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11. How to Tell Stories with Networks

Exploring the Narrative Affordances of Graphs with the *Iliad*

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No doubt, networks have become indispensable mathematical tools in many aspects of life in the twenty-first century. They allow us to calculate all kinds of relational metrics and to quantify the properties of their nodes, clusters and global structures. These modes of calculation are increasingly prevalent in an age of digital data. But networks are more than formal analytical tools. They are also powerful metaphors of our collective life, with all of its complexity and its many dependencies. This is why, among the various strategies of data visualization, networks seem to have assumed a paradigmatic position, spreading to the most different disciplines and colonizing a growing number of digital and non-digital objects, sometimes as mere decoration. Contemplating the visual representation of a network, we don't (always) need to compute its mathematical properties to appreciate its heuristic value – as anyone who has ever used a transit plan knows well. Networks are extraordinary calculating devices, but they are also maps, instruments of navigation and representation. Not only do they guide our steps through the territories that they represent, they invite our imagination to see and explore the world in different ways.

Over the past few decades, this visual representation of networks has seen a 'renaissance' thanks to the development of graphical user interfaces and network spatialisation algorithms. The analytical capabilities of graph mathematics have been written into software programs that multiply the visual representation and exploration of graph properties and extend them outside of expert circles (Pousman, Stasko & Mateas 2007). This proliferation of visual representations of networks through digital media shifts focus from the analytic capabilities of networks and raises questions about how such networks may be read narratively (Bounegru, Venturini, Gray & Jacomy 2016).

Can we think of the visual representations of networks as forms of digital storytelling (Couldry 2008; Seegel & Heer 2010)? Can we think of network analysis and visualization software packages such as Gephi, NodeXL and Pajek, as 'authoring systems' (Ryan 2005: 515), that hold

specific affordances for the production of narratives and the construction of narrative meaning? And how might the narrative affordances of networks be relevant for those conducting research in an 'age of big data'? It is this storytelling potential of networks that will be the focus of this chapter, not because this narrative potential is more important than the mathematical affordances of networks, but because the latter have a long tradition while the former have only recently become the subject of academic reflection.

A scan of recent literature reveals – perhaps somewhat surprisingly – that 'networks' and 'narratives' have been brought together in recent research in information and communication technology and organization studies. Concepts such as 'narrative networks' and 'narrative network analysis' have been used to describe organizational forms, processes and routines that emerge around information technologies (Pentland & Feldman, 2007; Weeks 2014). Other recent literature that is closer to our line of enquiry in this chapter uses these concepts to describe the application of network analysis to the study of narrative texts. Such work typically aims to bring quantitative methodological approaches to bear on and contribute to narrative and social theory by applying network models and social network analysis to narrative texts (See e.g. Moretti 2011; Bearman & Stovel 2000; Sudhahar, De Fazio, Franzosi & Cristianini 2013).

However, a closer look at these latter studies shows that even when network analysis is applied to the study of narrative forms such as novels or films, the focus of such studies is on the mathematical properties of networks and how they can contribute to the formal or structural analysis of texts rather than on the narrative affordances of networks.

A good illustration of this point is provided by a series of papers that, in the last few years, have analysed the characters' networks in classic epics and, in particular, the *Iliad* (Rydberg-Cox 2011; Mac Carron & Kenna 2012; Miranda, Baptista & Pinto 2013; Kydros, Notopoulos & Exarchos 2015). While offering interesting insights into the formal characteristics of the epic genre, these papers seem to overlook the fact that, beside the structures of the societies they describe, these networks may also be read narratively. However, this privileging of particular styles of analysis of networks is not without good reason. While the mathematical analysis of networks has strong disciplinary roots (such as in graph theory or sociometry), to date the conceptualization of the network visual properties remains comparatively underdeveloped.

It is for this reason that, in this chapter, we will take a different approach. We will temporarily bracket the mathematical properties of

networks and instead illustrate the narrative and storytelling potential of networks. We will do so through an examination of the *Iliad*'s network of characters. Much like the way in which a film or game adaptation of the *Iliad* would reconfigure or reassemble the story in accordance with the affordances and constraints specific to the medium, we are interested in exploring how network analysis as an authoring device organizes stories; how it reconfigures and reassembles basic elements of a narrative such as characters, plot, events, setting, temporality and causality; and by doing so how it mediates and structures the phenomena it represents. By this we do not claim network graphs to be narratives per se, but to have the potential of 'possessing narrativity'. The distinction between being a narrative and possessing narrativity is aptly described as follows: 'The property of "being" a narrative can be predicated on any semiotic object produced with the intent of evoking a narrative script in the mind of the audience. "Having narrativity," on the other hand, means being able to evoke such a script. In addition to life itself, pictures, music, or dance can have narrativity without being narratives in a literal sense' (Ryan 2004: 9).

Even though we illustrate our analysis on a literary text, our objective is not to use networks as analytical devices for the study of structural or formal properties of narrative texts. Rather, by taking inspiration from studies of the storytelling potential of data visualizations more generally (as for example in Segel & Heer 2010), we aim to explore the narrative affordances of visual representations of networks. Elsewhere we develop the link between the mathematical properties of networks and the stories they evoke through an analysis of the use of network graphs in a series of journalism projects (Bounegru, Venturini, Gray & Jacomy 2016).

We chose to illustrate the narrative affordances of networks through the *Iliad* because it is a well-known text, allowing the reader to intuitively grasp the stories told by the network, albeit different types of stories – which is partly the point of this chapter. The typology of 'network stories' that we illustrate, however, can be applied to the reading of (almost) any network. As we will try to show, these stories are rooted in the same local and global properties revealed by graph mathematics, only instead of calculating them with numbers, we will visualize them and tell them with words.

Three Perspectives on Networks and Six 'Network Stories'

In this section, we will examine three different ways to narrate a network, corresponding to three different perspectives that can be taken on them. Consider the case of a railway map, a kind of network that we are familiar with using, reading and dealing with. When looking at it, one can observe:

– The overall shape of the network – exploring, for example, which zones are denser in connections (indicating regional agglomerations) and which are sparser (indicating rural regions with few urban centres) and whether the transportation system is more developed in the north or the south, the east or the west.
– The specific situation of a given station – examining, for example, how some cities (the capitals maybe?) are better connected both in terms of the clusters of neighbourhoods around them and routes to further regions of the map.
– The connections between two stations or areas – trying, for example, to find the quickest route from the city where you are to the city that you would like to visit or, conversely, contemplating the possibility of going on a grand tour of the country.

In the next pages, we will exemplify these three perspectives – each translating into two different types of 'network stories' – in the case of the *Iliad*'s network of characters. Before we introduce our six types of 'network stories', however, we need to provide some information about the way in which our example network has been built. The protocol we used for the definition of the nodes and edges of the *Iliad* character graph is not particularly strict. This is because the focus of this chapter is not to contribute to the study of Homer epics, but to illustrate a series of techniques that can be used to narrate a network. Therefore, we contented ourselves with creating a node for all the entities performing one or more actions that influence the development of the story. We have been deliberately liberal in our definition of actors, in accordance with insights from Actor-Network Theory (see e.g. Latour 2005). Thus we have allowed the nodes of our network to represent not only mortals (e.g. Achilles) and divinities (e.g. Zeus), but also groups (e.g. the Myrmidons) and objects (e.g. the Golden Apple). Our definition of edges was equally supple: we connected two entities when the action of one influenced the action of another (e.g. Odysseus is connected to Achilles because if he had not unmasked him from his feminine disguise, the latter would have not joined the war).

Fig. 11.1:   Graph depicting the network of characters in the Iliad.
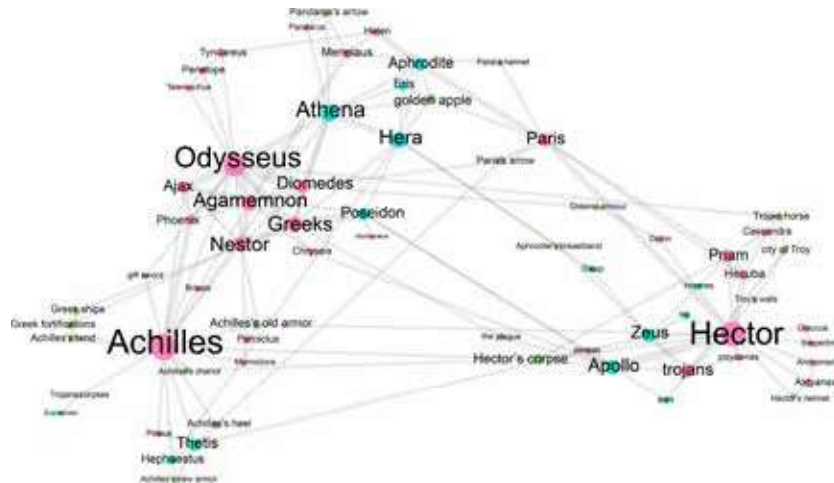
To visualize the network data thus obtained, we performed a number of operations that we will detail below using the network visualization software Gephi[1] (for more details, cf. Venturini, Jacomy and Carvalho Pereira 2015). The most important is the *force-vector spatialisation*. To place our nodes in the space, we used an algorithm that simulates a system of physical forces: nodes repulse each other, while edges act as springs attracting the nodes that they connect (on the specific algorithm we used, cf. Jacomy et al. 2014). Once the algorithm is launched it changes the distribution of nodes until reaching a balance of forces. Force-vector spatialisation minimises edge crossing and, most importantly, confers a meaning to the distribution of nodes in the space of the graph. At equilibrium, the geometrical distance between nodes becomes a proxy for their structural similarity: two nodes being closer the more directly or indirectly they are connected. Once the network was spatialised we gave nodes a size proportional to their degree, i.e. the number of edges adjacent to each node, and a colour corresponding to their nature (pink for humans, blue for gods and green for inanimate entities).

Knowing *Iliad*'s storyline, you can look at this network and recognize familiar elements in the graph (Figure 11.1). You may even discover things you ignored about the relations between characters. However, unless you are a network expert, you may not know the conditions under which your

1   Available at https://gephi.org.

observations are valid. This is not a problem in our case since our goal is to explore new narrative scenarios which may be used in the service of new modes of interpretation and inquiry. We would use different methods – such as statistical methods – to test and validate our hypotheses (cf. Tukey 1977). In this case our challenge is less to consolidate evidence, and more to organize disparate insights into a relevant whole. The six narrative views or reading paths we propose are strategies to achieve this coherence.

The Panorama > The Camps

The first family of narrative readings is called 'panorama' as it is meant to capture the global distribution of connectivity in the graph. In the two 'network stories' associated with it, 'the camps' and 'the (im-)balance of forces', we will not look at any individual nodes, but rather at the varying density of connections in the network. The first reading path, in particular, is intended to narrate the clusters of the network as camps of nodes that gather together in (relatively) tight communities. This view captures two opposing camps of characters, represented through two sets of node clusters separated by a structural hole (Burt 1995). Taking a bird's eye view, one notes the existence of two main regions in the *Iliad* graph, which unsurprisingly correspond to the two main armies deployed in the field (Figure 11.2). Network and cluster properties such as density, position and sub-clustering

Fig. 11.2:   The Panorama > The Camps. Narrative reading of network clusters as camps in *Iliad*'s network of characters.
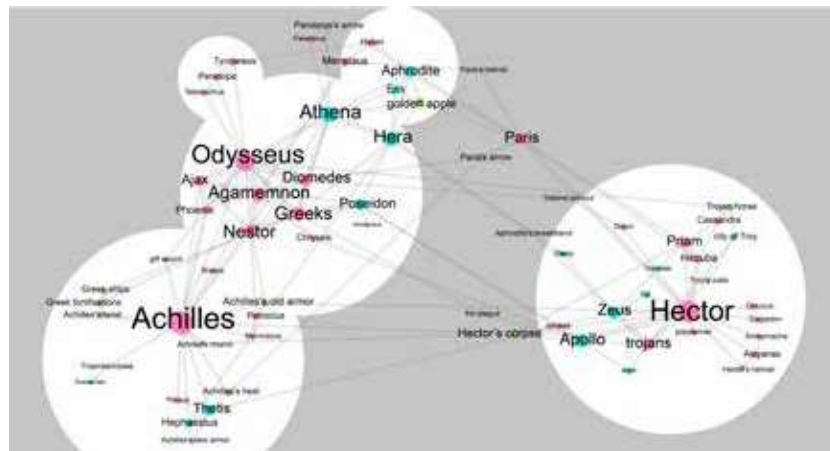
also evoke some of the qualities of these two groups of characters and their protagonists. The right side of the map is occupied by the Trojans mobilized around Prince Hector, King Priam and the city of Troy itself. It is a densely connected cluster showing no interior separations. On the other side of the graph, the Achaeans are, on the contrary, divided in two main sub-clusters: one gathering the main Greek warriors (Odysseus, Agamemnon, Diomedes, Nestor and Ajax) and the other occupied by Achilles and his cohort. As everyone knows, the *Iliad* narration begins by describing the rise of just such a division over a fight between Agamemnon and Achilles for the beautiful slave Briseis (notably positioned between the two factions) and its sore consequences for the Achaeans.

Two other smaller clusters are visible. They both correspond to characters that are relatively marginal in the narration of the *Iliad* itself, but that play a crucial role either before or after it. The first is located above the Greek heroes cluster and notably contains Aphrodite, Helen and the Golden Apple. This cluster is the principal cause of the war of Troy. Eris, goddess of Discord, offended for not having being invited to the wedding of Thetis and Peleus, throws a golden apple inscribed 'to the fairest' between Aphrodite, Athena and Hera. The three goddesses immediately start to quarrel over the apple and soon involve Paris (Prince of Troy and most handsome of the mortals) to judge their beauty. Paris gives the Apple to Aphrodite in exchange for the love of the prettiest woman in the world, the Spartan queen Helen. The Trojan War breaks out over the kidnapping of Helen and the will of Menelaus (Helen's husband) to defend his marriage. The other small cluster (on the top left) contains Odysseus' wife Penelope and son Telemachus who will play a crucial role in the narration of the Odyssey.

The Panorama > The Balance of Forces

The second type of 'panoramic' narrative reading addresses the balance (or imbalance) of the forces expressed in the network (Figure 11.3). To the description of the distribution of nodes and edges in clusters, it adds the discussion of the consequences that such distribution has on the phenomenon described by the graph, reading the nodes as weights and the edges as lines of force. The focus is less on how the network *is* and more on how it may *evolve*.

In our example, despite its duration and its convolution, the outcome of the war is never doubted in Homer's narration. Several prophecies have predicted the destruction of the city of Troy, as characters of both camps

Fig. 11.3:   The Panorama > The Balance of Forces. Narrative reading of cluster size and volume of nodes as imbalance of forces in *Iliad*'s network of characters.
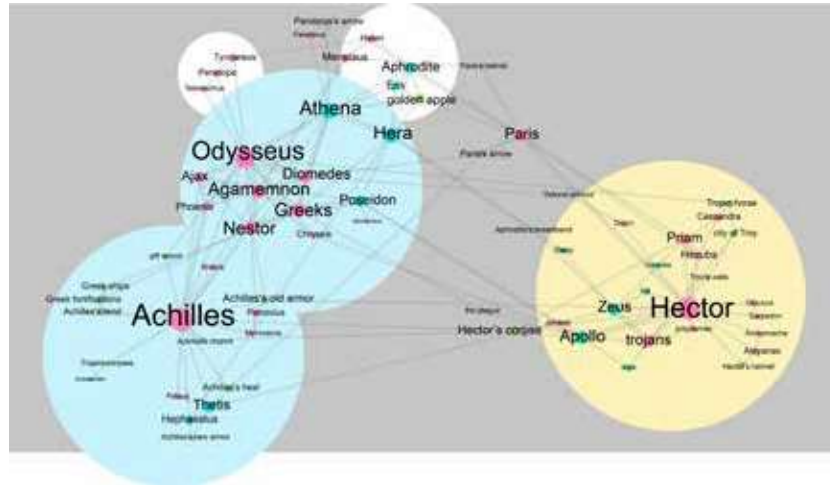
are often reminded. In Book 8, Zeus weighs the fate of the Trojans and the Achaeans on a divine scale and is forced to recognize that (despite his best wishes) Troy is bound to fall.

A similar imbalance of forces is clearly visible in the graph, as the size of the clusters corresponding to the two camps and their volume of nodes shows the Acheans are stronger and more numerous and it is only their division that prevents them from winning the struggle. The bigger size of the nodes of both the mortals and the gods playing in the Greek camp (confronted only by the greatness of Hector) indicates their higher degree of mobilization, suggesting that by uniting forces the Achaeans will have all the means to prevail.

The Vantage > The Crossroads

The second set of narrative views reads the location and size of nodes in order to highlight actors that occupy a vantage position in the network. The first such position is that of central nodes that, being highly connected, find themselves at the 'crossroads' of one or several regions of the graph (Figure 11.4).

In the Greek camp, the most central position is occupied by Odysseus, king of Ithaca. The importance of this character in the *Iliad* is well-known.

Fig. 11.4:   **The Vantage > The Crossroads. Narrative reading of the location and size of nodes to identify characters at the crossroads of multiple regions of the *Iliad*'s network of characters.**
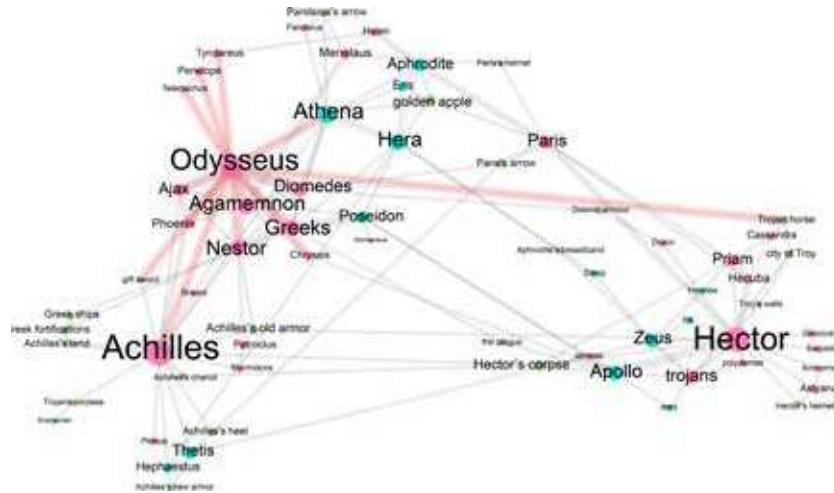
Though ruling over a small and not particularly rich island, Odysseus is by far the most ingenious of the Achaeans. His presence is felt in almost all books of the *Iliad*, not only fighting at the side of most other Greek heroes, but also through his constant work to keep the Greek army united. He repeatedly sermonizes the Greeks to renew their courage; he is the one who enrols Achilles in the war (with the ruse of the gift sword), the one who brings back Chryseis to her father and appeases the anger of Apollo, the preferred referent for Athena interventions; and, of course, the inventor of the stratagem of the wooden Horse which eventually wins Troy.

A similar role is played by Nestor, king of Pylos. Nestor is too old to fight directly, but, being the wisest of the Greeks, he counsels the other heroes. In particular, he is the one who persuades Patroclus to wear Achilles' armour to frighten the Trojans and push them back from the Achaeans' ships.

The Vantage > The Bridge

The second type of vantage position is subtler and characterizes nodes that, although located in a (relatively) marginal position, find themselves between two important and separated regions of the graph. Often located in one of the structural holes of the network, such nodes work as bridges

connecting two or more clusters (and sometime serve as the point of passage between them).

In our example, this position is notably occupied by Paris (Figure 11.5). Paris is not nearly as central to the Trojan camp as Odysseus is to the Greeks. In fact, he is located outside that cluster, somewhere in between the cluster of the Trojans and the cluster of Aphrodite and Helen. This position corresponds perfectly to the role of the young prince who fails repeatedly to support the cause of his city – most notoriously in Book 3 when he loses the duel with Menelaus and is saved only by the intervention of Aphrodite who teleports him into Helen's bed. This does not mean, however, that Paris does not have a crucial role in the *Iliad*. On the contrary: by separating Helen from Sparta and associating her with Troy he sets the story into motion by connecting the otherwise separated peoples of the Achaeans and the Trojans.

It is interesting to notice that this capacity to connect different regions of the narration is represented by Paris' ability in archery. The only real feat accomplished by the Trojan prince is to put an arrow (which is the closest node to him) through Achilles's vulnerable heel, thereby depriving the Greeks of their champion.

Fig. 11.5:   **The Vantage > The Bridge. Narrative reading of the location and size of nodes to identify characters that occupy 'bridge' positions in the *Iliad*'s network of characters.**
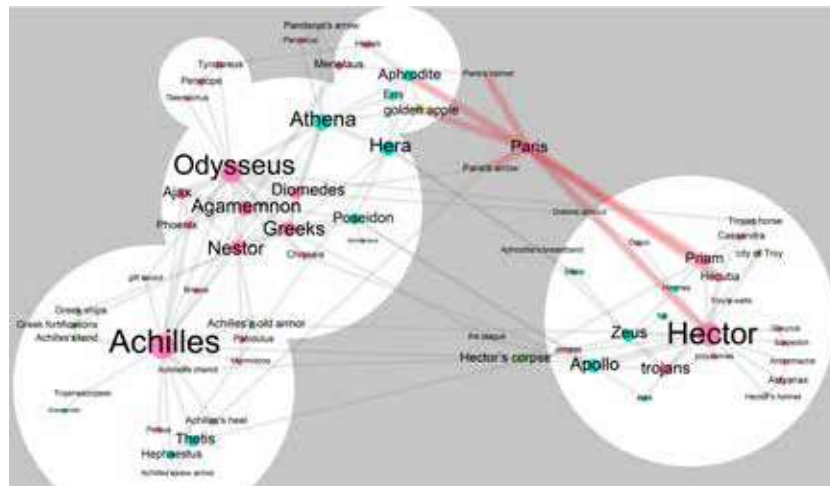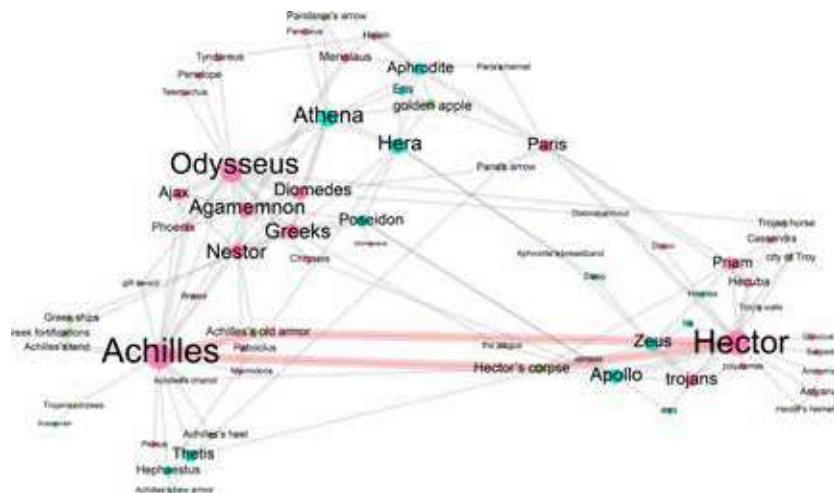
The Journey > The Shortcut

The third and final set of network views pertains to the paths between nodes. Conceptualized as journeys through the graph, these narrative reading paths do not describe the structure of the network but the movements that can be made through it. The first story of this kind is directly related to the peculiar topology of graphs. Although networks can be read to a certain extent as geographic charts, their topology is utterly different. Because of force-vector spatialisation, the spatial distance separating two nodes is not correlated to the length of the travel from one to the other but rather to the number of neighbours that they have in common. This means that distant regions of the network may sometime be connected by unexpected shortcuts. This phenomenon is the source of many surprising findings in graph topologies. The best example of such 'short paths' is provided by one of the most famous paintings by network artist Mark Lombardi, 'George W. Bush, Harken Energy, Jackson Stephens. c. 1979-1990', where the painter shows how unexpectedly connected the Bush and Bin Laden families are due to the entanglement of their respective economic interests.

   In our example, we can observe that while occupying two of the furthest and most distanced positions in the graph, Achilles and Hector are more directly connected than one would expect (Figure 11.6). Although

Fig. 11.6: **The Journey > The Shortcut. Narrative reading of paths that cut across the network as relationships between otherwise distant characters in *Iliad*'s network of characters.**

the opposition between them configures the *Iliad* graph digging a large structural hole between them, the two protagonists of the story are also connected by two two-step paths passing through Achilles' armour and Hector's corpse. Both these nodes have an important role in the ecology of the story: it is because Hector wears the spoils of Achilles that the Greek knows through which weak point to stab the Trojan and the *Iliad*'s last two books revolve around the difficulty of persuading Achilles to release Hector's body for proper burial. The symbolic symmetry of these two paths is also remarkable as both the armour and the corpse represent the separation between the heroes' spirit and their mortal remains.

The Journey > The Grand Tour

A second type of graph journey can be construed by following the sequence of creation of the edges between nodes and thereby reconstructing the chronological plot of the network. In this case, the focus is not on the edges that can cut across the network and shorten its diameter, but on patiently following the largest tour of its perimeter.

Reading our example graph (Figure 11.7) from top to bottom (and colouring the nodes with an increasingly saturated shade of red), we set off from Eris' Golden Apple arousing Aphrodite's yearning. Aphrodite persuades

Fig. 11.7:   **The Journey > The Grand Tour. Narrative reading of the story timeline by 'taking a tour' of the perimeter of *Iliad*'s network of characters.**

Paris to call her 'the fairest of goddesses' (over Athena and Hera) and in exchange helps the young prince to abduct the queen of Sparta and bring her to Troy.

The kidnapping of Helen pushes her husband Menelaus to ask his brother Agamemnon, king of Argos, for help. Agamemnon calls upon the other kings of Greece and convinces them to bring war upon Troy. Nine years after the beginning of the siege, the Greeks ransack Chryse (a town allied with Troy) and enslave its residents who implore Apollo to send a plague on the Achaeans. To appease Apollo, Agamemnon agrees to return Chryses but in exchange takes Briseis, one of Achilles' slaves. Insulted by this action, Achilles withdraws from the fight and retires to his tent.

After several reversals, the war seems to turn in the Trojans' favour and Achilles is implored by his friend Patroclus to lend him his armour. Disguised as Achilles, Patroclus enters the fight and succeeds in pushing the Achaeans back. He is, however, killed by Hector, prince and champion of the Trojans, who then takes Achilles' armour. Mad with grief for the loss of his friends, Achilles re-enters the fight and ends up killing Hector, thereby definitively tipping the scale against the Trojans.

Conclusion

This chapter has illustrated how narrative meaning can be construed from visual properties of network graphs such as topology, density of connections, absence of connections, size, position and colour of nodes. While the narration of networks is as old as social network analysis (cf. Moreno 1934 for some beautiful examples), such techniques have so far been taken for granted. By exploring six narrative readings evoked by the visual properties of the *Iliad*'s network of characters, we hope to have made a modest contribution towards explicating and formalizing them. The six network narrative views we introduced ('The Camps', 'The Balance of Forces', 'The Crossroads', 'The Bridge', 'The Shortcut', and 'The Grand Tour') should not be considered exclusive or exhaustive. They can be mixed and matched at one's pleasure, and can be complemented by other narrative strategies that we have not yet acknowledged.

Why should the narrative affordances of networks be of interest to media scholars? As powerful and indispensable as they are, we do not believe that the mathematical uses of networks exemplified by graph theory are in themselves sufficient for describing relational phenomena, nor do they fully account for the ways in which networks can be used to organize human

attention by bringing certain elements into the foreground and allowing others to recede into the background. No matter how many metrics they compute, network analysts will always have to provide some description of their objects. And this is all the more true for the humanities and social sciences, for which textual narration remains the main argumentative tool.

For this reason, the approaches that we outline above do not attempt to produce new knowledge about the literary text and advance the understanding of Homer's epic, nor to innovate the methods of graph analysis. In reading the graph of the *Iliad*'s characters, we restricted ourselves to using our lay knowledge of the *Iliad*'s plot, deliberately restraining from original interpretations or innovative findings. We leave the task of using networks to investigate narration to another equally interesting but somewhat symmetric area of research (cf. Franzosi 2004; Moretti 2015).

Our interest in this chapter was in how narration can help to convey findings about networks. In doing so we have, more modestly, tried to fill a gap in the toolkit for scholars working with networks, a gap that does not concern the analytical capacities of networks, but rather the construction of meaning from the results of such analyses. Common metaphors that compare network visualizations to 'hairballs' or 'bowls of spaghetti' may be considered to point to this gap. Over the many years in which statistics has been employed in journalism, sociology, policy and advocacy, we have developed a literacy around its visual representations (such as charts and tables) and an ability to read them narratively. Similarly, in order for networks to become powerful knowledge instruments, we now need to advance not just their formal analytical and computational affordances but also their narrative ones. It is the latter that this paper has tried to contribute to through the development of six narrative views or readings of networks.

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