Network Semantics. A beginning

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Abstract: This article follows two previous attempts at using networks for the understanding of drama, "Network Theory, Plot Analysis" (2011)—also in Franco Moretti, *Distant Reading* (New York & London: Verso, 2013)—, and "Simulating Dramatic Networks," *Journal of World Literature* (2020). Franco Moretti shows here the steps of "visualizing dramatic structure as a network" and critically engages the idea of symmetry in tragedy. In the course of the next two years, the METRA project will continue to investigate the heuristic potential of dramatic networks.

Keywords: tragedy, dramatic networks, network semantics

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I. Nodes, edges, weight, direction

Visualizing dramatic structure as a network requires four successive steps.[1] First, one displays the play's characters (in **Figure 1**, Racine's *Phèdre*) as so many potential "nodes", which are then linked together (**Figure 2**) if they speak to each other. It's a first snapshot Racine's character-system: Ismene is only linked to the play through Aricie, Théramène delivers the most famous narrative speech in the history of French drama from a peripheral position, Phèdre is the title-character, but Thésée has more connections (technically, "edges") than she does, and is in this sense more "central" in the play's structure. In **Figure 3**, each edge acquires its specific "weight", proportional to the number of words exchanged among the two characters involved; here Phèdre is the prominent figure, largely because of her exchanges with Oenone—her *confidente*, this great invention of French classicism—whom she addresses more often than her husband Thésée or her would-be lover Hyppolite. Finally, the arrowheads of **Figure 4** indicate the direction of the dialogue: some edges are balanced and others are not,

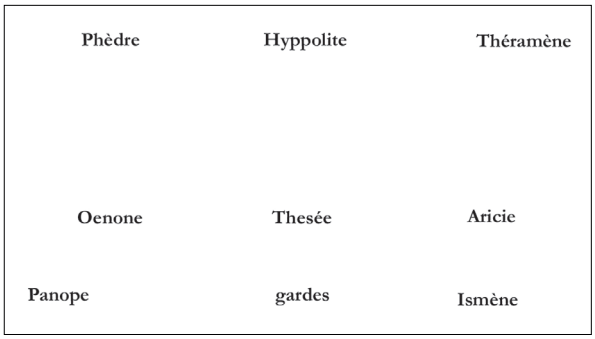


Figure 1: Phèdre, nodes

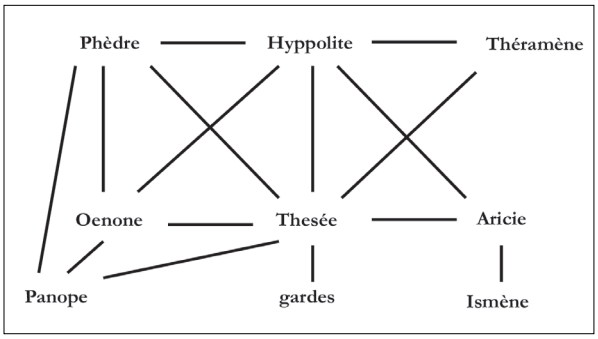


Figure 2: Phèdre, nodes and edges

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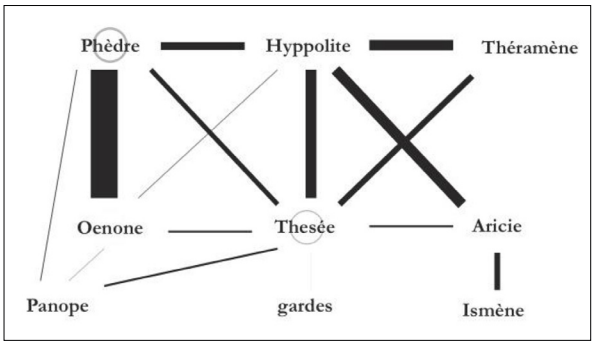


Figure 3: Phèdre, nodes, edges, weight

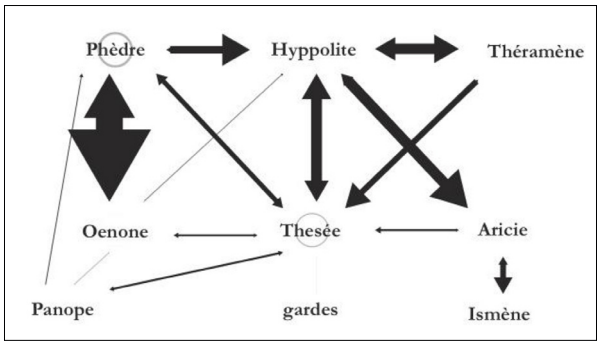


Figure 4: Phèdre, nodes, edges, weight, direction

exchanges between Phèdre and Oenone proceed mostly from mistress to servant for instance, as do those between Phèdre and Hyppolite—and in conclusion, one aspect at a time, Racine's dramatic network has taken its shape.

Yet a problem remains—one which network theory hardly addresses, but literary study cannot avoid. Edges, weight, and direction are ways to measure the quantity and the position of the words spoken in a play. Good. But what do these words actually *say*?

II. Most Distinctive Words

Let's suppose we want to know what words characterize, not a single character, but a recurring one, like the Chorus in Greek tragedies. One way to do so—one we came to use at the Stanford Literary Lab around 2011, calling it Most Distictive Words, or MDW – consista in finding the frequency of all the words in the corpus, and then, given how large the Chorus' word-space is, calculating the frequency with which each of them should be used. On this basis, for instance, we would "expect" the Chorus to say "song" 16.1 times every 10,000 words, "lovely" 9 times, "sing" 7.6, and so on. We then observe how often the Chorus *actually* utters those words, and it turns out that "song" is used 54 times every 10,000 words (and not 16), "lovely" 29, and so on. At this point (after having filtered against freak results, like the high frequency of "handkerchief" in Shakespeare's tragedies), dividing the observed by the expected values (**Figure 5**) shows that the chorus uses "song" 3.3 times more often than expected, "lovely" 3.2 times, "sing" 2.9 and so on. These are the Chorus' Most Distinctive Words: the vocabulary that sets it apart from other characters. Apart, in two opposite directions: words the Chorus uses more often than expected, of course, and those it uses *less* often (**Figure 6–7**).

word	exp	obs	obs/exp
song	16.135778	54	3.34660032
lovely	9.08796695	29	3.19103273
sing	7.60421724	22	2.89313144
dance	12.4264038	35	2.81658319
queen	14.6520283	38	2.59349758
golden	22.4417143	58	2.58447279
cry	26.3365573	67	2.54399234
strife	15.5793719	39	2.50331016
divine	17.9904652	44	2.44573998
bacchus	10.3862479	25	2.407029
ares	12.9828099	31	2.38777277
winged	11.3135915	27	2.38651007
cyclops	8.16062338	19	2.32825351
wisdom	12.0554664	28	2.32259783
aphrodite	10.3862479	24	2.31074784
blessed	16.5067155	38	2.30209335
river	7.41874853	17	2.29149161
cries	13.5392161	31	2.28964512
loud	14.4665596	33	2.28112287
anguish	9.64437308	22	2.28112287
blows	7.97515467	18	2.25700952
lamentation	9.8298418	22	2.23808281

Figure 5: Greek Chorus MDW

From the long lists of words which constitute the Chorus' Most Distinctive Words we can extract some reasonably consistent semantic fields: among positive correlations, the fields of song and dance, divinity, and geography; among negative correlations (which are also important, because what we never say defines us just as much as what we repeat all the time) the fields of the first person singular and of the family.

By and large, the MDW of **Figures 5-7** are unsurprising: the Chorus sings and dances, no wonder those terms appear often; it is a collective creature, of course it doesn't use the first-person singular. At this stage in the argument, though, unsurprising results are not disappointing, because we're not yet trying to *use* Most Distinctive Words, but only to test its reliability: had we *not* found the Chorus speaking of song and dance, we would have had quite a problem. Rediscovering "what we already knew" has proven that MDW can be as good as an informed human being. Can it also be a little better?

POSITIVELY correlated:
song sing dance
divine Bacchus Ares Cyclops Aphrodite Zeus dawn golden winged wings
river mountain flowing streams shore Ida Thracian

Figure 6: Greek Chorus: MDW

NEGATIVELY correlated:
my am mine
father brother concern piety dearest regard
Greek citizens
standing began going doing seeking begin

Figure 7: Greek Chorus: MDW

III. Extreme cases

Let's now place alongside the Chorus a second recurring figure of Greek tragedies – the Messenger. There is a subterranean affinity between Chorus and Messenger, as the two main sources – collective lament, and epic storytelling – of tragic art. Characters, yes, but not really persons, these two *anonymous* figures have remained untouched by the individualization that is so typical of drama; not by accident are they the two characters *who never die*, as if existing near the borders of tragedy proper.

Their early prominence becomes visible in the oldest surviving tragedy, Aeschylus' *Persians*, where Messenger and Chorus utter almost 60% of the play's words (**Figure 8**); in the following decades, as the interaction among the other characters increases their space shrinks drastically (**Figure 9**). Dramatic *dialogue* has come into its own, and has taken over from the initial, non-dialogic forms of expression.

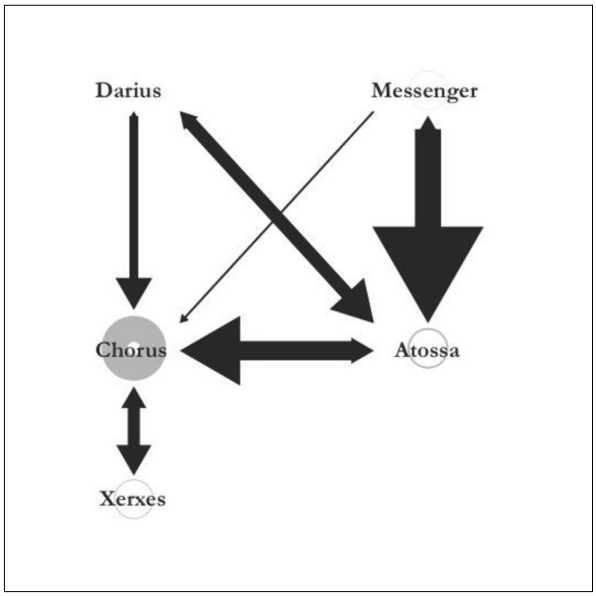


Figure 8: Aeschylus, Persians

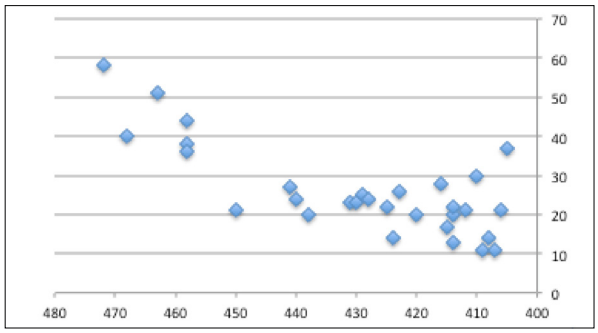


Figure 9: The Space of Chorus and Messengers in 5th-century tragedy

The extreme value of the Messenger's word space in *Persians* is due to the fact that the central "action" of the play is the detailed report of the Persian defeat at Salamis: a sign that, when a Messengers appears, the crucial fact is not the arrival of a character, but the fact that some kind of *event* is becoming visible through his words.

In terms of MDW, the main findings for the two groups appear in **Figures 10–11**: Messengers were characterized by a lot of verbs, and Choruses by a lot of adjectives. This of course doesn't mean that Choruses don't use verbs or Messengers adjectives: it means that *they don't use these parts of speech often enough to be characterized by them*. The specific contents vary from writer to writer, but the formal pattern holds, bringing to light the two extremes of tragic structure: the Messengers' past tenses and action verbs—*struck found won rushed seized fell*—define the pole of *narration*; the Chorus' evaluative adjectives—*deadly impious wise unhappy lawless*—that of *judgment*. Events—and comment. Within network semantics, the *morphological extremes* of tragic structure have become visible.

Reporting tragic events, judging them … but what about *generating* tragedy?

Aeschylus
Chorus: raise holds
Messenger: perished kept told open had were struck found assured command held gave bound

Sophocles
Chorus: –
Messenger: wailing went behold guide having struck called won stands spoke perished

Euripides
Chorus: –
Messenger: stood began spoke rushed cried drew seized fell running armed took said dragged drove entered dying lying raised

Figure 10: Chorus and Messengers: Most Distinctive Verbs

Aeschylus
Chorus: royal deadly low blessed impious divine further grievous Persian
Messenger: whole black Persian

Sophocles
Chorus: golden mighty wild swift fierce heavy white great wise mortal unhappy new deep
Messenger: high straight former

Euripides
Chorus: lawless fairest winged green heavenly Phrygian godless lovely swift honored golden unjust
Messenger: guilty straight

Figure 11: Chorus and Messengers: Most Distinctive Adjectives

IV. (A)symmetry

Let's leap two millennia, to the age of Shakespeare and Racine—the great bifurcation in the history of tragic form. Opposite settings, passions, temporalities, styles … and network shape. Here is *Andromaque* (**Figure 12**): four main characters and four *confidents*; the latter only speak to their masters or mistresses, who for their part interact frequently among themselves, on the basis of two opposite principles: the logic of power (where Andromaque is subject to Pyrrhus who is subject to Orestes, and indirectly to Hermione), and that of eros, which is its mirror image (Orestes in love with Hermione, in love with Pyrrhus, in love with Andromaque). The result is an extremely balanced overall structure, which returns regularly in other Racine plays (**Figures 13–15**)

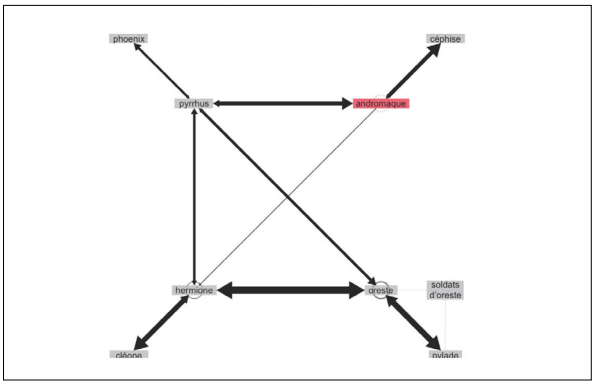


Figure 12: Racine, Andromaque

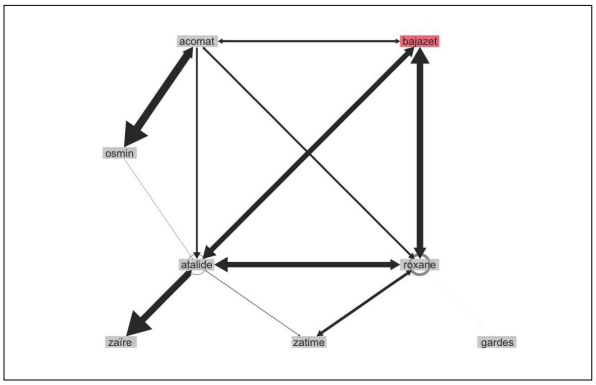


Figure 13: Racine, Bajazet

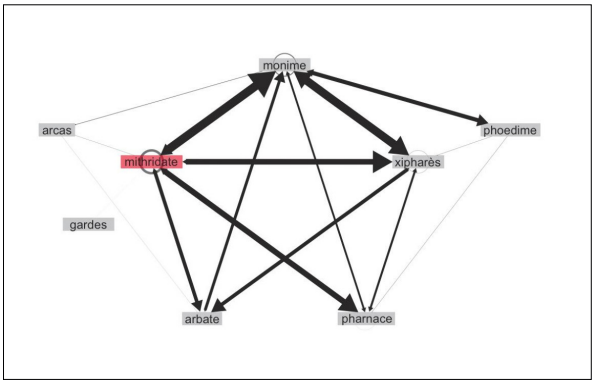


Figure 14: Racine, Mithridate

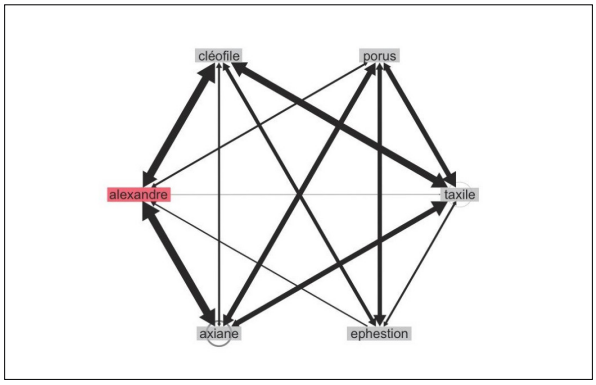


Figure 15: Racine, Alexandre le Grand

"Through various types of geometrizing forms [Racine] creates forms of symmetry that are not in the Greek precedent [...] invents oppositions and accentuates parallelisms"[2]

This plot-counterplot of power and eros is moreover entirely conveyed in rhymed couplets: there isn't a single verse that does not have an echo, or that doesn't split into nearly equivalent halves. Such ubiquitous symmetry seems almost indispensable to tragic action. René Girard: "If one were to define tragic art in a single sentence, one could only mention the opposition of symmetrical elements. There isn't an aspect of tragic plot, form, or language, where symmetry doesn't play a key role [...] the balance of forces makes it impossible for us to predict the outcome of their conflict."[3]

No aspect of tragedy where symmetry doesn't play a role. Then one turns to English drama with Racine in mind, and—**Figures 16–18.**

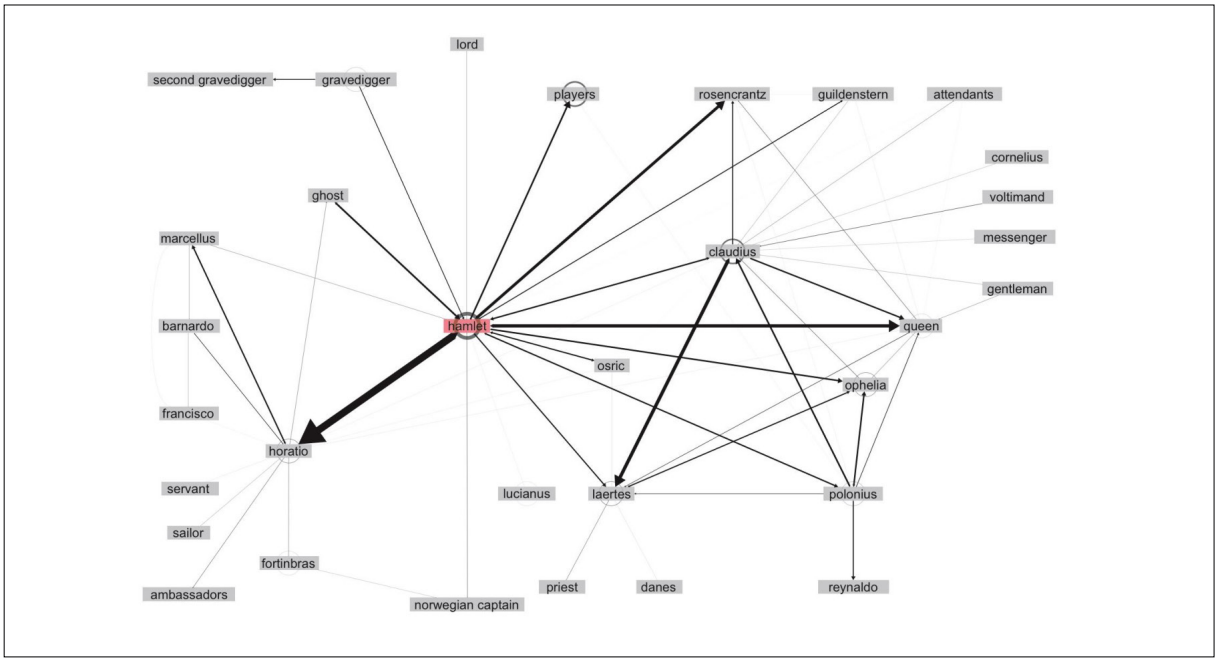


Figure 16: Shakespeare, Hamlet ↑

Figure 18: Shakespeare, Macbeth →

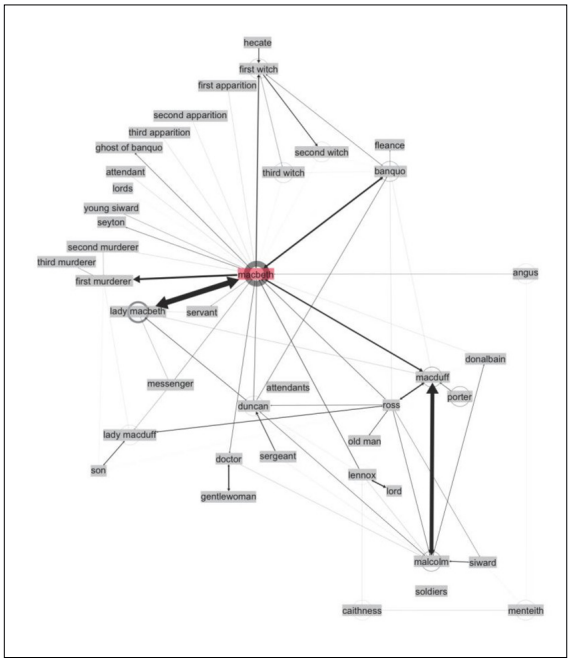
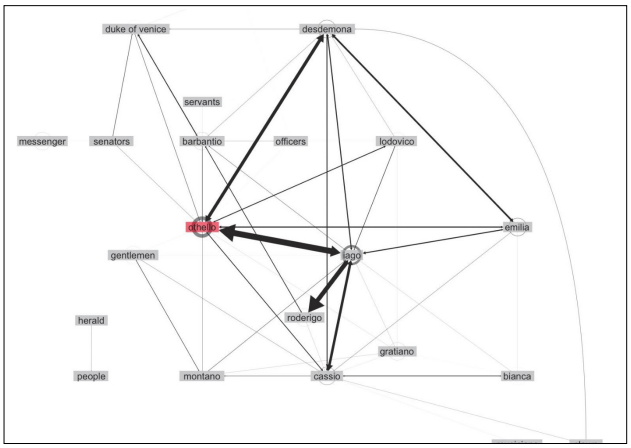


Figure 17: Shakespeare, Othello ↓



2. Elena Rossi, *"Les detours obscurs". Le annotazioni di Racine alle tragedie greche* (Fasano: Schena, 1994), 196–7.
3. René Girard, *La violence et le sacré* (Paris: Pluriel, 2010 [1972]), 71.

No symmetry at all. Almost certainly, because the networks are now much larger, and as the number of nodes grows, the system becomes inevitably unbalanced. Unbalanced, in more than one way. **Figure 19** is a histogram of how much the characters in *Antigone* speak**:** Creon utters 29 percent of the words in the play, the Chorus 20, Antigone 17; in *Phèdre* (**Figure 20**), Phèdre 29 percent, Hyppolite 21, Thesée 14, Oenone 12. The central character speaks 40-50% more than the next one, but the various word spaces remain comparable. But in *Macbeth,* Macbeth speaks 32 percent of the play's words, Lady Macbeth 11, and Malcolm 9; in *Hamlet*, Hamlet 39 per cent, Claudius 14, Polonius 9 (**Figures 21-22**). Not 50% more than the next character, but *three times* more. Here it's a-symmetry that seems to be intrinsic to tragic form. And which generates, as one would expect, major semantic consequences.

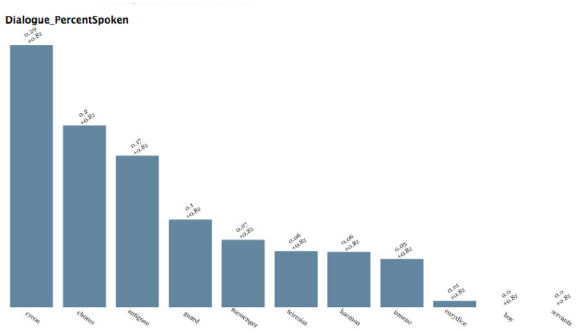


Figure 19: The word-space of tragic characters: Antigone

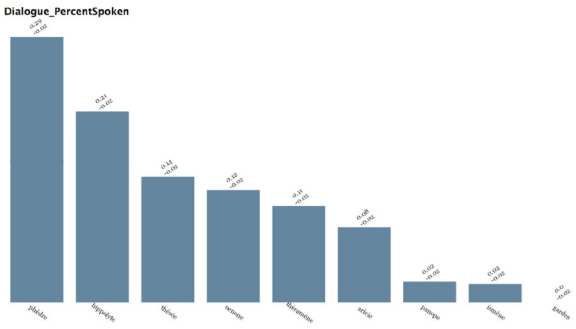


Figure 20: The word-space of tragic characters: Phèdre

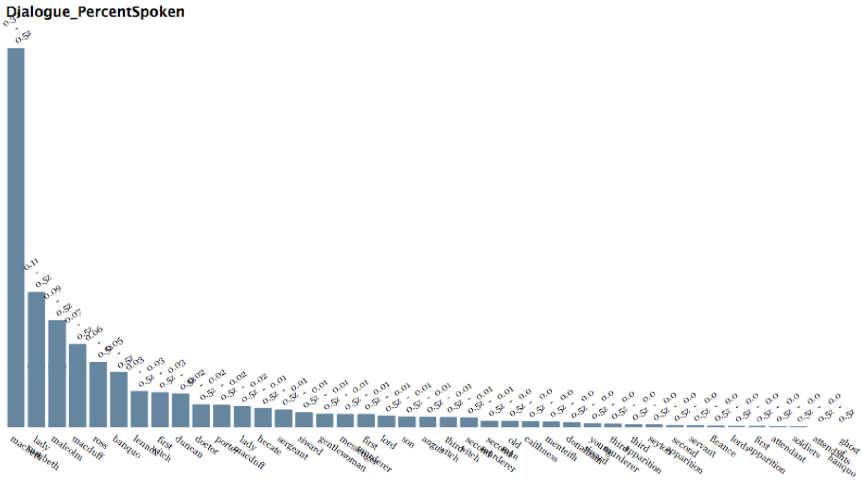


Figure 21: The word-space of tragic characters: Macbeth

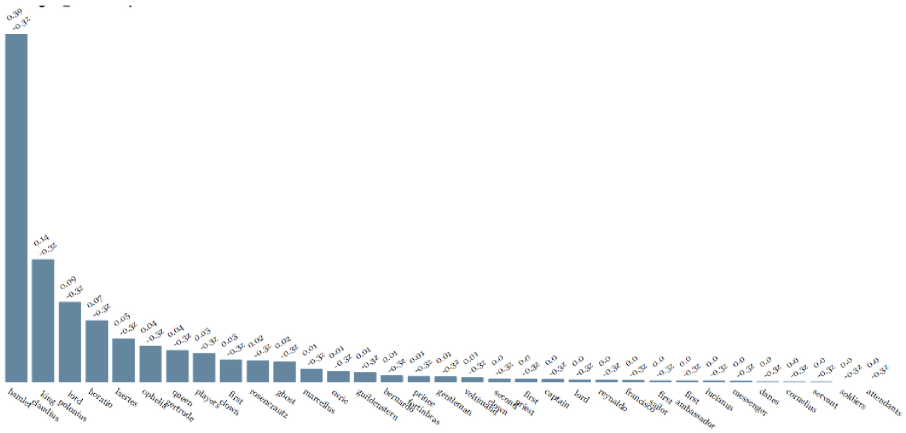


Figure 22: The word-space of tragic characters: Hamlet

V. Network Semantics

Early on, I have introduced network semantics via specific characters like the Chorus or the Messenger. Shakespeare's systematic asymmetry suggests a different approach, which leaves aside a character's social nature, to focus on its *network position* instead. Specifically, one of three positions: the core (for the two-three characters at the center of dramatic conflict), the periphery (for those at the margins, usually with a single link to the network, and uttering just a few words in the entire play), and a more diverse group placed between the two extremes.

These three regions have their distinctive semantics, but for now I will only focus on a list of nouns that appear among the core's MDW: *plague, beast, whore, black, feed, laugh, poison, gold,* and *madness***.** What these terms have in common is a feature with no equivalent among the MDW of the other two network positions: potentially, they are all metaphors—and in fact most of them *are* metaphors (though of course in *Hamlet* poison is "real", and madness is "really" pretended). In the plays there are many more metaphors than these of course, but the fact that, at the core of the network, metaphors *are frequent enough to become a distinctive trait*, suggests that different network regions, besides using different words, make *a different use* of words: as if the central position possessed a greater stylistic energy than the other two. And if this sounds obvious, this time it isn't: a masterpiece of stylistic analysis, Spitzer's essay on Racine's *klassische Dämpfung*, not only never feels the need to specify "where" in the character system the words he analyzes are uttered, but in fact claims that "Racine has taught all his characters to speak with his own voice."[4] And for Racine he is right, but there is no such thing as "Shakespeare's voice"—only a range of voices of varying complexity, which are all strongly correlated to a specific network position.[5]

Here ends this initial foray into network semantics. As the argument has developed, its ultimate ambition has become clear: the conjunction of edges and speech operated in network semantics points to a possible conjunction of plot and style, or narratology and stylistics—a synthesis literary theory has so far never achieved (and in fact almost never attempted). Beyond plot and style, an even more ambitious project can be glimpsed: treating drama as a small-scale model to study two fundamental features of human societies: plot, to understand how individual exchanges evolve into complex systems made of thousands of interactions; and style, to study how human beings make sense of such actions. What we do, and how we think about it: this is what a plot-style continuum may illuminate. But the road ahead is still very long.

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4. The sentence occurs in another of Spitzer's Racine essays, "Il 'Récit de Théramène'" (1948), in *Critica stilistica e semantica storica* (Bari: Laterza, 1975), 172.

5. Famous comic passages like those of the gravediggers in *Hamlet* and of the porter in *Macbeth*, for instance, occur regularly at the periphery of the network. In *King Lear*, the Fool acquires its enormous symbolic power precisely by being so unexpectedly close to the center of the network.