Rhetorical Figure Annotation with XML

Sebastian Ruan,* Chrysanne Di Marco,* and Randy Allen Harris**
*Cheriton School of Computer Science
**Department of English Language and Literature
University of Waterloo, Waterloo Ontario
saruan@uwaterloo.ca, cdimarco@uwaterloo.ca, raha@uwaterloo.ca

Abstract

There is a driving need to interrogate large bodies of text for pragmatic meaning, e.g., to detect sentiment, diagnose genre, plot chains of reasoning, and so forth. But this type of meaning is often implicit, 'hidden' meaning, evoked by linguistic cues, stylistic arrangement, or argumentation structure—features that have hitherto been difficult for Natural Language Processing (NLP) systems to recognize and use. Pragmatic concerns were historically the province of rhetorical studies, and we have turned to rhetoric in order to find new solutions to computational pragmatics. This paper highlights a form of rhetorical device that encodes deep levels of pragmatic meaning and yet lends itself to automated detection. These devices are the linguistic configurations known as *rhetorical figures*, which have been poorly understood and vastly underutilized in Computational Linguistics and Computational Argumentation. We present an annotation scheme using XML for rhetorical figures to make figuration more tractable for NLP, enhancing applications for argument mining, along with a range of other tasks. We also discuss the intellectual and technical challenges involved in figure annotation and the implications for Machine Learning.

1 Introduction

Rhetorical figures are cognitively governed linguistic devices that serve functional, mnemonic, and aesthetic purposes. Take the famous maxim from Kennedy's inaugural address:

1. Ask not what your country can do for you. Ask what you can do for your country. [Kennedy (and Sorensen) 1961]

This expression quickly became proverbial in the American consciousness for the way it captures the spirit of a particular historical moment, the ethos of a particular administration, and the aspirations of a particular generation. Countless more prosaic formulations, by Kennedy and others, expressed that confluence too, but they left a distinctly less memorable impression. Why? Two reasons. Firstly, the formal structure and the functional structure are virtually isomorphic: Kennedy (and speechwriter Ted Sorensen) expressed the rejection of one civic attitude and its replacement by the opposite one, in the iconicity of reversing the terms of reference. Secondly, that very snug form/function coupling inhabits a material structure that is, on its own, cognitively very sticky. The Kennedy-Sorensen phrase has become so widely known, that is, so easily shared, so frequently invoked and quoted and recited because of (1) the schematic congruence with which the form matches the Rejection-Replacement function its arrangement serves, and (2) the cognitive affinities humans have for its structural properties (opposition, repetition, and symmetry).

The cognitive affinities explain its mnemonic and aesthetic effects, but, an interest in Computation Argumentation scholars focuses attention on its tight form-functional correlation, in an approach known as *figural logic*. The form makes it tractable for automated detection, while the function gives us its rhetorical purpose. In terms of argument mining, an application that accessed this correlation could epitomize Kennedy's inaugural address (which argued for the rejection of an ethos of entitlement and its replacement by an ethos of duty) virtually on the basis of this expression alone.

We are developing an approach to computational pragmatics that combines the insights for argumentation that rhetorical figures provide, together with argument mining, corpus linguistics, and machine learning, with payoffs for both computer science and for rhetoric. There has to this point been success at detecting some rhetorical figures, but little sense of what to do with them once they have been detected.

There has been a growing interest in the convergence of rhetoric, argumentation, and NLP, sparked by such works as Teufel, Carletta and Moens [1999] Crosswhite [2000], Grasso [2002a, 2002b], Reed and Norman [2003], Green [2010, 2015], and Teufel [2010], largely under the presiding genius of Toulmin [2003/1958].[1] But aside from passing mentions here and there, rhetorical figures have been almost wholly neglected. Our work addresses this surprising omission.

Our approach is a more sophisticated use of rhetorical figures than has been attempted, operating at layers of formal and functional abstraction. It depends fundamentally on an annotation format for rhetorical figures.

In this paper we argue for the importance of rhetorical figures for NLP generally and argument mining specifically; we identify the challenges and opportunities of integrating a knowledge of figures into NLP; and, most specifically, we offer an XML annotation scheme for rhetorical figures that meets some of these challenges and therefore opens up new opportunities for NLP.

2 Opportunities and Challenges

Computationally, figures are important for four central reasons. First, they are endemic to human language. This is very well established for a few tropes, such as metaphor, which is the central focus of Cognitive Linguistics and deeply entrenched in ontologies like FrameNet and WordNet. But it is equally true of literally (a word we don't use lightly) hundreds of other figures. If we want language-perceptive algorithms, they must have knowledge of figure structure. Secondly, figures epitomize argument structure, increasingly a prime concern for NLP. Again, this is well understood for metaphor (and simile, though it gets much less overt attention), which epitomize analogic argumentation. Thirdly, many figures (especially the ones called schemes) work in terms of formal patterns that algorithms can detect through surface analysis; our Sentence 1 illustrates this aspect clearly. Fourthly, they correlate with rhetorical functions (pragmatic and argumentative meaning). We will illustrate this shortly. For now, the rejection-replacement function of Sentence 1 will have to stand.

The contemporary scholar most responsible for the position that rhetorical figures are constructions with especially tight couplings of form and function is Jeanne Fahnestock, whose figural logic is brilliantly articluated in *Rhetorical Figures in Scientific Argumentation* [1999; see also Tindale 2000:69-85; Harris 2013]. Fahnestock charts rhetorical figures not only for their pragmatic contributions to everyday language but for the way they epitomize lines of argument. As she cogently shows, this position goes back at least to Aristotle, who links specific figures directly to specific lines of argument (that is, topoi). But, aside from a very few important modern exceptions like Perleman and Olbrecht-Tyeca [1969], it was largely forgotten as figures came to be associated with style; style, with aesthetics and superficiality.[2]

But figures are not without their challenges for Natural Language Processing. Metaphor remains elusive, for instance, despite all the attention it has attracted in cognitive science, AI, and linguistics, including Computational Linguistics, in the last two decades. Metaphor is a type of figure known as a trope, which depends on semantic deviation. We are not yet successful enough with straight-laced semantics to support forays into semantic distortions. Some tropes (such as oxymoron, which is a juxtaposition of antonymic terms, such as *square circle* or *deafening silence*) can be reliably detected [Gawryjolek 2009]. We believe antithesis (juxtaposed opposite predications, as in Sentence 2, a double antithesis) has a similar potential for reliable detection. (We adopt the convention of identifying the defining figurative elements parenthetically.)

2. The young would choose an exciting life; the old a happy death. (young, old; life, death) [Alexis 2015:155]

But most semantic distortions—tropes—are far from tractable computationally. Nor do many of them provide the tight form/function coupling that has such a promising payoff for Computational Argumentation.

Another type of figure, schemes, are formal deviations, shifts of expected structure, as in Sentence 1, an antimetabole (reverse lexical repetition; in this case *you* and *your country*). The computational detection of figures, including antimetabole, is finding success [Gawryjolek 2009; Gawryjolek, Harris, and DiMarco 2009; Hromada 2011; O'Reilly 2010; O'Reilly and Paurobally 2010; Dubremetz and Nivre 2015].

The work of these researchers is sometimes only loosely connected to the rhetorical traditions. Many of them, too, *only* concerned detection—an essential first step but one that doesn't get us very close to argument mining. They did not attempt to find *meaning* in the figures they detected. Gawryjolek [2009], Hromada [2011], Dubremetz and Nivre

[1] We do not put Mann and Thompson's [1988] Rhetorical Structure Theory (RST) in this category because, while it has made some valuable insights into text linguistics, it is simply incorrectly named, by scholars who appear to know little or nothing about rhetoric. RST has really to do with text *coherence* rather than with *rhetoric* as traditionally understood, as the study of suasive language.

[2] As Rubinelli (2006) points out, topoi are various. Aristotle distinguished principally between common topoi, such as argument from opposites, argument from correlatives, and argument from definition, which can be applied to arguments in any domain, and particular topoi, which can be applied in particular argument fields. In this paper we are concerned with common topoi, which align with rhetorical figures, but see Gladkova, DiMarco, and Harris [2011, 2016] for our approach to particular epistemic topoi in ophthalmic clinical research. It differs both from Rubinelli's approach and, more generally, from the types of schemes being used in Computation Argumentation analysis by associating "constellations" of features, i.e., features that are linguistically, syntagmatically, and semantically related, with specific schemes (here, *topoi*).

[2015], for instance, appear to have been unfamiliar with the rhetorical functions antimetabole serves.

Antimetabole has a small set of rhetorical functions, keyed to the iconicity of its formal structure (which evokes balance and opposition, as well as sequence or priority). We have very limited space in this paper to demonstrate these rhetorical functions, so a few examples will have to suffice.

One function of antimetabole is to convey Reciprocal Force, illustrated by Sentence 3, Newton's third law of motion. (We adopt the convention of identifying the defining figurative elements parenthetically.)

3. If you press a stone with your finger, the finger is also pressed by the stone. (stone / finger) [Newton 1803.1 [1687]:15]

Newton's third law is often expressed as "for every action, there is an equal and opposite reaction," but Newton's own argument favored the antimetabole, whose very structure suggests "equal and opposite" (We give the example in English, but Newton's original Latin is also antimetabolic.)

A very similar rhetorical function of antimetabole is to convey Reciprocal Specification, a kind of mutual definition, illustrated by Sentence 4:

4. Gay rights are human rights, and human rights are gay rights. (human rights / gay rights) [Clinton 2013: 0:08-0:12]

In this phrase the notions of human rights and gay rights are reciprocally identified with each other. You can't have one unless you have the other.

Another rhetorical function of the antimetabole is to convey Comprehensiveness, illustrated by the ordinary-language example, Sentence 5:

5. A place for everything, and everything in its place. (place / everything) [Traditional]

The reverse repetition in Sentence 5 shifts from reciprocal force to a reciprocal *coverage*, largely because it has prepositional predication rather than the transitive predication of Newton's Sentence 3. We call this function comprehensiveness because the sequential iconicity *means* a back-and-forth, alpha-to-omega, omega-to-alpha coverage of some domain—in this case, the domain of tidiness. All things have assigned places; all places have their assigned things.

A fourth rhetorical function of the antimetabole is to convey Irrelevance-Of-Order, well known from algebra and predicate calculus:

6. $m + n = n + m$ (m / n) [Traditional; commutative principle]

There are other ways to express the principle of commutation, but none as natural and iconic as formulae like 6. Opposite sequences of the same variables, on either side of the same operator, pivoted by a predication of identity, equivalence, or equality inescapably *means* that neither sequence has priority. Order doesn't matter to addition (multiplication, union, etc.).

We have built a curated list of over 400 antimetaboles illustrating these functions, but only have space for a few more representative examples:

Reciprocal Force

7. A corollary of PHC [the Principle of Hierarchical Coincidence] is that resources flow toward political power, and political power flows toward resources; or, the power of state and of capital typically appear in conjunction and are mutually reinforcing. (resources / political power) [Sartwell 2014]
8. Women are changing the universities and the universities are changing women. (women / universities) [Greer 1988: 629]

Reciprocal Specification

9. The negation of a conjunction is the disjunction of the negations and the negation of a disjunction is the conjunction of the negations. (negation of a conjunction / disjunction of the negations) [De Morgan's law; traditional]
10. Anger and depression, the pop-psych books tell us, are two sides of the same coin: depression is anger suppressed, anger is depression liberated. (depression / anger) [Hertzberg 2008]

Comprehensiveness

11. I meant what I said and I said what I meant. (meant / said) [Seuss 1940]
12. Whether we bring our enemies to justice or bring justice to our enemies, justice will be done. (our enemies / justice) [Bush [and Frum] 2001]

Irrelevance of Order

13. With a similar qualification, in the Cambridge Grammar of the English Language, a head 'plays the primary role' in 'determining the distribution of the phrase' (introductory chapter signed by Pullum and Huddleston, in Huddleston and Pullum 2002:24) (Pullum / Huddleston) [Matthews 2007:24]
14. "Spanglish," [is] the combination of Spanish and English (or English and Spanish) (Spanish / English) [Unknown, "Western Spanglish Language"]

It is these functions, coupled with the relative ease of rhetorical-scheme detection, that make rhetorical figures so promising for computational tasks in which comprehension is central, like argument mining and text summarization.

Again, however, there are challenges. They are not as thorny as the challenges of most tropes because they concern surface analysis, not semantic plumbing. But they exist. In particular, figures rarely come in isolation. The Kennedy-Sorenson maxim, for instance (Sentence 1), is an antimetabole (you / your country). But it is also an antithesis (ask not X / ask X). It is, thirdly, a mesodiplosis (clause-medial repetition; here, *can do* occurs in the middle of both clauses).

We call this phenomenon, when figures co-occur and mutually reinforce each other, *stacking*. It presents both a challenge and an opportunity. It is a challenge because rather than detecting a single figure or multiple independent figures, we need to detect overlapping figures. It is an opportunity because the functions are enhanced and stabilized under stacking. When two or more figures coincide in the same utterance, the functions they convey are highly consistent. Formal stacking breeds a functional conspiracy.

For instance, when antimetabole stacks with antithesis (conjoined or highly proximal opposite predications), the joint function is primarily to reject the negated predication utterly and replace it with the positive predication. Again, Sentence 1 is our paradigm, but here are two more:

Reject-Replace

15. We don't build services to make money; we make money to build better services. (services / money) [Mark Zuckerberg, qtd in Magid 2012]
16. Plain statement must be defined in terms of metaphor, not metaphor in terms of plain statement. (plain statement / metaphor) [Buck 1899: 69]

The stacking of antithesis with the Reciprocal Specification function of antimetabole, however, generates a very specific Subclassification function, as in Sentences 17 and18, which say, respectively, that ultrabooks are a class of laptop, and compounds are a class of molecules:

Subcatetorization

17. Ultrabooks are laptops after all, but not all laptops are ultrabooks. (ultrabooks / laptops) [Unknown 2013, "Ultrabooks vs Laptops"]
18. All compounds are molecules (since compounds consist of two or more atoms), but not all molecules are compounds (since some molecules contain only atoms of the same element). (compounds / molecules) [Volpe 1975:7]

Some instances of stacking are so common and so predictable as to be entailments. Ploche, for instance, is simple lexical repetition, so it always stacks with antimetabole (reverse lexical repetition). If you find the latter, you always find the former. Rhetorically, ploche conveys the pragmatic function, Identity-Of-Reference, which is always embedded in the functions of antimetabole (if you have reciprocal force or reciprocal specification, for instance, you have identical entities in a reciprocal relationship). Further, mesodiplosis clause-medial lexical repetition) also entails ploche as well, conveying an identical force when the mesodiplosis is a transitive verb (e.g., Sentences 3, 7, and 8), identical specification when it is a copula verb (e.g., Sentences 4, 9, and 10).

We do not pretend to have a full and complete mapping of form to function, however. This work is still in the very early stages, but we believe it holds considerable promise, and we believe machine-learning corpus studies can be extremely helpful, especially for the challenges and opportunities of stacking.

Figural stacking, as we come to understand the functional combinatorics better, is perhaps the greatest promise of rhetorical figures for computational understanding of natural language. Our paradigm example, which stacks the schemes antimetabole, mesodiplosis (both entailing ploche), and the trope antithesis provides a pitch-perfect example of the rhetorical function, Reject-Replace. A computational analysis of Kennedy's inaugural address tuned to the workings of rhetorical figures could tell us what the address was about—namely, the rejection of an ethos of entitlement and its replacement with an ethos of responsibility—virtually on the basis of this particular stacking (along with, of course, the lexical semantics of *you*, *your country*, and so on)

We can, and should, rely on rhetoricians to tell us what the functions of certain figures and certain figure-stacks are, at least in these early stages. But the rhetorical tradition is haphazard, and sometimes conflicting. The terminology alone is forbidding. As much as computational argument studies can benefit from a better understanding of rhetorical figures, rhetorical figures can benefit from computational studies of form and meaning. (And, yes, that sentence was an antimetabole, stacked with mesodiplosis; the rhetorical function is Reciprocal Force, modulated by the possibility modality of *can*.)

The path forward is to bootstrap rhetoricians' knowledge by way of annotation, marked-up text corpora, and machine learning, so that computationally mined data can start to tell *them* what functions figures have, through confirmation, through refinement, and through new discoveries, all of which we have good reason to anticipate.

We can discover the proportionality of certain stackings (anecdotally, both antithesis and mesodiplosis strongly cooccur with antimetabole), the correlation of the stackings with the rhetorical functions (as specified above, on the basis of limited and anecdotal research). At its best, this work can revolutionize Computation Argumentation studies and rhetoric in the way corpus linguistics revolutionized lexicography and established ontologies like WordNet and Framenet. But even at its least productive, we are very confident of finding important form/function correlations that can importantly inform Computation Argumentation and discourse studies, in novel ways.

3 Figure Detection

There have been limited successes in figure detection over the past several years due to strict figure mappings and some unreported data [Gawryjolek 2009; Gawryjolek, Harris, and DiMarco 2009; Hromada 2011; Strommer 2011; Alliheedi 2012; Alliheedi and DiMarco 2012; Dubremetz and Nivre 2015]. But it has been restricted both in method and in scope and has been unconcerned with function.

Hromada's [2011] work, for instance, was very successful at the detection of antimetabole, but he defined antimetabole in an overdetermined way. Using the Waterloo Figure Representation Notation [Harris and DiMarco 2009][3] (where *W* stands for *Word*, the subscripts indicate identity, and "…" represents other linguistic matter, extraneous to the figure, possibly null), Hromada defines antimetabole as $<W_A\ W_B\ W_C \ldots W_C\ W_B\ W_A >$, whereas a more accurate definition (as in Harris and DiMarco [2009]) is simply $[W]_a \ldots . [W]_b \ldots [W]_b \ldots [W]_a$. That is, Hromada searched only for antimetaboles when they stacked with mesodiplosis (clause medial repetition), when there was no additional linguistic matter.

Most of these researchers did not look for stacked figures, except accidentally. Hromada [2011] looked for other figures (anadiplosis, epanaphora, and epiphora), but only in isolation.[4] Conversely, he 'searched' for mesodiplosis unwittingly, because of the way he defined antimetabole. He was unaware he was doing so and does not report his results. Dubremetz and Nivre [2015] found some antitheses, because they were using negation as a correlative of antimetabole (which markedly improved their success), but they were not looking for them and did not report their results. Only Gawryjolek [2009] looked for stacked figures, but that was not his focus. He did not interpret the stacking at all, nor report on the statistics. He was merely looking for multiple figures in the same corpus, many of which overlapped.

And, of course, detecting rhetorical figures is the beginning of the story. We know, from millennia of humanistic research, that linguistic forms correlate with rhetorical functions—that figures do communicative work beyond 'mere aesthetics'—and we can thank Fahnestock for collating and expanding this research so clearly in the contemporary era. On the basis of this research, we can use the detected figures to help chart meanings—sometimes very fundamental meanings, like the Reject-Replace antithetical antimetabole of Example 1, which diagnoses the exact tenure of Kennedy's inaugural address.

But how well do the form-function couplings that humanists have found stand up beyond the small sampling of discourse that humanists have been able to explore—in the conversations, news stories, opinion pieces, blogs, review articles, short stories, tweets, scientific arguments, and so on, that populate the vast sea of everyday and specialist human discourse? We don't know, but corpus studies should tell us. Do Reciprocal Force antimetaboles collate with transitive verbs, for instance? Do Reciprocal Specification and Subcategorization antimetaboles collate with copulas? Do Irrelevance-of-Order antimetaboles collate with conjunctions and disjunctions? How frequently does mesodiplosis collate with antimetabole? What other stackings are there, with what functional implications? We have intuitions, and much particularized research (that is, specific works of rhetorical criticism), but intuitions and particularized research need to be tested on copora.

How do figures cluster in terms of genres? Do individual authors have identifiable figure proclivities? Is sentiment a trigger for certain figures? Do certain argument types favour certain figures? Are there author-genre figural effects? Argument-sentiment figural effects? Author-sentiment? Again, intuitions and particularized research suggest answers; again, these need to be tested.

When multiple figures co-occur, as they almost always do, which functions stack, which remain independent, which

---

[3] Hromada [2011] calls this notation, Rhetoric Figure Representation Formalism or RFRF, which he adapts from Harris and DiMarco [2009]. Harris and DiMarco did not label their formalism in their paper, but we use their term for it here. The WFRN is a formalism for the general structure of rhetorical schemes, but it does not represent functions at all. For this we need a richer system, which may be provided by Construction Grammar (e.g., Hoffmann and Trousdale 2013). For an argument to this effect, see [Turner 1997:55-60]. Certainly, there are idiomatic deployments of these patterns that fit the Construction Grammar mandate fairly well. For instance, the well-known antimetabolic Easier-to-take-the-A-out-of-B-than-the-B-out-of-A catchphrase is the sort of expression that preoccupies Construction Grammarians:

i. [I]t was easier to take the girl out of the brothel than to take the brothel out of the girl. [Walker 2011: 72]

ii. It was much easier to take Kuhn out of Harvard than Harvard out of Kuhn. [Fuller 2001: 387]

iii. It was found easier to take the evacuee out of the slum than to take the slum out of the evacuee. [Waller 1940: 30]

iv. After twenty-five years in the field. I've traded the front seat of a 4 x 4 for a swivel chair and a desk. The change did not come easily for me. As the old saying goes — it's a lot easier to take the man out of the field than to take the field out of the man. [Unknown 1995, Oklahoma DWC 1995: 61]

v. I could take Tarzan out of the jungle. Could I take the jungle out of Tarzan? [Maxwell 2012: 254]

[4] Anadiplosis is clause-final-clause-initial lexical repetition ($< \ldots W_x >< W_x \ldots >$). Epanaphora is clause-initial lexical repetition ($< W_x \ldots >< W_x \ldots >$). Epiphora is clause-final lexical repetition ($< \ldots W_x >< \ldots W_x >$). Note that these researchers use somewhat different terminology. Hromada uses *anaphora* for our *epanaphora*, while Dubremetz and Nivre also use *chiasmus* for our *antimetabole*. In the first case, we avoid *anaphora* (a synonym in the rhetorical tradition for *epanaphora*) because of its more prominent designation in Computational Linguistics, for pronouns. In the second, we prefer the more specialized terms. It is worth noting that the terminology of rhetorical figures, resulting from over two millennia of research, is highly inconsistent, with different labels for the same linguistic configurations, with multiple linguistic configurations corresponding to the same label, and with some linguistic activity that really isn't figurative labeled as figures. The taxonomy of figures is, in short, a mess. We have developed a much more rigorous, consistent, and principled taxonomy of figures at Waterloo. See Chien and Harris [2010]; Harris [2013:571-575].

ones take precedence in the possibility of a conflict? Are there functional differences between "accidental" figures and "designed" figures. If figures are form-function couplings, does it even make sense to speak of 'accidental' figures (we don't speak of accidental predications or passive clauses; they just are)?

This work can undoubtedly be strengthened by machine learning. We have developed a format for annotating rhetorical figures, in parallel to the annotation formalisms developed for part-of-speech tagging, speech-act annotation, and so on. Corpora annotated with rhetorical figures can be used to train systems on new and more sophisticated detection tasks, especially for stackings and functional correlations.

4 Challenges and Solutions

We want to come at the detection problem for rhetorical figures from the other end. There is a "serious bottleneck … [from] the lack of annotated data" [Dubremetz and Nivre 2015]. We believe that texts curated by rhetoricians, marked up for all occurrences of certain rhetorical figures, will provide rich data for machine learning, and we have developed an annotation scheme to structure the data. The labels in our figure annotation scheme are in effect features pertaining to figure identification and classification. Algorithms trained on such data will, in turn, be more fully equipped for automated figure detection.

The Extensible Markup Language (XML) is widely used for annotations and we apply it here to rhetorical figures. The main challenges of using such an annotation scheme is in the intricacies that figure-rich texts present. These intricacies include stacking figures and interpenetrating figures. The annotation methods developed in this paper address these two issues. The desire is to develop an annotation scheme that will highlight the structure of rhetorical figures allowing them to be more easily understood by computational learning-based algorithms while keeping figures intact. Now, using XML we analyze the development process of a suitable markup.

We have used HTML in the past for annotating figures—specifically, JANTOR (Java ANnotation Tool Of Rhetoric) allowed for "manual and automated annotation of files in HTML format" [Gawryjolek 2009; Gawryjolek, Harris, and DiMarco 2009]—but XML presents such obvious advantages that we have adopted it in our recent work. It is especially valuable for the flexibility it provides in creating one's own tags and attributes.

Our original markup focused on the names of tags and did not include attributes. This is adequate, using a general markup template like the one in 19, for simple instances of isolated ploche, such as 20a (annotated as 20b):

19.
```
        <example>
        ...text...
        <figure-name>
                ...text...
           <figure-element-number>
                        ...text...
           </figure-element-number>
                        ...text...
        </figure-name>
                ...text...
   </example>
```

20. a. He hated white oppression and white domination, not white people themselves. (white)

b.
```
<example>
    He hated
    <ploche>
        <ploche-A-1>white</ploche-A-1>
        oppression and
        <ploche-A-2>white</ploche-A-2>
        domination, not
        <ploche-A-3>white</ploche-A3>
    </ploche>
    people themselves.
</example>
```

The container tag <example> marks off the beginning of the text while the <figure-name> tag reveals the beginning position of the figure. The vital tags of this markup are the <figure-element-number> tags which encompass the defining features of a figure. In Example 20b they are <ploche-A-[1 to 3]>. Figure 1 illustrates the hierarchical nature of the markup for 20b. These markers provide information about elements such as letter groups (A-Z are the same across tags if the content of the tag has the same word or group of letters) and relative positioning (1 to 3). Issues with this markup arise quickly, but the main idea of marking defining elements still has its uses.

There are syntactic and semantic issues that form when applying the markup to more figure-rich texts. By analyzing an example (1, repeated here for convenience), we demonstrate the problems. (A fully formatted example is given in Figure 2.)

21. a. Ask not what your country can do for you. Ask what you can do for your country. (your country / you; ask not x / ask y) [Kennedy (and Sorensen) 1961]

b. <antithesis-A-1><ploche1>...<antimetabole> <ploche2>...<mesodiplosis>...</antithesis-A-1> <antithesis-B-1>...</ploche1>...</mesodiplosis> ...</antithesis-B-1></ploche2></antimetabole>

```
<example>
    <antithesis>
        <antithesis-A-1>
            <ploche1>
                <ploche1-A-1>Ask</ploche1-A-1>
                not what
                <antimetabole>
                <ploche2>
                <antimetabole-A-1>
                    <ploche2-A-1>your country</ploche2-A-1>
                </antimetabole-A-1>
                <mesodiplosis>
                    <mesodiplosis-A-1>can do for</mesodiplosis-A-1>
                    <antimetabole-B-1>you</antimetabole-B-1>
        </antithesis-A-1>
        <antithesis-B-1>
            <ploche1-A2>Ask</ploche1-A2>
            </ploche1>
            what
            <antimetabole-B-2>you</antimetabole-B-2>
            <mesodiplosis-A-2>can do for</mesodiplosis-A-2>
                </mesodiplosis>
            <antimetabole-A-2>
                <ploche2-A-2>your country</ploche2-A-2>
            </antimetabole-A-2>
        </antithesis-B-1>
            </ploche2>
            </antimetabole>
    </antithesis>
</example>
```

Figure 2: The full hierarchical structure of Example 21b. Bolding indicates syntax errors.

A syntax issue arises in Example 21b where multiple figure tags close in the incorrect parent tag. For example, we have <antithesis-A-1>...<antimetabole>...</antithesis-A-!>... <antithesis-A-B>...</antimetabole>...</antithesis-A-B>. Figure 3 below shows the other figures that also fall to this error.

The syntax of XML does not allow the interpenetration of tags. When considering this problem, it becomes apparent that the tags marking off the beginning and endings of figures are causing the most trouble. Further analysis reveals that these tags are unnecessary. The key components of a figure are their defining elements such as repeating or contrasting elements (words, sounds).

The semantic complication has to do with nesting XML tags. Arbitrary hierarchies can form when some figures happen to appear inside others. Rhetorical figures may, however, contain other rhetorical figures which do observe hierarchical properties. Thus we require a method that is more explicit about creating hierarchies. This is achievable with the introduction of attributes and thus the creation of a new annotation scheme.

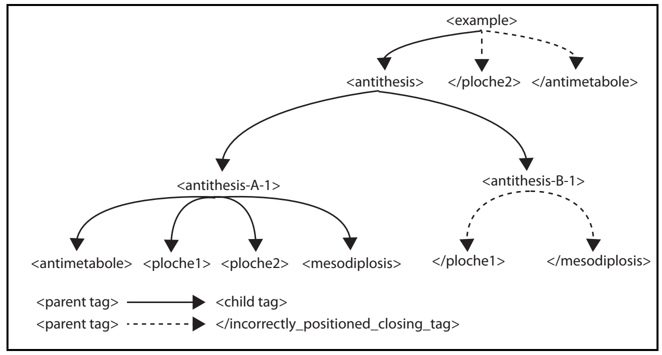

Figure 3: Problems arise from ending the antithesis tag before ending the antimetabole tag.

Figure 3 displays the complexity of this version of the annotation scheme. The dashed arrows represent the consequences of tagging when you need to mark the end of the antithesis before the end of the antimetabole; there is no hierarchy, or perhaps only a partial and .fragmentary hierarchy, but it creates havoc. The nesting, if we can even call it that, is incomplete, falling outside XML's basic capacities. Hierarchy problems also become apparent as <antimetabole-element-number> tags are sub-tags of <ploche>.

The improved annotation scheme recognizes the above problems and attempts to resolve them. It focuses on highlighting the defining elements of figures. A general markup is shown in number 22 (a fully formatted example for this markup is provided in Figure 5, given between the Conclusion and the Acknowledgements for purposes of layout):

22. <element figure='figure1 [figure2]' lettergroup= '[figure1-(A to Z)...]' position='[figure1-(1 to n)...]'>... text...</element>

If one wanted to create a hierarchy, say in the instance that figure1 always accompanies figure2 meaning figure1 is a subpart of figure2, this is still possible. The XML from the example would look like: <element figure='figure2'> … <element figure='figure1'> … </element> … </element>. This way we now have the option to create or avoid a hierarchy.

As Figure 4 reveals, the improved markup focuses on tagging parts of strings and providing them with more information. The figure focusses on antithesis, antimetabole and ploche, where *ploche* referes to ploche1. Notice how we

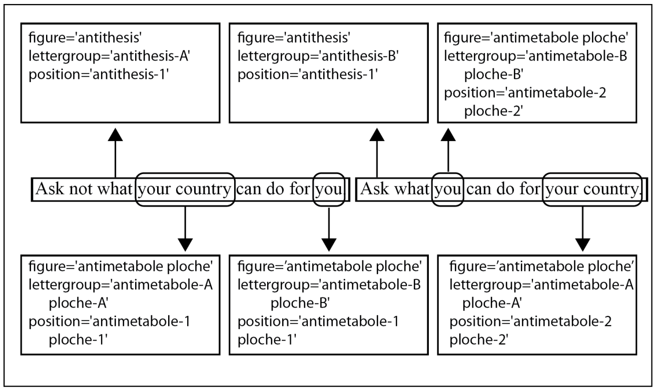

Figure 4: Improved annotation scheme, tagging parts of strings and providing more information.

are able to combine the antimetabole and ploche tags into one attribute and avoid a hierarchy

Using attributes also helps to separate information about a tag providing algorithms with easier access. The lettergroup attribute grants information on which tags surround the same word or, as the names suggests, groupings of letters. If the letters inside the tag are the same as inside another tag the attribute will end in the same character. The position attribute clarifies the location of the letter group in the figure. For example, antimetabole has two A's in its ABBA structure. To differentiate between them we write the position attribute of the first A as Antimetabole-1 and the second as Antimetabole-2. Using these tags and attributes to annotate rhetorical figures in text would create the required computational structure for figure analysis.

5 Conclusion

The computational uses of rhetorical figures are indisputable. We can clearly see their ability to enhance fields such as author and genre detection, NLP systems, and argumentation mining. We also know how intricate they can become. Stacking and intersecting with one another, many figures can be overlooked as observed in the previous works mentioned here. To exploit their uses, yet overcome their intricacy, a rhetorical figure markup becomes imperative and should be thought of as such.

Our annotation scheme represents the first move in what we hope will be a line of research that others will find profitable to join. The outline of the annotation scheme has been developed, and now the flexibility of XML allows others to improve and customize the mechanism for their own uses. The eventual goal is to develop a markup scheme that provides computationally accessible information for all rhetorical figures.

```
<example>
    <element figure='antithesis' letter group='antithesis-A' position='antithesis-1'>
        Ask not what
        <element figure='antimetabole ploche' lettergroup='antimetabole-A ploche-A' position='antimetabole-1 ploche-1'>
            your country
        </element>
        can do for
        <element figure='antimetabole' lettergroup='antimetabole-B' position='antimetabole-1'>
            you
        </element>.
    </element>
    <element figure='antithesis' lettergroup='antithesis-B' position='antithesis-1'>
        Ask what
        <element figure='antimetabole' lettergroup='antimetabole-B' position='antimetabole-2'>
            you
        </element>
        can do for
        <element figure='antimetabole ploche' lettergroup='antimetabole-A ploche-  A' position='antimetabole-2 ploche-2'>
            your country
        </element>.
    </element>
</example>
```

Figure 5: The full hierarchical structure of Sentence 1 (repeated as 21a), in accord with the tagging specified in 22.

Acknowledgements

We would like to thank Cliff O'Reilly for valuable XML advice, as well as our colleagues at the University of Waterloo, including Elena Afros, Adam Bradley, Ashley Kelly, Isabel Li, Ricky Rong, and Terry Stewart; our international colleagues, including Cliff (again), Marie Dubremetz, Jelena Mitrovic, Chris Reed, and James Wynn; and the Social Sciences and Humanities Research Council of Canada for financial assistance. We also thank three anonymous reviewers for CMNA, for their helpful queries and suggestions. Our figure-annotation research is part of an overall project of Computational Rhetoric at the University of Waterloo, organized around a comprehensive OWL-based ontology of rhetorical figures.

References

Alexis, Andre. 2015. *Fifteen dogs*. Toronto: Coach House Books.

Alliheedi, Mohammed. 2012. Multi-document summarization system using rhetorical information. Master of Mathematics thesis, Cheriton School of Computing, University of Waterloo. [Supervised by Chrysanne DiMarco; Randy Allen Harris, Second Reader.]

Alliheedi, Mohammed, and Chrysanne DiMarco. 2014. Rhetorical figuration as a metric in text summarization. *Proceedings, 2014 Canadian Artificial Intelligence Conference*, Montreal, QC, May 6-9.

Buck, Gertrude. 1899. *The metaphor: A study in the psychology of rhetoric*. in Contributions to Rhetorical Theory. Ed. Fred Newton Scott. Ann Arbor: Inland.

Bush, George W [and David Frum]. 2001. Address before a joint session of the congress on the United States response to the terrorist attacks of September 11. *The American Presidency Project*. Gerhard Peters and John T. Woolley. http://www.presidency.ucsb.edu/ws/?pid=64731

Chien, Lynn, and Randy Allen Harris. 2010. Scheme trope chroma chengyu: Figuration in Chinese four-character idioms. *Cognitive Semiotics* 10.6:155-178.

Clinton, Hilary. 2013. Statement for the Americans for Marriage Equality campaign. Human Rights Campaign. (18 March.) http://www.hrc.org/videos/videos-hillary-clinton-supports-marriage-equality#.UXAbPys4Xvl

Crosswhite, James. 2000. Rhetoric and computation. Symposium on Argument and Computation. Bonskeid House, Perthshire, Scotland. June 27.

Dubremetz, Marie, and Joakim Nivre. 2015. Rhetorical figure detection: the case of chiasmus. *Proceedings of NAACL-HLT Fourth Workshop on Computational Linguistics for Literature*, Denver, CO, June 4.

Fahnestock, Jeanne. 1999. *Rhetorical figures in scientific argumentation*. New York: Oxford University Press.

Fuller, Steve. 2001. *Thomas Kuhn: A philosophical history for our times*. Chicago: Chicago University Press.

Gawryjolek, Jakub J. 2009. Automated annotation and visualization of rhetorical figures. Master of Mathematics thesis, Cheriton School of Computing, University of Waterloo. [Supervised by Chrysanne DiMarco; Randy Allen Harris, Second Reader.]

Gawryjolek, Jakub J., Randy Allen Harris, and Chrysanne DiMarco. 2009. An annotation tool for automatically detecting rhetorical figures. *Proceedings, CMNA IX (Computational Models of Natural Argument)*, held with IJCAI-09, Pasadena, CA, July 13.

Gladkova, Olga, Chrysanne DiMarco and Randy Harris, 2016. Argumentative meanings and their stylistic configurations in clinical research publications. *Argument & Computation* 6.3: 310-346.

Gladkova, Olga, Randy Allen Harris and Chrysanne DiMarco. 2011. Schematic organization of clinical decision-making: Findings from qualitative corpus analysis. *Proceedings, CMNA XI (Computational Models of Natural Argument)*, 7 August 11, San Francisco, CA.

Grasso, Floriana. 2002a. Towards a framework for rhetorical argumentation. EDILOG 2002 - *Proceedings of the 6th Workshop on the Semantics and Pragmatics of Dialogue*, J. Bos, M.E. Foster and C. Matheson (eds), Edinburgh, UK, 4-6 September 2002, p. 53-60.

Grasso, Floriana. 2002b. Towards computational rhetoric. *Informal Logic* 29.3: 195-229.

Green, Nancy. 2010. Representation of argumentation in text with Rhetorical Structure Theory. *Argumentation* 24.2:181-196.

Green, Nancy. 2015. Identifying argumentation schemes in genetics research articles. In *Proceedings of the Second Workshop on Argumentation mining*, North American Conference of the Association for Computational Linguistics (NAACL), 12-21, Denver, CO, 2015.

Greer, Germaine. 1988. The proper study of womankind. *Times Literary Supplement* (3-9 June).

Harris, Randy Allen. 2013. Figural logic in Mendel's *Experiments on plant hybrids*. *Philosophy and Rhetoric* 46.4: 570-602.

Harris, Randy Allen, and Chrysanne DiMarco. 2009. Constructing a rhetorical figuration ontology. *Symposium on Persuasive Technology and Digital Behaviour Intervention, Convention of the Society for the Study of Artificial Intelligence and Simulation of Behaviour (AISB)*, Edinburgh, Scotland, April.

Hertzberg, Hendrik. 2008. The spat. *New Yorker* (February 11).

Hoffmann, Thomas, and Graeme Trousdale, eds. 2013. *The Oxford handbook of Construction Grammar*. New York: Oxford University Press.

Hromada, Daniel Devatman. 2011. Initial experiments with multilingual extraction of rhetoric figures by means of PERL-compatible regular expressions. *Proceedings of the Second Student Research Workshop associated with RANLP 2011*, Hissar, Bulgaria.

Kanoksilapatham, Budsaba. 2003. A corpus-based investigation of scientific research articles: Linking move analysis with multidimensional analysis. PhD dissertation, Department of Linguistics, Georgetown University.

Kanoksilapatham, Budsaba. 2005. Rhetorical structure of biochemistry research articles. *English for Specific Purposes* 24.3:269-292.

Kennedy, John F. [and Theodor Sorensen]. 1961. Inaugural Address. http://www.presidency.ucsb.edu/ws/index.php?pid=8032

Magid, Larry. 2012. Zuckerberg claims we don't build services to make money. *Forbes* (1 February) http://www.forbes.com/sites/larrymagid/2012/02/01/zuckerberg-claims-we-dont-build-services-to-make-money/

Mann, William C., and Sandra A. Thompson. 1988. Rhetorical Structure Theory: Toward a functional theory of text organization. *Text* 8.3:243-281.

Matthews, P. H. 2007. *Syntactic relations: A critical survey*. *Cambridge Studies in Linguistics* 114. Cambridge: Cambridge University Press.

Maxwell, Robin. 2012. *Jane: The woman who loved Tarzan*. New York: Macmillan.

Newton, Sir Isaac. 1803 [1687]. *The mathematical principles of natural philosophy*. Three volumes. Trans. by Andrew Motte. London. H.D. Symonds.

O'Reilly, Cliff. 2010. Lassoing rhetoric with OWL and SWRL. Unpublished MSc dissertation. Available: http://computationalrhetoricworkshop.uwaterloo.ca/wp-content/uploads/2016/06/LassoingRhetoricWithOWLAndSWRL.pdf

O'Reilly, Cliff, and Shamima Paurobally. 2010. Lassoing rhetoric with OWL and SWRL. Unpublished. Available http://www.academia.edu/2095469/Lassoing_Rhetoric_with_OWL_and_SWRL

Perelman, Chaïm, and Lucie Olbrecht-Tyteca. 1969. *The new rhetoric: A treatise on argumentation*. Translated by John Wilkinson. Notre Dame: Notre Dame University Press.

Reed, Chris, and G.W.A. Rowe. 2004. Araucaria: Software for argument analysis, diagramming and representation. *International Journal of AI Tools* 13.4):961-980.

Reed, Chris , and Timothy J. Norman, editors. 2003. *Argumentation machines: New frontiers in argument and computation*. Dordrecht, The Netherlands: Kluwer.

Rubinelli, Sara. 2006. The ancient argumentative game: Topoi and loci in action. *Argumentation* 20.3:253-272.

Sartwell, Crispin. 2014. The left-right political spectrum is bogus. *The Atlantic* (June 20). http://www.theatlantic.com/politics/archive/2014/06/the-left-right-political-spectrum-is-bogus/373139/

Seuss, Dr. [Theodore S. Geisel.] 1940. *Horton hatches the egg*. New York: Random House.

Strommer, Claus. 2011. Using rhetorical figures and shallow attributes as a metric of intent in text. Doctoral Dissertation, Cheriton School of Computing, University of Waterloo. [Supervised by Chrysanne DiMarco; Randy Allen Harris, Committee Member.]

Tindale, Christopher W. 2000. *Acts of arguing: A rhetorical model of argument*. Albany, NY: State University of New York Press.

Teufel, Simone, J. Carletta and M. Moens. 1999. An annotation scheme for discourse-level argumentation in research articles. In *Proceedings of the Ninth Conference on European Chapter of the Association for Computational Linguistics*, Stroudsburg, PA, 110-117.

Teufel, Simone. 2010. *The structure of scientific articles: Applications to citation indexing and summarization*. San Francisco: CSLI Publications.

Turner, Mark. 1997. Figure. In *Figurative language and thought*, Cristina Cacciari, Ray Gibbs, Jr., Albert Katz, and Mark Turner, eds. New York: Oxford University Press, 44-87.

Unknown author. Unknown date. Western Spanglish language: The United States unofficial language. *Western women in leadership and innovation: Discovering the wellsprings of metaphorical voices*. http://westernwomenleadershipinnovation.net/western-spanglish-language.html

Unknown. 1995. Oklahoma Department Of Wildlife Conservation. *Outdoor Oklahoma*. Volumes 51-52.

Unknown. 2013. Ultrabooks vs Laptops. 2013. *Java* (January 26). http://java-maheshyadav.blogspot.ca/2013/01/ultrabooks-vs-laptops.html.

Volpe, Peter E. 1975. *Man, nature, and society: An introduction to biology*. Dubuque IA: W. C. Brown Company.

Walker, Daniel. 2011. *God in a brothel: An undercover journey into sex trafficking and rescue*. Downers Grove, IL: InterVarsity Press.

Waller, Willard. 1940. *War and the family*. Hinsdale, Il: The Dryden press.