# Reading Orlando with the Mandala Browser: A Case Study in Algorithmic Criticism via Experimental Visualization

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## Abstract / Résumé

This paper describes the preliminary results of combining two complementary technologies: *Orlando*, a semantically-tagged XML collection of born-digital scholarly resources, and the Mandala Browser, an XML visualization tool. *Orlando*'s current delivery system privileges text as an approach to literary historical scholarship. The Mandala browser represents a radically different way of mediating between the user and the text, translating a text or set of texts into a circular visual form and pushing the user towards a more distant, or at least a more selective, reading of the materials than that associated with conventional print or screen rendering. Through experimental visualizations of *Orlando* content, we began to address questions concerning the participation of Victorian and Renaissance writers in various genres, the relationship between reproduction and literary production, the connection of censorship to the destruction of literary works, and the relationship between suffrage and liberal or conservative political groups. We argue that, just as a postcolonialist or a new historicist needs to learn about the tenets and processes involved in a postcolonial or new historical critical framework, so too an algorithmic critic should expect to invest some time learning the techniques of a given approach and how to apply them to a particular text or body of texts. These investigations may interest other humanities scholars working with online digital collections, as well as those thinking through the question of how to involve computational processes in complex inquiries using large quantities of texts.

## KEYWORDS / *MOTS-CLÉS*

algorithmic criticism, text visualization, text analysis, XML, literary criticism, interface design

## Contents



# Introduction

Ramsay proposes that computational methods can be usefully applied to problems in the humanities, not through attempts at generating objective proof for hypotheses, but instead through supporting the more mainstream humanities activities of interpretive inquiry.[1] He calls this approach, which parallels scholarly approaches such as postcolonialism or new historicism, by the name "algorithmic criticism":

> The "algorithmic criticism" here proposed rejects the empiricist vision of the computer as a means by which critical interpretations may be verified, and instead seeks to locate computational processes within the rich tradition of interpretive endeavours (usually aligned more with art than criticism), which seek not to constrain meaning, but to guarantee its multiplicity. Computational processes, which are perhaps more conformable to this latter purpose, may be usefully viewed as ways of providing the necessary conditions for interpretive insight. (167)

In this paper, we describe some suggestive preliminary results in the field of algorithmic criticism which we obtained by combining two complementary technologies: *Orlando*, which is a semantically-tagged XML (Extensible Markup Language) collection of biographical and critical accounts of British women writers, and the Mandala Browser, which is an XML visualization tool. XML is a standard that defines rules for encoding documents electronically, using plain ASCII text, so that they can be stored, transported, exchanged, formatted, and processed independent of proprietary software and for a wide range of purposes (W3C Consortium). *Orlando*'s current delivery system is predicated on a privileging of text, a refusal of "distant reading" (Moretti 1) as an approach to its literary historical materials. Its searches are designed to return users insistently to the text in which the terms they sought are embedded, since those particularities nuance and complicate implications of the semantic markup which might otherwise become the basis for unwarranted generalizations. The Mandala browser represents a radically different approach in mediating between the user and the text. Translating the ostensibly linear —though segmentable and densely interlinked—text into a circular visual form as opposed to its "natural" textual form constitutes a major transformation.

The unmediated material form of the *Orlando* text is, of course, in the form of bits stored as a set of files, and so is not exactly "linear." Nor is it linear as delivered by the current interface, given that it delivers its materials in various orders according to how it is called up by the user. Yet its published interface, by virtue of its reliance on the conceptual model of a reference work, invokes the conventionally linear arrangement of printed texts. The Mandala Browser, used for analysis of a digital surrogate of a printed text, such as a novel, literally transforms that linear form into a circular one.

In crossing the boundary between text and image, Mandala enables new ways of perceiving and exploring the relationships created by the tagging, and pushes the user towards a more distant, or at least a more selective, reading of the materials. Through experimental interactions with the visualization of

Humanities DocumentaryEditing Edition Electronic Editing History Humanities Computing XML computing interface design lateral projects loyalists nineteenth century ontology page, Ege, manuscript, leaf, script, Beauvais Missal, digital reconstruction, fragment pedagogy project development technology text analysis text visualization virtual reality

*Orlando* content, we began to address the following questions:

- what genres did Victorian women writers most commonly use (Figures 3, 4, 5, 6), and how does that breakdown compare to Renaissance women writers (Figure 7)?
- did Victorian women writers tend to be childless, especially the prolific ones (Figures 8 and 9)?
- was destruction of writings typically by authors themselves or by others, and is there any correlation between censorship and the destruction of texts (Figure 10)?
- does association with suffrage imply connection to liberal rather than conservative political groups (Figure 11)?

Finally, we argue that algorithmic criticism, like other forms of literary criticism, requires the scholar to spend some time learning the techniques of the particular approach and establishing how to apply them most fruitfully to a particular text or body of texts. Just as a postcolonialist or a new historicist needs to learn about the tenets and processes involved in a postcolonial or new historical critical framework, so an algorithmic critic should expect to follow a learning curve. Use of a digital tool, in other words, needs in some cases to be understood not as an incidental or trivial activity that precedes the actual research, but as an intrinsic component of the research methodology itself. In many ways, we are at the beginning of this learning curve. Nonetheless, what we have learned so far may be of interest to other humanities scholars working with online digital collections, and to those thinking through the question of how to involve computational processes in complex inquiries using large quantities of texts.

## Introduction to *Orlando*

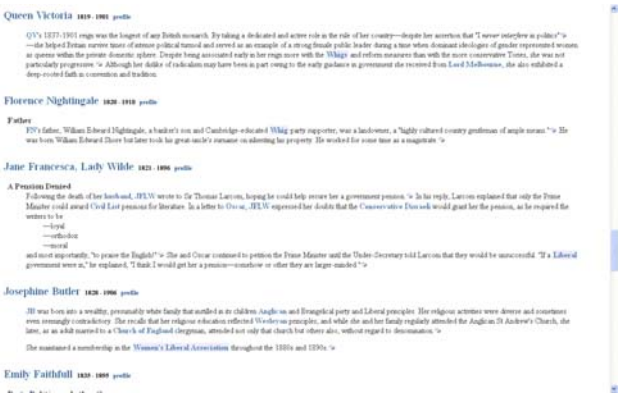
*Orlando: Women's Writing in the British Isles from the Beginnings to the Present* (Brown, Clements and Grundy, eds.) is an extensive literary historical textbase that provides a rich testbed for XML data mining and visualization. An experiment in the use of custom, domain-specific XML markup to support new ways of engaging in and supporting scholarly enquiry, it comprises more than 1,200 core entries treating the lives and writing careers of British women writers and other writers; 13,000+ free-standing chronology entries providing rich literary, social, and broadly historical context; 12,000+ bibliographical listings; and 2.3 million tags embedded in 8.5 million words of born-digital text. It provides a corpus for investigating everything from writers' relationships with publishers to their involvement in political activities or their use of imagery.

The current interface, published in 2006, lets users access entries by name or by searching on various criteria associated with authors, create custom chronologies by searching on tags and/or contents of dated materials, and search across the entire textbase for tags, attributes, and contents, or combinations thereof (Figure 1). For instance, a user can pull together all instances of the dramatic monologue within the Victorian period, or search for governesses who also wrote novels. The XML sits behind the readable text of the interface, and serves to structure the materials; to allow users (either directly or indirectly) to find specific material or bring together results sets according to particular interests; and to provide automatic hyperlinking of "core" tags (names, places, organizations, and titles).

*Figure 1: The published Orlando interface offers a variety of "entry points" shown along the left of the screen. Here we show the "People" entry point with an alphabetical list of author names.*


Search results in the current *Orlando* interface are provided in a variety of fairly conventional list forms, consisting either of complete entries or text snippets that have been dynamically collected in response to a query (Figure 2).

*Figure 2: An example of short text passages retrieved using the current Orlando interface.*




Recognizing that retrieving materials through tag searches is an alienating approach for many in our target user community of literary students and scholars, and also that our current interface is far from having fully plumbed the potential of *Orlando*'s experimentation in structured text, the team has begun to explore what other kinds of enquiry and interfaces the textbase can support. We have also begun to explore experimental interface possibilities that our commitment to W3C accessibility guidelines ruled out during development of our initial interface.

These investigations have focused on the unique linkages or embedded connections created by the XML. The most obvious linkages offered by the system are those created by the tags for personal names, organization names, names of places and titles of texts, all of which are automatically hyperlinked by the system. *Orlando* has close to 75,000 instances of such tags, creating a vast network of links (Brown, Clements, Grundy, Ruecker, Antoniuk, Balazs). These might be considered explicit links. The tags also create many other kinds of linkages or connections, which we call implicit links. The semantic tags indicate related semantic content across the textbase, and provide contextual information for other tags, including the explicit links. *Orlando*'s current delivery system exploits those linkages in text-centered ways: through hyperlinks on words, and through search query forms involving picklists or text boxes. Results are sets of semantically meaningful portions of text (a textual division or paragraph, for instance, or a chronological event containing the match).

## Introduction to Mandala

Visualization tools offer alternative means of representing and interacting with the relations embedded in the markup. The Mandala Browser (Gainor, Sinclair, Ruecker, Patey, Gabriele; Cheypesh, Pacher, Gabriele, Sinclair, Paulin, Ruecker) is an example of a tool designed to allow literary scholars to work interactively with text visualization. It is within a tradition of visual browsers such as the InfoCrystal (Spoerri), Text Arc (Paley), and Dust & Magnet (Yi, Melton, Stasko, Jacko), and forms part of a suite of prototypes developed over the past few years to explore the principles of rich-prospect browsing (Ruecker, Radzikowska, and Sinclair).

The Mandala is an open-source tool that was created as part of the Humanities Visualization project led by Sinclair and Ruecker. It is available for use at www.humviz.org. It can read any XML-encoded text, PDF, or plain ASCII text. It allows the scholar to subdivide a document into components that appear as dots around the periphery of a circular space. The scholar then defines "magnets" that sit in the interior and attract the dots from the periphery, using whatever criteria have been defined for each magnet. The resulting display (e.g. Figures 3, 4, 5, 6, 7, 8, 9, 10, 11) shows sets and subsets of dots, each of which represents a portion of the text that can be viewed in its entirety by clicking on a dot. Several dots can be opened at once by "lassoing" them, shift-clicking them, or double-clicking on a magnet, and the resulting texts can be exported for further study.

The kinds of inquiry that Mandala can support are dependent on several factors. First is how well the text markup of the particular corpus being used is suited to the particular inquiry. Any document (XML or even plain text) that can be automatically subdivided into meaningful components such as paragraphs can be studied with the Mandela, using free text searches for the magnets. However, by working with XML documents that also include semantic or hermeneutic markup, the scholar has the opportunity to draw directly on the markup by defining magnets that are constrained by these tags. The semantic tags in *Orlando* delimit text relevant to many aspects of the study of women's writing, ranging from birth order or levels of education to relationships with publishers or uses of nonstandard English in their writings. This highly interpretive tagset encodes the theoretical priorities of the team members, with the result that, for instance, the markup deals with education and politics, but doesn't deal with animals. Setting up magnets to look at the role of animals in relation to British women writers will therefore require some inventiveness in using free text criteria that would not be necessary if animal tagging had been a priority in creating the markup scheme, although some tags such as `THEMETOPIC` might be used to provide a sense of context.

Second is the ability of the scholar to make use of advanced search techniques. The Mandala uses Lucene (lucene.apache.org) as its search engine, which means the magnets can be defined using regular expressions. This capacity allows the scholar to create one magnet that meets several conditions, rather than producing one magnet for each condition. Knowledge of Boolean logic and the construction of complex string expressions will therefore allow users to specify the criteria for magnets with much greater precision.

The scholar's understanding of the markup in a collection is the third factor. In order to make sophisticated use of a visualization tool, it is very useful to know not only what kinds of searches the markup will support, but also what is implied by the interpretation that has been reified by the markup. A basic understanding of the structure of XML is helpful, such as the difference between elements and attributes, for instance, or the implications of nested structures. Beyond that, however, the kind of highly interpretive markup involved in *Orlando* is far from self-evident, and Mandala itself does not provide any definition of or documentation for any of the tags, so prior knowledge is a major advantage both in defining magnets and in interpreting the resulting visualization. It is not clear without documentation, for instance, whether the `SUBJECT` tag refers to the subject of a literary work, a subject studied in school, or something to do with the theoretical concept of subjectivity. For example, in setting up a magnet using the `NAME` tag, it is important to know whether the `NAME` tag encompasses just personal names or also animal names or character names. If only personal names, has the project tagged every instance of a name, or only the instances that seemed significant? If the latter, then it is possible that some dots won't contain all instances of a name: there may be untagged instances that are missed by a magnet defined solely using the `NAME` tag. Such factors can affect either the syntax used to define the magnet, or the interpretation of the results.

Fourth is the capacity of the Mandala as a visualization tool to address a particular line of inquiry. It constructs visualizations based on criteria related to tags, attributes, and their contents, and on any combination of these three. Multiple criteria can be attached to a single magnet and related using Boolean logic. Together, these features permit the construction of quite complex and

precise visualizations. However, the tool flattens out the tagging. Beyond linking attributes to their tags, it does not permit one to construct queries based on the nesting of tags within other tags. It cannot therefore construct visual forms that rely on the nesting of tags or their placement at a particular level of a hierarchy.

Given these four factors, we have found that using the Mandala browser with *Orlando* has allowed us to conduct some preliminary explorations that reveal relations implicit in this rich data set in ways that complement what is supported by the current interface. For example, one consequence of Mandala flattening the XML hierarchy is that it offers a query structure capable of bringing together different levels of the tagging hierarchy. Mandala also allows for the relatively unconstrained combination of free text searches, tag searches, and attribute searches, as well as successive refinement of queries.

Using the current *Orlando* interface, for example, a scholar who is interested in women writers' relationships to political parties might search on the word "party" within the organization tag, which produces a set of textual excerpts. This set can be narrowed by searching again using the tagging to apply a variety of constraints to the results: particular date ranges, specific political parties, occurrences within mentions of women writers' political activities, or textual treatments. Or a reader may simply begin to read for interesting connections and associations—though 235 excerpts from entries and 267 events constitute a lot of scrolling. Nor does the word "party" necessarily capture some of the organized political parties, such as the Radical Club.

Using the Mandala, on the other hand, the results can be explored and refined by adding and subtracting magnets from the display, dynamically reconfiguring the sets and subsets of attracted dots, before lassoing a group, double-clicking a magnet, or shift-clicking a few dots for reading. The transition into Mandala therefore means in many ways crossing a major interface boundary: leaving text behind – if only temporarily, since the source text can be accessed with the click of a mouse – in favour of working with configurations of coloured dots.

## Reading *Orlando* with Mandala

For our purposes, we loaded *Orlando* into the Mandala so that each dot represents an entry on a British woman writer. *Orlando* entries come in two parts: a biography and a writing history. We combined both of those parts into a single dot, so that magnets would attract dots where there was a match within either the biography or the writing document. This choice provides us with a clear visualization in which each dot represents a writer, which seemed a good choice given the size of the collection (which creates more than 1200 dots) and an interest in considering writers' biographies and their writing careers as a unit. Alternatively, we could have chosen to have separate dots for biography and writing, resulting in two dots per author, or we could have divided to a finer level of granularity, and had dots represent DIV2s, for example, which are meaningful sections at a level larger than the paragraph but much smaller than an entire author entry in our coding. Each of the alternatives has its strengths and weaknesses. Dots representing large amounts of text (e.g. writers) keep the visual results more manageable, since there are smaller numbers of dots, but the scope of text makes the coincidental rather than meaningful combination of search terms, especially in free text searches, more likely. Dots representing DIV2s reduce the coincidental co-occurrence of search terms, but make interpreting the visual results more difficult, since there will be dozens of dots for each writer.

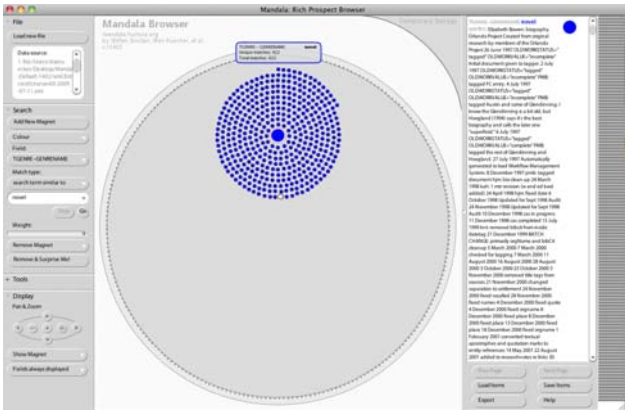
Choosing how best to subdivide a document is one of the skills that algorithmic critics using the Mandala need to acquire. Ideally, dots should represent meaningful units that, taken together, more or less encompass the entire contents of the file. For example, in studying plays, we have typically used the speech as the unit for a dot. Researchers using *Orlando* to explore individual texts, however, might choose in this case to use the DIV2 tag as a unit, since we use this tag to envelop substantial discussions of individual texts as well.

While the specificity of the individual results is lost with Mandala, or at least

recedes to the background until a dot or group of dots representing items in the collection is clicked to populate the text pane, what is gained is a sense of the whole subset of results, overlaps between groups, and the distribution of subsequent search terms within that subset, none of which is available within the exclusively textual interface.

For our first question, we decided to use Mandala to explore the activity of Victorian women writers with respect to genre. For tags with a limited range of values, the Mandala can automatically generate one magnet for each value. However, again the specifics of the tagset determine utility: for genre names in *Orlando*, doing so would generate 250 magnets simultaneously (or freeze in the attempt), a bit much for screen real estate to handle or the human eye to comprehend, so selecting a specific genre is more appropriate. Figure 3 shows all the novelists (For more information about the tagging of genre and other textual features in the *Orlando* project, see "Orlando Help: About the Tags" in Brown, Clements, Grundy, eds.).

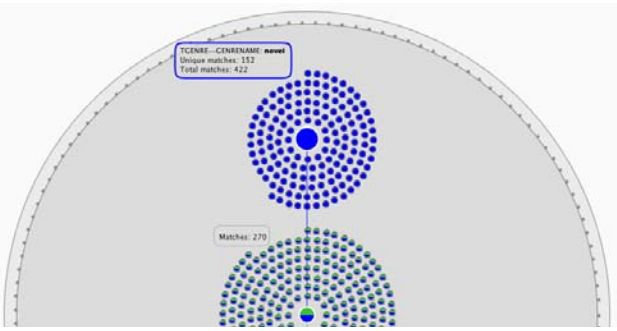
*Figure 3: The Mandala Browser. The dots (grey around the periphery and blue near the larger blue magnet) each represent an entry on a Victorian woman writer. The blue dots represent writers who wrote novels. In technical terms, the magnet is defined with TGENRE-GENRENAME similar to "novel." Subsequent figures will show the visualization pane alone.*

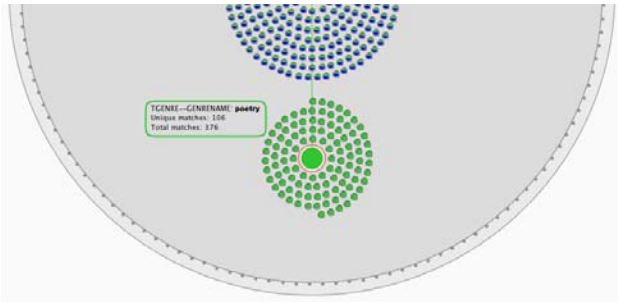



Clearly, there were many novelists during the Victorian period. This is consistent with our sense of the period as the one in which the novel became a dominant form. Note that not all of the visual details of the Mandala convey meaning. For instance, the location of the magnet with respect to the periphery is not important, since it is based on an algorithm that simply tries to create space between magnets. Nor is there any significance to the relative positioning of subsets between two or more magnets. Finally, the colour is usually not important, since there is a default colour palette that applies sequentially to each magnet as it is created; however, since the user can override these defaults, in some particular cases the colours have meaning. For example, in Figure 11, below, we used blue for conservative political organizations, green for suffrage, and red for liberal.

In our next iteration (Figure 4) of our exploration of genre, we added a magnet, again using TGENRE-GENRENAME, to attract all entries that contain a tag for poetry.

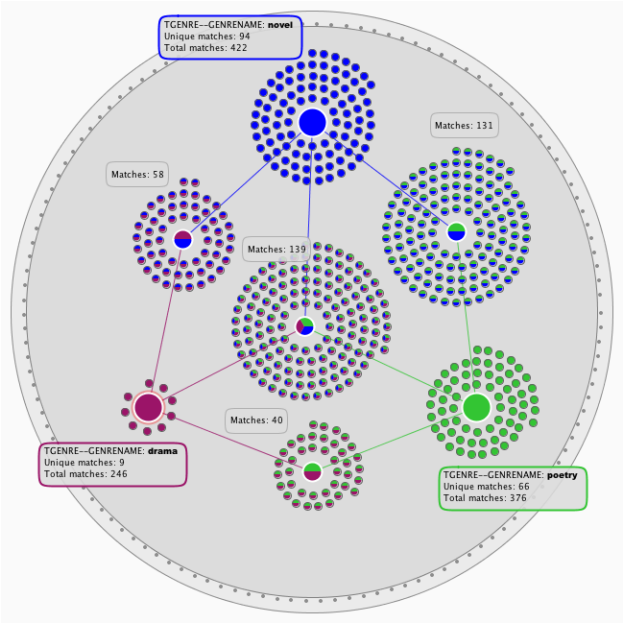
*Figure 4: Victorian novelists (blue), poets (green), and authors working in both genres (blue/green).*





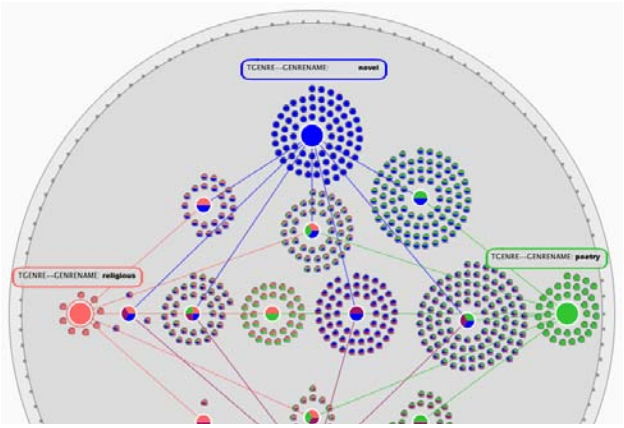

There are perhaps a surprising number of Victorian poets. In fact, there are nearly as many poets as novelists in the *Orlando* textbase, and nearly 50% of those groups who wrote both. Next, we added a red magnet for drama (Figure 5).

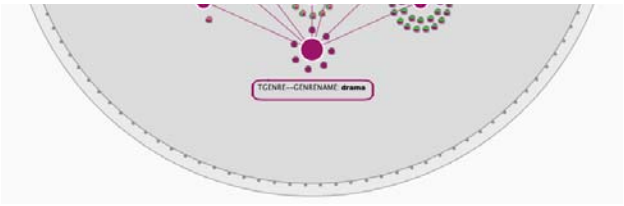
*Figure 5: This visualization of Victorian novelists (blue), poets (green), and playwrights (red) shows considerable overlap in the form of people who wrote in multiple genres.*




At this stage, we noted the large set of writers who worked in all three genres, and the extent to which few people in the group wrote in none of these. The sense that the age was one that was largely hostile to theatre, and particularly drama by women, is reinforced insofar as relatively few Victorian writers covered by *Orlando* wrote drama alone. Finally, we added a fourth magnet for religious writing (Figure 6). As with drama, nearly all writers of religious material within the *Orlando* set also worked in other genres.

*Figure 6: Victorian novelists (blue), poets (green), playwrights (red), and religious writers (orange).*

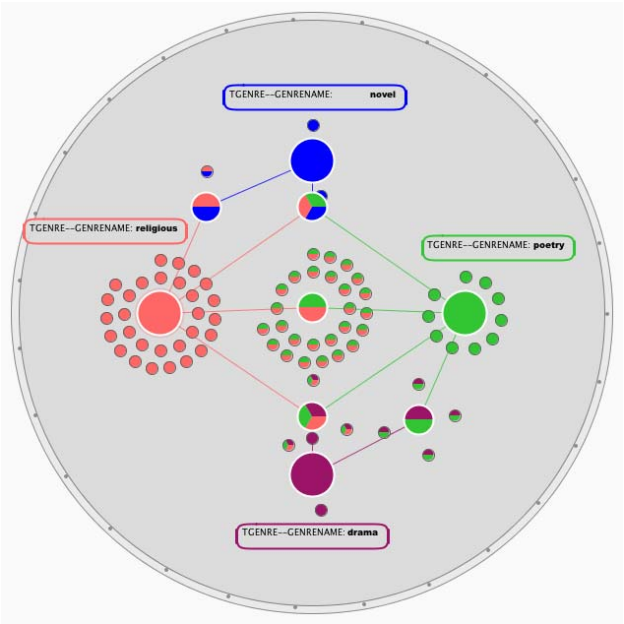





Our sequence of Mandala visualizations allows us to reflect on the implications of genre distribution and its relation to gender: most but not all of these are women writers. We also see a preponderance of some genres, although the novel is not quite as dominant as one might expect. The number of poets suggests there may be some feminization of poetry. Such a conjecture could be pursued by separating out the female from the male writers and comparing the two, although the imbalance in numbers would be a concern and ideally one would wish to have a comparison corpus of the same number of male writers, tagged on the same principles. There is also considerable overlap between different genres, with relatively few, for instance, writing just drama or just religious writing.

Although not particularly startling, Figure 6 begins to suggest that there are patterns worth further investigation, and that these patterns might be hard to discern for someone who is simply reading through the text of entries or a set of search results. One further step might be to create a comparable Mandala for writers of another period, which would allow for contrast (Figure 7).

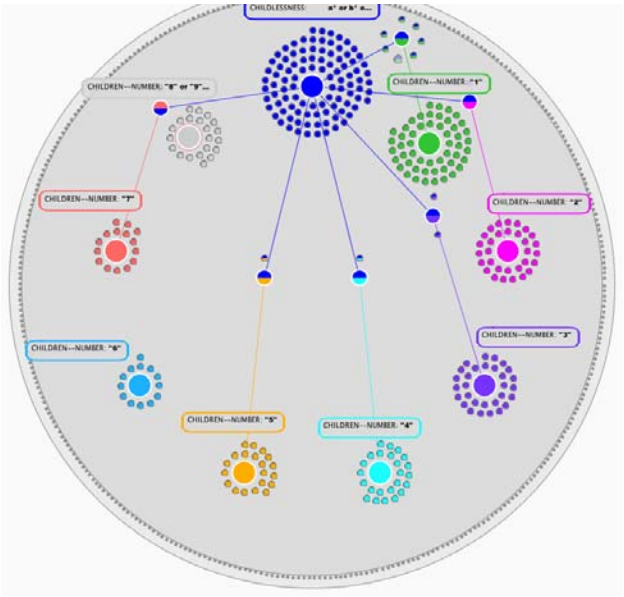
*Figure 7: Renaissance novelists (blue), poets (green), playwrights (red), and religious writers (orange).*




The results of the same sequence for the smaller set (104 writers) in the Renaissance period show fewer writers, but also a very different distribution of generic activity. Several items here are worth further investigation—not least of which is the concept of Renaissance novelists. There is an inversion of novel and religious writing, and not much work in drama. Despite our strong sense of the Renaissance as a period when drama flourished, this was not apparently the case for women.

Our next investigation (Figures 8 and 9) dealt with a belief that was at one point in literary history considered relatively well established, although in more recent decades it has been refuted. This is the premise that in the Victorian period, literary production was incommensurate with childrearing.

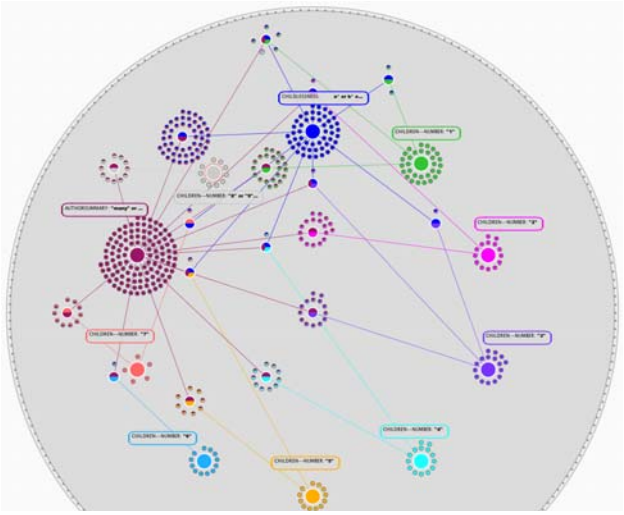
*Figure 8: This visualization shows Victorian women writers organized by number of children, with no children at the top and increasing numbers of children going clockwise to a maximum of eight or more at top left.*




We again loaded the Mandala with each dot representing a Victorian writer, then created one magnet for each number of children. Royal blue represents childlessness, with the remaining colours representing children numbers one through eight or more. Progressing clockwise, the number of children increases, and the number of writers with that many children decreases, until we get to more than 7. There are, however, dots around every magnet. This image counters quite dramatically the impression based on writers such as George Eliot and the Brontës that writing and rearing children were incompatible, suggesting, for instance, that Gaskell's juggling of a large family with the demands of writing was more typical of Victorian writers than one might have thought. The same results could be shown to some extent in a bar graph, for example, but that type of visual representation would not show the intriguing overlap between the use of two different tags: one for childlessness and the other for number of children.

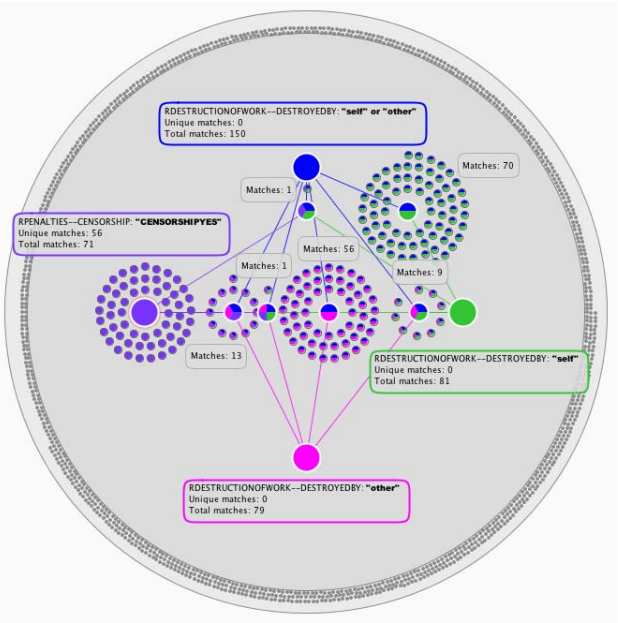
The possibility remains, however, that women without children were still more prolific. However, if one then looks for content in the AUTHORSUMMARY tag, which encapsulates a writer's achievements, for the words "prolific" or "numerous" or "many" to try to get in a very rough way at the high-producing writers, there is not a markedly greater proportion of high producers among the authors who are childless, or even those with smaller family sizes (Figure 9). This visualization indeed leads one to speculate that having four children, or indeed seven or more, seems to have made writers quite productive.

*Figure 9: Zoomed view of the visualization in Figure 8 with a red magnet (left) where the tag AUTHORSUMMARY contains any of the words "many"/"numerous" /"prolific", addressing the question of whether having many children negatively impacted literary productivity.*



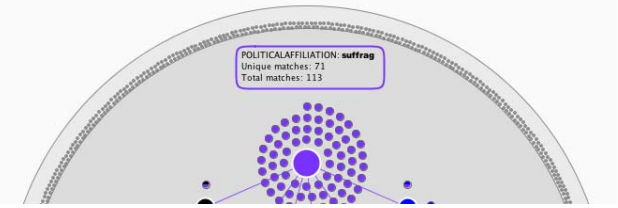
Our next visualization, in Figure 10, is based on the entire set of *Orlando* entries, rather than a period subset. The results map out some of the relationships between the destruction of a literary work (the blue magnet at the top) and the attributes of that tag for destruction of work by the writer herself (green, on right, the commonest cause of destruction) or by others (pink, on the bottom). However, the overlaps with the CENSORSHIP attribute on the PENALTIES tag (purple, on the left) are not necessarily co-occurring in the same instance of a DESTRUCTIONOFWORK tag, since there may be more than one such tag per document. So there are limitations to the kinds of searches that can be done with the interface, and also the strong possibility that someone not very familiar with both the tagset and the structure of the data is likely to misread Mandala results.

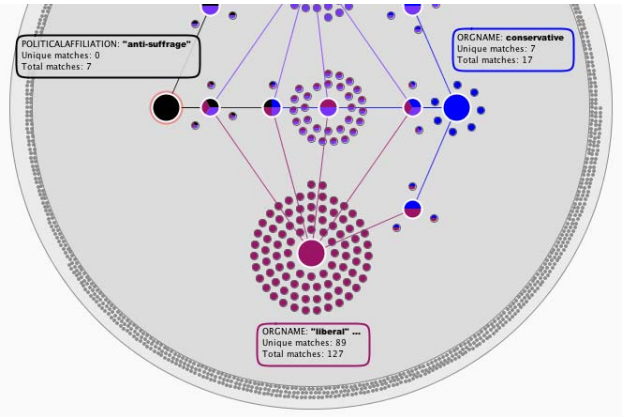
*Figure 10: Destruction of literary texts (all periods). Destruction of work is blue, destruction by self green, and destruction by other pink. Purple is for censorship.*




We conclude by asking a question about suffrage (Figure 11). That is, does affiliation with the suffrage movement imply a particular position on the political spectrum? The visualization shows a considerably greater overlap between writers associated with suffrage and liberal organizations than between those and conservative ones, as one might expect. Still, the participation of conservatives might come as a surprise to those who would assume a congruence between liberal politics and the extension of the franchise to women. There is also some overlap between writers associated with liberal and conservative organizations, and one writer in whose entry all three converge is Beatrice Webb, who publicly recanted her anti-suffragist position; hers is the four-coloured dot near the pie magnet at the centre of the visualization.

*Figure 11: Writers whose political affiliation is "suffrage" (purple) or "anti-suffrage" (black), as related to ORGANIZATION tags containing the word "conservative" (blue) and to those containing "liberal" or "radical" (red).*






Further investigation seems indicated. Note that what are visualized here are simply links of some kind to conservative or liberal organizations. Running a parallel visualization on the POLITICALAFFILIATION tag rather than ORGANIZATIONNAME tag produces a visualization in which the overlap between "conservative" and "liberal" or "radical" affiliations is considerably less than in the previous one, but the extent of overlap between suffrage affiliation and these two ends of the political spectrum is almost the same, and even more writers belong to all three sets (For more information about the use of tags for organizations versus political affiliations, see "Orlando Help: About the Tags" in Brown, Clements, Grundy, eds.). In other words, this is the beginning of an inquiry, rather than an answer to a question.

## Conclusion

Clearly, readers of a corpus with a visual browser need to be savvy about how both a particular tagset, as applied to the corpus in question, and the browser, with its particular modes of representation, work in order to be able to interpret the results effectively. Without such knowledge, interpretation using Mandala will be speculative in the sense of mere guesswork, while with informed use the browser offers a process of inquiry that approaches that described by Johanna Drucker and Bethany Nowviskie as "speculative computing." Such an approach emphatically involves "an interpretation enacted by an interpreter. The computational processes that serve speculative inquiry must be dynamic and constitutive in their operation, not merely procedural and mechanistic" (Drucker and Nowviskie). This case study in using Mandala to read *Orlando* suggests that using this type of browser as the basis for interpretive work may require a fairly high level of training and knowledge from users. This is of course the case with many other interpretive approaches to texts such as Deconstruction. But this feature of algorithmic criticism will run against the expectations of many regarding computer tools, both because of the expectation that computer interfaces should offer ease of use and immediate results, and because the epistemology associated with computing tends to be positivist.

Because the tool is one step in an ongoing hermeneutical process, one wants to be able to get to the text itself in order to assess the visualization and pursue the inquiry further. Although not our emphasis here, the principle of being able to get to the text that is being browsed to make sense of the results is part of the fundamental conception of the Mandala browser. It is also consistent with Steve Ramsay's notion of an algorithmic criticism which does not attempt to close down or clinch interpretation, but instead to open it up, seeking "in the narrowing forces of constraint embodied and instantiated in the strictures of algorithmic processing, an analogue to the liberating potentialities of art and the ludic values of humanistic inquiry" (167).

And Ramsay's link to the ludic, as well as Drucker and Nowviskie's "aesthetic provocation," leads to another, unanticipated aspect of the Mandala browser, which is the aesthetic pleasure involved in using it. At least for some users, there is a real satisfaction in, say, matching up the color associations of the magnets involved to the concepts they represent (hence red for liberal and blue for conservative in Figure 11, and the implementation of the ability to select the colour of your magnet within the browser). It is also possible to

produce a particular aesthetic effect in a set of results by carefully sequencing searches, as can be seen in the pleasing symmetry in that same figure. At the same time, such ludic activity also brings home the extent to which the Mandala creates what Johanna Drucker terms a "visual epistemology" (*SpecLab*). Moreover, the ordering and layout of the magnets has an impact on what is most prominent in a visualization. Thus, for instance, Figure 11 obscures the lack of overlap between the anti-suffrage and conservative groups in ways that a different ordering of the magnets does not. Both the construction and interpretation of a visualization are thus inextricable from the hermeneutic process.

Much work remains to be done to see how receptive humanities scholars in general are to such mediations of digital text. However, these initial explorations suggest that such visualization provides a promising complement to exclusively textual methods of accessing complex semantic relationships such as those embedded in *Orlando*. The visual interface of Mandala offers the possibility of arriving at unanticipated patterns and insights as part of the complex, speculative processes of interpreting digital texts.

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## Notes

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