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Galileo's Ariosto: The Value of a Mixed Method Approach to Literary Analysis

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Abstract

Using Galileo Galilei's *Saggiatore* (1623) and Ludovico Ariosto's *Orlando furioso* (1532) as a focal point, this article evaluates a mixed method approach for identifying matches of words and phrases that are rich material for close reading and contextualization. The method focuses on ngram matches and networks of phrases that are used together. The similarity of Galileo's treatise to Ariosto's poem is compared to 45 other early modern Italian texts to evaluate the relative exceptionalism or normality of the findings. Ngram matches reveal a series of previously unknown connections between the *Saggiatore* and *Furioso*, which indicate an analytical understanding of the poem, rather than borrowing of narrative or figurative expression. Network analysis offers a preliminary outline for two communities of texts that frequently use the same ngrams found in the *Furioso*.

Modern scholarship and the archival record agree that Galileo Galilei (1564-1642) was a great admirer of the late-Renaissance poet Ludovico Ariosto (1474-1533) and his epic poem, *L'Orlando furioso* (1516, 1521, 1532). (Heilbron, 12) Galileo quoted directly from the poem in several of his works, heavily annotated different editions of the work, exchanged letters on the literary debate surrounding Ariosto and Torquato Tasso, and was reported to have nearly the entire poem memorized. Since the *Furioso* was one of the most popular books of the late-Renaissance, we have to ask: was Galileo's interaction with Ariosto's poem unique for its time? To understand Galileo's Ariosto, we must also understand early modern writers' Ariosto. I will argue that a mixed method approach built on quantitative and qualitative analysis brings into relief the intertextual community of which Galileo was a part, but also highlights the unique ways in which he was appropriating aspects of the poem. The approach expands the horizon of what we know about the profound intertextuality dominating Italian written culture in the sixteenth and seventeenth centuries. Importantly, Galileo's incorporation of pieces of the *Orlando furioso* reveals elements of humanistic analysis of literature that informed his critique of arguments in natural philosophy.

The first of the methods in this approach is based on the same principles as plagiarism detection: text mining for similarity between Galileo's treatise on comets, *Il Saggiatore* (1623) and the expressive features of Ariosto's poem by finding matching strings of alphanumeric characters (words and phrases).[1] The search for matching words and phrases goes beyond scanning for the early modern editorial cues of indentation, italicization, glossing, and marginal quotation marks that signal the presence of another author's text in a work. Where early modern readers memorized texts and

[1] The code used for all aspects of this article is designed to be adaptable to any corpus of Italian texts. It can be found at https://research.bowdoin.edu/galileos-library/GalileosAriosto/code.

ambitious twentieth-century critics created concordances of vocabulary, here I have scanned for matching words as well as two-, three-, and four-word phrases, then counted and compared results to guide subsequent close-reading and interpretation. There are more advanced approaches to be applied, but the goal here is to report on initial findings. Using the 1532 Ferrara edition of the *Orlando furioso* as a point of reference, the underlying computational method for this study highlights two types of connections with the poem and Galileo's *Saggiatore*, visualized conceptually in Figure 1:

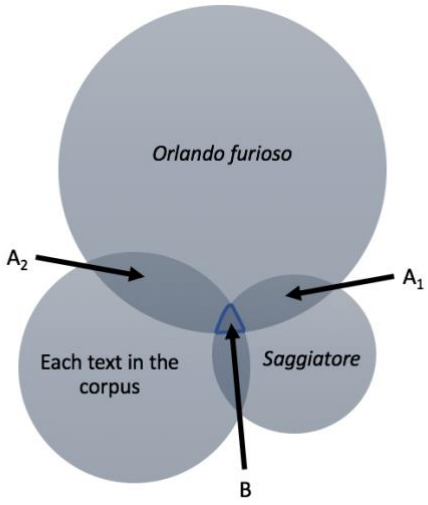

Figure 1. A Venn diagram illustrating the concept behind the computational analysis of similarities with Ariosto's *Orlando furioso*. The shaded areas are proportional to the number of phrases in each text. Highlighted areas labeled "A" are the unique phrases in common between the Furioso and Galileo's *Saggiatore* (A_1) and between the Furioso and each work in the corpus of texts studied (A_2). Area "B" indicates the phrases that occur in all of the three works.

An examination of singular matches between texts and the *Furioso* (A areas in Figure 1) allows for a quantitative comparison of Galileo's proportion of similar words or phrases and those of other authors. Since 82% of the vocabulary that Galileo uses is also found in the *Furioso*, it begs the question of whether or not this similarity is relatively high for the period. To test that, I compared Galileo to a corpus of 45 early modern texts that encompass poetry and prose, drama and narrative, translations and adaptations, as well as original material written by canonical and lesser-known authors. [2]

[2] All texts transcriptions of original editions made available electronically through the Biblioteca Italiana, hosted by La Sapienza, Università di Roma and Early English Books Online (EEBO). They were chosen based on availability and because the digital text reflects the printed volume as it appeared in the sixteenth or seventeenth century, without the editorial interventions of modern scholars. See Sapienza Università di Roma, *Biblioteca italiana*, last modified 2013, http://www.bibliotecaitaliana.it/ Accessed August 15, 2017. Six Italian texts are from Early English Books Online (EEBO), made available through the Text Creation Partnership (TCP) Phase I. Two

Understanding the frequency of use across a corpus of texts responds to the question: to what extent were the similar words or phrases an indication of Galileo's Ariosto, rather than the portions of the poem that other authors frequently adopted or turns of phrase that were common throughout written materials in the period? This approach anticipates the concern that Galileo was not singular in his stylistic or lexical similarity to Ariosto. In fact, it quickly shows that more than 20 other texts are much more similar to the *Furioso* than the *Saggiatore*. These include Tasso's *Gerualamme liberata* and *Rinaldo*, Botero's *Ragion di Stato*, Trissino's *Italia liberata dai Goti*, and Piccolomini's *Istituzione dell'Uomo*. Before looking at commonalities, it is important to note that the majority of ngrams that occur in the *Furioso* did not match any documents in the corpus.

The second method identifies words and phrases in common across multiple texts, a network analysis approach that provides a preliminary outline of communities of authors defined by which features connect their texts to the *Furioso*. The interplay of the communal attributes with the unique aspects of Galileo's connections to Ariosto offers new dimensions to our understanding of that relationship. Although the level of similarity between Galileo's treatise on comets and the *Orlando furioso* was not unusual (in the relatively small corpus of works presented here), the examples below support the hypothesis that Galileo was part of a larger literary-linguistic family with ties to Ariosto. Nonetheless, he was also turning to features in the poem to which his contemporaries were not, and doing so with a witty rhetorical force for those who were able to recognize the connections.

These quantitative measures point to lexical building blocks that are rich ground for the remaining methods in this approach: literary analysis and historical contextualization of the impact those features had on figurative expression in Galileo's treatise. Such a multi-pronged search for textual matches with this mixed methods approach has revealed previously undocumented connections between Galileo's treatise and Ariosto's poem, primarily at the scale of single terms and four-word phrases that are indicative of longer intertextual passages. Moreover, each piece of evidence presented below should also be taken as the provocation to ask these questions for other authors in the corpus.

An example will offer a rationale for the choice of words and phrases to study by means of an introduction to Galileo's treatise and the terminology for describing the computational aspects of this research. Galileo's primary goal in the *Saggiatore* is to dismantle, line-by-line, the arguments presented in the Latin treatise *The Astronomical and Philosophical Balance* (1619), written under the pseudonym of Lothario Sarsi. Sarsi uses the *Balance* to critique an earlier treatise on comets, published under the name of Galileo's student Mario Guiducci. The sections of the *Saggiatore* follow a typical structure: copying Sarsi's Latin, revealing Sarsi's error, and declaring Sarsi's hidden motivations for critiquing Galileo. For example, early in the treatise, Galileo claims that Sarsi's deliberate misreading of Guiducci's text "ha voluto abbarbagliar la vista al lettore." (Galileo, 124; translation: "he wanted to dazzle the reader's vision.")[3] Are there any unusual words or phrases here that would have helped a reader connect the *Saggiatore* to other texts, or the *Furioso* in particular? My method examines this question through four types of structures referred to generally as ngrams (sequential pieces of text composed of n units). The largest in this study is the four-word phrase, or

texts were transcribed by a research assistant. A detailed list of titles used for this portion of the research can be found at: https://research.bowdoin.edu/galileos-library/GalileosAriosto/texts Accessed August 20, 2017.

[3] Unless otherwise indicated, all translations from Italian to English are by the author.

fourgram, identified in blue in Figure 2. Searches for longer ngrams revealed only the lengthy direct quotations from the poem that were apparent to readers through visual cues in the text.

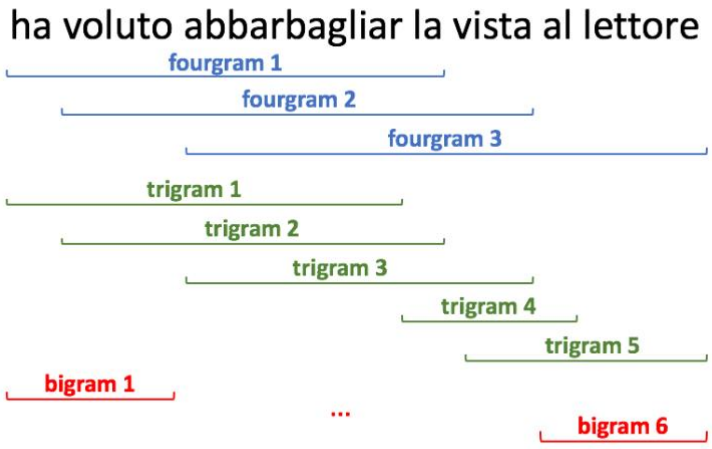

Figure 2. Diagram of how fourgrams, trigrams, and bigrams are identified. Bigram structure is elided to the first and final instances.

In the 47 texts studied, other than the *Saggiatore*, there are no matches to the *Furioso* for these fourgrams or the smaller trigrams contained in this quotation, while the bigrams of *ha voluto*, *la vista*, and *al lettore*, are, expectedly, quite popular across nearly all texts. Galileo is the only author in the corpus who uses this exact phrase. These examples also indicate the larger importance of bigrams as building blocks of expression (articulated nouns, prepositional phrases, and verb forms), while trigrams and fourgrams are combinations of those bigrams that appear in specific contexts.

The interpretation of Galileo's passage and its connection to Ariosto relies on the final type of ngram covered in this study, a single vocabulary word, a unigram. *Abbarbagliare*, loosely translated as "to dazzle," is a poetic term that has roots in Dante's *Paradiso* (XXVI.20) and later Petrarch's *Canzoniere* (LI.2). The term's etymology reveals the earliest theories of optics in which images emanated from an object and penetrated the eye. It is a frequent word in the *Orlando Furioso* where it is used only to describe the knight Ruggiero's magic shield that shines with a light so bright it incapacitates all who see it. Importantly, this magic shield is only used on monsters in the poem, and it is considered unchivalrous to use it against other knights. In fact, when Ruggiero accidentally reveals the shield to his companions, he casts it into a lake so that it can never disgrace him again. I would argue that Galileo is absolutely using the term with this chivalric connotation in his suggestion that Sarsi is trying to rhetorically stun readers so that they cannot see the erroneous philosophical logic that lies behind his words. In the collection of sixteenth and seventeenth century Italian texts used for this study, which represent a range of genres, this verb only appears in five other works: the rewriting of the *Canzoniere*, *Petrarca Spirituale* (1536) by Girolamo Malipiero; the Ferrarese Giraldi Cinzio's *Fiamme* (1548); an Italian translation of Ovid's *Metamorphoses* (1563);

Ferrarese-educated Cardinal Silvio Antoniano's *Educatione cristiana* (1584); and Francesco Peretto's odes, *Gli Occhi* (1616). None of these works use the term in the moralizing way that Ariosto employed it in the *Furioso*. In a work that is almost entirely about how to see and understand comets, Galileo uses a poetic term about sight, based on an interpretative (not just narrative) reading of the poem, in order to describe rhetorical and argumentative strategies.

Closer examination of the unique and low-frequency unigram matches between the *Furioso* and *Saggiatore* reveal Galileo's humanistic mastery of Ariosto's poem. We can take, for instance, Galileo's use of the word *ramarichi*, a hapax legomenon in the treatise that occurs three times in Ariosto's poem. While the term does not appear in the works currently available in plain text original editions used for this study, it is relatively frequent in early sixteenth-century works, including other works by Ariosto, Pietro Bembo, and Pietro Aretino. Galileo uses his literary understanding of the term to undermine an argument about authorities in natural philosophy that Sarsi had made in the *Balance*. Sarsi had suggested (in Latin) that Galileo unnecessarily criticized his use of Tycho Brahe as an authority by vainly invoking a line from Seneca, in order to "deplore the misfortune of this age." (Sarsi, 71) In the earlier treatise by Galileo's student, Mario Guiducci had referred to Seneca's advice to suspend judgement on two competing truths pending more precise knowledge of the shape and structure of the universe. (Guiducci, 57) Given the edict of 1615, banning support of Copernicanism, Galileo finds himself in a seemingly impossible situation in which he cannot support Copernicus, the evidence refutes Ptolemy, and the leading authority, Brahe, is null (according to Galileo). He defends the reference to Seneca with the following line in the *Saggiatore*: "non però tra ramarichi e lagrime deploro, come scrive il Sarsi, la miseria e la calamità di questo secolo" (Galileo, 120; translation: "not, however, through sorrows and tears do I deplore, as Sarsi writes, the troubles and calamity of this age.") Galileo adds the details of "tra ramarichi e lagrime" to complete the hendecasyllable presentation of his refutation and he goes on to say that, since he is powerless to change the situation, his "querele" ("complaints") are not in vain (using variants of the word three times).

These contextual terms add clues to the passage's connection with the *Furioso*: Canto XXXVIII, in which Bradamante agonizes over the two tragic outcomes possible from the announced battle to the death between her destined husband Ruggiero (fighting for the African king) and her brother Rinaldo (fighting for Charlemagne) in order to determine the ultimate victor of the war. While Bradamante searches for a third solution, Ariosto describes her physical and emotional suffering: "chiama con ramarichi e querele / Ruggiero ingrato, e il suo destin crudele." (Ariosto, 38.70.7-8; translation: "with sorrows and complaints she calls / Ruggiero ungrateful and her destiny cruel.") Bradamante is spared the loss of either her brother or future husband by the intervention of the sorceress Melissa. Galileo has no other recourse than Seneca, skillfully contextualized through unigrams within the complexities and emotive power of his favorite poem.

Turning to critical analysis via close reading supplements the quantitative approach that identifies all ngram matches, yet it would be erroneous to call matches to *ha voluto* or *la vista* (the bigrams in Figure 1) stylistic borrowing or intentional intertextuality. In this case, a second quantitative method can add insight that close reading cannot. Any similarities revealed by phrases such as *ha voluto* are suggestive of sounds and styles, and also subject matter, that run throughout the corpus. The quantitative approach reinforces the uniqueness of each text, while providing an opportunity to dive deeply into these similarities. Moreover, the ngrams that match Ariosto's poem are found primarily in one or two texts. While the 82% vocabulary similarity between the *Saggiatore* and the *Furioso* means that over 40% of Galileo's text is composed of a word used in Ariosto's poem,

the average overall textual similarity between any text and the *Furioso* was 15%. Those percentages decrease dramatically as length of the ngram increases, to 0.1% for fourgrams. In addition, more than 75% of the fourgrams were used in only one or two texts other than the *Furioso*, so they have been excluded from the figures below in order to focus on the well-defined lexical families. In the case of bigrams, without filtering out these low frequency phrases, there would be nearly 26 million connections between over 100,000 phrases to visualize. In future research, these low-frequency and unique ngrams could point to site of meaningful connections between texts, much in the same way the unigram matches did. Here, those loosely connected phrases would distract from the core question, and the more prominent aspect of the network: which phrases are most commonly used with one another and which authors are using them?

By visualizing these ngrams as a network of phrases commonly used together in texts, we can identify common lexical or stylistic patterns. This is not a claim about intentional authorial sampling, but instead a way to probe the contours of genre and expression. Network analysis provides a means to identifying these communities mathematically by looking for groups of texts that share more ngrams between each other than they do with the rest of the corpus. Visualization of these quantitative attributes can highlight patterns that exist in the connections between phrases frequently used together in texts. This method offers layouts that emphasize these communities, color-coding of highly-connected groups of phrases, and filters that show the network of phrases used by each author. Figure 3a offers the example of the network of fourgrams that occur in at least three texts and the 1532 edition of the *Orlando furioso*. A fully interactive version of this graph is available online for exploration.[4] There are five communities of highly connected fourgrams in this network, most predominately the group in blue that is a cluster of general purpose expressions containing terms about objects in the world (gente, terra, ciel, parte), opposite the brown community that uses abstract descriptors (cose, poco, altro, tempo). Close reading of the other clusters reveals a divide within the expressions of war that pervade the *Furioso*. Most distinct are the two groups that feature *physical* terms related to conflict (morte, sangue, spada, arme) and *emotional* terms related to conflict (odio, ira, sdegno), in green and red, respectively. We expect phrases on these topics in works with similar plots or themes as the *Furioso*. The purple community will be discussed with Figure 3b.

[4] Link available through the supplemental site: https://research.bowdoin.edu/galileos-library/GalileosAriosto Accessed August 31, 2017.

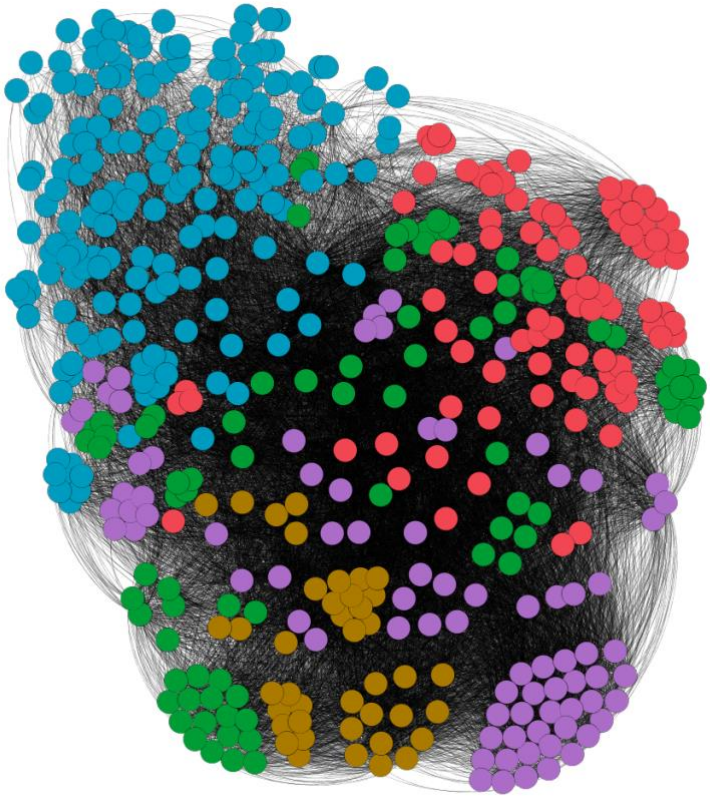

Figure 3a. A network diagram made with Gephi 0.9.1. Nodes (circles) represent four-word phrases found in the *Orlando furioso* and used by other authors: their color indicates their community as determined by Gephi's Louvain modularity algorithm, their size is constant (no symbolic significance). Edges (lines) represent that two phrases are found in the same text: thickness of the line indicates the relative number of those phrases. Only edges that occur three or more times are shown. Layout created with Force Atlas algorithm and Expansion.

What network analysis helps to identify are texts that are predominantly composed from one cluster or another. By applying a filter to focus on the phrases used by a particular author, we see the communities in which that text participates. For example, Figure 3b compares the fourgrams that only Galileo, Torquato Tasso, and Giambattista Giraldi Cinzio use, respectively, highlighting the different ways in which these authors' texts share similarities with Ariosto's poem.

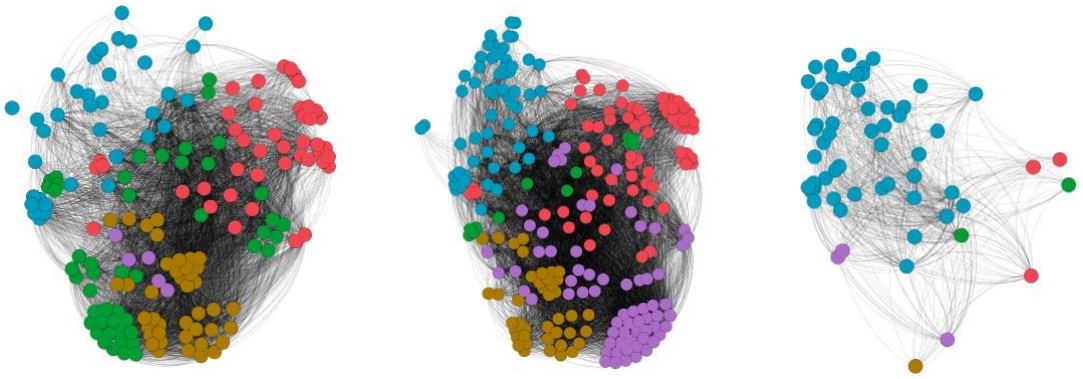

Figure 3b. Subsets of network diagram Figure 3a made with the same settings. Nodes (circles) represent four-word phrases found in the Orlando furioso and used by Tasso in the *Gerusalemme liberata* (left), Giraldi Cinzio in the *Ercole* (center), and Galileo in the *Saggiatore* (right). Only edges that occur three or more times are shown.

The comparison of the authors' networks emphasizes the physical combat (green) in the *Gerusalemme liberata* and the non-bellicose (blue) ways the *Saggiatore* are each similar to the *Furioso*. Tasso's preference for the abstract would also seem to be suggested by the absence of fourgrams that incorporate terms related to objects (the blue nodes). Cinzio's encomiastic heroic poem *Ercole* (Figure 3b, center), narrates the feats of Ercole II, Duke of Ferrara, notably with significant overlap with the fourgrams in Tasso's poem that match the *Furioso* (emotions of conflict, red), yet also certain omissions (physical combat, green). In Cinzio's subnetwork, the puple fourgram community, absent in Tasso, represents fourgrams used frequently with phrases in the other communities, with significant overlap in key terms: ira, parte, altro. Seeing these comparisons raises the question: which texts are using similar phrases?

To answer that question, the overlap between the *Furioso* and two other texts (the matches in the "B" area in Figure 1) can be organized as a network of texts connected by their common use of an ngram. In this way, we can see communities of authors who use similar ngrams. Such a rephrasing of the question can offer insight about the ways in which literary or biographical features such as period, geography, or notoriety of an author could be related to usage patterns. Although the analysis can include unigrams, single words would tend to reveal topical communities on comets, swords, love, etc. and topic modeling would be a more appropriate tool for examining these relationships. On the other hand, the communities that use similar phrasing are consistent for bigrams, trigrams, and fourgrams; trigrams are represented below. Labels are present for the ten texts that have the highest number of trigrams in common with *Orlando furioso*, sized relative to that number. The five most peripheral nodes (texts) are the only ones not connected to every other work in the entire corpus.

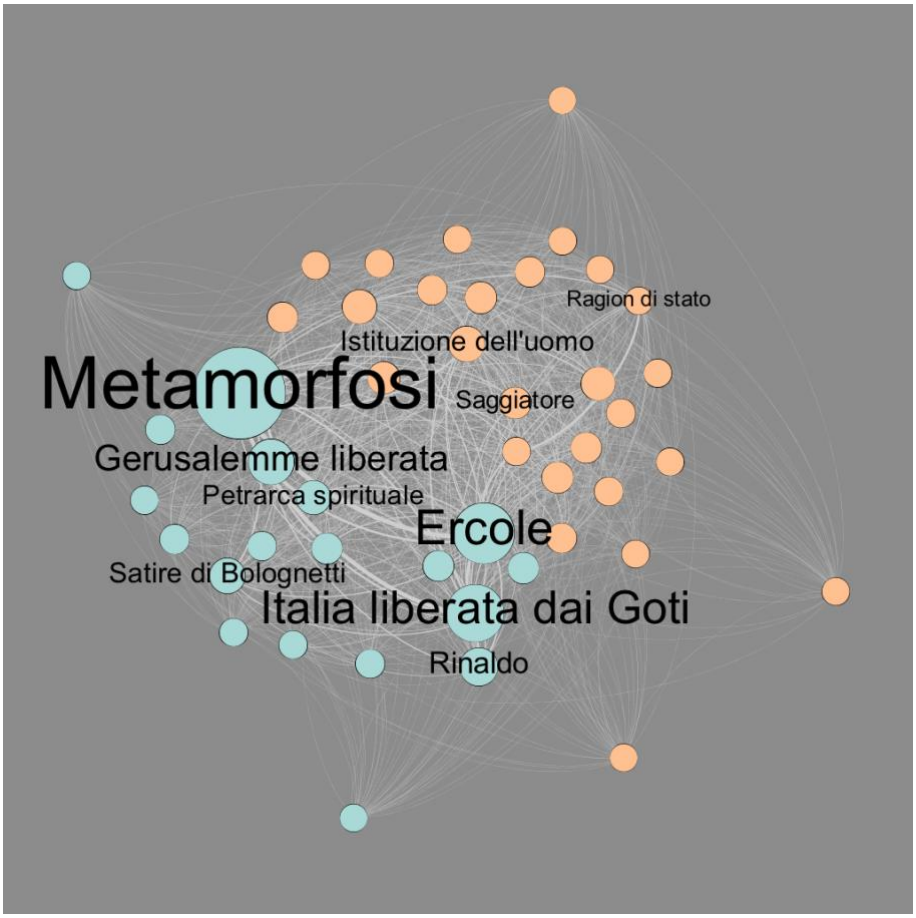

Figure 4. A network diagram made with Gephi 0.9.1. Nodes (circles) represent texts: their size indicates the number of trigrams the text has in common with the *Orlando furioso* that no other work in the corpus shares with that poem, their color indicates their community as determined by Gephi's Louvain modularity algorithm. Edges (lines) represent that two texts use the same trigram found in the *Orlando furioso*: thickness of the line indicates is relative to the number of those common trigrams, filtered for edges the occur more than 4 times. Layout created with Force Atlas algorithm on default settings and adjusted manually for legibility of labels. Labels provide short titles for the 10 texts with the highest number of overall trigrams in common with the *Furioso*.

As mentioned before, the early modern texts studied here only have small percentages in common with Ariosto's poem, but Figure 4 confirms that what they do share with *Orlando furioso*, they share with each other. This is the tip of a larger research question about intertextuality and style in the early modern period. There are no clear genre lines dividing the two groups, nor are they chronologically or geographically distinct. Galileo consistently appears with the same authors mentioned earlier for their use of *abbarbagliare*: Alessandro Piccolomini, Cardinal Silvio Antoniano, and Giovanni Botero. While ultimately confirming that in terms of quantity and commonalities, Galileo's similarity to Ariosto was not exceptional, these results outline a method for exploring the relationship between Ariosto, Cinzio, Tasso, and other authors of epic in future studies.

At the same time, the approach also highlights unique aspects of texts' relationships with the *Orlando furioso*. Given that the vast majority of matches with the poem only occur in one text, what are the singular similarities identified through computation? This again pushes the investigation towards the aspects of Galileo's texts that are not captured by network analysis, but through automated searching for matches, the A_1 area in Figure 2. As expected, when combined with close reading, the fourgram searches provided clues to larger moments of intertextuality, particularly through the phrases that only occur once in the corpus, and are otherwise excluded from the networks above. Even here, computationally scanning for matching text can only provide limited information about any expressive importance between the similarities. While the four words themselves might carry little communicative weight, they are unique enough to point to passages from which Galileo was likely borrowing as he composed his rebuttal to Sarsi's critique. The mixed methods allow us to see the context in which Galileo's singular sampling of Ariosto occurs and to bring to light evidence of his humanistic skills of literary analysis in a work of natural philosophy.

For example, one of the fourgrams in common between Galileo's text and Ariosto's poem is the seemingly innocuous phrase "al primo motto che" ("as soon as" or more literally "at the first word that"), used only once in each text, and not present in any other text in the corpus. Early in the *Saggiatore* Galileo begins his routine of defending his earlier statements about comets by descending into hypothetical constructions of the delight he would take in being victorious over a multitude of enemies (his term) who claim that the comet in question must be very far from Earth since viewing it through the telescope produces a negligible change in its apparent size. In spite of the reports coming from all corners of Europe to support such an argument, Galileo says (with my emphasis added): "io *al primo motto, che di ciò intesi*, molto chiaramente mi lasciai intendere che stimavo questo argomento vanissimo" (Galileo, 113; translation: "*at the first word, that I understood of it*, I let myself be understood very clearly, that I held that argument most vain.") Ariosto uses the phrase in a similar situation of conflict when Ruggiero is called crazy and a liar by an enemy for believing (correctly) that his shield is his rightful property (with my emphasis added): "Come ben riscaldato àrrido legno / a piccol soffio subito s'accende, / così s'avampa di Ruggier lo sdegno / *al primo motto che di questo intende*." (Ariosto, 26.103.1-4; translation: "As well heated dry wood / at a tiny whiff of air immediately ignites, / so too Ruggiero's anger blazed up / *at the first word that he understands of it*.") The fourgram match is an indication of an entire verse from the *Furioso*, highlighted by the similar phrases that are underlined. Galileo's can now be read not just as acting quickly to declare his position, but as an impassioned defender of what he knows to be the truth.

Similarly, the phrase "a tutta la sua" ("and all of his/her/its") is a unique match in Galileo's text and Ariosto's that points to a longer passage of meaningful intertextuality masked by slight grammatical alterations. In the *Saggiatore*, the phrase appears in the context of a rhetorical question to Sarsi (with my emphasis added): "ma perché non perdona egli questo assunto al signor Mario, ed ad Aristotile sì ed *a tutta la sua setta*...?" (Galileo, 204; translation: "But why does he not pardon this assumption for Sig. Mario, as well as for Aristotle and *for all his faction*...?") In Ariosto, this appears in an excerpt from the princess Olimpia's narration of her sowerful plight: "Io per l'odio non sì, che grave porto / a lui e *a tutta la sua iniqua schiatta*, / il qual m'ha dui fratelli e 'l padre morto, / saccheggiata la patria, arsa e disfatta." (Ariosto, 9.33.1-4; translation: "Not so much by hate, which I bear, grievous, / for him and *for all of his wicked stock* / that killed my two brothers and father, / sacked, burned, and destroyed my fatherland.") Decorum would have meant that *iniqua schiatta* was quite inappropriate for the treatise, but *setta* allows for the allusion without implying the same rage or judgment. Without taking the further step of close reading and contextualizing the results of text

mining, this intertextual connection risks being dismissed as simply common use of the quotidian phrase *a tutta la sua*.

A final example reinforces the rich connections between texts that could be suggested by fourgrams that lack content-bearing terms such as *schiatta*, *intende, abbarbagliare,* or *ramarichi*. When disputing the fact that the telescope could be called the same instrument when applied differently, Galileo writes (with my emphasis added): "*vi è, s'io non m'inganno*, un poco di equivoco" ("there is, if I am not mistaken, a bit of a misunderstanding"). (Galileo, 171.) Like the use of *abbarbagliare*, this connection to the *Furioso* relies on literary analysis, here an understanding of the voice of the poet, a more sophisticated incorporation than just a topical or emotional turn of phrase to make Galileo's point. Ariosto expresses something similar when describing Astolfo's travels in Africa. In a statement to the reader about the presence of the fabled Prester John in Ethiopia, Ariosto writes (again with my added emphasis): "*Gli è, s'io non piglio errore*, in questo loco / ove al battesmo loro usano il fuoco." (Ariosto, 33.102.7-8; translation: "He is, if I am not mistaken, in this place / where at baptisms they use fire.") Using overt declarations of authority such as this, the poet in *Orlando furioso* frequently winks at readers to signal what Albert Ascoli has called "lies with a lying face" that are obvious for their dubious status as truth. (Ascoli, 254) The phrase "if I am not mistaken" creates an opportunity to evaluate the validity of the statement, but in the jocose spirit of Ariosto's poem, or the witty rhetorical display of the *Saggiatore*, the reader should be on guard. Galileo capitalizes on this mechanism's power to deflect authority onto the reader, making the criticism against Sarsi all the harsher for the transparency of his error to likely nonspecialists. The implication is that there is no misunderstanding; Sarsi is wrong once again. While text mining alone would suggest only a commonly used phrase, and the lexical networks would have missed this unique rhetorical sleight of hand, the contextualization within the longer passage and the literary devices of Ariosto's poem bring to the fore Galileo's use of humanistic knowledge to strengthen his critique of a natural philosophical argument.

By identifying these unique connections, we also know who was not adopting these phrases to describe quick action, cast doubt, complain, or criticize. The computational approach applied here contextualizes philological work within the expressive trends of the time, in a way that will grow as the project develops. Although the networks, text mining, literary analysis, historical contextualization, and interpretation of Galileo's humanistic methods reveal a considerable common linguistic ground between two communities of authors, the unique and singular matches found in Galileo bring into relief the kinds of intertextuality operating in early modern Italian texts. Beyond quotations and sampling, turns of phrase connect texts at different levels with different consequences for the reader who can recognize them. The by-products of following this one, rather elementary, line of computational inquiry are many. Understanding Galileo's Ariosto has also required a preliminary outline of 45 other versions of the intertextual Ariosto operating in early modern Italian written culture. Now there is a baseline to evaluate the depth of literary analysis with which those other authors gestured toward the *Furioso* or other works. These are 45 areas of research that will likely lead to other fruitful connections between this Renaissance masterpiece and the expressive goals of the writers who followed after him.

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