

Shakespeare's Tragic Social Network; or Why All the World's a Stage

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Abstract

We propose that network visualization is a digital humanities method that can “explore” and “negotiate” the space between text and performance in the study of Shakespeare. The networks developed in this project use the language of Shakespearean plays to trace the relationships between characters in space, in effect, translating the literary text into a web of spatial relations, which are difficult to perceive solely in the act of reading. Our analysis presents a particular method of network visualization, and also demonstrates how this technique can be used as a critical tool to revise our understanding of social disorder in Shakespearean tragedy. We therefore propose a dual scope for this paper. At a methodological level, we argue that network visualization is a way to infer staging and the “blocking” of theatrical space from the language of the playtext. In our case study, we show how this technique can be used as a form of Shakespearean literary criticism deploying this method to reframe the larger question of social disorder in his tragedies. The network visualizations used in this analysis serve as a stable and reproducible way, beyond any single performance, to delineate how the language of Shakespeare's plays structures the relationships of characters in space. This study represents the beginning of a digital method that aims to bridge text and performance in the study of Shakespeare by reading the dramatic text for the linguistic codes that organize the space of the stage.

Hence the question may legitimately be asked whether the space for discontinuity between text and performance was not used quite significantly. Was it, perhaps, potentially a site in which cultural difference between imaginary representations and physicality in performance could be presented, explored, negotiated, released, or otherwise delivered? [Weimann 1999]

Introduction

Robert Weimann has suggested that bridging the “discontinuous” space between the literary text and the theatrical performance would require us to reimagine the gap between the two media as a productive site of cultural “negotiation,” rather than an irreconcilable methodological divide [Weimann 1999, 427]. In this essay, we offer a response to Weimann's theoretical proposal, by arguing that network visualization gives us the specific tools to “explore” and to “negotiate” the space between text and performance in the study of Shakespearean drama. In this approach, digital humanities techniques serve as a way to link traditionally different modes of aesthetic engagement, such as, in the case of Shakespeare, reading his plays as literary texts or performing them on stage. The networks developed in this project use the language of Shakespearean playtexts to trace the relationships between characters in space, in effect, translating the literary text into a web of spatial relations, which are difficult to perceive solely in the act of reading. Our analysis presents a particular method of network visualization, and also demonstrates how this technique can be used as a critical tool to revise our understanding of social disorder in Shakespearean tragedy. We therefore propose a dual scope for this paper. At a methodological level, we argue that network visualization is a way to infer staging and the

“blocking” of theatrical space from the language of the playtext. In our case study, we show how this technique can be used as a form of Shakespearean literary criticism deploying this method to reframe the larger question of social disorder in his tragedies.

Our network visualizations quantify from the beginning to the end of each scene in Shakespeare’s thirty-seven plays the number of words and lines spoken by each character, which characters interact by responding to one another (i.e. if character A speaks, and character B replies, the program counts this as a reciprocal exchange of language) and how frequently the two characters interact by this response mechanism. Here we have adapted Emma Pierson’s counting method, which measures network interaction by “counting the number of lines of A spoken immediately after B, and vice versa, and summing them” [Pierson 2014]. This logic defines interaction in terms of dialogic response: if two characters are adjacent in the playtext, our program measures this as a proxy for a reciprocal linguistic exchange. To validate our method, we will compare the network diagrams to actual performances by the Royal Shakespeare Company to show that the density or sparseness of each play’s network, and the proximity and distance of the characters composing that network, correspond to the positioning and arrangement of the actors’ bodies on stage. This homology between the network and the embodied performance is logical because each character’s speech structures their relationship to others, and frames their physical interaction in the space of the stage. There are, of course, exceptions to this trend (dumbshows, asides, and eavesdropping scenes are some of the obvious examples), and the network can by no means function as an exact template for a performance. However, the network visualizations used in this analysis serve as a stable and reproducible way, beyond any single performance, to delineate how the language of Shakespeare’s plays structures the relationships of characters in space.

The networks lead us to a new vantage point on Shakespeare’s dramatic art, allowing us to revise a longstanding view that his plays draw their power from the subversive portrayal of social disorder, either in the form of the carnivalesque or as the “conflict and waste” of tragic violence. The network visualizations reveal a new, more subtle logic of enantiosis, or *discordia concors*, which requires the building of dense social networks on stage as a performance strategy representing a disordering of the social in the plot. Shakespeare’s plays bind characters into a social network in space so as to break apart the social order. This is important because it complicates contemporary network theories that define the social network as an array of positive relationships bound by affiliations or affinities – for instance, the friends or family in a social media network. Our network analysis of the tragedies adds a level of historical nuance to our understanding of social network structure, by showing how Shakespeare builds the densest social networks at precisely the moments where the social order is being destroyed. In Shakespeare’s tragic social networks, then, *making* a network link between two characters can actually signify the *breaking* of a social relationship between them. The network visualization method permits us to see how this counterintuitive performance strategy unfolds by translating the language of the text into an array of character relationships in space. This study represents the beginning of a digital method that aims to bridge text and performance in the study of Shakespeare by reading the dramatic text for the linguistic codes that organize the space of the stage.

“Reading toward Performance”: Character-space and Stage Geography

The attempt to use digital humanities tools to span the methodological distance between textual criticism and theater studies responds directly to the recent critical project exemplified by Lukas Erne, Patrick Cheney, David Scott Kastan, and Peter Stallybrass, among many others, which has recuperated a vision of Shakespeare as a literary artist, who did not simply write plays for theatrical production, as the commonplace assumption has long held ([Erne 2013]; [Cheney 2008]; [Kastan 2001]; [De Grazia and Stallybrass 1993]). This laudable historical work emphasizing Shakespeare’s literariness has persuasively demonstrated that the playwright was indeed interested in the textual dissemination and afterlife of his works in the marketplace of books and ideas. We intend to affirm and complicate this critical trend by exploring the space between text and performance as a productive site of critical reading in its own right. The word “reading” is used both purposefully and provocatively here, since Shakespeareans have traditionally recognized the limits of reading the plays as only one part of the range of signification made possible by the text. As Gary Taylor, editor of the Oxford editions of Shakespeare’s complete works, famously puts it, “the written text depended upon an unwritten para-text...an invisible life-support system of stage directions, which Shakespeare could either expect his first readers (the actors) to supply, or which those first readers would expect Shakespeare to supply orally” [Taylor 2002, 4]. Or, to

the mind of Antony Hammond, “ninety percent” of the materiality of performance and staging lies beyond the scope of literary critics.

The plain fact of the matter, which has been ignored by most editors and by many academic critics, is that while better than ninety percent of the dialogue text can be recovered, with a good degree of accuracy, for most surviving plays of the Elizabethan period, ninety percent of what actually happened on stage in their performance is not to be found in the stage-directions of any manuscript or printed text, or in the occasional descriptions of performances, and illustrations. The actors’ movements, quite apart from their body language, their positioning and grouping (what directors call “blocking”) and their business with props, is largely unrecoverable terra incognita. [Hammond 1992, 81]

[¹] Taylor and Hammond influentially have cast the final form of the play as non-textual, and thus mark performance as something in excess of the literary critic’s capacity to analyze the linguistic contours of the text.

Recent work in the theory of dramatic narrative, however, offers an alternative by not foreclosing performance from the gaze of the critic ([Jahn 2001]; [Fludernik 2008]; [Nünning 2008]; [Richardson 2007]). Ryan Claycomb, to take the most recent example, has argued that dramatic narratives encode their own rules of performance - “they tell us much about their understanding of the relationship between author and production...in short, they tell us how and to what degree we should be reading toward performance” [Claycomb 2013, 161]. Claycomb suggests that theatrical performance inheres in the dramatic narrative itself, and so readers can gain some insight into the performance strategies immanent to the play. More specifically in Shakespeare criticism, Robert Weimann has notably claimed, much like Claycomb, that inscribed within the text itself lies “both play and production,” or “representational acting and presentational playing” [Weimann 2000, 420]. Similarly, Michael Goldman considers the text to be a “design for performance,” [Goldman 1985, 15] while Inga-Stina Ewbank insists that Shakespeare’s text encodes a “grammar” of the situation...where words repeat in small what Shakespeare and the actors do at large” [Ewbank 1983, 55–75]. The crucial difference between Claycomb’s general model of “reading toward performance” and the corresponding trend in Shakespeare criticism is the latter’s emphasis on space and not narrative ([Ichikawa 2013]; [Stern 2009] and [Stern 2004]; [Paul 2008]; [Weingust 2007]; [Foakes 2006]; [Gurr 1992]; [Weimann 1987]). Erika Lin, exemplifying this turn to theatrical space, argues that the playtext expresses within its language a “stage geography” where “bodies act as signifiers in theatre” [Lin 2012].

Franco Moretti and his Literary Lab have participated in this effort to understand the playtext as a “grammar” for the organization of characters’ bodies in space, toward the “stage geography” proposed by Lin. However, unlike Shakespearean performance space critics such as Lin, Tiffany Stern and Mariko Ichikawa, who employ a materialist method, the Literary Lab fashioned networks as a way to analyze the space structured by the text of *Hamlet*. Networks translate narrative time into space, by representing “a character-system arising out of many character-spaces” [Moretti 2011, 2]. His innovation lies in using networks, and not just close reading or materialist historiography, to study how the text of *Hamlet* shapes a specific “character-space,” to borrow Alex Woloch’s terminology [Woloch 2003]. For Moretti and the Literary Lab, networks change our “perception of the plot” by turning the interaction between characters into an array “visible” in space, and not just as the readerly printed text. His use of networks to examine the “character-space” inscribed within the play moves the study of space as the medium linking the literary text and theatrical performance in a provocative new direction.

Methods: From Network Theory to Network Visualization

The present argument builds on the work of Moretti, but our visualization method defines and constructs the Shakespearean networks differently than the Literary Lab and other existing analyses of literary networks. A scan of previous network methods would be useful here to sharpen the contrast with our own techniques. In his pamphlet, Moretti defines a network as “made of vertices and edges...basically, two characters are linked if some words have passed between them: an interaction is a speech act” [Moretti 2011, 3]. By contrast, an earlier network study from 2003 conducted by a group of evolutionary psychologists makes very different choices in crafting networks of Shakespeare’s plays. The psychologists, Stiller, Nettle, and Dunbar, explain their method as follows:

The network structure calculations were obtained by treating each speaking character as a node, and deeming two characters to be linked if there was at least one time slice of the play in which both were present (that is, if two characters spoke to each other or were in each other's presence, then they have a link). [Stiller, Nettle, and Dunbar 2003, 399]

As Moretti draws a contrast between their two approaches, his networks exclusively use "explicit" data - "some words passed" between characters - as a measurement of social interaction, whereas Stiller, et al. infer "implicit" relationships as well, by using both verbal exchange ("if two characters spoke to each other") or silent proximity on stage (if they "were in each other's presence") [Moretti 2011, 3]. More recently, Emma Pierson of the statistical analysis website fivethirtyeight.com attempted to quantify network relationships in Shakespeare's romances programmatically, and not manually as the previous two studies had done, "by writing a computer program to count how many lines each pair of characters in *Romeo and Juliet* spoke to each other" [Pierson 2014].

There are strengths and weaknesses to each of these prior network methods. Moretti's use of "explicit" ties in language is a concrete and specific way to mark interaction, but he admits that "some questionable decisions" were made in the study since he concedes that the "edges" between characters "are not weighted": "when Claudius tells Horatio in the graveyard scene, 'I pray thee, good Horatio, wait upon him', these eight words have in this Figure exactly the same value as the four thousand words exchanged between Hamlet and Horatio" [Moretti 2011, 3]. He acknowledges that this flattening of all linguistic exchanges to "exactly the same value" paints a picture that "can't be right." Amounting to what he calls the "childhood of network theory...before the stern adulthood of statistics," Moretti recounts a struggle "to find a non-clumsy way to visualize weight" of the speech between characters, and "as a consequence, the networks in (his) study were all made by hand." He adopted this approach to construct his networks since "machine-gathering of the data, essential to large-scale quantification, was not yet a realistic possibility" [Moretti 2011, 10]. The resulting manually constructed networks are based upon a hazy description of what constitutes a "speech act." The measurement of "some words" exchanged between characters defines an imprecise approximation of how language structures the links in the network.

In the case of the paper by Stiller, et al., the primary advantage of their approach lies in the attempt to include "implicit" stage presence alongside "explicit" spoken language, but as in the case of the Literary Lab's network analysis, the problem of a lack of weighting arises. Their networks deem "two characters to be linked if there was *at least one* time slice of the play in which both were present." The ">1 instance" approach treats a single encounter as being identical to many recurring encounters, having the effect of flattening the distinction between strong patterns of interaction and more sporadic ones. Additionally, their study does not weight "implicit" and "explicit" interactions differently: "presence" is determined by "two characters (who) spoke to each other *or* were in each other's presence." The "or" criterion defines explicit linguistic interaction as being equivalent to implicit shared stage presence. This ignores much of the nuance of dramatic performance by eliding the distinctions between different kinds of relationships into a single generic metric of non-specific social bonds.

In sum, both the Literary Lab and Stiller, et al. encounter problems with how to accurately weight the volume and frequency of interactions (i.e. how do repeated interactions have a greater weight than less frequent ones?) and in how to weight the difference between explicit and implicit interactions (i.e. how do direct linguistic exchanges have a different weight than characters who silently share the stage?). The technical problem of weighting is not exclusive to network analyses of Shakespeare. Hoyt Long and Richard So's methodology in examining modernist poetic networks "treats every published poem as essentially equal, and thus commits to a flagrant abstraction of the cultural content from which (their) network data is derived." This is a tactical choice on their part, however, because they aim "to identify broader structural patterns" [Long and So 2013, 9]. By contrast, Pierson's quantitative network analysis adds a level of methodological sophistication by attempting to weight interactions by "counting how many lines each pair of characters in *Romeo and Juliet* spoke to each other," but her study places a self-imposed limit by focusing exclusively on dyads in Shakespeare's love stories, and does not consider multivalent relationships between several characters across all of his many plays and numerous genres.

How can we resolve these problems of accurate weighting in measuring interaction in Shakespeare's plays? It is

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important to acknowledge that the strengths and weaknesses of these existing network methods derive from the technical choices these scholars have made in constructing their networks. As Borgatti explains, a central assumption of network theory is that “it is the researcher - by choosing a set of nodes and a type of tie - that defines the network.” The choices involved in building a given network “should not generally be regarded as an empirical question. Rather it should be dictated by the research question and one’s explanatory theory.” This necessary logic of selection stems from the fact that “in contrast to groups, networks do not have ‘natural’ boundaries,” and are artificial abstractions used to visualize complex systems [Borgatti 2011, 2].^[2]

With this proviso in mind that the investigator’s methodological choices governed by an explanatory theory inflect the structure of the network, our network analysis uses actor-network-theory (ANT) as a theoretical framework organizing our methodological decisions. ANT gives us a useful working vocabulary to define our networks, and is the most robust network paradigm dominant in the humanities, social sciences, and in business and organizational studies today that specifically adopts linguistic exchanges as the medium of social interaction composing the network’s structure. ANT is additionally useful for literary criticism since it unabashedly places theatrical and literary metaphors such as “actor,” “performance,” “stage,” and “narrative” at the center of their definition of how networks constitute the social.^[3] ANT defines a network as a social structure created by a lattice of intersubjective communication. According to Bruno Latour and John Law, the form of the network maps the circulation of social energy by tracing the movement of language between “actors” in space, in a process called “translation.” The network thus offers to us a model of the social that does not rely on the ordered arrangements of hierarchies, institutions, ranks, categories, or taxonomies. ANT describes the social order in a seemingly chaotic, unordered way, where the linguistic transactions between actors in the network empirically determine the nature of the social structure in the first place, without any formal, *a priori* presupposition of what the social organization should look like. Thus, if conceptualized in the form of the network, our introduction to the fractured political world of Elsinore looks something like this (Figure 1).

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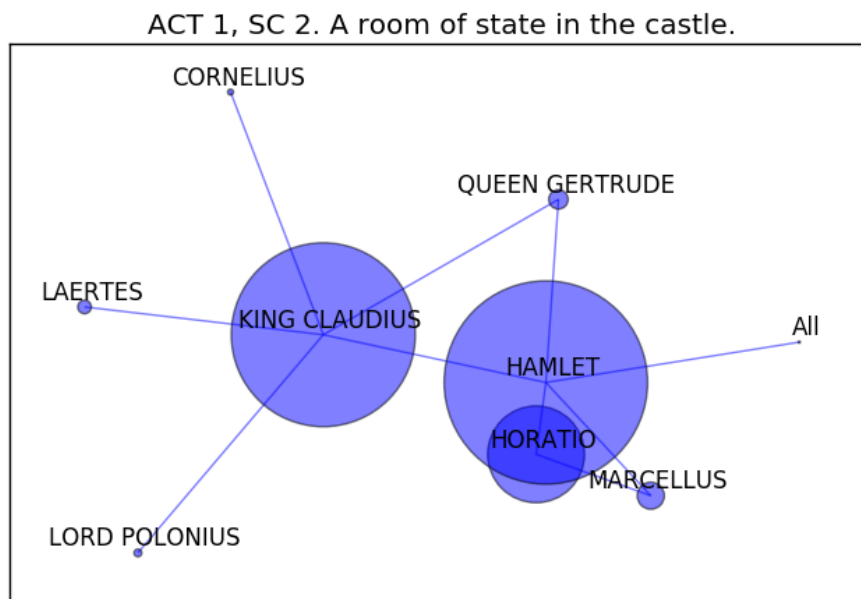


Figure 1. *Hamlet*, Act 1, Scene 2.

The network organizes the competing factions in space, organized around the hubs of Hamlet and Claudius, with Gertrude caught in between. This more closely matches the experience of spectators who would first encounter power relationships by inferring spatial and linguistic interactions between characters, and would have to figure out for themselves the tensions and allegiances driving the play’s plot. By contrast, modern text editions, such as the Oxford Shakespeare shown in Figure 2, provide the reader with a neat organization classified by rank, nationality, gender,

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heredity, or among other rubrics, in the form of a cast of characters, which was not provided to Renaissance audiences, or many theatergoers today [Wells and Taylor 2005].

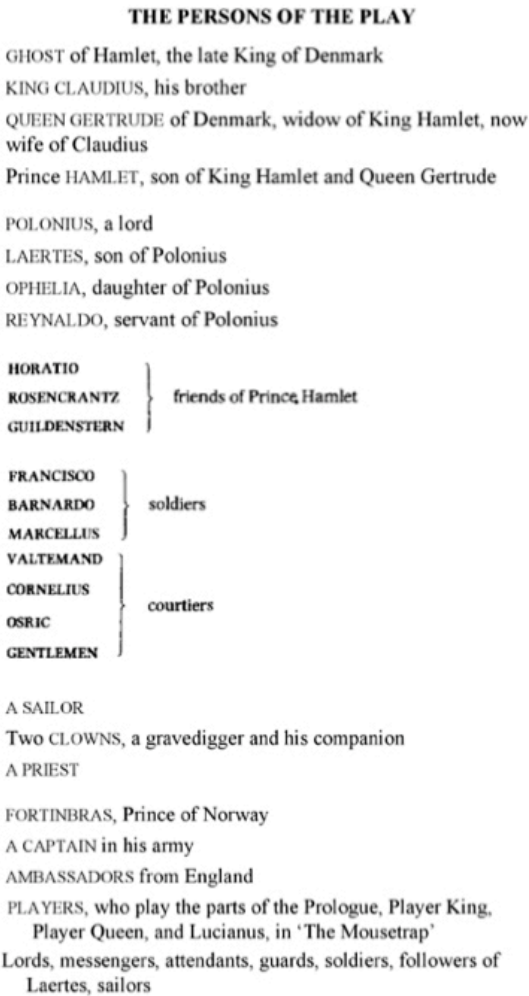


Figure 2. Cast of Characters from the Oxford Shakespeare.

Unlike the seemingly codified hierarchy of the cast of characters, the social relationships visualized in the network are not static. The network captures the ephemeral dynamism of unstable and constantly shifting social vectors. It is defined by its actors and their movements structuring relationships in a web. The actions composing the network involves a range of verbs describing the tracing and writing performed by the actors: “there is an actor whose definition of the world outlines, traces, delineate, limn, describe, shadow forth, inscroll, file, list, record, mark, or tag a trajectory that is called a network” [Latour 1996, 14]. The discourse of texts resulting from these acts compose a network that “renders the movement of the social visible to the reader” [Latour 2007, 128]. The network translates the “movement of the social” into a “visible” form, revealing a social structure determined by intersubjective relationships mediated by language. Central to ANT’s definition of the network is a literalization of the word “actor.” Latour attempts to “reactivate” the actor’s theatrical signification as a way to redefine agency in the network [Latour 2007, 46]. Theatrical action is “borrowed, distributed, suggested, influenced, dominated, betrayed, translated” in a constant linguistic negotiation of social energy with other actors and agents in the fictional space of the stage. The collective agency performed on the theatrical stage serves as a useful paradigm for ANT by providing a well-developed model describing how linguistic exchanges between actors in space create a social world in miniature. Our network analysis of Shakespeare’s plays thus enacts a productive cross-talk between theater and the network. ANT has appropriated the technical vocabulary of drama to define its “actors” in space, while we are reciprocally using ANT as a framework to define the space of the stage latent in Shakespearean language.^[4] ANT’s articulation of an organic, emergent model of the social in which the linguistic relationships between actors constitute the social structure itself, gives us an alternative technical vocabulary to

examine the social organization of Shakespeare's plays from a different spatial angle. ANT's stress on linguistic exchange as the basis of defining "actors," "performance," and the "stage" of the network gives us a specific framework to work with the language of the plays as the medium of social interaction.

ANT's definition of language as the tissue binding the performance network together also suggests a way to resolve some of the problems of weighting found in the prior network analyses of Shakespeare's plays and literary works. To address Moretti's admitted issue of a lack of weighting the volume and frequency of dialogue between characters, we have adapted Pierson's method of using the number of lines exchanged between speakers as a way to weight different magnitudes of interaction. The result of Pierson's quantitative weighting of line numbers provides a way to avoid hand-drawn diagrams, and permits the development of a machine-based technique of constructing the play's networks that Moretti has suggested was not yet possible. This technique defines each line of the play as an "event tie," which is a concept in network theory where connections have a "discrete and transitory nature and can be counted over time...Cumulated over time, event-type ties can be dimensionalized in terms of frequency of occurrence...It is these kinds of ties that researchers have in mind when they define networks as a 'recurring pattern of ties'." ([Borgatti 2011]; [Dubini and Aldrich 1991]; [Ebers 1997])

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Our own network visualization method aims to learn from the existing range of network analyses outlined above. To trace the relationships between characters in all of Shakespeare's plays, we created the diagrams using the Python library NetworkX, which has been used by scientists to examine complex systems and by social scientists to visualize social media networks. The network visualizations are divided by scene, and not the whole play, which was a shared problem of scale in the networks of Moretti, Stiller, Nettle, and Dunbar, and Pierson. Each network layers four dimensions of textual information into a single visualization: interaction between characters measured by who a speaker directly responds to (the edges between the nodes), frequency of interaction with other characters (the length of the edges between nodes), volume of each character's speech (the radius of the node), and network density (the number of edges surrounding each character). In developing this definition of "interaction" or "ties" in the program producing the network visualization, we concur with Moretti, and draw from actor-network-theory, by using explicit textual criteria to determine whether "two characters are linked" if "words have passed between them" as a type of "speech act" constituting interaction in the network. Pierson's counting method also gives us a basic rubric for measuring these linguistically based interactions programmatically (as opposed to manually), by "counting the number of lines of A spoken immediately after B, and vice versa, and summing them" [Pierson 2014]. This measurement of adjacency and proximity in dialogue directly accounts for *response* to a previous speaker as a proxy for reciprocal or mutual ties composing a two-way communication exchange. Here we have attempted to factor in the central distinction in network theory of "strong" versus "weak" ties. Network theorists define "strong" ties as recurrent, direct, mutual, reciprocal relationships and "weak" ties as indirect, uni-directional, faint, or sporadically occurring relationships ([Granovetter 1973]; [Easley and Kleinberg 2010]; [Greteman 2015]). Network theory uses this distinction to evaluate how the two tiers of interaction have different roles in composing a heterogeneous network structure. Thus, measuring the frequency of lines spoken after a certain character attempts to identify "strong" reciprocal bonds where speakers respond directly to the person speaking before them in the dialogue to engage in a conversation.

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Based on this definition of reciprocal, strong interactions as a response in the dialogue that can be counted as "event ties," the *edges* between the nodes in our network diagrams signify each character's relationship to others, or the characters to whom the character explicitly responds in the text's language. We measured the *length* of the edges between the nodes by calculating the inverse of how frequently a given pair of characters speak to one another - the more they respond to each other in the dialogue, the closer they will be in the network and the edge between them will be proportionally shorter. Using frequency of interaction in the playtext's language as a metric modulating the distance between speakers' nodes represents a way to gauge the strength or reciprocity of their relationship by tracking how much they respond to one another. Characters that reply a single time to an interlocutor will be distant, while characters that repeatedly respond to one another will have a more recurrent tie, and the distance between their nodes will be correspondingly shorter. Our method identifying response frequency by measuring adjacent or immediately proximate speech aims to weight the strength or weakness of interactions. This addresses some of the limitations of previous network studies that vaguely considered "some words" passed between characters (in the case of Moretti) or "at least

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one" interaction (in the case of Stiller, et al.) to create connections that are not precisely scaled to the actual amount of interaction that takes place in the play. Thus our network method does not employ an absolute scale in which any interaction greater than a single occurrence creates an unweighted edge between speakers. Rather, our scalable model modulates the length of the edge between characters' nodes as a proportion of the number of direct responses between them.^[5] To verify these machine-based results, we manually checked all of the scenes included in the analysis to validate that the line response method of measuring interaction accurately reflected the narrative spirit of the scene. The manual verification found an average error rate of 2.56% of misattributed interactions across the tragedies studied in this analysis. Some fairly clear trends emerged among the false interactions that the algorithm struggled to parse. First, when too many characters speak at once, such as when two or more characters respond in sequence to one character's speech. Take for example when Lodovico and Gratiano both respond to Iago's vow of silence:

Iago: Demand me nothing: what you know, you know:

From this time forth I never will speak word.

Lodovico: What, not to pray?

Gratiano: Torments will ope your lips. (*Othello*, 5.2.349-352)

Second, the reverse also held true: when one character speaks to several characters at once, such as in Act 1, Scene 5 of *Hamlet* when the Ghost responds to his son by commanding Horatio and Marcellus to "swear" from offstage. This is not a conversation, but in responding to Hamlet, he also directs his imperative to the other two characters. Third, eavesdropping and spying interactions were difficult to account for, with a famous example being Claudius eavesdropping on Hamlet in Act 3, Scene 1. Eavesdropping is a boundary case, because Claudius doesn't directly engage with Hamlet (i.e. he listens, but they don't exchange words), but for the sake of accuracy we included these moments. Overall, the manual reading found that characters do indeed predominantly respond to the speaker before them as a general rule shaping Shakespearean dialogue.

The methods described above, and the technical and theoretical choices informing our measurement of interactions between characters in the network diagrams aim to quantify strong ties, or as Moretti puts it, the "explicit" links created by direct verbal address and response. But what about weak or implicit ties, such as being present on stage without directly conversing? The effort to include implicit ties was a strength of the study by Stiller, et al., but their lack of weighting made both explicit linguistic interactions, and implicit spatial ones, equivalent. This assumption of equivalence seems to go against the spirit of dramatic performance, which consciously plays between the two. Our method accounts for these weak ties implicitly by structuring the network visualizations at the scale of the scene and not the whole play, as Moretti, Stiller, Nettle, and Dunbar, and Pierson all chose to do. An aggregate whole-play network makes it difficult to infer who shares the stage with whom at any given point. They are also difficult to interpret since they tend to create, as Nathan Yau puts it, graphs that "in total look hairball-ish," and which are fairly nonspecific in flattening subtle differences between plays, possessing "similar network densities, which suggests similar story structures" across texts [Yau 2015] [Grandjean 2015].

Some of this information, however, is already encoded by the plays, within the structure of each scene as a narrative unit that groups a set of characters, selected by Shakespeare himself, to interact both explicitly and implicitly in the frame of the stage. The more focused scale of our method inherently limits the number of ties that are possible because only a certain set of characters, determined by the text, can be present on stage during a scene, and all possible connections in that scene can only occur between these characters. By chunking our network visualizations to represent the local narrative context of the scene, and not the macro-level agglomeration of all interactions in the entire play, our networks capture the range of characters who share the narrative space of each scene implicitly by respecting Shakespeare's own organizational rules.

To enrich the layers of information represented in the networks, our visualizations have two further dimensions. Within the network, we have scaled the *radius* of each node according to the number of lines that the character speaks - the larger the node, the more he or she dominates the scene with speech. Calculating the node radius in this way allows us to compare a given character's volume of speech in general to the volume of speech that is used to communicate with others in the network (represented by the edges). This is a way to measure the total amount of language spoken by a

character versus the language defining his position in relation to others. Scaling node radii in this manner expands upon previous network techniques, where nodes were simple vertices or flat points between edges.

The final dimension in our network method is *density*. Comparing the number of edges linking a character's node to others, and the distance between characters and their interlocutors, allows us to perceive the network density surrounding each speaker within each scene. Increasing the number of links connecting a character to others, and drawing the edges closer to one another with more frequent reciprocal interactions, create an effect of network density that indicates a high frequency and intensity of network connectedness and social interaction. Scenes with a great deal of interaction will display a dense network of character nodes that are tightly clustered together. Scenes with fewer interactions among characters result in a sparse network with few connections between distant nodes.

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The network visualization method transforms the language of Shakespeare's plays into an array of spatial relationships structuring the network based on four different measurements. The four metrics encapsulated in our network diagrams - character interaction, frequency of interaction, the volume of each character's speech, and network density - give us multiple scalable methods of visualizing how the language of Shakespeare's playtexts structures a lattice of social interactions. Our approach attempts to build on the aforementioned precedents in network analysis. This technique with multiple dimensions in a single visualization offers a richer, and more granular understanding of Shakespeare's social networks than previous network studies that elided the difference between scenes by constructing aggregate networks for whole plays, flattened the key distinction between strong and weak ties, and did not weight interactions precisely. We propose that our networks learning from these precedents open up a new method using visualization technologies to study a literary or dramatic text from multiple angles simultaneously in a single network diagram.

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Network Analysis between Text and Performance: Revising the Social Disorder Hypothesis

With the visualization method we have developed, what types of network analysis are made possible? How might other critics use this network technique to find new avenues of research in the study of Shakespearean drama and dramatic literature more generally? In the case study that follows, we demonstrate how the networks constructed by our methodology function as a *critical tool* used to evaluate and to test a widely-accepted scholarly consensus on the nature of social order in Shakespeare's tragedies. Our visualization technique transforms the *idea* of social order into actual social networks of Shakespeare's dramatic world. We use Shakespeare's social networks created by the interactions within the plays to read the results of the visualizations against the grain of two other methods predominant in Shakespeare studies - close reading and theatrical performance. Reproducing this critical methodology entails independently conducting three levels of analysis in parallel - network visualization, close reading, and the visual analysis of staged performance - in order to test the results of any given approach against the others. Comparing the network graphs with still images from theatrical performances of the plays will demonstrate how the network analysis reveals to the reader some aspect of embodied performance that they could not perceive intuitively through a reading of the text alone. In this way, the network visualization represents the beginnings of a method that will allow us to read between the written playtext and the theatrical performance. Our argument uses the network analysis as a novel way to study both text and performance in a single visualization, which effectively translates Shakespeare's language into the web of relationships structuring the characters in the space of performance. It focuses our critical gaze on the exchange between the words and bodies that work together to define Shakespearean performance by transmuting the words of the playtext into character relationships in space.^[6] If Hammond has asserted that "blocking" or the positioning and grouping of characters in space is "unrecoverable" for the Shakespearean critic, we propose that the network visualizations allow us to imagine such a spatial arrangement. The network analysis does not create a single, inescapable way of staging inherent in the text, but it does offer to us a way to envision how the text structures the character-space that embodied performances ultimately occupy through the decisions of directors and actors. Ultimately, we propose that Shakespeare's drama must be shown and not exclusively read, but through a visualization method that is fundamentally textual and rooted in the structure of Shakespeare's language. By aligning Shakespeare's text and images from staged performances alongside our network diagrams, we suggest that the playtext itself can be used as a template to begin to organize the space of the Shakespearean stage.

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Using the network visualizations, we aim to address a live question in the digital humanities today: can computational methods teach us something new about literary texts, or do algorithms and visualizations simply confirm readings, arguments, and theories we already know well? The promise of the network method lies precisely in offering to critics a new vantage point that would otherwise not be possible through a conventional reading of the text. The network allows us to rethink one of the oldest stories in Shakespeare criticism and pedagogy, what we will call the social disorder hypothesis. Since A.C. Bradley influentially defined the essence of Shakespearean tragedy as “division of spirit involving conflict and waste,” and not the ultimate reconciliation or renewal suggested by Hegel, generations of critics to the present have described the tragic nature of *Hamlet* in terms of *thanatos*: confusion, destruction, and violence that violates natural law, ethics, and social order ([Bradley 1909]; [McAlindon 2013]; [Heller 2005]; [Prendergast 2005]; [Aebischer 2004]; [Foakes 2003]; [Danner 2003]; [Marshall 2002]). T.S. Eliot famously describes the violence of the play as an attempt to “express the inexpressibly horrible” that is marred by “excess” [Eliot 1998, 58–59]. George Santayana describes the play as fundamentally “incoherent” and it represents a confusion or “disarray” of the social world [Santayana 1968, 145]. More recently, Franco Moretti has inferred from his qualitative, manually drawn network analysis of *Hamlet* that the net effect of Shakespearean tragedy is a “scattering” and a “total disproportion” of social connections. Moretti’s conclusion from the networks simply reconfirms the standard story of tragedy as disorder [Moretti 2011, 4]. Readers of the comedies have developed a parallel hypothesis on social disorder in accounts of the carnivalesque. Drawing inspiration from the work of Mikhail Bakhtin in *Rabelais and his World*, a long tradition of critics has focused on the inversions and disorderings of political and sexual hierarchies opened up in the chaos of Shakespeare’s comedies ([Bakhtin 1984]; [Goldberg 2013]; [Pikli 2010]; [Grady 2001]; [Knowles 1998]; [Gorfain 1991]; [Bergeron 1991]; [Wilson 1987]; [Newman 1987]; [Kastan 1985]; [Danson 1984]; [Bristol 1983]; [Logan 1982]; [Berry 1972]; [Salingar 1976]. As Brian Richardson has put it, comedies such as *A Midsummer Night’s Dream* perform “the overthrowing of law - in particular, the laws of nature” [Richardson 1987, 302]. In this story told about Shakespeare, the tragedies and comedies draw their power and enduring interest from the subversive representation of social disorder. For the sake of space, the present argument focuses on Shakespeare’s tragedies, and acknowledges that the comedies and histories require further analysis.

This canonical account of Shakespearean drama as a fictional space for the eruption of disorder severing social bonds and overthrowing political hierarchies certainly holds true at the level of plot, and Act 5, Scene 2 of *Hamlet* is one of the most striking examples of this. However, the critical vocabulary of entropy and chaos - incoherence, conflict, waste, violence, destruction, scattering and disproportion - used to describe tragic plot as the unraveling of society and the destruction of human bonds, fails to capture the dramatic technique required in a performance to represent this “scattering” of the social on stage. The network in Figure 3 demonstrates that scenes of a tragic “scattering” disorder and the most disruptive and violent severing of social bonds are precisely the moments where the closest connections between characters are made, and the densest concatenation of network links exists.

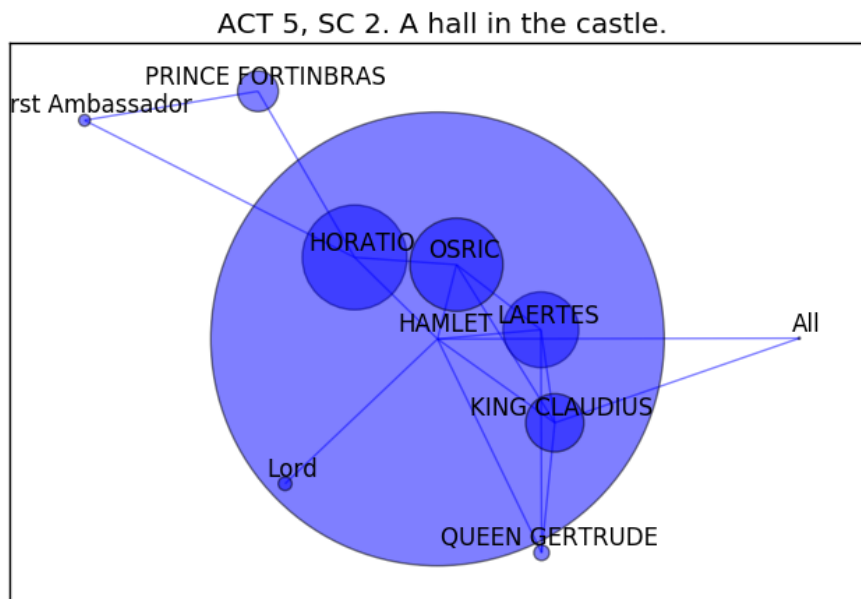


Figure 3. *Hamlet*, Act 5, Scene 2.

The network density at the end of *Hamlet* revises the commonly accepted notion, expressed most recently by Emma Smith, that “tragedies tend to move towards the isolation of a single figure on the stage, getting rid of other people, moving towards a kind of solitude, whereas comedies tend to end with a big scene at the end where everybody’s on stage” [Smith 2009]. The network structure suggests precisely the opposite. It is true that in this explosion of murder and political upheaval concluding the tragedy, all of the characters could not be more distant from one another in terms of kinship and affective bonds. The network visualization of this culminating scene, however, suggests that the play enacts a “scattering” and destruction of Elsinore’s social fabric by crowding the characters into a more densely packed and interrelated social network. To put this point in narrative terms, at the level of discourse, the play links and intermeshes speakers and bodies in a dense knot so as to represent the intersubjective disorder between previously “close” or related characters at the level of plot. The network visualization of 5.2 pushes the characters at the moment of violence and the greatest political and filial disorder into uncomfortably close relationships - the dense proximity of characters in relation to one another signifies that they speak to each other with a high level of frequency.

This counterintuitive network structure adds an important level of historical nuance to contemporary network theory, which defines social networks most frequently as affinity or affiliation groups bound by positive relationships between people. The assumption of positive bonds defining network links is most readily apparent in the persistent example of “friends” composing social networks. As Mark Granovetter suggests, relationships with “close friends” and “acquaintances” make up a social network [Granovetter 1983, 203] and Easley and Kleinberg define the social network itself as “the collection of social ties among friends” [Easley and Kleinberg 2010, 1]. By contrast, Shakespeare’s tragedies exhibit precisely the opposite structure: they are not composed of affinity networks bringing together friends or family, but rather these networks represent an array of negative relationships, where social bonds are being broken. In Shakespeare’s historical networks then, each edge in the network that initially signaled kinship or affiliation can, within the scenes of greatest social discord, signify the destruction of a social relationship between the two characters. Thus analyzing the social structure of Shakespeare’s plays adds a useful level of historical subtlety to our understanding of network behavior, which is often grounded in the study of social media networks in the present.

A more precise way to define network relationships lies in the concept of “clustering” from quantitative network theory. Mark Newman explains network clustering as a type of transitive relationship in space: “If vertex A is connected to vertex B, and vertex B to vertex C, then there is a heightened probability that vertex A will also be connected to vertex C. In the language of social networks, the friend of your friend is likely also to be your friend” [Newman 2003, 183]

[Newman 2010]. The network visualization of 5.2 exhibits such clustering behavior, with the scene populated by triangles of transitive relationships between all of the characters. The clustering displayed by 5.2 differs markedly from the “hub and spoke” model of 1.2, where Hamlet and Claudius serve as the social hubs around which the spokes of the network gather (Figure 1). The culminating violence of 5.2 displays a far more dense network clustering pattern, with the characters in the network interacting far more frequently with others, and not simply relaying their communication through the central figures of Hamlet or Claudius.

A second way to think about the density of the network in this instance is the distance between nodes. The close positioning of Hamlet, Claudius, Gertrude, Laertes, Osric, and Horatio at the center of the network signals a greater frequency of interaction between the characters than we have seen in previous scenes. In the dense clustering of the network, characters speak to more people, more frequently: the density of lines between characters traces the increase in interaction, and the decreased distance between nodes signifies a greater intensity of communication, with more frequent speech exchanged. To describe the density of the network in quantitative terms, 5.2 has 34 total network connections between characters, or 23.6% of total network links in the play as a whole, as opposed to the symmetrically organized scene of Act 1, Scene 2 above, which displays 9 network connections or 13% of the play’s total network links. Additionally, 5.2’s 34 connections creates a network that is approximately 450% more dense than the play’s average of 7.57 connections per scene (Figure 4).

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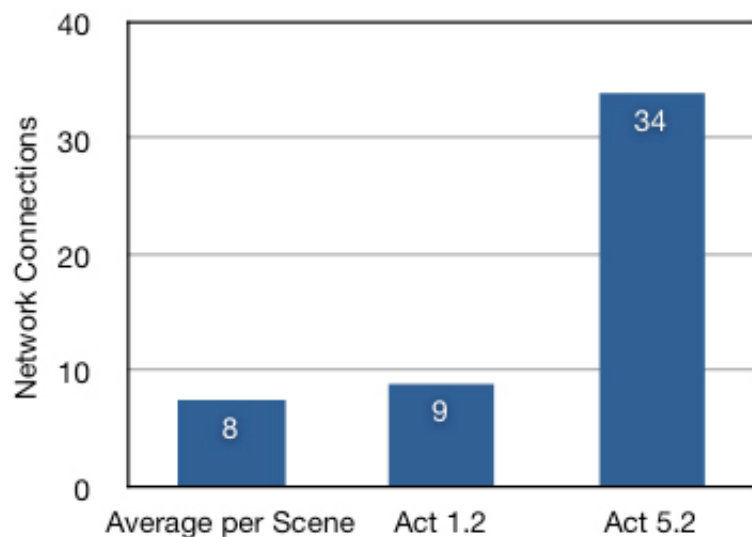


Figure 4. Network Density in *Hamlet*

The clustering density of 5.2 describes a world unraveling with more frenetic social energy and thickly intermeshed social connections than we have seen in the previous scene, which had exhibited a relatively diffuse network characterized by greater distance between characters and fewer total network connections between them. In the scene representing the destruction of the social order of Elsinore, the play constructs a social network to bind the characters being destroyed together at the moment of the greatest “scattering” and chaos. The positive act of theatrically connecting bodies in a dense network tells the story of the negative act of breaking apart the social bonds between characters that had held Elsinore together.

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The dense clustering of characters and bodies in scenes of social disordering is not isolated to *Hamlet*. A scan of other tragedies substantiates the same logic of dense imbrication in a social network created at the moments of the greatest social unraveling. Figures 5-7 show several key scenes from *King Lear* that contain the key moments where filial bonds are broken and inverted, and where blood relations degenerate into bloodshed.

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ACT 1, SC 1. King Lear's palace.

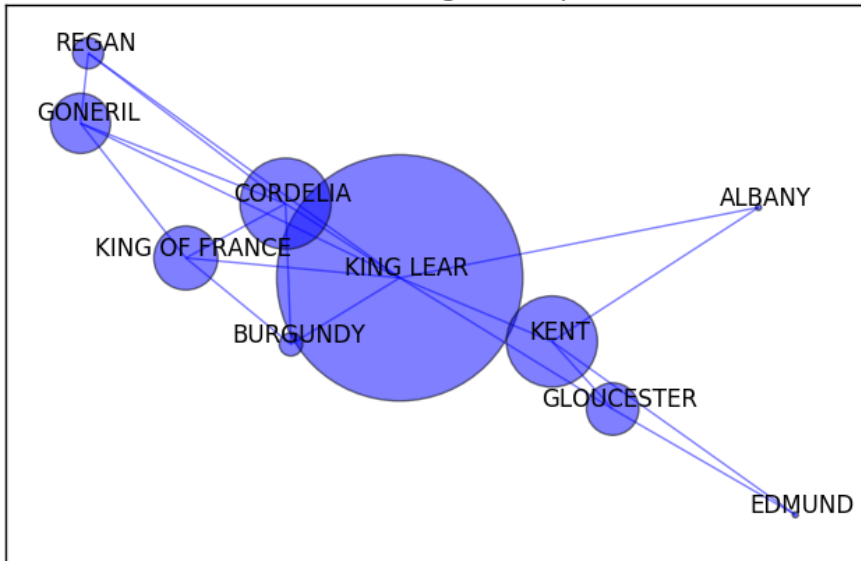


Figure 5. *King Lear*, Act 1, Scene 1.

ACT 2, SC 4. Before GLOUCESTER's castle. KENT in the stocks.

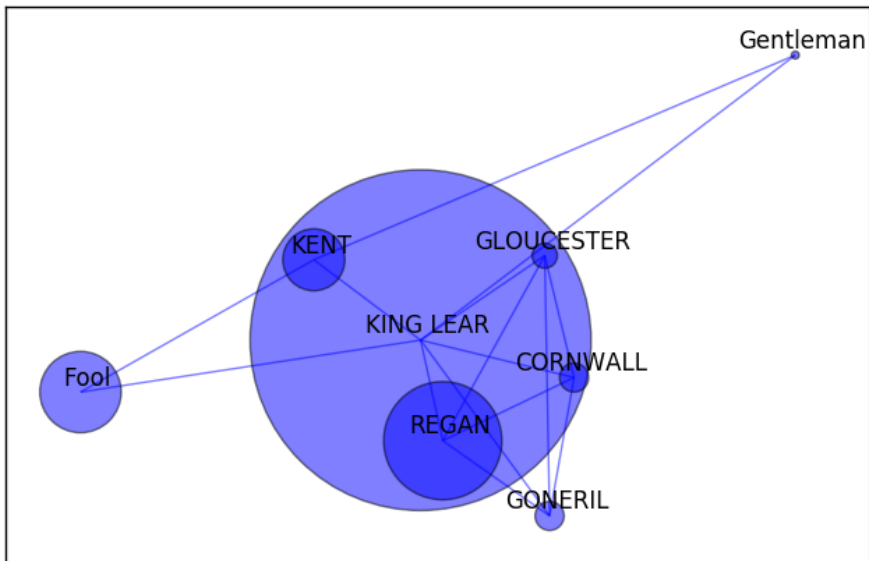


Figure 6. *King Lear*, Act 2, Scene 4.

ACT 5, SC 3. The British camp near Dover.

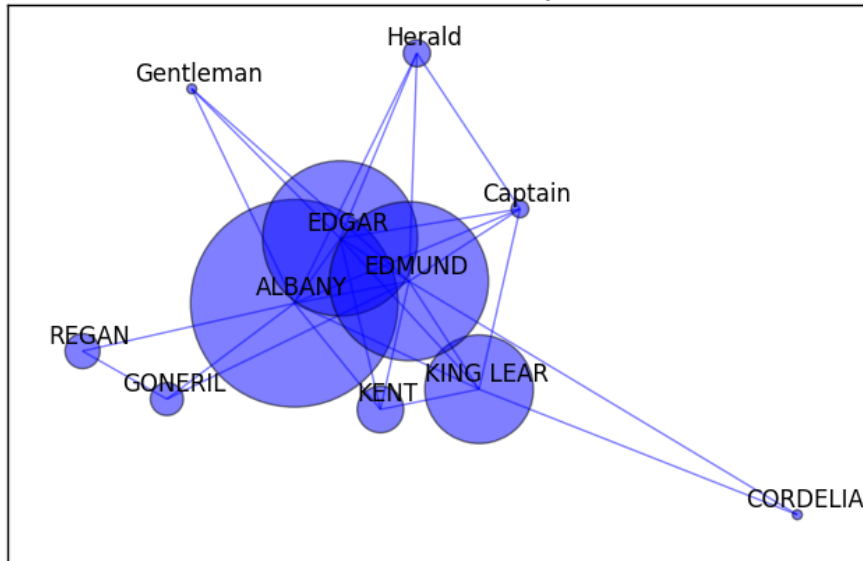


Figure 7. *King Lear*, Act 5, Scene 3.

Act 1, Scene 1 depicts Lear's famous opening move dividing his kingdom into thirds in return for verbal affirmations of the strength of his paternal bond with his daughters, Act 2, Scene 4 represents the scene of conflict where Goneril and Regan strip Lear of his retainers, and Act 5, Scene 3 is the moment of tragic reversal where the web of filial and political betrayals leads to the deaths of Lear, Cordelia, Goneril, Regan, Gloucester, and Edmund. All of these scenes representing the rending of family bonds and the established political order exhibit heavily concatenated networks marked by clustering behavior, with a high number of connections between characters and a dense clustering of speakers in close spatial relation to one another.

As an internal point of reference or control, Figure 8 shows Act 4, Scene 7, which depicts Lear's reunion with Cordelia.

ACT 4, SC 7. A tent in the French camp. LEAR on a bed asleep,

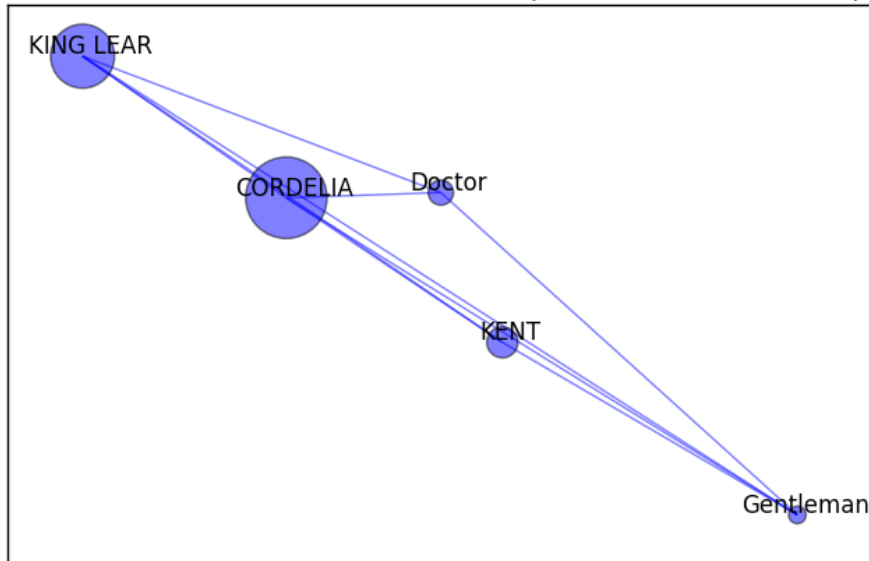


Figure 8. *King Lear*, Act 4, Scene 7.

This scene of re-establishing a family bond, a reunification and a linking together of father and daughter, results in a sparse network, with greater distance between affectively “close” characters, and fewer overall network links. To be more precise about the comparison of network density, the three scenes of greatest social discord disproportionately possess 73% of the play's total network links - the 3 scenes out of 26 total scenes contain 124 out of 168 total social connections. The anguishing conclusion of Act 5, Scene 3 alone has 56 network connections, or 33% of the play's total, in comparison to the thinness of the reunion in Act 4, Scene 7, which has 18 connections, and to the play's overall average of 6.46 network connections per scene (Figure 9).

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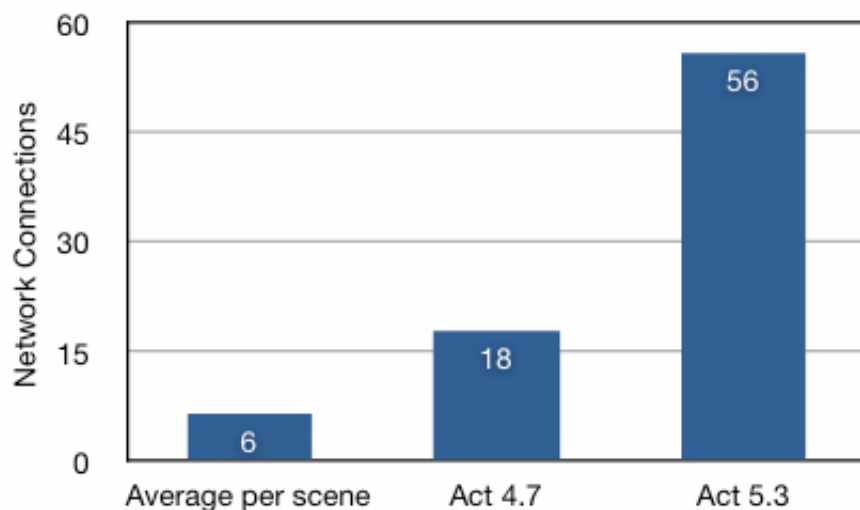


Figure 9. Network Density in *King Lear*.

That a single scene containing the greatest moment of social discord has the densest network of the play by far, with 33% of the entire play's social links or over 300% of the network ties compared to the scene of reconciliation with Cordelia, and over 850% of the average network connections per scene, shows that the “dissolving” (5.3.202) and “decay” (5.3.296) of the play's social world densely packs the stage with speakers and with bodies as the performance

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strategy necessary to depict the act of “dissolving” the bonds between those speakers - a clustering in space so as to divide in the plot. The network thus visualizes the manner in which the play’s structure - the internal relationships between speakers formed by the text’s language - works according to a logic that is the reverse of the content or plot of the scene. The network functions according to a logic of clustering and increased social interaction that is the reverse mechanism of the plot’s dissolution of social bonds.

A census of Shakespeare’s tragedies, including *Coriolanus*, *Julius Caesar*, *Antony and Cleopatra*, *Titus Andronicus*, and *Romeo and Juliet*, all demonstrate the same logic of dense network clustering at the moment of social unraveling (Figures 10-14).

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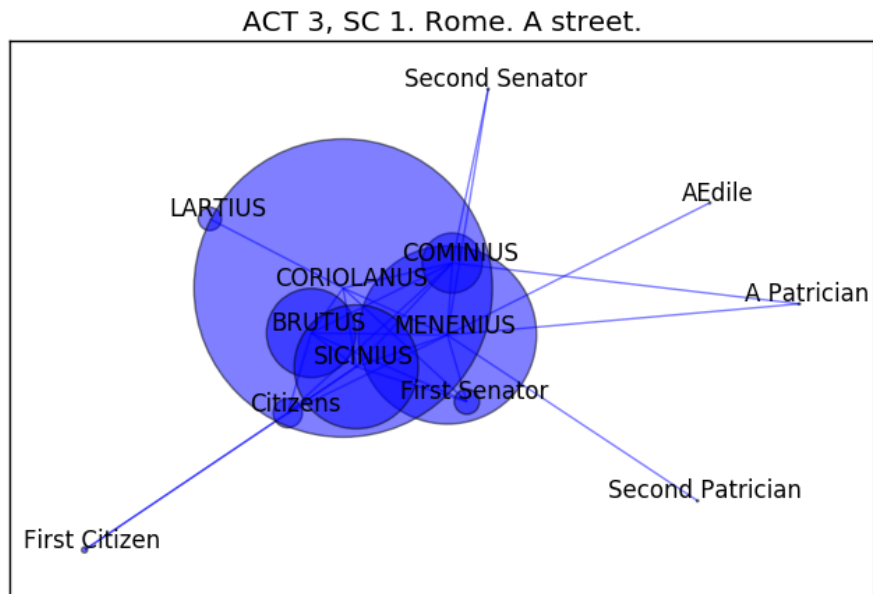


Figure 10. *Coriolanus*, Act 3, Scene 1.

ACT 3, SC 1. Rome. Before the Capitol; the Senate sitting above.

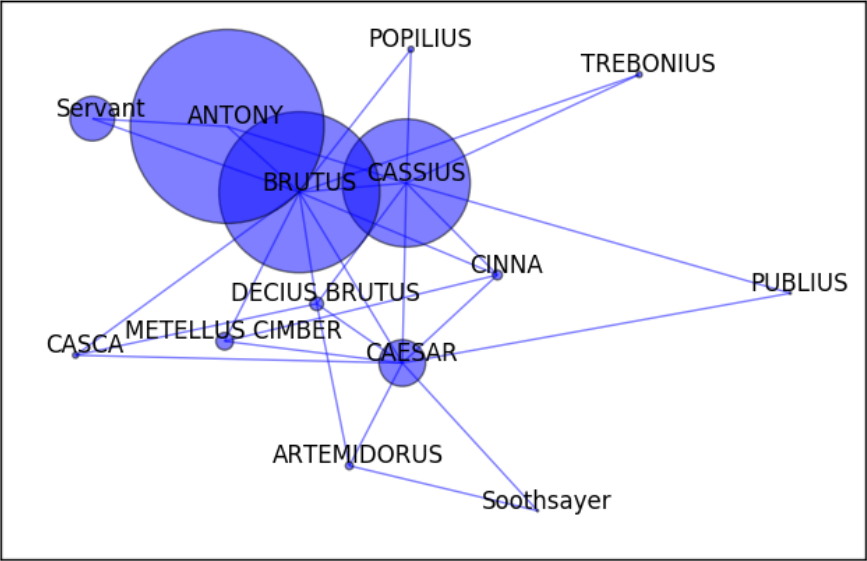


Figure 11. *Julius Caesar*, Act 3, Scene 1.

ACT 5, SC 2. Alexandria. A room in the monument.

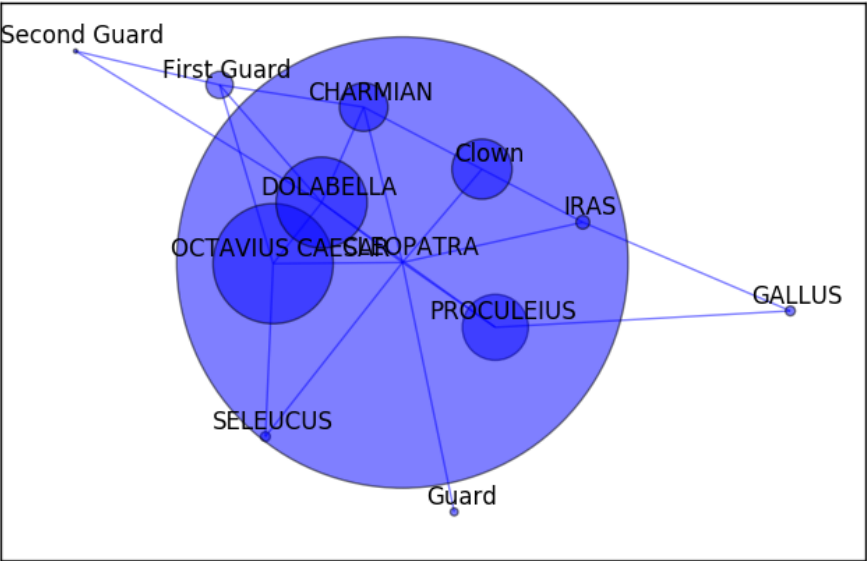


Figure 12. *Antony and Cleopatra*, Act 5, Scene 2.

ACT 1, SC 1. Rome. Before the Capitol.

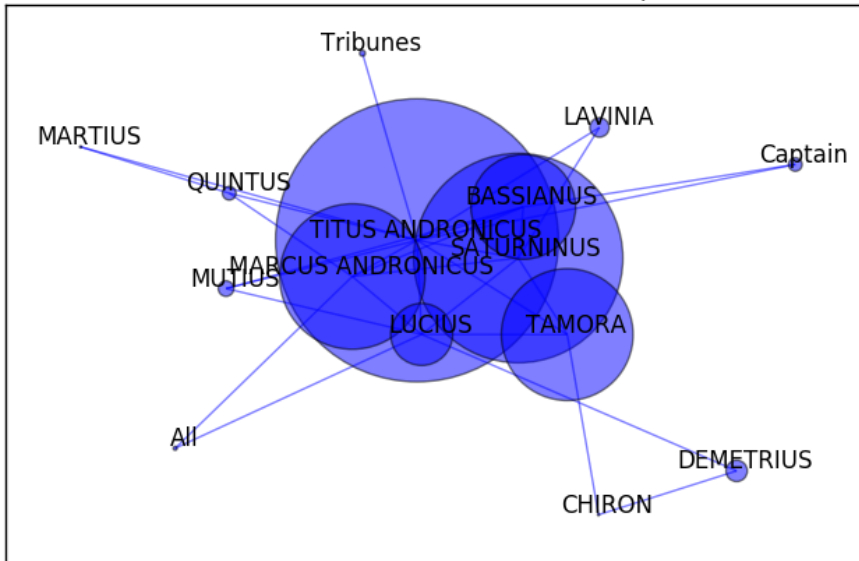


Figure 13. *Titus Andronicus*, Act 1, Scene 1.

ACT 5, SC 3. A churchyard; in it a tomb belonging to the Capulets.

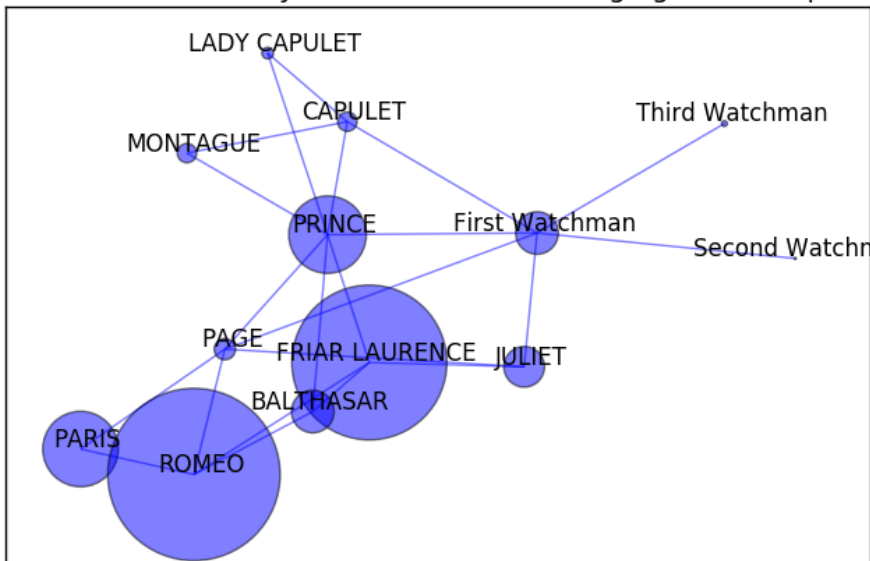


Figure 14. *Romeo and Juliet*, Act 5, Scene 3.

These pointed scenes of disarray, ranging from Coriolanus' brawl in the Senate, Julius Caesar's assassination, Cleopatra's suicide and Octavius Caesar's conquest of Egypt, the violent introduction to Titus' perverse Rome, and the fatal conclusion to *Romeo and Juliet*, all spin a dense web of social connections to represent social and political breaking points. By quantifying the network densities across these scenes of heightened disorder versus the average number of network connections in all scenes of the play, we can see that the moments of greatest tragic *frisson* exhibit much denser social networks than the average for each play (Figure 15).

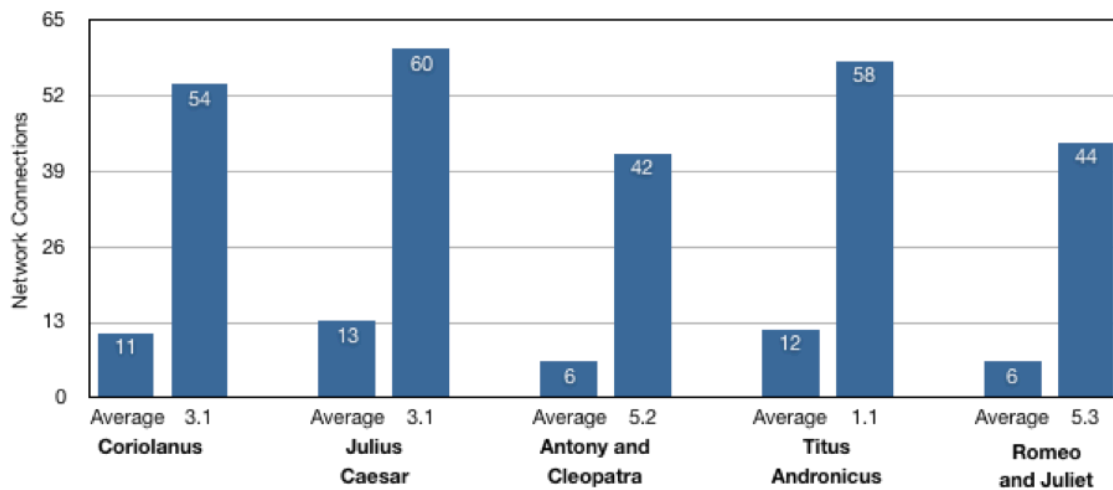


Figure 15. Network Density in a Census of Tragedies.

The networks from this cross section of Shakespeare's tragedies suggest a performance strategy of binding in a social network so as to break apart the social. The plays also describe in their own language the structure of dense binding and knitting that occurs in the final scenes of chaos. Cleopatra defines her own suicide as being wound in a "knot intricate" in 5.2.295 visualized above (Figure 12). *Othello* most persistently uses the language of nets and webs to describe the intersubjective mesh that binds the characters. Othello, for example, defines himself during the violence of 5.2 as "being wrought, / perplexed in the extreme" (5.2.355). Being "perplexed" gestures to his confusion upon being "enmeshed" in Iago's "net." However, the etymology of "perplexed" adds a second level of meaning to Othello's final self-definition. The verb "to perplex" derives from the Latin *perplexitas*, which signifies a knotting, winding, or binding.^[7] Othello therefore voices in the word "perplexed" a basic state of being confused, but based on the Latin root, also defines himself in an "extreme" knotted or tangled state. Othello's state of perplexity reflects the play's sustained obsession with how individuals become bound in intersubjective nets. The network traces in spatial form the play's own vocabulary of nets and webs entangling individuals with others. In Act 2, Scene 2, Iago voices the broad strokes of his plot as a web: "With as little a web as this will I ensnare as great a fly as Cassio...I will gyve thee in thine own courtship." (2.2.169-171) The "little web" expands beyond Cassio in Act 2, Scene 3, to "enmesh" Cassio, Desdemona, and Othello in a "net":

His soul is so enfeathered to her love
That she may make, unmake, and do what she list,
[...]
And out of her own goodness make the net
That shall enmesh them all. (2.3.319-336)

Iago's consistent use of the language of "webs" and "nets" as the method to "ensnare," "gyve," and "enmesh" others into his scheme does not suggest that Shakespeare was thinking in terms of networks, in the contemporary sense of the word, when the play's characters speak of "webs," "nets," "mesh," "snares," and being "perplexed." The play does, however, persistently mobilize the language of webs and nets as a way to dramatize the discord between them. The network captures how the playtext spins a "web" or "net" of conflict between the characters in the language of the text and between the bodies of the speakers on stage as a linguistic and physical way to structure intersubjective tension.

The network visualization of Act 5, Scene 2, alongside frames from two performances of the play, show the extent to which Othello is "perplexed in the extreme" in a web of other characters ([Burge 1965]; [Parker 1995]; [Nunn 1990]). The network of speakers "enmeshes" Othello in this scene of murderous unraveling in a "perplexed" relationship to others that matches the density and clustering found in other tragedies (Figures 16-20).

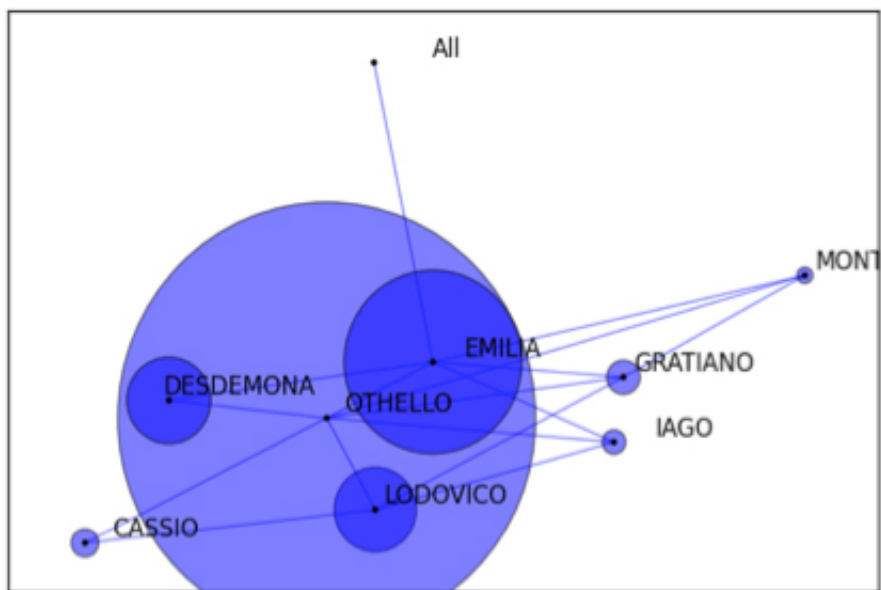


Figure 16. *Othello*, Act 5, Scene 2.



Figure 17. Performance of *Othello* 5.2 (Oliver Parker production).



Figure 18. Performance of *Othello* 5.2 (Oliver Parker production).



Figure 19. Performance of *Othello* 5.2 (Stuart Burge production).



Figure 20. Performance of *Othello* 5.2 (Trevor Nunn production).

The final scene of violence, then, demonstrates that Othello is not “all-in-all sufficient” (4.1.262), but comes to be defined by his binding in a network of other characters circumscribing him at the moment of his self-destruction. For Othello, his binding in the network precipitated by Iago’s scheme signifies a basic confusion or “perplexity” in defining the self.

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To extend the visual homology, the network of Act 5, Scene 2 in *Hamlet* corresponds to the arrangement of bodies in productions featuring actors as diverse as Tennant, Branagh, Richard Burton, and Sir Laurence Olivier ([Doran 2008]; [Branagh 1996]; [Gielgud 1964]; [Olivier 1948]). The network visualization is structurally analogous to the clustering of bodies that results in the various performances of Act 5, Scene 2 (Figures 21-26).

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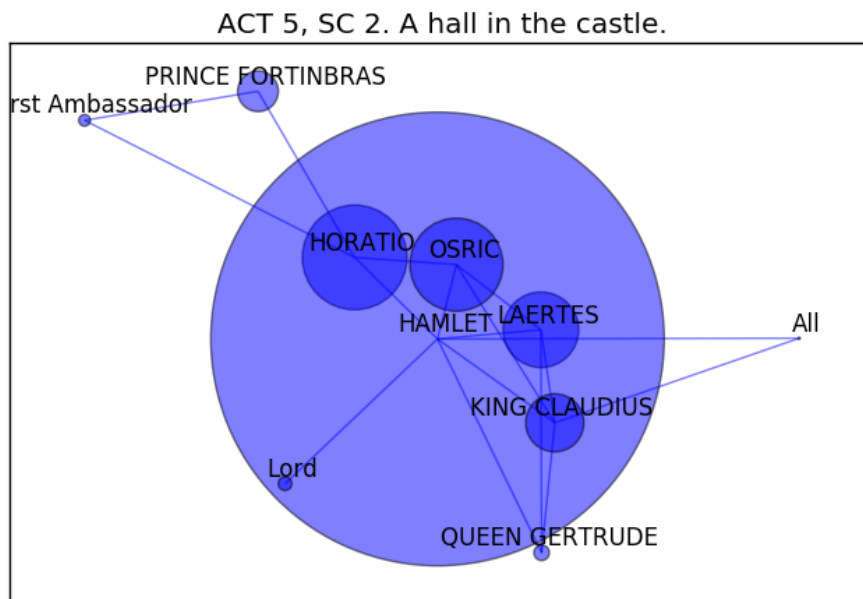


Figure 21. *Hamlet*, Act 5, Scene 2.



Figure 22. Performance of *Hamlet* 5.2 (Gregory Doran production).



Figure 23. Performance of *Hamlet* 5.2 (Kenneth Branagh production).



Figure 24. Performance of *Hamlet* 5.2 (Kenneth Branagh production).



Figure 25. Performance of *Hamlet* 5.2 (John Gielgud production).



Figure 26. Performance of *Hamlet* 5.2 (Laurence Olivier production).

In the networks and the performance staging, Hamlet lies at the focal point of the network of bodies defining the final scene. Claudius, Laertes, Gertrude, Horatio, Osric, Fortinbras, the Ambassador from England, and the “audience” all are clustered around Hamlet’s body as the hub of this final tragic tableau as a network of mangled bodies. To a certain

extent, the film images demonstrate that the collision of bodies on stage as a way to precipitate conflict and disorder is somewhat obvious - characters need to be brought together to engage physically and to inflict violence upon one another. However, readers of Shakespearean drama such as Nietzsche, Hegel, Bradley, and other critics of tragedy in general in their wake have focused on the thematic content of disorder, chaos, and the breaking of the social order, without adequately acknowledging the organization of bodies in space - close connections and physical proximity - as the basic condition needed to create a theatrical frame for the tearing apart of human relations being expressed in the plot.

The network and each film's *mise-en-scène* cannot be identical since every performance requires interpretive decisions left open by the text to each director and actor. The point of the network analysis is not to say that every performance will be the same, which is obviously impossible. What is significant in the comparison in the network to the two performances is that despite the artistic latitude opened by Shakespeare's plays, the underlying structural logic defining the relationship between the characters as a chaotic arrangement of bodies in space in this catastrophic scene is remarkably consistent.^[8] The spatial organization of the network describes a character-space that directors and actors populate with movements, gestures, and speech. We could examine many more scenes to compare the network to the performance as a mode of methodological control. But beyond verification, the point of the present analysis is to suggest that the network visualization method can teach us something new about Shakespeare's plays that revises a widely-held critical consensus. The network analysis performed here opens up a space for reading between text and performance, precisely as Weimann proposes, and should not be understood as an authoritative account of tragedy. This represents the beginning of a methodological conversation, rather than the final word on Shakespearean tragedy in networks or in performance.

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These claims may seem terribly abstracted from the content of the play itself. But Shakespeare's text demonstrates a persistent metatheatrical preoccupation with precisely this translation of words into embodied performance, or how language can be represented in space. Hamlet defines himself in his final moments not in terms of an ontology - moving away from the question of "to be or not to be" - but rather in terms of his literariness: "in this harsh world draw thy breath in pain / To tell my story" (5.2.290-291). By impelling Horatio to "report" him "aright" and by giving Fortinbras his "dying voice," (5.2.298) Hamlet transforms his afterlife, that "undiscovered country" into an act of correct narration, a "story." Hamlet's final transplantation of voice focuses on the act of linguistic articulation and "report." However, Horatio's final story is not vocative or oratorical in nature. Rather, Horatio and Fortinbras perform a crucial modification in transforming Hamlet's story into a spatial arrangement of bodies on a "stage":

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Horatio: Give order that these bodies
High on a stage be placed to the view;
And let me speak to th'yet unknowing world
How these things came about. So shall you hear
Of carnal, bloody, and unnatural acts,
Of accidental judgments, casual slaughters,
Of deaths put on by cunning and forced cause;
And, in this upshot, purposes mistook
Fall'n on th'inventors' heads. All this can I
Truly deliver.
Fortinbras: Let us haste to hear it,
And call the noblest to the audience.
[...]
Horatio: Of that I shall have also cause to speak,
And from his mouth whose voice will draw on more.
But let this same be presently performed,
Even while men's minds are wild, lest more mischance
Of plot and errors happen. (5.2.321-339)

Horatio's account moves away from the idiom of "story," "report," and "voice," dictated by Hamlet. He instead orders that

"these bodies / High on a stage be placed to the view," translating Hamlet's "story" and the act of "reporting" from the articulation of the voice to a spatial arrangement of bodies. The story is told not only in words, but also in the placement of "bodies high on stage" as the materials of "carnal, bloody, and unnatural acts, / Of accidental judgments, casual slaughters, / Of deaths put on by cunning and forced cause." These bodies function in the plane of vision - they are "placed to the view" - transmuting Hamlet's story into an act of spectatorship. Fortinbras compounds this definition of the metatheatrical space by calling the "audience" and commanding that the soldiers bear Hamlet "to the stage." Horatio insists that the "story" will not take the form of an ode or an oratory. He argues that the voice given to him by Hamlet is insufficient to represent the events of the tragedy, since he will have to "draw on more" than speaking alone. The ultimate account of Hamlet's life takes on the form of a theatrical performance: it will be "presently performed." The performance in question exerts a "wild" effect, reflecting the chaotic social disorder and violence of the final scene. For Horatio, the "plot" will paradoxically be most accurate, with the fewest "errors" and "mischance," in this state of wildness. As in the preceding reading of the network, the bodies densely clustered on stage for the performance of Hamlet's story reflects the state of wildness that concludes the play. The network analysis corresponds with Horatio's own metatheatrical appraisal of performance. Both lead to the conclusion that the gathering and performance of bodies in the space of the stage is the most accurate way to recount the "wild" disordering of Elsinore's social bonds.

Reading the contours of the network as a way to translate the text into the relationship of bodies in space is not an anachronistic imposition of digital tools onto the Shakespearean text. The network visualization follows the rules of Hamlet's own metatheatrical commentary, and a commonplace understanding in the Renaissance of the crosstalk between the body and the text. If anything, this reading strategy converting language into spatial relationships takes seriously the metatheatrical rules of performance that Hamlet himself articulates in the play. In the "purpose of playing" speech in Act 3, Scene 2, Hamlet advises the players to "suit the action to the word, the word to the action," insisting that proper performance technique requires a movement beyond the enunciated word to a more dynamic conversion of the written word into the "actions" of the moving body. The translation of word to action occurs in space, indicated in Hamlet's statement of the "purpose of playing."

...the purpose of playing, whose end, both at the first and now, was and is to hold as 'twere the mirror up to nature, to show virtue her own feature, scorn her own image, and the very age and body of the time his form and pressure. (3.2.19-22)

Transmuting the word into dramatic action functions as a "mirror up to nature" in space, "showing," representing "images," and revealing to the "very age and body of the time" the physical contours of "his form and pressure." The mirror analogy, and the gesture to Aristotle's image of the wax seal as a "form and pressure" defines "playing" as a play in space - a specular optics or an experience of spectatorship - constituted by a visual array of images, bodies, and forms [Aristotle, 412a6-412b6]. Putting Hamlet's body on a "stage" at the end of the play is therefore a fitting final confirmation of his preoccupation with "playing." Beyond his specific fate, however, Hamlet's injunction to "suit the action to the word, the word to the action" reflects a broad Renaissance *topos* understanding the body's gestures as a crucial component of linguistic communication [Hammond 1992, 82]. One example within Shakespeare's corpus is the response of the witnesses at the conclusion of the *Winter's Tale*: "There was speech in their dumbnesse, Language in their very gesture" (5.2.11-12). The convertibility of body and language was not simply theatrical, however, with Thomas Wilson's rhetorical manual calling for "the whole bodie stirring together" as an embodied component of rhetorical eloquence and delivery [Wilson 1909, 220-221]. Hamlet's model of visualizing the word that "denotes" the spatial "play" of actions and of bodies is precisely what the network analysis attempts to accomplish by using the language of the text as the basis of tracing the social links between different characters in space. This is not to claim over-literally that Hamlet urges us to create networks. He is, however, concerned with the translation of the linguistic "word" of the playtext into the "play" of bodies in visual space, which is the basic logic of the network analysis method. For Hamlet, theater is not meant to be read as the word, but rather "shown" as a series of images. The network graph is a good way of analyzing these spatial relationships in a repeatable, robust way representing the ephemeral experience of theatrical performance.

The methodological problem lies in the fact that broad themes of conflict, violence, and social disorder at the level of content and plot can be readily perceived through reading, but visualizing the web of social relationships in the reading

process proves to be more difficult. Reading the Shakespearean text necessarily requires a linear syntax, the unidirectional physical movement through the language arranged in the space of the line on the page Figure 27.

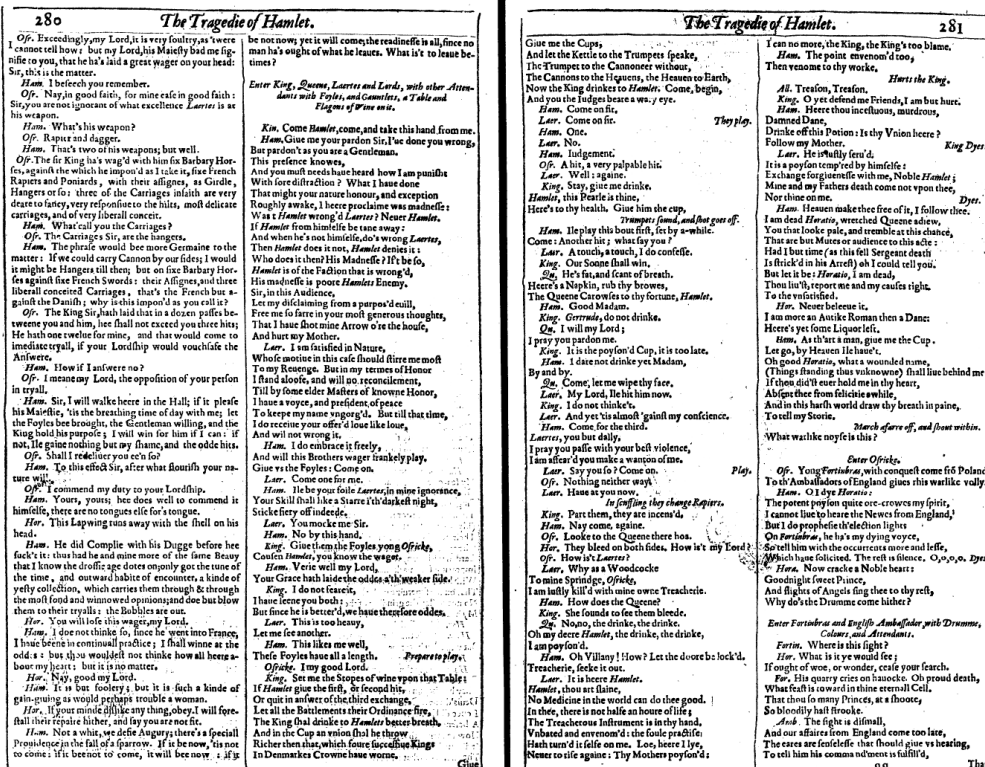


Figure 27. *Hamlet*, Act 5, Scene 2 printed in the First Folio.

To begin to think about how the page translates to the stage, Shakespeareans have taken up Jerome McGann's famous dictum that the "reading eye is a scanning mechanism as well as a linear decoder" by attempting to understand how the spatial structure of the printed play influences the reading experience and performance [McGann 1991, 113]. For example, Margaret Jane Kidnie's focus on how stage directions force a "two-axis" reading beyond linear syntax, suggests that the printed page contains "impressions of activity" encoding actions to be performed on stage [Kidnie 2004, 169]. The visualization method we are proposing adds another dimension to a multi-axis reading practice by translating the relationships (or "impressions of activity") traced on the printed or inscribed page into the space of a network. The network organizes the language of the play into coordinates in graphical space that can more accurately delineate the complex relationships between multiple characters across all of the scenes composing the play. The network graphing method therefore functions as an intermediate step in the conversion of the unidimensional syntax of the written playtext into the 3D performance of bodies in the space of the stage.

The network's visualization of character interactions within the space of performance more accurately matches early modern understandings of the stage itself as a place framing the actors' bodies. The 1595 Swan sketch, which is the only surviving drawing of the interior of an Elizabethan theater, shows a performance in progress on the proscenium, with the actor's bodies serving as the focal point of the theatrical space. The positioning, motion, and embodied gestures of the three characters on stage in the Swan sketch begin to tell a story of social interaction based on the proximity and distance, and the intensity of physical connection in space in precisely the same way that the network attempts to capture based on the text's language (Figure 28).



Figure 28. Buchel / DeWitt Sketch of the Swan Theatre (1595).

By contrast, influential modern renderings of the Globe Theatre's interior by C. Walter Hodges [Hodges 1947] represent the Elizabethan theatre as a disembodied architectural space, focused on the building's structure (Figures 29-30).

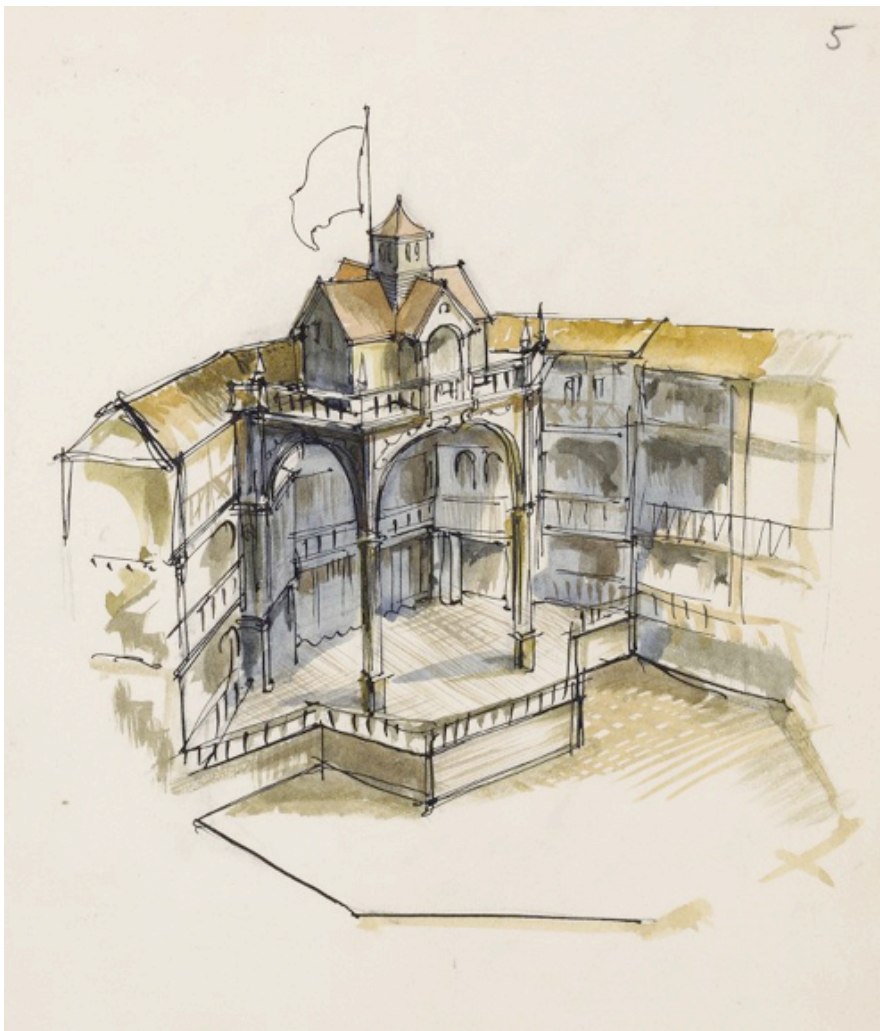


Figure 29. C. Walter Hodges' rendition of the Globe Theatre.

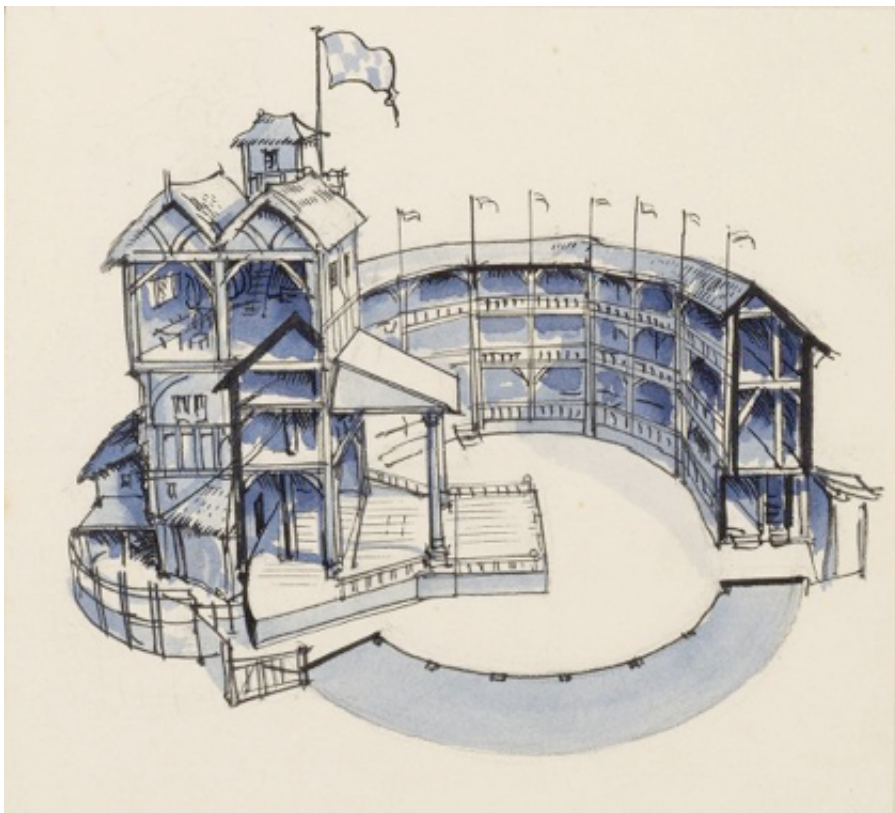


Figure 30. C. Walter Hodges' rendition of the Globe Theatre.

The Swan sketch suggests an Elizabethan understanding of theater organized around the actors' bodies as the hub of the performance space, while more recent diagrams attempting to imagine the Globe have studied the theater as an architectural problem, or in terms of the class stratification of the audience [Cook 1997]. The actors on stage in the Swan sketch are in the midst of performance, and the image presents the interaction and movement of characters. The left hand of the standing actor touches the shoulder of the seated actor facing him, and his right hand gestures outward. The proximity and physical connection between the characters on stage contrasts with the motion of the third character, who stands at a distance from the other two and is captured in a state of more dynamic movement across the stage closer to the groundlings, while gesturing away from his plane of motion. Hugh Richmond has argued that the dynamism of Shakespearean performance was a function of the performance space itself. The presence of pillars on the Globe's stage blocked the sight lines of spectators, and thus its design required "an enormously active, dynamic blocking plan" that was "almost violently active and mobile, rather like a rugby league match" in order to ensure that the audience could see what was happening [Richmond 2004, 74]. The Swan sketch's attention to the positioning, gesture, and dynamic movement of characters on the stage (or blocking, which Hammond believes to be irrecoverable) affirms Richmond's take, and represents a model of theatrical space that organizes the characters' bodies in performance in a state of motion, rather than defining that space as disembodied architecture, or through the conjectural experience of the audience. The network analysis corresponds closely to the understanding of the theatrical space in terms of blocking and the positioning of characters and bodies, and attempts to recuperate the early modern vision of performance as the conversion of "action to the word, word to the action."

We have much more evidence about the importance of character-space and stage geography in contemporary productions of Shakespeare. The director Gregory Doran describes the Royal Shakespeare Company's 2008 production of *Hamlet* (visualized in Figure 22) as precisely a process of theatrical "translation" that begins with a bibliographical examination of the Company's First Folio edition, exploring the text "word-by-word, line-by-line" in order to structure the blocking and positioning of the "stage geography." The meticulous process of close reading reveals the characters' "relationships with each other," and Doran insists that the playtext itself contains a sort of blueprint for the organization of, and movement within, space, apart from the director's intervention: "the scenes begin to move

themselves” [Doran 2008, 1–5]. The network’s approach to understanding the play’s social world by reasserting the importance of character-space as an organizing principle of the playtext hews closely to the imagination of theatrical performance as the clustering of bodies interacting within the spatial geography of the stage, evinced by the Swan Sketch and as the mode of “translation” between “words” and “stage geography” practiced by the Royal Shakespeare Company today.

Shakespeare’s plays and Renaissance theatrical discourse thus contain a latent meditation on the movement from text to performance, from words to bodies performing on stage, which the network method allows the critic to perceive. Hamlet’s final metatheatrical preoccupation with how “story,” “voice,” and linguistic “report” can be translated into “bodies high on a stage placed to the view” to be “presently performed” before an “audience” shows that the Shakespearean text contains within itself a blueprint of sorts describing how to perform the movement from text to stage. With network visualizations, the critic is able to conduct a form of double reading, unpacking the signification of the printed language composing the text simultaneously with a spatial analysis showing how the text’s language structures a relationship between speakers on stage.

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A New Vantage Point on Shakespeare’s Dramatic Art and Network Theory

We are beginning to move our understanding of Shakespearean tragedy away from the “conflict and waste” hypothesis mobilized by countless critics since Bradley. Rather, the paradoxical theatrical move of linking together as a means of disordering the social gestures to the logic of enantiosis, or *discordia concors*, articulated by the pre-Socratics and later appropriated as a model by both Hegel and Nietzsche to define tragedy [McAlindon 1991, 11 and 261–262]. If Bradley’s understanding of tragedy as a “division of spirit involving conflict and waste” attempted to reject the Hegelian and Nietzschean view of tragedy as a dialectic of order and disorder, the network visualization shows that Shakespeare’s playtext itself structures the space of tragic scenes in a more nuanced, if paradoxical, way [Hegel 1975] [Nietzsche 1956]. The performance of tragedy is not characterized by a wasting away or violent incoherence, nor is it defined by a dialectical movement of order and disorder. Rather, the network shows that scenes of tragic violence perform a disordering of the social by organizing the characters as a densely clustered network of bodies arranged in theatrical space. The scattering of social bonds at the level of plot requires a movement away from order and toward the alternative organizational indices of *density* and *clustering* as ways to measure social bonds or connectedness at the level of the theatrical discourse, or the language structuring the relationships of characters and their bodies in the space of performance.

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The network visualizations thus demonstrate spatially that the anti-social explosions of violence tearing apart the social order of the play’s world require the assembly of a dense social network on stage in order to be represented to the audience. Shakespeare’s plays represent systems of increased disorder in these paradigmatic scenes of tragedy by creating a different form of order - the network - on stage. The clustering patterns of the network differ substantially from the social order of the beginning of the plays, defined by hierarchies characterized by a neat hub and spoke organization in space. The counterintuitive play of a disordering made possible by the ordering of a network corresponds to actor network theory’s appropriation of Michel Serres’ definition of social systems. As John Law describes, ANT has embraced Serres’ description of the social world as “patches of order in a sea of disorder” as an organizing principle of networks [Law 2009, 5].^[9] For Law, the form of the network traces the “boundaries between order and disorder” and is capable of “imagining the uncertain messengers that pass between different orders or between order and disorder” [Law 2009, 5]. For theorists such as Law and Latour, then, the network structure can represent social systems forged in the interaction of order and disorder in a way that traditional models built upon the assumption of order as the absence of disorder (such as hierarchies, rankings, organizational charts, or dendrograms) cannot. The interface between order and disorder also functions as a central concept in Niklas Luhmann’s influential alternative account of the network as a boundary between an organized system and the arbitrary, complex, and chaotic world surrounding it. For Luhmann as for network theorists, the network represents a space of order and the “reduction of complexity” in a “sea” of disorder and maximum entropy [Luhmann 1995, 27]. Both influential network models define the social system as a pocket of order and reduced chaos in a vast universe defined by randomness and disorder.

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The present analysis of the networks traced within Shakespeare’s plays reverses these precedents set by actor network

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theory and by Luhmann. The Shakespearean networks do not create order as something different or partitioned from a surrounding state of disorder, and networks do not represent an oasis of order in a bleak entropic desert of disorder. Rather, Shakespeare's plays present a dramatic social world that turns the logic of the empirical networks suggested by Law, Latour, and Luhmann on its head. Shakespearean tragedy stirs the reader and audience by representing a state of chaotic social disorder emerging from the assembly of a densely organized network of bodies and characters on stage. The characteristic disordering of the social world in the plot of Shakespearean tragedy requires the construction of an ever-increasingly dense social network of actors, agents, bodies, witnesses, combatants, interlocutors, or characters crowding the theatrical space where the chaos unfolds. Tearing apart the relationships structuring the play's initial social world - ordered by laws, decrees, rules, ranks, filial bonds, gender norms, national or geographical allegiances, and hierarchies - requires a new form of social order that represents the complete overthrow of that original hierarchy. The new social order resulting from Shakespeare's tragedies is a state of disorder most appropriately represented in the form of the network that visualizes this counterintuitive spatial organization that is not based upon sharp boundaries between order and disorder. In this seemingly paradoxical inversion of social cause and effect, a new order captured by the network rises from a state of chaotic tragic disorder, which is defined in terms of the asymmetrical, seemingly chaotic form of network complexity, density, and clustering. The network coalesces according to a logic best described as diffuse, non-linear, intercalated, non-hierarchical, multidimensional, and perhaps rhizomatic [Deleuze and Guattari 1987]. Understanding the network in this manner thus revises an old story in Shakespeare studies echoed by several generations of critics that describes the overthrow of the social order as a unifying theme of the Shakespearean corpus. According to our reading, what seems to be an explosion of chaos and disorder in the plot in fact sets the stage for tracing a new social order of the non-hierarchical network on stage. Shakespeare's plays therefore do not destroy the social regime through a chaotic disordering, but rather unbuilds the old social order based upon hierarchy, family, or law so as to reimagine the social in terms of the rhizomatic branching of the network through performance. The network, then, is not only a tool to explain the social structure of Shakespeare's plays. By the end of the tragedies, its concatenated, non-linear form becomes the structure of a disordered social world itself, leading us to a new imagination of social organization on stage based on density and clustering.

What can we make of network theory after this analysis of Shakespeare's plays? This analysis of Shakespeare's tragedies reveals a more nuanced model of a social network, which does not simply describe a mode of reduced complexity or heightened organization (as Luhmann argues) or shape the relationships between subjects and objects (as argued by Latour and Law). The network demonstrates a counterintuitive mechanism where actors perform a disordering of the basic coherence of the social by organizing bodies together into a network. Shakespeare's plays use these eruptions of social disorder as an occasion to forge a new mode of non-hierarchical, non-linear sociality in the form of the network. This analysis stands as an early modern revision of network theories that have been created with contemporary data, and have not adequately studied the historicity of networks across time.

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Our case study on Shakespearean tragedy performs the methodological shift from network theory to the description and analysis of actual networks that Bruno Latour has proposed. Latour laments that although the scholarly community has access to a "mass of data," this information is only "accessible through an incredibly poor visual landscape" [Latour 2011, 809]. He has recently asserted that the next horizon in analyzing the social networks composing our world involves a methodological shift from network theory to actual networks that "transform the mass of quali-quantitative data" into a "visual datascape" [Latour 2011, 809]. What is needed to enact this shift are more robust and accurate visualizations of networks built upon a combination of qualitative and quantitative data that can represent the intercalated lattice of "performances," "parts" and "actors" working in relation to one another, precisely in the way that the dramatic performance visualizes the playtext as an embodied, visual performance of actors interacting on stage.

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We have argued that the network method suggested by Latour is a way to harness the technical resources of the digital humanities to bridge the age-old divide between text and stage in the study of Shakespeare. The networks decipher how Shakespeare encodes within the text the spatial relationships of characters in performance space, and his plays give us a rule book of sorts to accomplish this, by meta-theatrically meditating upon how this translation of word to bodies in space occurs. The digital method reveals a network structure that allows us to revise a widely accepted story on social disorder and the overthrow of law in Shakespeare's plays, but this is by no means exhaustive, and it

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represents the beginning of new readings made possible by network visualization. The network method allows us to tell new stories about Shakespeare, and provides us a different technical vantage point fusing textual close reading and the study of performance in space. As a critical tool, the networks open up a multi-tiered method that tests the digital visualizations against the results of close readings and staged theatrical productions of the same scenes. Our case study of the social networks of Shakespeare's tragedies proposes a hybrid methodology that investigators and students can use to engage in several parallel techniques so as to gain multiple critical perspectives on a single literary problem. Ultimately, we propose that the network methodology opens a new perspective on Shakespeare's dramatic art. Far from turning his body of work into a cold, inert dataset that seems antithetical to humanistic inquiry, the network method enlivens the text, allowing a wide range of readers - from scholars publishing research to undergraduates encountering his plays for the first time - to perceive the subtle manner by which the movements and energies of embodied theatrical performance inhere within the Shakespearean text.

Acknowledgements

James Lee was generously supported by the Andrew W. Mellon Foundation's Digital Bridges for Humanistic Inquiry Grant. The authors would like to thank Erik Simpson, Blaine Greteman, Steve Andrews, Tim Arner, and Bill Ingram for their input and useful discussions along the way.

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Notes

[1] See also [De Marinis 1993] on the irreversibility of theatrical transcoding. More recent digital work [Smith et al. 2013] has attempted to use "avatars" to allow users to position characters on a virtual stage. However, this tool does not base the organization of space on the text of plays.

[2] So, for example, [Borgatti 2011] specify that a researcher interested in communications networks may study email exchanges and phone calls, whereas a researcher examining kinship networks would study psychological and affective bonds.

[3] By contrast, sociological, organizational, and quantitative network theories define networks in much more general terms. Quantitative network theory defines a social network as "a set of people or groups of people with some pattern of contacts or interactions between them" [Scott 2000] [Wasserman and Faust 1994]. Easley and Kleinberg define "the idea of a network" as "a pattern of interconnections among a set of things" [Easley and Kleinberg 2010, 15]. In organization studies, Borgatti and Halgin posit that "a network consists of a set of actors or nodes along with a set of ties of a specified type (such as friendship) that link them" [Borgatti 2011, 2].

[4] John Law's definition of the network in terms of "playing parts" and the "enactment of performance" echoes Jaques' famous declaration in *As You Like It* that "all the world's a stage / ... and one man in his time plays many parts" (2.7.138-141), as well as Antonio's melancholic assertion in the *Merchant of Venice* that the "world" is "a stage where every man must play a part" (1.1.79) [Law 2009, 151]. The theatrical worldview adopted by network theory is already inscribed within Shakespearean drama, which presents an insistent performative definition of the social that defines the "world" as immanently theatrical, precisely as network theory has begun to do four centuries later.

[5] To test the resulting visualizations, we used two other forms of methodological verification. Adapting Pierson's method to our own dataset, we "counted the number of lines A spoke in scenes in which B was present, and vice versa, and added these two numbers together." We then "computed the above number but, for each character in each scene, multiplied by a 'normalization factor' equivalent to the number of lines that character spoke in the scene divided by the total number of lines in that scene." The three methods agreed at a much larger scale than in Pierson's analysis, which aggregated the results for whole plays and only focusing on the romances, while we applied this methodological verification to all of Shakespeare's plays at the more local context of the scene [Pierson 2014].

[6] Will use film versions for the sake of analyzing a repeatable and stable performance of the plays in question. Performances produced by the Royal Shakespeare Company, or performed by actors trained by the Royal Academy of Dramatic Art.

[7] The OED describes the etymology of "perplex" from classical Latin as: *perplexus* — involved, confused, intricate < *plexus* - interwoven, entangled, involved, intricate, past participle of *plectere* to plait, interweave. For another prominent example, Spenser's *Faerie Queene* describes Redcrosse Knight's entanglement in Error's "wicked bands" as a state of "great perplexitie" [Spenser 2006, l.i.xix.]

[8] Ichikawa has emphasized the important, and largely ignored, role of corpses in shaping the space of the Shakespearean stage. For this, see: [Ichikawa 2013, 129f.]

[9] Also note [Latour 1996, 4]: "Universality or order are not the rule but the exceptions that have to be accounted for. Loci, contingencies or

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