On the Limitations of Language and Logic[1]

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While most types of writing are expected to be clear and logical, these properties are demanded especially of academic writing. As a result, the teaching of writing for scholarship and research often emphasizes precise language and critical thinking. However, as this paper endeavors to show, language is inherently complex and difficult to tame and traditional logic fails to encompass the actual reasoning methods used in academic discourse. Pedagogies that emphasize the teaching and application of specific principles and rules of language and logic are therefore insufficient for making young scholars adequate writers of research papers. Better results might be obtained, this paper suggests, by focusing on methods that embrace the social aspects of language and logic.

1. Education and Writing

Education prefers clarity.

If knowledge and skills are to be learned, it is believed, the relevant facts, principles, and processes need to be conveyed to students with definiteness and precision. Terms must be well defined, textbooks must be logically organized, and teachers must speak distinctly. Testing, in particular, usually demands extraordinary exactness—statements are to be marked either true or false, multiple-choice questions have unique answers, blanks can be filled in in only one way. And students' learning is rated on linear scales with unambiguous letters and numbers.

One reason for this focus on clarity, of course, is that both teachers and students have found clarity to be useful and necessary for many types of learning. Vague language and sloppy presentation do not help students learn algebra, anatomy, or the Armenian alphabet. But the need for exactness is also driven by institutional imperatives, because the granting of grades and diplomas, and of the concomitant social status, requires fairness and accountability. The result can be an excessive focus on clarity and precision even with subjects that, in their essence, are nebulous and ill-defined.

One such subject is writing. The act of writing, whether of novels, term papers, or user manuals, is inherently the creation of something new; a person who reproduces a previously written text is a copyist, typesetter, or plagiarist, not a writer. When writing is taught, the students are therefore expected to produce original texts, texts that have never been written before, texts that therefore cannot be said to be correct or incorrect. But despite the indeterminacy of this creative act, the teaching of writing frequently succumbs to the educational demand for precision. From the formatting of the printed page and the punctuation of citations and references to the roles of sentences in paragraphs and of paragraphs in longer texts, writing is often taught to students as if it were nothing more than

[1] This paper is an expanded version of half of a lecture that I gave on February 16, 2013, at the 1st International Symposium on Academic Writing & Critical Thinking, held at Nagoya University. The title of that talk was "Integrating Writing with Critical Thinking: First-Year Undergraduate Writing Programs at the University of Tokyo"; the programs referred to in that title were described in the other half of the talk, which is not covered here.

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the assembly of the pieces of a puzzle or the combination of the ingredients of a recipe. Accustomed to being taught other subjects in the same way, students rarely object to this prescriptive, procedure-based teaching. In fact, they often welcome it; after all, it is *clear.* The fact that it distorts the nature of writing, and is insufficient to make students proficient writers, is rarely noticed.

2. Language Is Lousy for Critical Thinking

The limitations of cooking-recipe approaches to the teaching of writing become even more apparent when one remembers that writing is a form of language and that language is fiercely resistant to clear, comprehensive description. Take, as just one example, the fluidity of the meanings of individual words. The entries in dictionaries for nearly all commonly used words contain multiple senses: *back* can denote a location, a direction, a body area; *blue* is a color, a mood, or a kind of butterfly. And dictionaries, constrained by the limitations of space and editorial resources, indicate only the most common senses of words. A close examination of any particular word in multiple contexts will reveal meanings and nuances not captured by any dictionary. In fact, as the lexicographer Allen Walker Read once noted, the meaning of a word is different every time it is used (Stacey 1989, 62).

A case in point is the word *critical.* Consider the following four instances, taken from academic writing, of its adverbial form, *critically*:

(1) I decided to take him aside for 20 minutes to see if I could uncover why a successful team leader had such problems with presentations.... He said he seemed to derail in his presentations when he perceived the audience as blank and disengaged, and felt they were **thinking critically** about him.... (Lee 2003, 102)

(2) In early adolescence, contemporary problem novels and wish fulfillment stories provide an opportunity for the reader to "find oneself" through literature and to begin **thinking critically** about it, which parallels a burgeoning critical view of the world. (Knickerbocker and Rycik 2002, 199)

(3) **Thinking critically** is an ability which is to be developed in the EFL [English as a foreign language] class as a result of the generalized process of globalization, immigration and poverty. It is essential for teachers to be aware of the fact that tolerance, dialogue among cultures and deconstruction of texts need to be exercised so that students can dissect dominant discourses and allow for diversity knocking down stereotypes. (Farralelli 2009, 26)

(4) The overall aim was to create a more explicit and methodical induction of incoming students into the disciplinary academic practices of reading, **thinking critically,** and writing in the appropriate forms. (Clarence 2012, 131)

Although those citations are all from academic texts, the phrase *thinking critically* has a different meaning in each. In (1), *thinking critically* means thinking disparaging thoughts about another person; this is probably the most common meaning of *critical*, and it is used often in everyday speech and writing. In (2), the phrase refers to the analysis and interpretation of literary works, a more academic though still widely known sense. The phrase in (3) refers to a particular approach to social issues, one that emphasizes awareness of power relations and active attempts to overcome injustice; this meaning of *critical,* which has been associated with the writings of Paulo Freire, Henry Giroux, and others, is used often by some academics and political activists, but it is much less common in general contexts. Finally, in (4) the phrase refers to thinking clearly, logically, and analytically—the meaning in which it is used most often with regard to the teaching of academic writing.

While these four senses overlap somewhat, they are largely distinct. One can think critically as in (1) based solely on a subjective, emotional reaction to another person's appearance or behavior; that thinking does not need to be literary, political, or logical. Similarly, critical thinking as in (2) need not share any of the main characteristics of (1), (3), or (4). And (3) is different from the others, as is (4). Thus the same word, *critically,* used in similar collocations, can take on vastly different meanings depending on the context. Furthermore, even a well-read, educated reader might not recognize the intended meaning; this writer, for example, has more than once initially interpreted *critical* or *critically* to mean (1), (2), or (4) but later realized that the author or speaker had in fact meant (3). Similarly, scholars and activists for whom (3) is an everyday sense might expect that, say, speakers at a symposium on academic writing and critical thinking will be discussing issues such as global capitalism and neoliberalism rather than the logic and structure of academic papers.

The word *critical* is far from unique in the diversity and fluidity of its meanings. Other words essential to academic discourse—whether *culture, society, knowledge,* or *truth*—are equally difficult to corral into definite semantic boundaries. One consequence of this fluidity is that it hinders educational approaches that emphasize precision. It would be very difficult, for example, to include on a multiple-choice vocabulary test of English a question to determine whether the test-takers understand the meanings of *critical,* as the question would have to focus on only one of the meanings—most likely (1) for a general-purpose language test, maybe (2) or (4) for a test of academic English—at the expense of the others (including senses not discussed here).

A more significant problem is that language's fluidity makes it a poor tool for—in the sense of (4)—critical thinking. If we wish to convey our arguments clearly and convincingly to others, it is essential that our words be interpreted as we intend them to be. But with the meanings of words constantly shifting, and with every reader's and listener's understanding of language somewhat different from others', interpretations can be only partially faithful.

A medium more precise than language for thinking clearly and logically does exist. In higher mathematics, terms are defined with a rigor and precision that makes them nearly invulnerable to misinterpretation. Expressions such as *complex number, Galois field,* and *topological space* are defined completely and uniquely, and mathematicians are rarely confused about what any term means in any particular context. Special symbols, to which specific meanings are assigned unambiguously, are frequently used to reduce the possibility of misunderstanding even more.

Unfortunately, outside of physics, chemistry, and some other fields of the physical sciences, precise definitions and symbolic representations in the style of mathematics are of very limited use. Most entities studied in the social sciences and humanities, in particular, are too complex, too diverse, too numerous to be precisely defined, and attempts to use mathematics-like formalities to advance knowledge in such fields have rarely been successful. To think critically about most subjects that involve human beings, we are stuck with language. But language is lousy for critical thinking.

3. Logic Is Limited, Too

The type of critical thinking being considered here depends in part on logic, that is, the process of drawing conclusions from assumptions. A classic example of logic is deductive reasoning, such as in the following syllogism:

> John is a bachelor.
> All bachelors are male.
> Therefore John is male.

In order for such reasoning to work, each of the premises must have a binary truth value, that is, it must be either completely true or completely false. In fact, statements like "John is a bachelor" are chosen for examples of logical reasoning precisely because, at first glance, they seem in the real world to indeed be either true or false. If John, it is assumed, has never signed a marriage certificate that has also been signed by a woman and certified by a competent legal authority—an act that, it would seem, either has happened or hasn't—or if all of his previous marriages have been dissolved in equally well-defined ways (divorce, annulment, death of a spouse, etc.), then the statement "John is a bachelor" must be true; otherwise, it is false. The truth value of "All bachelors are male" seems similarly binary; in fact, it is supposed to be regarded as invariably true because the word *bachelor* is assumed to mean "an unmarried male person."

Suppose, however, that the time is April 2013 and that John is a gay man living in the state of Delaware in the United States. John has been in a committed relationship with another man, Steve, for the past fifteen years. Delaware does not allow same-sex marriage, but in July 2007, while on a vacation in Canada, which does allow same-sex marriage, John and Steve (who is a Canadian citizen) got married under the laws of Canada. That marriage is not recognized under the current laws of Delaware, where John and Steve live, but a bill has been submitted to the Delaware legislature to legalize same-sex marriage. The bill seems likely to pass, but it is not yet known when it will take effect or whether, in the bill's final form, John and Steve's Canadian marriage will be recognized in Delaware.

In such a situation, what is the truth value of "John is a bachelor"? Even if the word *bachelor* is interpreted according to legal definitions, the statement's truth value is uncertain. A court decision would probably be necessary to determine whether or not John's Canadian marriage means that he is also married in Delaware, and, with legislation pending, Delaware courts in April 2013 might hesitate to rule on such a case. The truth value is even more uncertain if we consider how the word *bachelor* is understood not legally but in general: some people, such as those opposed to same-sex marriage for religious reasons, might consider "John is a bachelor" to be true; others, such as John and Steve and their friends, might consider it false; and others, including this writer, would be unsure.

If the truth value of such a simple statement can be uncertain,[2] then there is little hope that the statements that are made in real discourses—even careful, formal, academic writing—will have binary truth values. Consider, for example, the following sentence taken from an academic paper:

> This paper argues that the traditional definition of the scope and practice of management control which was developed in the mid 1960s is now too restrictive as it is based on a context of large, hierarchically structured organizations which are now in relative decline. (Otley 1994, 289)

As this is the paper's thesis statement, the author is arguing in favor of the stated proposition. While it is completely reasonable to argue for such a complex proposition in an academic paper, such a proposition cannot be assessed as being merely true or false.

For example, the word "too," in "too restrictive," is normally meant to be interpreted with a considerable degree of subjectivity. An author could, one supposes, assign numerical values to "too restrictive" and "not too restrictive" so that the distinction between them becomes clear and unambiguous. However, such everyday words are rarely defined in academic writing; if they were, academic papers would become nearly incomprehensible.

[2] The statements "All bachelors are male" and "John is male" are nearly as problematic from a truth-value perspective. Explaining the fuzzy boundaries of the word *male* in the 21st century is left as an exercise for the reader.

Furthermore, the main clause ("the traditional definition ... is too restrictive") is modified by propositions in subordinate clauses, specifically that "[the traditional definition] is based on a context of large, hierarchically structured organizations" and that those organizations "are now in relative decline." The validity of those propositions affects that of the entire sentence in subtle ways. If, for example, large, hierarchically structured organizations are in fact not in relative decline (suppose, instead, that all organizations, including small, egalitarian ones, are in similar decline), then the thesis statement might become weaker without becoming false.

In the following thesis statement, from another paper, the central assertion hinges on the word "should":

> This paper argues that policy makers should make CPRs [common property resources] an important component of rural development, especially in such areas as India's dry region. (Jodha 1992)

It is difficult to imagine that such a statement—common in fields like political science and economic policy studies—could be assessed as "true" or "false." This sentence is more a policy recommendation as a factual claim, and policy recommendations—which are based on moral, ethical, economic, and political considerations—do not emerge convincingly through purely logical arguments.

The point of these two examples—which could be extended to the thousands by a simple search at Google Scholar for the phrase "this paper argues that"—is that arguments in serious discourse are often expressed through statements that cannot be assessed as being simply true or false. As a result, the tools of traditional logic, which depend on such binary truth values, are of limited use when teaching young scholars to write more effectively.[3]

4. The Social Basis of Reasoning

The distinctive forms of both language and reasoning emerge through interactions among people of particular social groups. For language, this process is clear to anyone who has examined how people actually talk and write. Language, after all, varies in pronunciation, grammar, and the meanings of words according to country, region, social class, age, and other criteria by which people form groups. The members of each group interact with each other frequently, so the language they use with each other gradually takes on distinctive characteristics.

The reasoning methods used by different groups of people can also be different. One example is the sorts of evidence that members of any particular group accept as the basis for arguments. An extreme case is theological arguments: a believer in a religion might take as assumed without question—as statements of Eternal Truth—the assertions of the religion's fundamental teachings and therefore accept any argument that clearly follows from those assertions; a non-devotee scholar studying the same religion might approach those teachings with an open mind, neither accepting nor doubting; and a follower of another religion might reject those teachings out of hand. Some academic fields, while perhaps not quite as dogmatic as literalist religions, exhibit similar acceptance of foundational texts, with scholars in psychoanalysis citing Freud, in deconstructionist literary theory Derrida, and in generative grammar Chomsky as evidence in support of their arguments.

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[3] Another example of the limitations of traditional logic is shown in a statement that I recall the mathematician Paul Halmos (1916–2006) attributing to George Boole (1815–64) in a class on mathematical logic that I took from Halmos in the 1970s: something to the effect that "Although the development of formal logic has continued for more than two thousand years since Aristotle, it is still not possible to prove the truth of the statement 'If a horse is an animal, then a horse's head is an animal's head.' " I might very well be misremembering from whom I heard this statement or to whom it was attributed, but the point seems valid: Traditional logic captures only a subset—perhaps even a small subset—of all commonly accepted reasoning processes.

Scholars in different fields use not only different assumptions but different reasoning processes as well. In mainstream pure mathematics, for example, it is accepted that, for every well-formed statement, either the statement is true or its negation is true. Thus, if "*A* is *B*" is false, then "*A* is not *B*" is true. This "principle of excluded middle" makes possible arguments such as the following:

> If *n* is a prime number greater than 2, then *n* is odd. Therefore, if *n* is not odd, then *n* is not a prime number greater than 2.

Such arguments do not work in fields where the truth values of statements are not black or white. The following argument, for example, is unlikely to be accepted by scholars of literature:

> Shakespeare's plays contain complex renderings of the human condition, so they deserve to be studied for generations to come. Consequently, because the plays of Neil Simon are of only temporary interest, they do not contain complex renderings of the human condition.[4]

Such differences in reasoning methods can create deep rifts between academic communities. Mathematicians and physicists, in particular, accustomed to tight mathematical arguments, can be disparaging of the looser argumentation of the humanities. (Scholars in the humanities, in contrast, usually do not understand enough higher mathematics to judge its methods of argumentation.)

As fields of study evolve, new ways of reasoning can be born. An example from the field of linguistics is the methodology that was developed in the 1950s and 1960s for making arguments about sentence structure in the context of generative grammar. This syntactic argumentation generally accepts native speakers' intuition as evidence for whether any particular string of words forms a grammatical sentence. Generative grammarians' arguments also frequently rely on deep generalizations about linguistic phenomena.[5] In contrast, linguists in areas such as corpus analysis prefer more empirical descriptions based on spontaneous language use. Thus even within the same field, linguistics, scholars can differ both about what sorts of evidence to accept and how to reason with the evidence that is accepted.

I mention specifically the reasoning methods of mathematics and linguistics because these happen to be two fields with which I am familiar. But it is apparent that other academic fields also possess their own standards—sometimes explicit, often merely understood—about how arguments should be made. In fact, those differences in reasoning methods—together with differences in the objects of study—play an important role in distinguishing between different academic fields. In other words, people are organic chemists or cognitive psychologists or social historians not only because they study carbon-based compounds or mental processes or the experiences of ordinary people in the past; they have also learned to reason and argue like other scholars in the same field.

5. What Can Be Done

By recognizing that, like languages, methods of reasoning differ among groups and that those differences emerge and are reinforced through intragroup interactions, we can see how we might try to overcome the limitations of language and logic when teaching academic writing and critical thinking. Rather than striving for unobtainable clarity and precision—for meanings that cannot be misinterpreted, for rules that should never be violated, and for arguments that cannot be countered—we should continue to create structures and processes

[4] This argument is, of course, not completely parallel to the mathematical argument immediately above, because the forms and terms of literary arguments are not as precisely defined and regulated as those of mathematics.

[5] For an extensive account of syntactic argumentation, see Aarts 2001.

that replicate the actual contexts and social interactions in which scholars learn the language and logic of their fields. By intelligently guiding our students through those structures and processes, using methods that we already have—tutorials, peer review, discussion, debates, collaborative writing, etc.—and by constantly refining and improving those methods, we can help our students learn through those interactive processes how to think and write more effectively.

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