or weakened.

Among the situations under which an assessment might change are:

a. realizing that some of the evidence has been overlooked;

b. altering the emphasis placed on a particular part of the evidence; and

c. reevaluating the relevancy of portions of the passage to determining whether the criteria are satisfied.

The reasoning to determine whether or not there is an argument is in most cases, but not all, not going to be definitive. Consequently, both the possibility of there being evidence not previously taken into account and the possibility of being wrong must be allowed for. It other words the reasoning is non-monotonic and defeasible.

Any system for dealing with argument recognition and identification is going to have to be compatible with these aspects of the situation.

Amongst the tools utilized in informal logic texts to help students achieve the goals of argument identification and reconstruction are rules and instances. I want to examine each of these in turn.

3. Rules

Many of the activities of formal logic are rule-based. Consequently, a number of texts that take informal logic to be elementary applied symbolic logic utilize rule-based procedures as the model. However, it has long since been recognized that a strictly algorithmic approach will not do.

Ordinary language is far too complex for us to be able to write a general argument-recognition program. There is no algorithm, or set of precise instructions, by which a person or machine, presented with an arbitrary body of actual discourse, can mechanically pick out in a finite number of steps just those sequences of sentences that are associated with the appropriate claims and thus constitute arguments. (Blumberg 1976, 21).

But there are other construals of “rules” than as algorithms. However, arguments have been raised against these construals as well. The algorithm option is considering rules as a set of universally applicable syntactic rules that, if applied, would correctly lead to both the determination that an argument is present as well as what the argument is. A second rule-oriented approach is to have ceteris paribus rules – rules that are utilizable other matters being equal. A third rule-oriented approach is to propose guidelines, e.g., a list of indicator words which frequently, but not invariably, indicate that an inference is present. All of these variations of a rule-oriented approach face difficulties.

Govier (1990) argues that rules for the purposes we are considering could not hold with strict universality. This eliminates the first type of rules – algorithms. On the other hand rules of thumb despite being called "rules" are, at best, indicators. They lack the systematicity to be true rules. Rejecting them as rules does not mean they are not useful as their frequent inclusion in informal logic texts attests. The plausible candidate is a rule with a ceteris paribus clause. But then how do we deal with the application of ceteris paribus clauses? The application of such clauses appears to require either an exhaustive listing of the conditions under which the ceteris paribus clauses apply or a set of rules is available to govern their application. The exhaustive listing presupposes knowing all the situations in which the ceteris paribus clauses are applicable – something the inclusion of the clause tacitly acknowledges is not the case. Rules for applying rules raise the specter of infinite regress.
It seems to me that there are yet other possible construals of rules besides those considered by Govier above, e.g., default logic, sets of rules which form heuristics, etc. The arguments against rule-based systems considered above may be correct, but they are working with an impoverished conception of rules. Perhaps a rule-based system can be made to work. Certainly systems such as default logic provide a rule-based way to establish a non-monotonic reasoning system with defeasibility characteristics.
However, there is another alternative to explore.

4. Cases
A second type of entity that regularly occurs in informal logic texts is the individual case or instance – as exercises, examples, or illustrations. Are all individual cases the same? What is the role for individual cases in informal logic? Do individual cases play roles other than as examples, illustrations, and exercises?

First what is the variety of ways in which we consider individual instances? Among the words used to refer to specific cases in English is the following list with definitions culled from *Webster's II New Collegiate Dictionary*:

**case* – <Lat. *casus* p. part of *cadere*> – to fall 1. An instance of the existence or occurrence of something. 3. A set of circumstances: SITUATION. 4. A set of reasons, arguments, or supporting facts offered in justification of a statement action, or situation. (Plus another 7 other possibilities.)

**exemplar* – <Lat. *exemplum*> – example 1. One worthy of imitation: MODEL. 2. A typical example 3. An ideal serving as a pattern: ARCHETYPE. 4. A copy, as of a book.

**example* –< Lat. *exempleum. eximere* – to take out> 1. One representative of a group 2. One serving as a specific kind of pattern <a good example> 3. A case or situation serving as a precedent or model for another one that is similar. 4.a. A punishment given as a warning for others. b. The recipient of such punishment. 5. A problem or exercise that illustrates a method or principle. – for example – Serving as an illustration, model, or instance.

**illustration* – 1. An act of clarifying or explaining or the state of being clarified or explained. 2. Something used to clarify or explain. 3. Visual matter for clarifying or decorating a text. 4. Obs. Illumination.

**model* – <Lat. Modulus –dim.of modus> – measure 1. A small object, usw. built to scale, that represents another, often larger object. 2. A preliminary pattern serving as a plan from which an item not yet constructed will be produced. 3. A tentative description of a theory or system that accounts for all of its known properties. 4. A design or style of an item. 5. An example to be imitated or compared <a model of politeness> 6. The subject for an artist or photographer 7. One whose job is to display clothes or other merchandise.

**pattern* – 1.a. An archetype b. An ideal worthy of imitation 2. A plan, a diagram, or model to be followed in making things. 3. A representative sample: *SPECIMEN* (Plus 7 more definitions)

prototype – <Gk: protos – first + tupos> – model 1. An original type, form, or instance on which later stages are based or judged <the V-1 as a prototype of modern rockets> 2. A typical early example 3. Biol. A primitive or ancestral form or species.

These words and their lexical definitions suggest a number of different functions for individual cases. One function is simply an instantiation qua instantiation – nothing special, but the relevant criteria are satisfied. A second function is as an ideal instantiation – somehow the criteria are especially well satisfied or satisfied in an ideal way without complications. A third view has them functioning as a guide in the consideration of additional cases.

As either mere instantiations or ideal instantiations cases might play several roles. The first view is that the instantiations are merely used to illustrate the theory. A second view is that they are necessary to provide the interpretation of theoretical terms in rule based formal systems. How is the formal system to be interpreted in terms of practice? One way is to use cases where the relevant terms apply. Providing rules for the interpretation of rules only leads to an infinite regress so the utilization of cases is essential. However, when functioning as a guide cases can not only provide cognitive content, but also play a central role in the reasoning process with respect to that subject matter.

What I want to explore is the possibility that a role of instances in informal logic might be to provide a *case-based reasoning system.* "Case-based reasoning is a sequence that proceeds from one (or a series of) preceding case to one similar, subsequent case, and draws a conclusion about the subsequent case, based on, similar, relevant features of the preceding cases. In arguments about precedents, the subsequent case needs to be judged in relation to some existing rule or practice, and the problem is whether it might lead to a new rule, or modification of the existing rule."(Walton 1992, 118)

It has been suggested that some of the characteristics of a domain that indicate that a case-based approach might be suitable include:

1. records of previously solved problems exist;
2. historical cases are viewed as an asset which ought to be preserved;
3. previous cases are frequently cited;
4. specialists talk about their domain by giving examples; and
5. experience, rather in the field or working on exercises, is at least as valuable as theoretical material. (Harrison 1997). On these characteristics it would appear that informal logic might be a viable candidate.

5. Examples of Case-based Reasoning

Instances of case-based reasoning are not unknown. In a number of areas of endeavor case-based reasoning is construed as central: scripts in various social situations; judges reasoning from prior cases and lawyers looking for precedent cases; case studies in MBA programs; casuistry in ethics; and, programs used in artificial intelligence in conjunction with categorization and pattern recognition.

Before characterizing case-based reasoning more fully in the abstract it would be useful to have an example. Any of the examples mentioned above would work, but I am going to examine the role Kuhn has proposed for exemplars in science. Given the controversy that interpreting Kuhn frequently evokes I intend to allow Kuhn to do as much of his own talking as I can by liberal use of quotations.

By exemplar Kuhn means "the concrete puzzle solutions that students encounter from the start of their scientific education, whether in laboratories, on examinations, or at the ends of chapters in scientific texts. To these shared examples should, however, be added at least some of the technical problem-solutions found in the periodical literature that scientists encounter during their post-educational research careers and that also show them by example how their job is to be done." (Kuhn 1996, 187)

"Close historical investigation of a given specialty at a given time discloses a set of recurrent and quasi-standard illustrations of various theories in their conceptual, observational and instrumental applications." (Kuhn 1996, 43)

What is the kind of knowledge resident in exemplars?

"When I speak of knowledge embedded in shared exemplars, I am not referring to a mode of knowing that is less systematic or less analyzable than knowledge embedded in rules, laws, or criteria of identification. Instead I have in mind a manner of knowing which is misconstrued if reconstructed in terms of rules that are first abstracted from exemplars and thereafter function in their stead. Or, to put the point differently, when I speak of acquiring from exemplars the ability to recognize a given situation as like some and unlike others that one has seen before, I am not suggesting a process that is not potentially fully explicable in terms of neuro-cerebral mechanism. Instead I am claiming that the explication will not, by its nature, answer the question, 'Similar with respect to what?' That question is a request for a rule, in this case for the criteria by which particular situations are grouped into similarity sets, and I am arguing that the temptation to seek criteria (or at least a full set) should be resisted in this case. It is not, however, system but a particular sort of system that I am opposing." (Kuhn 1996, 192).

How is the practice of normal science carried out?

"The practice of normal science depends on the ability, acquired from exemplars, to group objects and situations into similarity sets which are primitive in the sense that the grouping is done without an answer to the question, 'Similar with respect to what?' One central aspect of any revolution is, then, that some of the similarity relations change. Objects that were grouped in the same set before are grouped in different ones afterward and vice-versa." (Kuhn 1996, 200).

"Philosophers of science have not ordinarily discussed the problems encountered by a student in laboratories or in science texts, for those are thought to supply only practice in the application of what the student already knows. He cannot, it is said, solve problems at all unless he has first learned the theory and some rules for applying it. Scientific knowledge is embedded in theory and rules; problems are supplied to gain facility in their application. I have tried to argue, however, that this localization of the cognitive content of science is wrong. After the student has done many problems, he may gain only added facility by solving more. But at the start and for some time after, doing problems is learning consequential things about nature. In the absence of such exemplars, the laws and theories he has previously learned would have little empirical content." (Kuhn 1996, 187-188).

"A phenomenon familiar to both students of science and historians of science provides a clue. The former regularly report that they have read through a chapter of their text, understood it perfectly. But nonetheless had difficulty solving a number of the problems at the chapter's end. Ordinarily, also, these difficulties dissolve in the same way. The student discovers, with or without the assistance of his instructor, a way to see his problem as like a problem he has already encountered. Having seen the resemblance, grasped the analogy between the two or more distinct problems, he can interrelate symbols and attach them to nature in the ways that have proven effective before." (Kuhn 1996, 189).

6. Case-based Reasoning In the Abstract

On the basis of the discussion in the artificial intelligence literature there appears to be a broad understanding of the components involved in deploying case-based reasoning.

"It is the job of the case based reasoner to have a library of cases; a method of storing new cases that allows them to be found again when needed; an indexing scheme that reflects processing that has gone on while a case was initially considered; a method of partial matching that allows new cases to be considered in terms of similar ones; and a method of adaptation that allows information garnered from one case to be applied to another." (Riesbeck and Shank 1989, 24)

Utilizing these components case based reasoning consists of the following four steps:

1. retrieving the most similar case (or cases) comparing the case to the library of past cases;
2. reusing the retrieved case to try to solve the current problem;
3. reviewing and revising the proposed solution if necessary;
4. retaining the final solution as part of a new case.

These steps can be broken down into more specific tasks:
1. Retrieving a case starts with a problem description and terminates when a best matching case has been found. The sub-tasks involve: identifying relevant problem descriptors; searching for similar cases; returning sufficiently similar cases on the basis of a similarity threshold of some kind; and selecting the best case from the cases returned.
2. Reusing the retrieved case solution in the context of the new case consists of: identifying the differences between the retrieved and the current case; and identifying the part of a retrieved case which can be transferred to the new case unmodified or with modification can be transferred.
3. Reviewing and revising occurs after a solution has been proposed. It focuses on: evaluating the proposed solution and, if there are faults, with the attempt to modify the proposed solution in ways that eliminate the fault.
4. Retaining the case incorporates whatever is useful from the new case into the case library. This involves deciding what to retain and in what form to retain it; how to index the case for future retrieval; and integrating the new case into the case library. (Harrison 1997).

This general characterization still leaves many specific issues to be resolved. There are numerous points at which instances of case-based reasoning can vary. There are a variety of different methods for organizing, retrieving, utilizing and indexing the knowledge retained in past cases. The two general problems are:
a. how to find matching cases and
b. how to achieve the necessary knowledge base of cases.
Sub-questions of the first include:
1. What is the search strategy to be employed?
2. How are cases indexed for efficient retrieval?
3. How is the similarity between a new problem and a retrieved case assessed?
Sub-questions of the second include:
4. How are cases selected for retention?

5. How is indexing information learned?
6. How is additional domain knowledge required for the assessment of similarity acquired?
7. How does generalization occur during learning? (Bareiss 1989, 96)

There can be variations in: the type of information represented by a case – instance, paradigm, analogy, search strategy; indexing systems; criteria for making similarity judgments; whether the similarity judgments involve global or local similarity, criteria for determining the hierarchy among matching cases; criteria to determine which cases are retained in the library; the extent to which contextual information is included with the cases; and the permissible moves to making in modifying a case or in revising a case.

Besides these theoretical differences there are also domain specific differences in how similarity judgments are made and how priorities among cases are determined, i.e., how these determinations are handled in casuistry versus the law versus science.

7. Rules versus Cases

What are the differences being claimed between a rule-based system and a case-based system? Separation is going to be imperfect – a case-based systems is going to contain some rules or guidelines while a rule-based system with generally be supplemented with cases. Nonetheless, there appear to be important differences.

On the case-based view the concept of argument is represented extensionally. The definition of the concept is implicit in its instances; no explicit definition is abstracted. Consequently, information about feature correlations, acceptable feature values, and realizable concept instances is preserved in the instances.

When using case based reasoning, the need for knowledge acquisition can be limited to establishing how to characterize cases rather than be concerned about ascertaining what rule covers all of the cases. Case based reasoning allows the case base to be developed incrementally and continuously. If one were to utilize rules instead, then cases would be discarded thereby eliminating the rule base that might later need to be revised. Decisions to generalize are always incomplete as not all possible contingencies will have been taken into account.

One might view a set of cases as a body of knowledge from which rules might be constructed, but have not yet been constructed. On this position dealing with cases is simply a postponement of induction to a rule. This postponement, however, has a number of key characteristics. “A rule induction generalization draws its generalizations from a set of… examples before the target problem is even known; that is it performs eager generalization…. This is in contrast to CBR, which delays (implicit) generalization of its cases until testing time – a strategy of lazy generalization.” (A.Golding nd). Moreover, eager generalization or rule induction emphasizes the statistical power of a number of cases rather than the unique properties of a particular case. Rule induction “derives its power from the aggregation of cases, from the attempt to represent what tends to make one case like or unlike another. CBR derives its power from the attempt to represent what suffices to make one case like or unlike another. CBR emphases the structural aspects of theory-formation, not the statistical aspects of data.” (Loui 1997). “General principles are impoverished compared with original experiences. Generalization is never perfect and there is always the danger of losing some quite important information.”

In case-based reasoning a case from the library of cases is transformed to achieve the solution providing flexibility whereas in rule-based reasoning a rule qua rule is to be applied to the situation with no transformation.
Aha (1997, 3-4) has suggested the following benefits of lazy problem solving in the context of designing expert systems:
1. *Elicitation*: Lazy approaches require the availability of cases rather than difficult-to-extract rules. (This is also true for most machine learning approaches.) This can significantly refocus knowledge acquisition efforts on how to structure cases.
2. *Problem Solving Bias*: Because cases are in raw form, they can be used for several different problem solving purposes. In contrast, rules and other abstractions can generally be used for only the purpose that guided their compilation.
3. *Incremental Learning*: Lazy approaches typically have low training (i.e., data processing) costs in comparison with approaches that attempt to compile data into concise abstractions. However, the trade off often exists that lazy approaches require more work to answer information queries, although smart caching schemes can be used to decrease this workload (e.g.,Clark & Holte 1992).
4. *Disjunctive Solution Spaces*: Lazy approaches are often most appropriate for tasks whose solution spaces are complex, making them less appropriate for approaches that replace data with abstractions (Aha 1992).
5. *Precedent Explanations*: By virtue of storing rather than discarding case data, lazy approaches can generate precedent explanations (i.e., based on the retrieved cases). Characteristic (i.e., abstract) explanations, if requested, can always be

derived from the stored set of cases in a demand-driven manner.
6. *Sequential Problem Solving*: Sequential tasks often benefit from the storage of a history in the form of the states that lead to the current state. Lazy approaches are used to store this information, which can then be used, for example, to disambiguate states (e.g., McCallum1995).

Psychologically there appears to be an advantage as well. For humans cases appear to be easier to retain than rules. It is difficult to remember an abstraction, but it is easy to remember a good coherent story.
There appear to be a number of important differences between case-based systems and rule-based systems in terms of flexibility, the type of characteristics emphasized, and the ability of non-experts to start applying knowledge to new situations.

*8. Case-based Reasoning in Informal Logic***[i]**
An interesting characteristic of introductory courses in either formal or informal logic is their reflexive nature. While the subject matter is not reasoning itself, but rather some type of normative theory about the results of reasoning, we are nevertheless presupposing that the students do possess both the ability to reason and to evaluate their reasoning. The focus of our concern in this paper has been the meta-reasoning which goes on in informal logic. It is somewhat ironic that the meta-level logic appears to be more sophisticated than the object-level logic customarily considered.
I believe that case-based reasoning is already utilized in many informal logic texts, but not explicitly recognized. Common cases that occur are worked examples or answers to problem sets in the back of the book. It is also striking how frequently discussions with students are in terms of experienced problems and examples. However, there has been limited discussion of the assumptions and presuppositions underlying this approach when applied to informal logic as well as the criteria to use in selecting the appropriate cases.
In developing a case-based method for informal logic there is a fairly obvious set of categories of questions that would need to be addressed:
*Questions about the individual cases:
*What is to count as a case for informal logic?
*What are the features that it is important to include in a case?
*Questions about the collection of cases or library:
*How should the cases be indexed?

*Along what dimensions should similarity judgments be made?
*What would an appropriate set of cases for informal logic be?
*What would constitute a full set of cases for an individual to qualify as a skilled argument identifier and evaluator?
*What would constitute a full set for someone who is an expert in some particular field?
*What should the stages be in developing a library during the course of a semester long informal logic course? What would the contents of a library at the end of a semester long course be?
*Questions about reuse:
*What are the factors that enter into the determination of whether a solution can simply be copied?
*What are the modification and adaptation techniques that can be employed?
*Questions about review and revision:
*What are the standards for having achieved a satisfactory solution?
*What sorts of changes result in a revision of the solution?
*Questions about retention:
*What are the factors involved in determining what new information is retained?
*How is new information integrated into the already existing library of cases?

Answers to these questions are going to vary with the conception of argument employed and the standards employed to determine if an argument is “good”. Spelling out the case set and methods for even one of the conceptions of argument would be a substantial undertaking let alone undertaking the task to do a comparative review of differing conceptions.
Despite these demurrals certain sorts of situations one would want in cases for case-based reasoning in informal logic seem relatively apparent: the standard problems involved in achieving standard logical form, e.g., eliminating ambiguity, etc.; various complex argument diagramming situations; single/complex arguments contrasts; ampliative/non-ampliative argument contrasts; logically correct/logically incorrect argument contrasts; sound/unsound argument contrasts; arguments which exhibit overall argument strength versus those that do not.
A potentially interesting empirical study would be to subdivide the collection of informal logic texts into those with roughly the same conception of argument and study the set of examples and worked problems provided by the authors, analyze their contents, their sequencing, any cross-referencing that occurs, the centrality

of arguments in each of the examples, etc.

While attempting to determine the overall implications of adopting a case-based method for informal logic would require having answers to the above questions, some implications seem rather immediate:
Arguments should be included in all of the cases. This suggests that issues such as ambiguity, vagueness, etc, should be looked at in the context of arguments rather than independently;
Suggests not immediately starting with complex cases from ordinary discourse, but rather developing a case set in a carefully staged way. The overall case set should illustrate commonly encountered problems including situations subject to multiple interpretations;
It may explain why lists of key words or inference indicators work to the extent that they do and are also as frustrating as they are. Lists of key words or inference indicators can be construed as decontextualized component parts of cases.

What are the pedagogical implications of such a view for both the structure of texts and courses in informal logic? Theoretical considerations arising from the theory of argument being deployed would be one consideration in determining what is presented in the cases and how they are sequenced, but psychological factors should also be taken into account. What is the data on students being able to start out comprehending a complex environment in which they are required to do multiple tasks and retain what they are taught? What is the literature regarding learning a skill?
This paper has attempted to examine the role of cases in informal logic and argue that they have a much more central role to play than that of illustrations. Case-based reasoning plays central role in determining whether an argument exists and what that argument is. It appears productive to further explore the conception of meta-reasoning in informal logic as case-based reasoning.

NOTES
[i] There are apparently some discussions of the application of case-based reasoning to informal logic that I was not able to gain access to prior to the deadline for completing this paper – Wisdom (1957/1991) and Govier (1980).

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