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Modelling power dynamics in piratical networks

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Dasha Evsina, BA, MA

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Eternal gratitude to my parents and Max.  
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## Abstract

The aim of this thesis is to apply social networking and data analysis techniques to two historical novels set in the 'Golden Age' of piracy at the turn of the 18<sup>th</sup> century, in order to elucidate the illicit nexuses of existing interrelationships between miscellaneous members of the criminal organisations described in each literary work. These networks are established using methods of historical social network analysis (HSNA) and implemented using the R programming language. The networks thus generated can then be explored from the perspective of the circulation of information, the transference of resources (both material and otherwise), the propagation of ideas, and the consolidation of cohesive communities. They will be used in an endeavour to unveil the power dynamics of piracy inherent in the two novels under study; these are *Captain Blood: His Odyssey* by Rafael Sabatini and *The Only Life That Mattered* by James L. Nelson, published in 1922 and 2004, respectively. The approach employs algorithms ranging from centrality calculations to community detection along with an unsupervised machine learning approach. Modelling of the data sets and visualisation of the results then enables the core actors, as well as underlying structures, to be identified. The thesis concludes with an examination of the potential fragmentation preceding the complete collapse of these networks.

## Abstract in Deutsch

Das Ziel dieser Masterarbeit ist, soziale Netzwerke und Datenanalysetechniken auf zwei historische Romane anzuwenden, welche im „Goldenen Zeitalter“ der Piraterie an der Wende des 18. Jahrhunderts etabliert sind. Sowohl illegale Verknüpfungen zwischen den Mitgliedern der kriminellen Organisationen, als auch deren Einfluss auf den Informationsfluss werden in diesem Werk erläutert. Diese Netzwerke werden mit Hilfe von Historical Social Network Analysis (HSNA) aufgebaut und mit der Programmiersprache R umgesetzt. Aus den erzeugten Netzwerken werden vier Hauptkonzepte analysiert: die Verbreitung von Informationen, die Übertragung von Ressourcen (sowohl Materielle als auch andere), die Ausbreitung von Ideen und die Festigung zusammenhängender Gemeinschaften. Die angewendeten Methoden decken die Machtdynamik der Piraterie in den beiden untersuchten Romanen *Captain Blood: His Odyssey* von Rafael Sabatini und *The Only Life That Mattered* von James L. Nelson, die 1922 bzw. 2004 veröffentlicht wurden, auf. Der Ansatz der verwendeten Algorithmen reicht von Zentralitätsberechnungen bis hin zu Erkennung von Gemeinschaften und eine Unsupervised Machine Learning Methode. Durch die Modellierung der Datensätze und die Visualisierung der Ergebnisse lassen sich die Kernakteure, sowie zugrunde liegende Strukturen, identifizieren. Schließlich befasst sich diese Arbeit mit der möglichen Zersplitterung, die zu dem vollständigen Zusammenbruch dieser Netzwerke führen.

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# CHAPTER 1

## INTRODUCTION

Criminal webs of piracy are an elaborate coalescence of circumstances, characters, inducements, and careful combinations with one unifying thread: power. As a means of assessing it minutely, a close reading of two primary sources is merged with data science techniques in social network analysis. The literary texts under study are *Captain Blood: His Odyssey* written by Rafael Sabatini in 1922 and the 2004 novel *The Short and Merry Lives of Anne Bonny, Mary Read, and Calico Jack Rackam* by James L. Nelson (henceforth alluded to by its abbreviated title).

Ergo, the overarching objective of this master's thesis is an attempt to model sundry graph dynamics of the characters that appear in two historical fiction novels to gain a profound understanding of the unobtrusive reservoirs of power, the political overtones, the relationships and memberships in social subgroups, as well as the ulterior motives behind complicated interconnections. Social network analysis visualisations propose an encapsulation of intricate interactions, revealing the pivotal individuals in the data sets. Placing them in clusters facilitates the observation of power play on the macro scale.

There are four ensuing segments to this thesis. Chapter 2 presents an overview of the field of social network analysis before providing a contextualisation of the literary works. The tools and techniques are elucidated. Defining the scope of the analysis impacts the collection, cleaning, and pre-processing of the data sets, which is

demonstrated in the inclusion of certain members into the networks, together with the identification of relationships. In connection with scale, whole networks and subgroups are generated while bearing in mind the remarkable individuals invested with power, as well as the configurations and distributions thereof in social communities. Commencing the panorama of methods and measures employed, the size, diameter, density, and transitivity of the graphs are outlined within the framework of the general structure of the models.

In Chapter 3, the actors in the models are put under a microscope. The way that structural holes can be profitably exploited by brokers defines concentrations of power in the hands of central characters who influence the flow of resources and information. Magnitudes of centrality to demarcate these powerful personages are computed by four metrics. First, degree centrality serves as an indication of actors' connectedness. Betweenness centrality delineates the prestigious brokers and opinion leaders. Closeness centrality exposes to view the structural distances for the (unimpeded) circulation of intelligence. In closing, the power centrality measurement considers the struggle for domination among equals.

Chapter 4 concerns the manner in which political accords shape piratical activities. Succeeding the establishment of a benchmark for the creation of clusters using unsupervised machine learning, the characters are arranged into subgroups by applying community detection algorithms. The greedy ground-up Louvain approach, the bottom-up hierarchical agglomerative Walktrap method, the top-down divisive edge betweenness algorithm are implemented successively. Over and above, this chapter includes cliques and k-core visualisations. Moreover, the targeted elimination of actors is executed to explicate the detrimental impact of fragmentation on the network structures. Ultimately, the last chapter summarises the results.

## CHAPTER 2

### BACKGROUND

The genesis of social network analysis — an investigation into the entire assortment of connections joining individuals and groups — dates back to the initial development of a unique approach in the 1930s. At this early stage, the fusion of sociometry and theoretical mathematics bore fruit in the form of an empirical study conducted by the sociologists George A. Lundberg and Margaret Lawsing, who charted the “energy currents or forces” that define community structures by conceptualising the “patterns [...] existing in social space”. (Lundberg and Lawsing, 1937: 323) The authors of the academic article accentuated that the prestigious socio-economic status of major characters in their constellations determined social groupings. (cf. Lundberg and Lawsing, 1937: 333-334) In a number of respects, these observations would shape the very bedrock of the field.

Progressively, from the year 1941 onwards, both sociometry and its sub-disciplines became “generally accepted and universally applied”. (Toeman, 1949: 255) Nevertheless, it was not until the 1950s that the categories of relationships in group dynamics underwent a closer inspection, which resulted in the demarcation of specific structures, such as kinship and friendship. (cf. Scott, 2012: 13-14) During the second wave in the late sixties and early seventies, the heretofore untapped potential of graph theory moved to the forefront. In effect, the vast majority of the fundamental terms and concepts in social network analysis originated in graph

theory, “a branch of mathematics that focuses on the quantification of networks” as pairwise relations between objects. (Prell, 2012: 9) An increasingly systematic methodology was inaugurated in the late 1960s with the implementation of computers for data analysis. (cf. Scott, 2012: 14) By the 1970s, the study of networks had garnered widespread attention in academia. Thus, the emergence of social network analysis as a separate, albeit rather niche subject with a compendium of tools took place in the 1960s and 1970s.

Attaining new heights in the 1990s, network analysis was applied in a broad range of fields, be it biology and communications or business analytics and physics. The rapid rise in computing power paved the way to markedly more complex observational studies that could be undertaken. This growth has not waned in the new millennium, with HSNA (historical social network analysis) gaining in prominence. It has not lost its pertinence one iota.

All in all, social network analysis is generally “considered by its pioneers as a theoretically coherent perspective developed through cumulative and incremental contributions of researchers”. (Yousefi Nooraie et al., 2020: 120) Although nowadays it encompasses both a body of theory and a rich “conceptual, methodological and analytical” toolbox involving quantitative methods, the multidisciplinary discipline still appears to be devoid of a clear-cut definition. (Prell, 2012: 19)

A sub-branch of social network analysis comprehends literary network analysis, which primarily investigates the relationships that exist between the characters in literary texts. In many aspects, Andrew Beveridge and Jie Shan set the tone for the subfield in 2016 by plotting the “intricate character relationships” in the *Game of Thrones* saga. (Beveridge and Shan, 2016: 18) Rather than predicting plot development, as was the case in their research project, however, the piratical networks in this thesis aimed to unearth the power vested in individuals and amplified through partnerships, cooperations, cliques.

Yet another study that converged the method of network analysis and literary studies benefitted from a paradigm referred to as ‘distant reading’, which attempts to process a greater corpus of texts computationally. As demonstrated in the article published by Frank Fischer and Daniil Skorinkin on the Russian literary canon, this can be regarded as “a formal approach revealing hitherto invisible structures and structural changes in literary history”. (Fischer and Skorinkin, 2020: 533)

Critiques of social network analysis, which should not be overlooked, cover the issue of factuality. In lieu of an objective truth, the graph visualisations propose an argument that is construed from a subjective vision. The researcher has a direct impact on forming the data, posing the questions, and making observations into the bargain. According to the reflections of the Italian literary historian Franco Moretti who applied network techniques to novels, “this process of reduction and abstraction makes the model obviously much less than the original object”, meaning that care should be taken when analysing the networks outside of the context of the text. (Moretti, 2011: 84) An awareness of these considerations was all-important for the construction of the models of piracy. Among the advantages of exploring this avenue of research is that a qualitative ‘close reading’ method in the humanities could be blended with quantitative techniques in computational analysis.

One of the prime motivations for constructing social networks of the novels *Captain Blood: His Odyssey* and *The Only Life That Mattered* resides in the notion that such an approach offers “a bird-eye view of the group social structure, the interaction patterns, as well as the mapping of all communications in the relational space” that may not be examined as constructively by other methods. (Saqr and Alamro, 2019: 2) The varied configurations among the individuals present in the study, which can be of a political, social or commercial nature, could be examined at both the macro and the micro level by prioritising specific nodes or entire subgroups, respectively. Social network analysis could therefore “reveal larger structural patterns that would

otherwise stay invisible”, allowing the data to be interpreted more meaningfully. (Fischer and Skorinkin, 2020: 527)

By the same token, this form of analysis places considerable emphasis on the structural properties at the heart of the piratical networks. It “provides a collection of descriptive procedures to determine how the [social] system behaves, and statistical methods to test the appropriateness of the propositions”. (Wasserman and Faust, 1994: 22) This is explored at length in the ensuing sections.

Hence, several areas of particular interest in this thesis can be acknowledged. Indubitably, the relations between the actors are central. Equally essential is the manner in which information is disseminated throughout the social networks. The structural and relational aspects of actors constitute their analytically relevant features, whereby the relational ties in their conglomerations are treated as mechanisms for the transmission of resources and information alike. These flows are constantly “circulating through the channels of connection between nodes”. (Castells, 2004: 3) Aiming to explore the social fabric of the two literary narratives from a network perspective, the produced graph visualisations integrate the characters into a structure that is conditional on certain links, thus elucidating their immersion in the social environment, but also unveiling their personal involvement in the web of interactions and transmissions. The potential brokers involved in bridging chasms between communities were also examined.

## **2.1 CONTEXTUALISATION**

At its core, the present thesis completes a comparative analysis of two literary compositions by laying bare the masked authority, artful manoeuvres, and complicated interchanges of individual characters as they navigate the intricacies of illegal piratical operations. This is achieved by modelling these selfsame actors in networks. In so doing, a comprehensive picture is provided.

The first publication that serves as part of the source material for the study is *Captain Blood: His Odyssey*, published in 1922. Penned by the Italian-English writer Rafael Sabatini, it depicts the adventures of the eponymous protagonist as political circumstances impel him to abandon his thriving career of a practicing physician, escape enslavement and apply his experience as both a skilled soldier and seasoned sailor to become a prominent pirate. On this subject, it would appear to be appropriate to specify that Peter Blood represents a collective image of at least two real-life historical figures: the rebel pirate Henry Pitman and Henry Morgan<sup>1</sup>. (cf. Little, 2010: 309) As such, each served as inspiration for separate phases of the fictional buccaneer's life.

In the second novel called *The Only Life That Mattered*, the historical nautical author James L. Nelson gives flesh to the bones of a pair of legends — the female pirates Anne Bonny and Mary Read. By intersecting the paths of these two women and Captain Calico Jack Rackam at different junctures, as well as interspersing their voyages with both personal and political matters that act as obstacles to their remarkable raids, this account of their vicissitudes masterfully melds facts with fiction. Apropos of the historical documentation, the biographies of the three most consequential pirates in Nelson's novel were gathered from *A General History of the Pyrates* (1724), written under the nom de plume Captain Charles Johnson. The true identity of the author of this book, however, remains ambiguous. In spite of the proposition that the work could be attributed to Nathaniel Mist, "a former sailor who later became a printer and a journalist", this claim is not incontestable. (Bialuschewski, 2004: 22) Therefore, the common consensus seems to be that the book should, in fact, be ascribed to Daniel Defoe. (cf. Lillie, 2020: 32)

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<sup>1</sup> In *The Only Life That Mattered*, the "massive fleets" of Sir Henry Morgan, a past privateer who was not only pardoned and granted knighthood, but also appointed Lieutenant Governor of Jamaica, are alluded to as the epitome of piratical triumph by Anne Bonny, which can, in some measure, bespeak the magnetism and reputation of this individual in certain circles. (Nelson, 2004: 148-149)

In principle, the novels *The Only Life That Mattered* and *Captain Blood* were selected due to their sheer ambit. Notwithstanding that the narrative of both of these books can be situated in the late 17<sup>th</sup> to the early 18<sup>th</sup> century (a period of time that is most widely known under the denomination of the ‘Golden Age of Piracy’) and that they share the same general geographical area, they likewise exhibit polarity. While Captain Peter Blood was active on the cusp of the second and third timeframes of piracy, Bonny and Read are firmly fixed in the third period of piracy’s golden age. (cf. Simon, 2022) Another matter to be taken into account is that the two novels were written virtually a century apart (Sabatini published his work in 1922, whereas Nelson released his in 2004). Hence, the outlook on the pirates’ networks can be examined as a phenomenon that evolved over almost a hundred years. Interpretations can be made in terms of differing frames of reference. Both of the literary works were treated as historical sources, though the content is curated and the set of characters cannot be seen as arbitrary.

Regarding the characters themselves, it should be made clear that Anne Bonny was the preferred spelling variant employed throughout this thesis. The same applies to Calico Jack: despite other sources substituting his name with John Rackham, Captain Jack Rackam is the variant that appears in Nelson’s *The Only Life That Mattered*.

Over the course of the analysis, special attention was accorded to the character interactions that significantly impacted the flow of opportunities (and resources) within the graphs, particularly with regard to actors that could be identified as potential bridges between seemingly separate sections and subgroups of the social networks. The interdependencies of the four protagonists in the novels (Captain Blood, Mary Read, Anne Bonny, and Calico Jack Rackam) were evaluated.

## 2.2 TOOLS AND TECHNIQUES

An integral aspect of the present research was the selection of the appropriate tools and software that would enable the network visualisations to be as informative and intelligible as possible. Whilst the open-source Graph Viz platform Gephi could have been a viable option for the networks themselves, such a software tool was not optimal for the additional data analysis measurements that needed to be calculated. Also, unlike the R working environment, Gephi has certain limitations regarding the manipulation of the data and the publication of the research results (as the software does not present a possibility to create a Markdown document to provide a comprehensive overview). Alternative network analysis tools such as Cytoscape and the Microsoft Excel add-on NodeXL were deemed unsuitable in view of their specific fields of application: bioinformatics and social media analysis, respectively.

Thus, the decision was made to generate the entirety of the graphs in the statistical programming language R, whereas data cleaning was performed with another tool, namely Microsoft Excel. In contrast to other programming languages that could also be used, Python being one example, R has a great quantity of excellently developed network analysis packages and it relies on statistical methodologies. (cf. Hackenberger, 2020: 66) It should be noted that R is a free, open-source language produced by and for academics, statisticians, and researchers with libraries that are easily accessible, as well as data and project management capabilities.

For importing the tabular CSV data sets into the R working environment, the `readr` R package was used<sup>2</sup>. The bulk of the study relied on the `igraph` R package for network creation and manipulation, in addition to the assessment of “basic

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<sup>2</sup> It should be kept in mind that there exist two possible options for loading a CSV file into R. The built-in `read.csv` function call loads a data frame. Otherwise, the function `read_csv` in the `readr` R package converts the data into a so-called tibble format, which is comparable to a data frame. The latter was used owing to its superior efficiency. Also, it has improved robustness suitable for printing larger data sets.

properties of network graphs". (Kolaczyk and Csárdi, 2020: 13) These visualisations were optimised by adjusting the function arguments whenever necessary. As far as the visual aesthetics were concerned, the *dendextend* R package refined the tree diagrams (or dendrograms) produced by hierarchical clustering, ensuring better readability. Lastly, the robustness, resilience, and vulnerability of the networks to attack strategies were assessed with the help of the functions contained in the *NetSwan* (Network Strengths and Weaknesses Analysis) R package.

## 2.3 SCOPE

With the aim of establishing the scope of the social network analysis in terms of chronology, the novels serve as a point of reference — the events depicted in *Captain Blood: His Odyssey* can be allocated on a timeframe of approximately four years from the year 1685 to 1689, while the novel *The Only Life That Mattered* incorporates verging on a decade of piratical activities in the timespan of 1711 to the fateful trial concluded in 1721. The geospatial region that defines the study is vast, ranging from Europe to the Caribbean and North America, as per the voyages set forth in both books. Whilst far from all of the actors share a common function, political alliances can be traced among certain individuals, as well as fundamental relationships, such as kinship and friendship. Additionally, the crew members of Captain Peter Blood and Calico Jack Rackam can be perceived as colleagues (and subordinates), which largely forms their sense of identity.

Nevertheless, the mainstays of the research project are the novels themselves, a circumstance that poses at least a couple of glaringly obvious problems. It should therefore be taken into account that the social network analysis depends on the authors' interpretation of historical facts. The constrained evidence entails that only a single point of view could be modelled. Aside from that, historical sources are not neutral. They have their own rhetoric. Inevitably, a crucial limitation of the analysis

was the transposition of the implicit biases and assumptions from the literature onto the data when the source material was taken at face value.

### 2.3.1 DATA COLLECTION AND PRE-PROCESSING

In essence, the two fundamental building blocks of social networks are actors and ties, whereby actors are represented by the nodes of the graph that depict the individuals (including, but not limited to, people and organisations) and ties are depicted in the form of edges (in an undirected graph) or arcs (in a directed one). (cf. O'Malley and Marsden, 2008: 3) These are the relationships and connections between actors, which can be kin ties, friendships, organisational relationships or joint memberships of associations.

As outlined previously, the data gathered essentially consists of internal references within two different novels. The overwhelming majority of the characters were included in the network, with the exception of anonymous and meta-fictional actors in view of their lack of bearing on the transmission of information and resources<sup>3</sup>. In this context, the former category would encompass any characters that are devoid of a name, a specified occupation or both. Hence, in the book *The Only Life That Mattered*, the 'Jailor' and the 'Bailiff' are represented as separate nodes since their professions are clearly indicated, but the soldiers that attack Mary Read and Anne Bonny in Cuba are indistinguishable based on their jobs, which resulted in them being excluded from the collection of nodes. Overall, the data set encompassed a grand total of 61 characters. In *Captain Blood: His Odyssey*, there were 63 actors altogether.

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<sup>3</sup> Even though the data sets generated from the two novels omit anonymous actors, admittedly, this is not the sole course of action. In the research project *Clerical Exile in Late Antiquity*, for instance, the project director Julia Hillner intentionally incorporated anonymous groups ("around 500 clerics in Carthage, mostly lectors and children" or "other disciples of Antony") into the database. (Hillner et al., 2018)

With regard to the actual ties between the given actors, a relationship would have to be stated explicitly for it to qualify as such. Ergo, in cases where, by way of illustration, two characters simply appear in the same paragraph together, this would not be considered as sufficient evidence of an interaction. On the whole, actions and dialogues alike were incorporated into the data sets, irrespective of directionality.

In terms of the format, the data sets were created based on the tidy data principles in the sense that each variable formed a distinct column, whereas each observation formed a row. (cf. Wickham, 2014: 4) Both of the data sets consist of single-mode data on account of the fact that all of the actors are attributed as being of the same type or class — they are all individuals.

Arguably one of the most common methods of organising social network data is a so-called node and edge list, which was used in the given case for the reason that it allows a large quantity of data to be gathered about the subject that can subsequently be represented in various manners. The underlying principle is that it presupposes two distinct data sets: a node list comprehends all of the actors, as well as any potential attributes (the relevant features were nationality, a boolean integer for fictional and real-life characters, and their gender); an accompanying edge list contains all of the interactions between the actors, including the weight of these relationships. (cf. Yang et al., 2017: 8) Recipient matrices would have been another method of achieving similar outcomes, although they do not adhere to the principles of tidy data and would typically be used for small data sets.

In order to elaborate upon the variety of attributes that have been modelled, it should be emphasised that the strength of the relationships was categorised as a reflection of the connection between particular personages on a scale of positive integers from one to four. In this manner, the lowest score of 1 would imply that two characters exhibit hostile behaviour towards one another, whereas 2 would be an indication of a work relationship (regardless of whether the individuals are on an equal footing as colleagues or one is in a position of leadership). A score of 3 suggests

the presence of friendship or a romantic relationship. Finally, the highest value of 4 is assigned to kinship ties.

On the whole, the weight attribute can be construed as a manifestation of the strongest bond. As an exemplification, in *The Only Life That Mattered*, the interplay between Mary Read and Billy Bartlett evolves from a working relationship to enmity with an escalation into an outright confrontation in the form of a duel. (cf. Nelson, 2004: 334) In this case the edge was weighted as 1. In a similar vein, the relationship between Captain Peter Blood and Captain Levasseur in Rafael Sabatini's novel was likewise classified as hostile despite their initial business partnership.

Another element of data cleaning and pre-processing involved the elimination of certain nodes. Solely political figures that were considered pertinent to the principal plot lines were integrated into the data set, not characters engaged in peripheral political developments or alliances that can be interpreted as a mere historical backdrop in the novels. The following extract from *Captain Blood: His Odyssey* is a case in point: "The megalomania of Louis XIV had set Europe in a blaze of war [...] the people had grown weary of the bigoted tyranny of King James. It was reported that William of Orange had been invited to come over." (Sabatini, 1922: 289) In this instance, neither Louis XIV, nor William of Orange have been included in the data set as this societal state of affairs purely places the piratical proceedings in a wider context, thereby embedding the ramifications of the civil war into the plot development.

Lastly, a distinction was made between fictional and real-life characters that appeared in both of the novels, which was added as boolean node attributes (0 corresponded to fictional characters and 1 represented real ones). Once the data was saved in two distinct CSV files (also referred to as comma-separated values files), the data sets were imported into the R working environment.

## 2.4 SCALE OF THE NETWORK ANALYSIS

A major aspect of the network tradition is examining multiple levels of scale, which, according to Manuela Caiani, can be divided into three classes: nodes, subgroups, and whole networks. (cf. Caiani, 2014: 382) Viewed from this perspective, a fundamental concept is the ego-net, which focuses on a single, central node and the associated actors that are connected to them (commonly referred to as the ego's neighbourhood at the node-based level of analysis). One of the obvious advantages of having such a visualisation where a hero of the study has ties radiating out from them is that this egocentric network "affords a means of analysing big networks". (Crossley et al., 2015: 20) The title of Rafael Sabatini's novel appears to revolve around the protagonist Captain Blood, while the three main characters can be found in the subtitle of James L. Nelson's novel. Nevertheless, for the purposes of the present study, the literary works were modelled based on the latter two network types, namely whole networks and subgroups.

Whole networks focus on a broader population of actors, the "whole structure of social relations connecting different individuals" typically composed of a collection of ego-nets, although they do not concentrate on a single actor's standpoint. (Scott, 2017: 74) In this manner, the entire set of nodes (which, in this given case, solely relate to the actors and exclude organisations) were treated equally in terms of their inclusion in the study. Narrowing down the study to (a series of) ego-nets would have an adverse effect on the correctness of the centrality calculations for locating the powerful characters since the balance of forces would be tipped in the favour of the ego from the very beginning. As long as the full structural information underpinned the whole networks, they painted a maximally accurate picture of the piratical interactions contained in the two novels. Also, a whole network approach was best suited for the contained population of the piratical domain in question.

At the meso level, subgroups or clusters indicate the distinct communities within a network. (cf. Caiani, 2014: 382) In this regard, it would have been possible to

identify blocks of actors through blockmodelling, which combines structurally similar actors (specifically, individuals who can be seen to have substantially similar relationships) in order to produce the "usual representations for the grouping of actors". (Wasserman and Faust, 1992: 14) Generally, as the ensuing analyses demonstrated, the act of distinguishing subgroups by employing community detection algorithms was a useful means of approaching networks (of larger populations in particular). Measurements could be made and information could be derived by comparing certain groups of individuals against each other.

Furthermore, the network analysis as a whole is anchored in two theoretical frameworks: formalism and relationalism. The formalist approach, as established by Georg Simmel, primarily centres around a descriptive analysis that is concerned with the identification of underlying typologies and patterns instead of the contents or contexts of the relationships, which are treated as "necessarily secondary". (Erikson, 2013: 228) In this respect, it can be characterised by a foundation in a priori (logic-based) thought with a synthesis of ideal versions of network models as well as theoretical combinations of actors and forms within these selfsame networks. (cf. Erikson, 2013: 225)

In relationalism, on the contrary, a significantly stronger emphasis is placed on subjective interpretations and a rejection of essentialism. (cf. Erikson, 2013: 223) As its name suggests, meaning stems from the content and context of the relations (which may be denoted in the form of transactions or interactions) between actors. Over the course of the present study, a mixed method was utilised whereby formal models (where standard common network structures play a central role) were the cornerstone for defining meaning, but this was also taken a step further by dissecting graphs based on the relationships within them.

## 2.5 GENERAL MODEL STRUCTURE

Appraising the structure of the models is a practical means of outlining their basic characteristics. The size and diameter of the networks coupled with two more factors, density and transitivity, were calculated to provide initial insights into the graph structures before tackling the finer concepts and components in the consecutive chapters.

Comparable in size, the model of the literary work *The Only Life That Mattered* is comprised of 61 nodes and 130 interconnecting relationships; *Captain Blood* contains 63 actors and marginally more edges: 153 in total. In the subsequent stage, the level of compactness of the graphs was computed based on geodesics (the shortest paths across a network), an introductory measure that attests to the efficiency of transmitting information and other resources. (cf. Luke, 2015: 15-16) The maximum geodesic in both of the models amounted to 5. Such a low diameter signals that they are highly compact since all it takes is a chain of five acquaintances (or intermediaries) to link two nodes that are the farthest apart in the piratical networks. There are five degrees of separation. Accordingly, the models are tightly organised and closely integrated.

### 2.5.1 DENSITY

Generally considered to be a "global measure of cohesion", density essentially represents a measure of the inclusivity and completeness of a social network ranging from 0 (implying no density whatsoever) to 1 (which is an indication of total density). (Bandyopadhyay et al., 2010: 10) A network is understood to be inclusive insofar as all of the actors are connected to a larger network structure rather than existing in small fragments or being isolated. Along the same line, a network is viewed as being complete insofar as all of the actors share ties with the other nodes in the network.

Density as a statistic, however, is not without its drawbacks. To name but one, as the number of actors increases in a graph, the density scores tend to substantially decline. The reasoning behind this is that individuals possess a finite amount of attention that can be devoted to other actors creating, by extension, an upper limit on the number of relationships that can be maintained. Consequently, it was expected that the density of the book characters analysed in this work would be noticeably lower than the theoretical maximum. Due to the restricted social capital that the individuals are able to spend, the observed maximum density in groups modelled from historical reality (as opposed to purely theoretical evaluations) rarely exceeds 0.5, that is, half of the possible number of ties.

Having generated the edge density for the two novels in R, it could be asserted that the aforementioned concept remains valid in this particular instance as well — the network based on *Captain Blood: His Odyssey* has a value of 0.078, which is slightly higher than the measurement for the other literary source at 0.071. In this context, it should be borne in mind that different types of relationships appear to have varying levels of density. Kinship networks, by way of example, often have high completeness and lower inclusivity, whereas communication networks would have higher inclusivity and lower completeness. As both of the pirate networks contain miscellaneous forms of edges, this may explain the somewhat low density score.

Another factor affecting density that should not be disregarded during this investigation is the population size that is being considered: larger graphs are distinguished by lower density. Compared to Zachary's famous karate club data set of 34 nodes that was used as a case study by Girvan and Newman, both of the networks in this analysis contained close to twice as many individuals, specifically, 61 and 63 actors. (cf. Girvan and Newman, 2002: 7823) Moreover, the presence of pendant actors that are attached to the remainder of the graph by a single connection likewise impacts the measure of density and could suggest a greater quantity of

structural holes in the Anne Bonny and Mary Read network. For the most part, in view of the low density of both networks, a preliminary analysis gave the impression that the two graphs were highly centralised.

Therefore, a denser web of ties can indicate cohesion in a network since there would, as a rule of thumb, be more information flows towards that particular area. Such a graph “facilitates the transmission of ideas, rumours” and it can be assumed that the network with the greater density score (in other words, Captain Blood’s graph) is an example of “a cohesive community, a source of social support, and an effective transmitter”. (Kadushin, 2012: 29) Drawing on this, the identification of communities of actors is closely associated with cohesion in that it embodies the density (or scarcity) of connections.

## **2.5.2 TRACING TRIADS THROUGH TRANSITIVITY**

Apart from the previously mentioned edge density, there exist several other network metrics that can be applied to the data sets to gain a better insight into their inner workings: the mean distance (reflects the average number of steps necessary to cross the graph between two specified points A and B); the components (represent the maximal weakly or strongly connected components of a graph); the shortest path (otherwise stated, the “shortest number of steps required” to traverse the graph); the transitivity, which is related to clustering. (Luke, 2015: 15) It is altogether self-evident that different statistics are generated in each case. Transitivity, which can be a noteworthy measure for detecting structural holes exploited by brokers, certainly merits a closer examination.

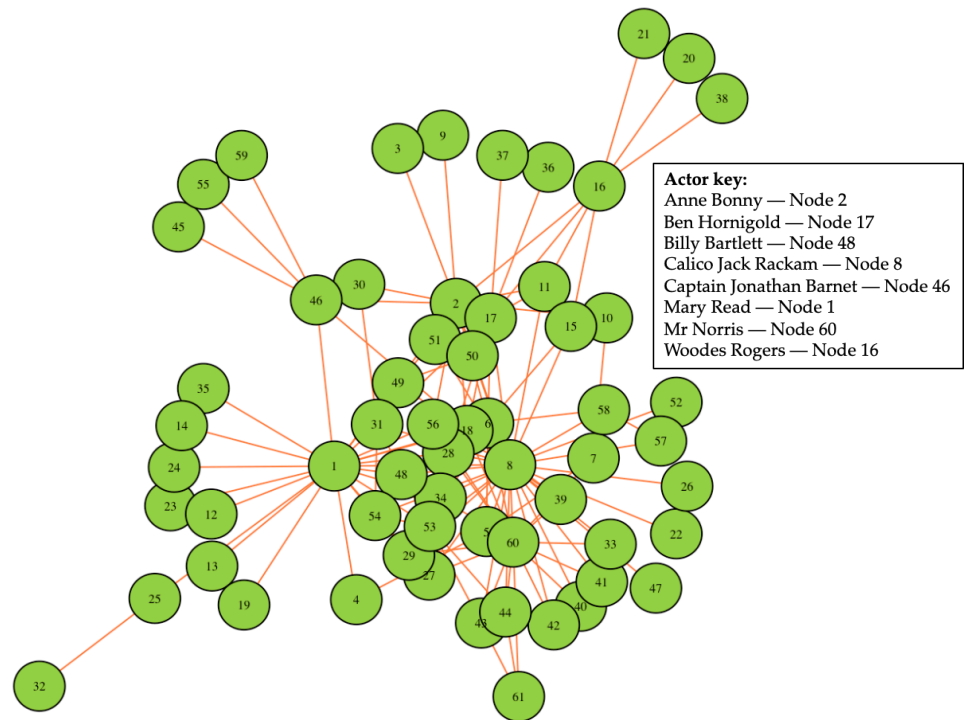
By definition, social network analysis requires the existence of at least two actors and one tie at its atomic level, which constitutes a dyad. Nevertheless, subgraphs consisting of three nodes, commonly referred to as triads, “are often considered to be the structural foundation of social networks” that are capable of

unveiling intrinsic patterns. (Felmlee et al., 2021: 3) In a broad sense, networks have a tendency towards closure. This process that occurs “when two people who share a common friend also become friends themselves” is highly conducive to the development of triadic structures. (Luke, 2015: 16) Transitivity, a concept that developed from and is equal to the clustering coefficient, is an effective technique of discerning “how closely the nodes are knitted around the central value of the clusters”. (Dey, 2019: 290) The underlying calculation is based on the “proportion of closed triangles [...] to the total number of open and closed triangles”. (Luke, 2015: 16)

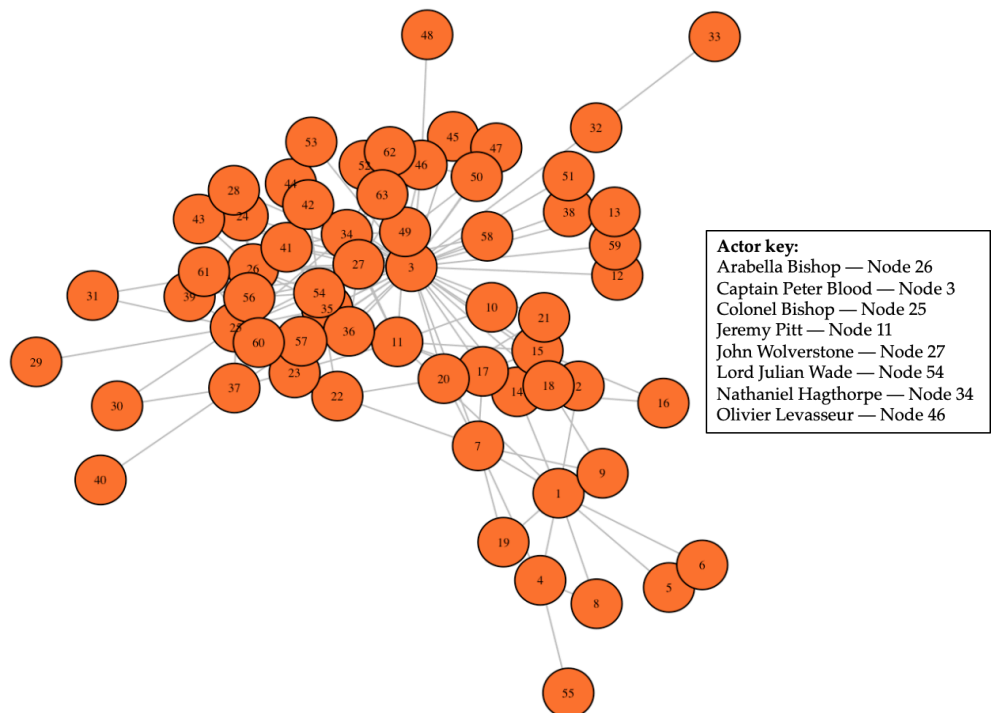
Global and local clustering coefficients complement each other in light of the fact that the “former is computed for the network, whereas the latter is computed for a node”. (Camacho et al., 2020: 93) Thus, the appropriate function in R enables triangles and, by extension, clusters to be detected as a general feature of the two networks. Similarly to the clustering coefficient, the transitivity index of the social networks is likewise “bounded between zero and one”. (Estrada, 2016: 250)

As a means of highlighting the authority and influence of individual vertices in the two novels, the presence of triadic relationships was revealed by evaluating the local transitivity. The general guideline is that it would be substantially more likely for a node with a membership in a greater number of clusters to be located in a section of the graph that features high connectivity. Figure 1 provides a visual aid to illustrate the overall structure of the models *Captain Blood* and *The Only Life That Mattered* when looking into the transitivity scores.

## The Only Life That Mattered graph



## Captain Blood graph



**Figure 1:** General structure of the models

When viewed through these lenses, the character that participates in the most considerable quantity of triangles in the novel *Captain Blood: His Odyssey* is the protagonist (Node 3), by a wide margin, with as many as 48. Next in line is a fellow pirate called John Wolverstone (Node 27) with 24 triads, which could suggest that this particular member of Captain Peter Blood's crew carries weight. Thus, Wolverstone is in a position to steer the ship's company in a certain direction, he is deeply immersed in a close community. The chief antagonist, Colonel Bishop (Node 25), is party to significantly fewer triads, specifically only 19. Conversely, in *The Only Life That Mattered*, Jack Rackam represented as Node 8 is located in the greatest number of triads (60, to be precise). The character Mary Read (Node 1) can be placed in a total of 30 triangles, whereas Mr Norris, the Register (indicated on the graph as Node 60), appears in 22 triads. These calculations underline the authority of the captain and the remarkable influence of Mary Read throughout her career, but also uncover the command of the public official during the ultimate trial.

A comparison of the overall transitivity of each graph — a value of 0.18 for the Captain Blood network against a measure of 0.21 in the Bonny and Read graph — implies that the latter is substantially more closed. Even though this high degree of closure could positively impact the quality of "fine-grained information" that is transferred, it runs the risk of "cementing relationships into a stable network structure, even when [they] are no longer beneficial". (Giuliani and Pietrobelli, 2011: 9-10)

Remarkably, Captain Peter Blood has a perceptibly lower transitivity score (at 0.05) than his arch-nemesis, Colonel William Bishop (at 0.14), which indicates a higher number of closed triangles surrounding the antagonist. An analogous tendency can be observed with regard to the local transitivity of Mary Read (at 0.13) in contrast to Billy Bartlett (Node 48), an adversary who jeopardises the female pirate's standing on numerous occasions throughout the novel and has complete transitivity. One of the primary motivations for this could be the presence of

structural holes in both cases with low transitivity scores. These actors can effectively gain an upper hand over their rivals by acting as gatekeepers between distinct groups, accordingly manipulating the circulation of information and resources to their benefit.

## CHAPTER 3

### PERCEIVABLE POWERBROKERS

Advancing from the character-based constituents in this chapter to the community-wide components in the next enables a meticulous examination of the alignment of forces in the novels. The individuals occupying central positions in networks are no strangers to power. Therefore, this chapter visualises scenarios where powerbrokers were labelled as such by miscellaneous methods— whether it be the quantity of connections in degree centrality, the exploitation of opportunities in betweenness centrality, the distance separating peripherals from the kernel actors in closeness centrality or the effect of influential figures in power centrality. Above all, the bonds of brokerage were viewed as being interlinked with domination.

In the intricate and multifaceted social networks that are populated by diverse actors, brokerage can be denominated as a structural formulation that “occurs when one actor (the broker) is connected to two other actors (alters) who are not themselves connected”. (Kwon, 2020: 1095) A precondition is therefore an element of openness in the graph that restrains certain figures and that can, simultaneously, be capitalised upon by high-powered or well-placed individuals.

Prior to any in-depth analyses in this regard, a distinction should be drawn between brokers and bridges. Throughout the present work, the concept of bridges exclusively relates to the edges “whose removal increases the number of components in the network”. (De Nooy et al., 2018: 173) Such connections can accomplish definite

functions by enabling the transmission of knowledge, for instance. (cf. Forti et al., 2013: 1380) The term ‘broker’ solely appertains to nodes (which, in the main, can be identified by their position of superiority).

This thesis treats brokerage as a conglomerate term that incorporates bridges, brokers, and boundary spanners that are a direct consequence of groups “separated or hindered by some gap or barrier”, which can be “a physical gap such as geographic location”, a “cognitive or cultural gap” or a lack of confidence. (Long et al., 2013: 1) As it so happens, the piracy network visualisations exhibit the presence of all three gaps. Extensive periods of seafaring effectuate a certain chasm between the individuals who remain on land and the pirate crews. The alternating allegiances to assorted states as an ultimate ace-in-the-hole survival tactic or, alternatively, as a voluntary proclamation of commitment signify that, more often than not, intelligence from the pirates’ homeland has to be conveyed through messengers. True to form, the reliability of such intermediaries and the accuracy of their reports is open to doubt. Exchanges can be impeded by language (and cultural) barriers when dealing with local traders. Mistrust is inherent to the line of business.

Following on from brokerage itself by placing it within the broader context of social network analysis, brokers can be delineated as “intermediary links in systems of social, economic, or political relations who facilitate trade or transmission of valued resources that would otherwise be substantially more difficult”. (Stovel et al., 2011: 21326) The presence of such actors not only moulds the literary narrative itself, but also — more substantively — defines the complexities of mutable interrelations and power shifts between the different characters within the books.

By performing a wide array of calculations that eventually produced informative network visualisations modelling a specific historical time period (namely, the golden age of piracy), the role of brokers in the formation of piratical social circles was demonstrated. Ergo, the fundamental objective was the identification of characters in the two novels that act as brokers, thereby influencing

the interchange of information and assets. In each case, a distinction was made whether the potential broker possessed the means to connect different segments of the graph politically, economically, socially or as a combination thereof.

From a strictly historical standpoint, brokerage can bring to light the manner in which distinctive actions shaped events, as well as the way in which events, in turn, have repercussions on individuals (and vice versa). It provides a conceptual structure for evaluating and modelling these correlations. Thus, it is crucial both for comprehending the spread of ideas (with the purpose of discovering the development of intellectual movements, for instance) and the establishment of new relationships. The source material *Captain Blood: His Odyssey* and *The Only Life That Mattered* is rife with situations where brokerage was inevitable: there are negotiations between parties with a dearth of trust in one another, individuals who evidently facilitated the creation of relationships, as well as the linkage of disparate communities. In the ensuing sections, brokers and influential actors are pinpointed and examined at length.

### 3.1 CENTRAL CHARACTERS

Typically, the exploitation of social power and brokerage go hand in hand. Based on this assumption, centrality presents an effective means of quantifying influence in social networks. Contrary to density, which is "the number of links between actors within the whole network", centrality measures this on "an individual basis". (Broadbent and Vaughter, 2014: 207) This allows the prominence and dominance of different characters within the novels to be estimated.

Attributed to the American sociologist Linton C. Freeman, the various approaches to centrality share three common denominators. Central actors are considered as such in terms of their active participation within the social network. Thus, peripheral nodes that neglect the maintenance of multitudinous relationships can gradually become isolated from "direct involvement". (Freeman, 1979: 220) Also,

the significance of efficiency cannot be overstated. An actor's communication competence is a critical criterion for high centrality. Additionally, characters that fall "between pairs of other points on the shortest or geodesic paths connecting them" is a feature that should likewise be taken into account when evaluating power dynamics. (Freeman, 1979: 221)

According to the American author Scott Adams, "the power a person holds in the organisation is inversely proportional to the number of keys on his keyring"; hence, in spite of the fact that a caretaker may be endowed with keys to unlock every single office, they are definitely not on a high perch. (Tsvetovat and Kouznetsov, 2011: 46) Stretching the metaphor, actors with a lower centrality measure require significantly more effort and resources in order to gain access to specific individuals, to form coalitions and gain valuable insights. Those with higher centrality, however, are capable of avoiding gatekeepers by engaging in their transactions without resorting to third parties. As a matter of course, all the doors are open for them.

Consequently, centrality can be used to discern actors that play a central role by virtue of the advantageous position they occupy within the social network. (cf. Landherr et al., 2010: 372) In this regard, "[n]odes connecting otherwise disconnected individuals are more critical to convey information exchange", thereby assuring supremacy in their separate subgroups and solidifying their social status in the network at large. (Forti et al., 2013: 1380)

Judging by the title of the novel by Sabatini, it could be assumed that the main character, Captain Peter Blood, would figure prominently among the most influential actors in the network. In the book by James L. Nelson, the narrative discourse is chiefly focalised around the female pirates Anne Bonny and Mary Read, which, naturally, underscores their contribution to the criminal enterprises and could connote the outstanding centrality scores of both nodes. Yet the validity of these hypotheses had to be verified in order to substantiate the claim that these individuals were, de facto, as pivotal as they may appear to be at first glance. With this in view,

centrality was considered to be an apt collection of measures that could be generated to analyse this concept. For an optimisation of the calculations, the fundamental premise was that the relationships contained in the data set were invariably reciprocated, resulting in symmetric graphs. (cf. Krackhardt, 2003: 357)

Despite there being no universally applicable method of measuring centrality, multiple algorithms can represent social relationships mathematically. The different measures of centrality allow baselines to be established by comparing the population of a graph against itself, thereby determining which actors are the most popular, the most structurally crucial (for the flow of resources through the graph or for acting as a broker between individuals). On the whole, there are four principal centrality measures.

First and foremost, degree centrality indicates the highest quantity of direct ties emanating from one node to others in a network. (cf. Zhang and Luo, 2017: 301) Hence, the “central actors”, which in this literary context would incorporate the protagonists of the two books, “must be the most active” members of their communities, especially in terms of communication. (Meyborg, 2013: 78) Secondly, closeness refers to individuals who, by their position in a given graph, are structurally close to other actors. This “stands for the convenience and ease of connections between the focused node and the other nodes”. (Zhang and Luo, 2017: 301) Therefore, a high degree of closeness can be achieved in the case of swift, uninhibited interaction when the transfer of information is not hinged on another actor. Betweenness concentrates on the actors that participate in the largest number of short paths. Finally, the eigenvector centrality demonstrates the influence of a particular node — a manifestation of an actor’s centrality is based on their relation to other central actors. (cf. Ruhnau, 2000: 360)

Against this background, three out of the four possible centrality measures are applicable to the detection of brokers and their influence. Betweenness divulges the presence of potential brokers. Degree centrality reveals the undercurrents of power

based on the influence that can be exerted over other members of the selfsame network. Closeness investigates the structural holes that can profit gatekeepers. Each of these is explored in the units below.

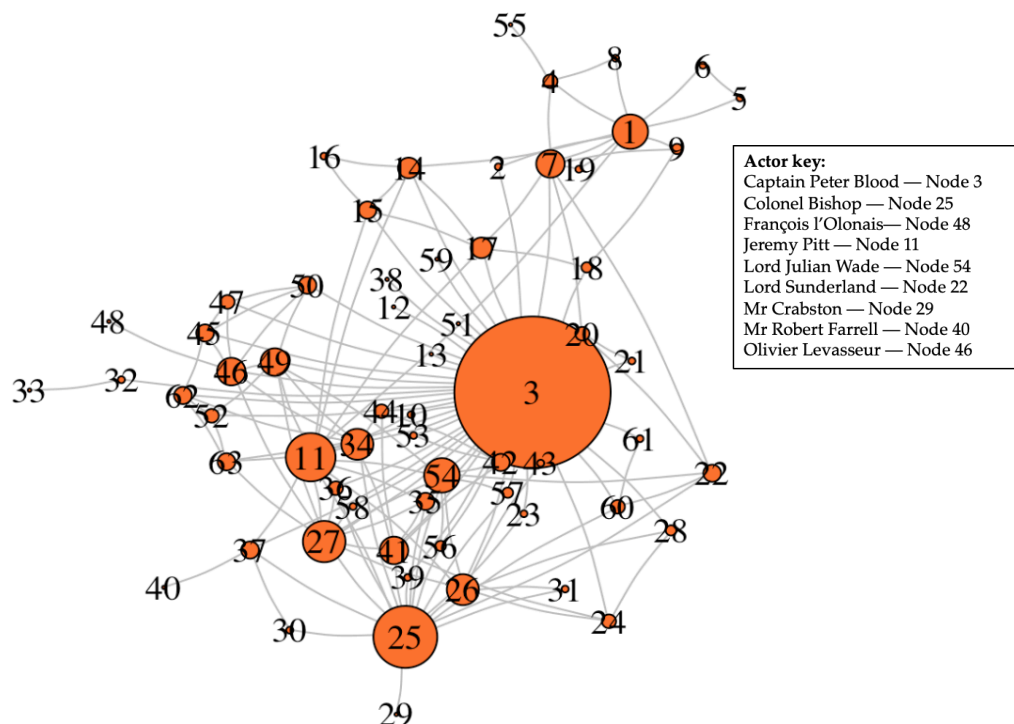
### **3.1.1 DEGREE CENTRALITY**

Part and parcel of establishing the presence of prominent and powerful personages is perusing their position in their immediate environment. As touched upon previously, centrality can be a means of identifying influential actors that display an abundance of connections within the graph. This can illustrate their relative significance. Simply defined, degree centrality relates to the manner in which "nodes vary in their number of ties within the network", which implies that well-connected, popular individuals with a higher degree centrality would, in all likelihood, be more knowledgeable. (Crossley et al., 2015: 14) Such an actor who keeps their ear to the ground can become privy to insider information from sources in distinct clusters, which, aside from allowing them to leverage their networks for opportunities, enables them to marshal resources and support from others.

In more ways than one, the intricate internal operations of network dynamics can be made overt through centrality measurements in general and degree centrality in particular, the latter of which is typically "expected to lead to power because it provides an exclusive control of information flow". (Krackhardt, 2003: 357) Actors with a high centrality score can, of their own volition, act as critical links in the chain of transmission or impose an impediment to the uniform distribution of intelligence among all the other members of the graph. Considering that "information flows along channels determined by network structure", it can be averred with a degree of certainty that the very fabric of the social networks being investigated is a direct reflection of the mediated, manipulated, and modified knowledge at the hands of central characters. (Van Alstyne and Bulkley, 2004: 152)

The discernible advantage of applying degree centrality as an attestation to the influence of specific nodes is that “the results are relatively easy to interpret and communicate” — undoubtedly, the cultivated connections make them more potent and conspicuous. (Landherr et al., 2010: 372) A baseline average centrality was calculated for the *Captain Blood: His Odyssey* and *The Only Life That Mattered* networks by generating functions in the R igraph package. It should be recalled that neither one of the networks is directed; hence, the total (or Freeman) degree was a befitting measurement.

The broad network of Sabatini’s *Captain Blood: His Odyssey* encompasses the entire population of characters that are referenced in the novel. Also, the whole network approach ensures that each and every one of the actors could be included without emphasising one exceptional individual (as in the case of an egocentric network), hence, the nodes are treated as structural equivalents in the visualisation below.



**Figure 2:** Degree centrality in *Captain Blood: His Odyssey*

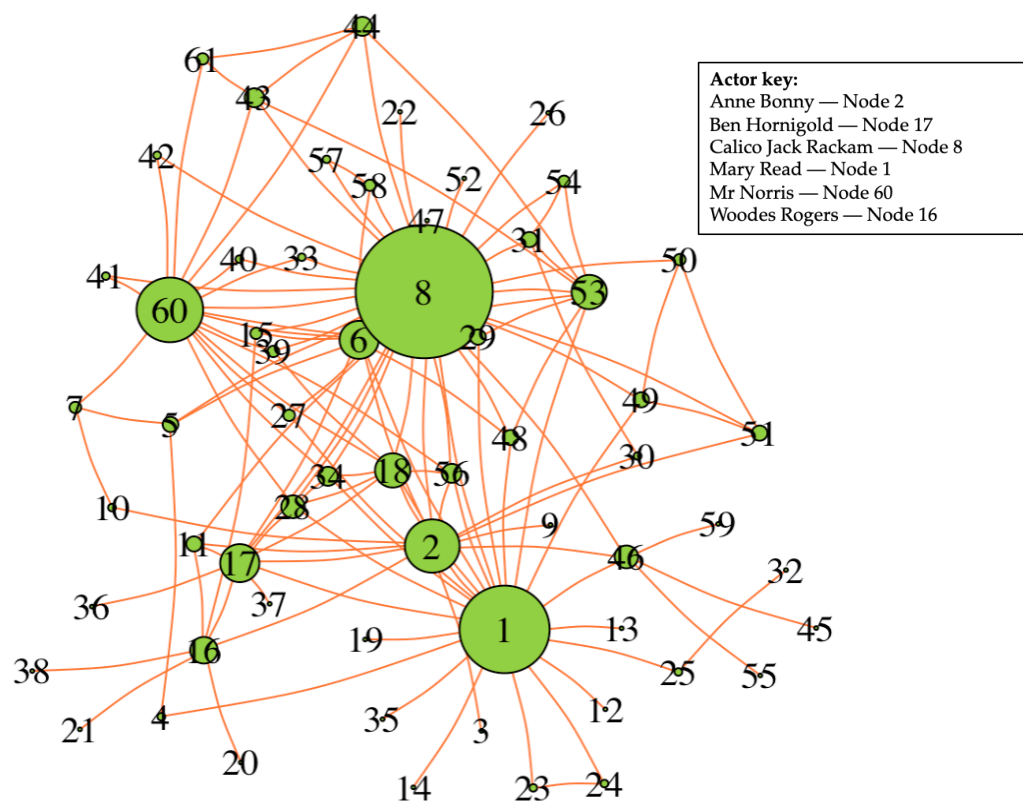
On account of this exploratory analysis, it became apparent that Node 3 (Captain Peter Blood) has the highest degree centrality of 43, which supports the proposed hypothesis that the protagonist would figure among the most dominant actors in the novel. His superior status may be attributed both to his leadership qualities and wealth of social bonds due to the capacity of his job — he is expected to build up his clientele as an irreplaceable medical specialist during his captivity (as a means of survival) and he manages the subordinates on his ship. In fact, his commandeering is so compelling that other renowned pirates offer collaboration, which widens Blood's network even further. The multitude of assistants is a characteristic that Peter Blood shares with his arch-nemesis. It would appear that Colonel William Bishop boasts an outstanding degree centrality score of 17, though he is closely followed by Jeremy Pitt, Blood's right-hand man and fellow pirate, whose centrality equals 14, which suggests that both of these actors are considerably influential as well.

Notwithstanding the magnitude of the node depicting Captain Peter Blood that dwarfs the remaining actors, certain constellations have certainly materialised for a more detailed examination. The graph clearly demonstrates the high centrality of Colonel Bishop (Node 25) and Jeremy Pitt (Node 11), which substantiates the claim that these actors are gatekeepers for pendants, brokering exchanges. Neither the *Captain Blood* network, nor the graph in Figure 3 include any isolates, making them inclusive. This is in line with the genre: in novels, all characters typically interact or influence one another. Isolates allude to nodes in a graph that are not connected to any other actors, whereas pendants such as the slave trader Mr Crabston represented by Node 29 are only attached to a single node (Colonel Bishop, in this instance). (cf. Hawe et al., 2004: 973) This lack of ties highlights the significance of existing connections.

The outer rim of the generated graph shows an area with numerous pendant actors (and chains of pendants in some cases): the doctor Mr Robert Farrell and the privateer François l'Olonais as represented by Nodes 40 and 48, respectively. This

could suggest that the inner node Olivier Levasseur (Node 46) acts as a gatekeeper for the pendant l’Olonais — he is deeply immersed in the trade with his far-reaching and motley contacts within the wider web of piracy.

Degree centrality in the network could likewise be indicative of cumulative advantage. Actors with a higher centrality that are located closer to the centre appear to be more appealing to others, signifying that even more individuals wish to be associated with them. The honour of having Lord Julian Wade (symbolised by Node 54 in the network) as an acquaintance induces the inhabitants of the colonies to become engaged in social interactions with him. Recognised as a “very distinguished passenger” travelling on an English man-of-war ship, the social milieu of Lord Julian Wade grows rapidly, even though he is only introduced midway through Sabatini’s novel. (Sabatini, 1922: 203) Evidently, Lord Sunderland’s envoy Wade enjoys a special standing in society, irrespective of geographic region.



**Figure 3:** Degree centrality in *The Only Life That Mattered*

In the graph of *The Only Life That Mattered*, the edges “simply indicate which nodes are adjacent to one another, so the length of each line does not communicate any substantive information”. (Luke, 2015: 46) As illustrated, the nexus of the network seems to be Calico Jack (Node 8 in the centre), which is the actor with the greatest degree centrality in Nelson’s novel. A patently observable example of high centralisation can be found at the bottom right of the network, where “all relationships involve a single actor”, namely Mary Read (depicted as Node 1). (O’Malley and Marsden, 2008: 9) A star pattern with several pendant actors appears to be radiating out from Read. This gives the impression that she dominates a substantial section of the network. Apart from emphasising the significance of her status among her fellow pirates, the contours of clusters could begin to be extracted from this alignment. Mary Read could be an overpowering gatekeeper with exclusive ties to certain individuals in social circles that are beyond the captain’s reach, making her both a mighty ally and a redoubtable opponent rolled into one.

Unlike Mary Read (who could pose a severe threat to Jack Rackam’s ubiquitous influence among the privateers), Anne Bonny (Node 2), though consequential in her own right, is not nearly as well-connected. On the left, Node 60 appears to be in a central position as well, which can be attributed to Sir John Norris’ duties as a Register — throughout the proceedings of the trial, he is the driving force behind recording the depositions of the felons and imparting their convictions. Therefore, he can be esteemed as the middleman between the convicted pirates and the enforcers of the law.

Furthermore, the veteran privateer-turned-pirate Ben Hornigold (Node 17), who is in league with first Royal Governor of the Bahamas Woodes Rogers likewise looms large on the piratical terrain. Social relations can be exploited as an asset inasmuch as the actors procure, “spread or retain information strategically because they have control over [its] diffusion”. (De Nooy et al., 2018: 172) As Hornigold opts

for an allegiance with Rogers, he creates a bottleneck in that he can filter the knowledge he gains from his past colleagues before recounting it to his superior, which enables him to pursue his private, strategic intentions.

Over and above the obvious characteristics attributed to nodes with high centralities, this measurement can also quantify the actors' autonomy. According to the psychologist Harold Leavitt, "it is felt that where centrality and, hence, independence are evenly distributed, there will be no leader, many errors, high activity, slow organisation, and high satisfaction." (Leavitt, 1951: 50) Unequivocally, the centrality and, by extension, degree of independence in the two aforementioned networks are unevenly apportioned among the different characters in the novels. Leadership roles are predominantly occupied by the captains. In stark contrast to the graph of *The Only Life That Mattered* where Mary Read, the unofficial second-in-command, has considerable control, the command of Captain Blood is challenged by his adversary, Colonel Bishop.

On the opposite end of the spectrum, an individual with a low centrality relative to the other actors can be identified as a follower since they depend on the leader, "accepting his dictates, falling into a role that allows little opportunity for prestige, activity, or self-expression". (Leavitt, 1951: 50) Best exemplified in the interrelationship between John Davies (Node 40 in Figure 3) and Captain Jack Rackam, this member of the pirate crew is in an inferior, disadvantaged position. Although a fully fledged sailor along with the likes of Noah Harwood and John Howell, John Davies seems to occupy a second-rate position in piratical schemes compared to his counterparts. Analogously, Mrs. Barlow (Node 12) in the *Captain Blood* network is employed by Peter Blood as a servant, she is subservient to him, which can be evinced from her low degree centrality. In a general sense, the number of connections that each character develops can impose constraints and present opportunities in equal measure.

It would appear as though the presumption that higher centrality is an indication of an actor's power over other actors and, as a consequence, in the network as a whole, remains altogether valid. (cf. Broadbent and Vaughter, 2014: 208) A salient difference between Rafael Sabatini's and James L. Nelson's masterpieces, however, is that in *The Only Life That Mattered*, not all of the protagonists exercise the same power. The degree centrality of Jack Rackam amounts to 36, placing the pirate captain in the most formidable position, which is consistent with the on-board chain of command in the novel. Yet Mary Read (with a degree centrality of 22) is evidently the most notable female pirate to be recognised in the ranking. Sir John Norris (the Register) is revealed as a pre-eminent individual, insinuating that the counterbalance of the political and legal government to pirates is significantly more substantial in Nelson's novel.

As a rule of thumb, individuals tend to be more influential when others are dependent on them. Highly connected actors become less powerful when surrounded by other highly connected actors. The principle is that it is undeniably preferable to be a big fish in a small pond rather than a big fish in a big pond surrounded by other big fish. In order to remedy this, it is plausible that the actors with the highest degree centrality scores in each of the novels would divide their spheres of influence. Thus, Captain Peter Blood and Colonel Bishop could establish themselves as leaders of their respective domains. Mary Read's distaste for Jack Rackam (which develops into unreserved antipathy), however, undermines the captain's authority. This emergence of Read's continuing and overwhelming influence on Rackam's territory leads to the pirate's downfall.

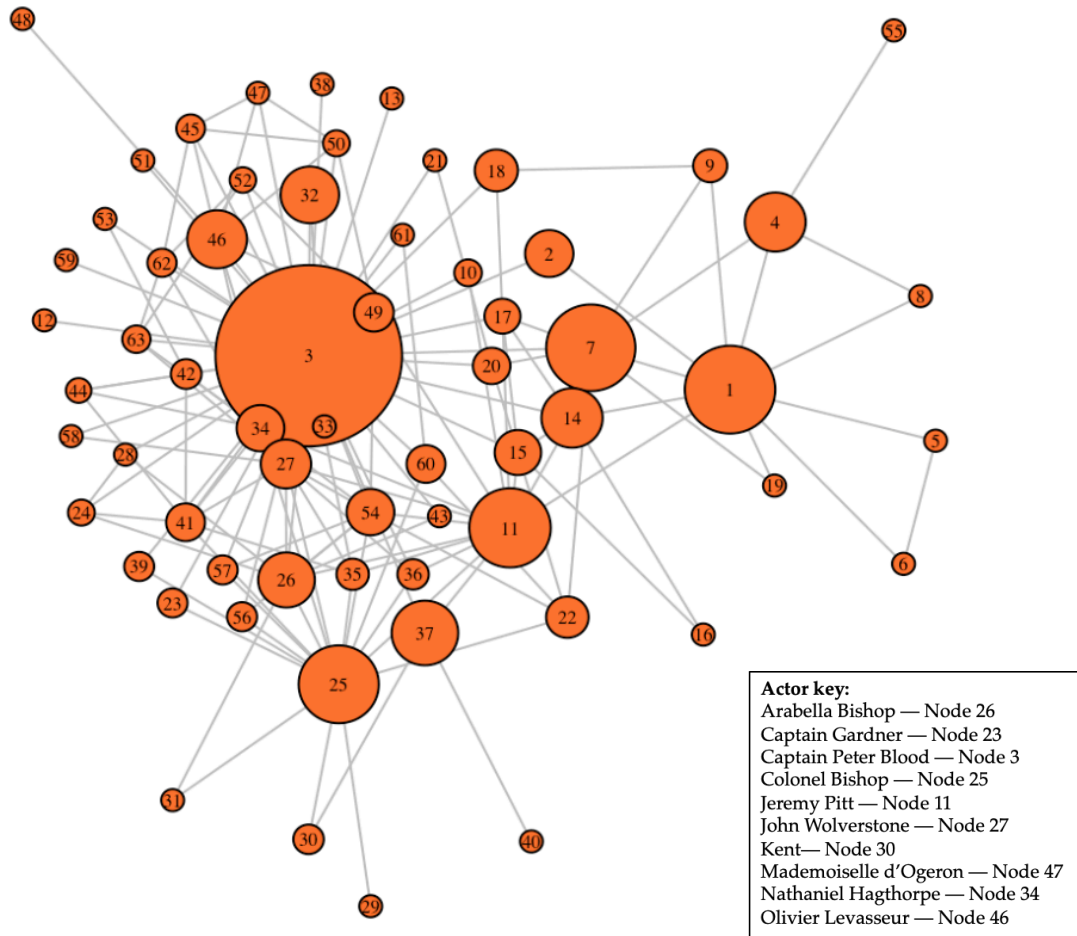
Elaborating upon this further, power can be perceived as the adroitness to mobilise social resources. Access to these resources can be gained by actors with the ability to reach other nodes. In the novels being examined, apart from tangible assets (such as accumulated loot and riches), this would also concern theoretical elements (such as the spread of information along with political propaganda). In situations

where individuals are reliant on others for access to the network, the gatekeepers gain in power and influence alike by, for instance, harnessing or gathering information from miscellaneous sources, as well as manipulating or withholding messages. Since integration is made possible via bridges formed across communities, the interactions between distinct clusters are contingent upon the control of these selfsame bridges. (cf. Burt, 2004: 351)

### **3.2 BROKERS BUILDING BRIDGES**

A most effective technique for measuring the spread of information and structural connectivity in social networks is betweenness centrality, which reflects the number of shortest paths that flow through an actor. A node with a high betweenness can be regarded as a gatekeeper with a "potential for control" over the distribution of resources between other actors that would otherwise be unable to get in touch with one another. (Hawe et al., 2004: 974) The resources themselves can vary in nature, ranging from intelligence on merchant vessel itineraries that would facilitate triumphant pirate raids to commercial goods. In this fashion, brokers (who can be characterised as the nodes with the highest betweenness scores) dominate structural holes.

This measure is particularly germane to mediation and communication networks such as the present ones as it enables clusters to be distinguished while also shedding some light on the individuals who promote the establishment of bridges between these selfsame communities. In the diagram underneath, the node size is proportional to the betweenness centrality of every individual.



**Figure 4:** Betweenness centrality in *Captain Blood: His Odyssey*

The decisive factor for displaying the data set in this manner was the optimisation of readability, in other terms, “the capability of conveying the meaning of the diagram quickly and clearly”, which would minimise edge crossings. (Battista et al, 1994: 236) As with the preceding visualisations, the network illustrated in Figure 4 was produced by the force-directed graph drawing algorithm developed by Kamada and Kawai (commonly abbreviated as the KK layout). This approach ensures that the “forces between the nodes can be computed based on their graph theoretic distances, determined by the lengths of shortest paths between them”. (Kobourov, 2014: 383) Contrarily to the Fruchterman-Reingold algorithm (which is another example of a force-directed strategy), the KK layout is perfectly adapted for larger data sets

containing upwards of 60 nodes, such as the ones in question, while having the supplementary advantage of outperforming the former in the matter of speed. (cf. Brandenburg et al., 2005: 80-81) An attempt was made to normalise the node labels to avoid overlaps whenever possible by utilising the node IDs in place of the characters' names as they appear in the book.

Not counting Peter Blood, who saliently stands out in the central section of the visualisation as a broker, both Jeremy Pitt and Colonel Bishop could likewise be potential brokers for certain sections of the graph. As a result, the overall social structure that emerges from the processed data set is that of patent clusters with occasional links between communities. The actors that are evidently endowed with brokerage potential are diverse both in terms of their aspirations and the benefits reaped from sustaining their contacts.

A typical close reading of the novel (or excerpts thereof) would, assuredly, bring the conglomeration of Captain Blood's pirate crew to the fore, though it can be enhanced by the computed network, as displayed in Figure 4, which compellingly stresses individual actors. Officer John Wolverstone, a fellow-convict and friend represented by Node 27, is well-reputed among his comrades-in-arms. By prevailing upon the captain, Wolverstone instigates an alliance with the Frenchman Levasseur that was otherwise met with reluctance. He lays the groundwork for a cooperation between the two commanders.

On more than one occasion, John Wolverstone proves to be an opinion leader. During the complications in Maracaybo, he openly confronts the French buccaneer Cahusac in his endeavour to defy the captain's orders, thereby dispelling any contemplations of defiance and preventing an uprising. Wolverstone stifles the cries of Cahusac, "who was exposing them to mutiny". (Sabatini, 1922: 173) Taking into account the fact that "opinion leaders are not people at the top of things so much as people at the edge of things, not leaders within groups so much as brokers between groups", it becomes evident that this relates to the middle-aged, one-eyed

Wolverstone. (Burt, 1999: 51) Through a synthesis of expertise and authority, he possesses the trust of not only the protagonist, but the entire crew.

The betweenness centrality reflected in the size of Node 34 is comparable to that of Node 27, implying that Nathaniel Hagthorpe can likewise be considered an opinion leader of note. When debating the fate of Colonel Bishop, Hagthorpe mercifully propounds the idea of releasing the abhorred enslaver as an alternative to dispatching him. (cf. Sabatini, 1922: 106) Acting upon the express commands of Captain Blood, Nathaniel Hagthorpe dominates his entourage of pirates and ventures to conciliate on their behalf with the Spaniards. Finally, although irrefutably occupying a place in the shadow of her uncle, Arabella Bishop (Node 26) is an outstanding broker as well, not least in light of her gender — among the women in the literary work, solely she is recognised as such.

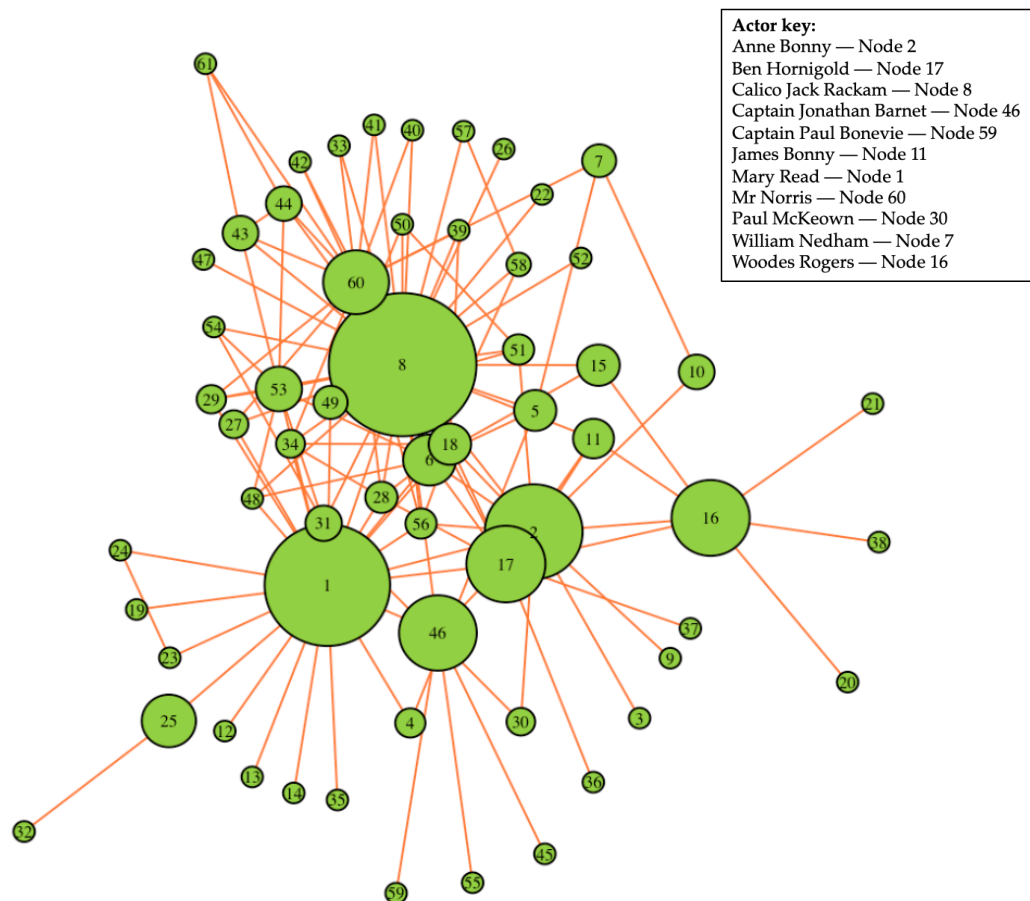
The weak ties that exist in areas of relatively low density (as at the bottom of Figure 4) provide a golden opportunity for diffusing information (and misinformation alike) across a network since the actors in a tightly-knit cluster located at the centre of the network would usually have access to equivalent, if not identical, insight. Colonel Bishop, who cultivates weak ties with his subordinates (exemplified by Kent, Node 30) and business associates in Carlisle Bay, Barbados, could have an advantage in influence over actors with exclusively strong ties. Bishop's fateful negotiations with Captain Gardner (Node 23), the master of the Jamaica Merchant, acquaint him with the future pirates, setting a series of striking events in motion. Bishop, the cunning slaveholder and military commander, has fingers in many pies, which makes him a truly weighty opponent.

According to the sociologist Mark Granovetter, weak ties are markedly more likely to initiate the formation of bridges and have a positive impact on the transmission of information. (cf. Granovetter, 1973: 1366) It is through the creation of bridges that Colonel Bishop is able to pull the strings, exercising authority far and wide. In accordance with this principle, Blood's development of a wide array of weak

ties that act as connectors between groups throughout his travels firmly entrenches him in power, which confirms this postulation.

Another conceptualisation concerning the behaviour of weak ties that is exposed in the visualisation is that of the elimination of a forbidden triad. Where there are two strong ties, the absence of a third connection (whether weak or strong) is irregular. (cf. Granovetter, 1973: 1363) The interaction between the Irishman Peter Blood and the Frenchman Captain Levasseur (Node 46) can be characterised as strong on account of the emotional intensity and the intimacy of their relationship: the pirates consent to a pact based on their mutual interests, which, ultimately, culminates in utter animosity as Blood thwarts Levasseur's attempt at racketeering. This strong tie draws Mademoiselle d'Ogeron (the Governor's daughter, as well as Levasseur's lover, symbolised by Node 47) and Captain Blood together, promoting "triadic closure" for cohesive relationships. (Easley and Kleinberg, 2010: 48) Opportunity fosters a bond between the two strangers. Their interaction, in turn, reinforces M. d'Ogeron's conviction that Blood can be trusted. In gratitude for rescuing his daughter, the Governor of Tortuga provides "powerful protection" for the buccaneer by augmenting his fleet and social standing. (Sabatini, 1922: 171) Trustworthiness is a rewarding commodity, which drives this relational structure.

Furthermore, betweenness centrality was calculated for each of the characters described in *The Only Life That Mattered*. The brokers, reflected by the node diameters, are revealed in the social network below.



**Figure 5:** Betweenness centrality in *The Only Life That Mattered*

Customarily, the three main characters (denoted as Nodes 8, 1 and 2) overshadow the remaining brokers. They would also appear to divide the network into governable segments detectable in the upper left, lower left, and bottom right portions, respectively. Such a structural separation interferes with the amalgamation of information derived from different, often contradictory, sources. By way of illustration, Paul McKeown (the captain's mate aboard the *Nathaniel James*, depicted by Node 30) is duped into believing Anne Bonny's false intentions when she introduces herself as a lady by the name of Miss Patricia Clark who is seeking passage to Barbados, a carefully crafted deception that occasions the seizure of the ship by Rackam's crew. Thus, Anne Bonny is elected as a representative broker —

Rackam delegates her to negotiate an exchange with an outsider. (cf. Gould and Fernandez, 1989: 92) McKeown, the actor attached to the broker Bonny, is unable to corroborate the news that is shared, he cannot validate the accuracy or even the veracity of the knowledge that is imparted to him. By being denied access to either Richard Corner or George Fetherston, the other pirates who could confess her real identity, McKeown has no choice but to place confidence in the genuineness of her claims. Brokerage permits Anne Bonny to withhold facts and mould the truth on demand.

In addition to the power invested in Jack Rackam, Mary Read and Anne Bonny, Woodes Rogers (Node 16) is an unmistakable broker that steals the limelight on the right-hand side of the visualisation. Rogers, the acting governor of the Bahamas, is determined to categorically neutralise the pirate threat in Nassau, an undertaking that entails the cultivation of a wide-ranging web of informers, renegades and double-dealers. (cf. Nelson, 2004: 79) In this respect, the Governor's significant betweenness centrality score serves as an indication of the non-redundancy of the sources of information he relies upon — as a person “connected to different parts of the network”, Rogers benefits from “a wider variety of information at his [...] disposal”. (Krackhardt, 2003: 356)

The wheels of his information-gathering machine, however, have to be oiled. As a result, incentive is given in the form of payment for services rendered, an offer that entices James Bonny (the husband of Anne Bonny) to betray two individuals “fixing to go on the account”. (Nelson, 2004: 81) The weak ties between Woodes Rogers and his informants are conditional on financial rewards.

While casting a relatively wide net to glean any insight into unsanctioned activities in his province, Rogers, Governor of the Bahamas, nevertheless tends to rely on Hornigold for expert counsel, as well as reliable reports. The aim, in this case, is twofold. Disparate actors willing to voluntarily supply similar information on a specific subject provide the broker with the advantage of applying this knowledge in

the generation of ideas. (cf. Resch and Kock, 2021: 1) The expulsion of infamous pirates from Nassau is one of the tactics in Rogers' grand strategy of terminally eradicating piracy in the region. Yet in order to avoid "information overload" as a broker "accessing broad information" of various origins, the Governor heeds the advice of Hornigold, his primary point of contact with the locals. (Resch and Kock, 2021: 1)

From this standpoint, the brokerage relation of Ben Hornigold (Node 17) typifies gatekeeping, he "selectively grants outsiders access to members of his [...] own group". (Gould and Fernandez, 1989: 92) It is likewise implied that the past pirate processes and sifts through the messages that he receives, preventing them from travelling further. During an encounter with Jack Rackam and the other members of his pirate crew, Hornigold discloses that he was fully aware of their arrival but consciously chose not to notify Rogers. (cf. Nelson, 2004: 352) He has a vested interest in Rackam's escape.

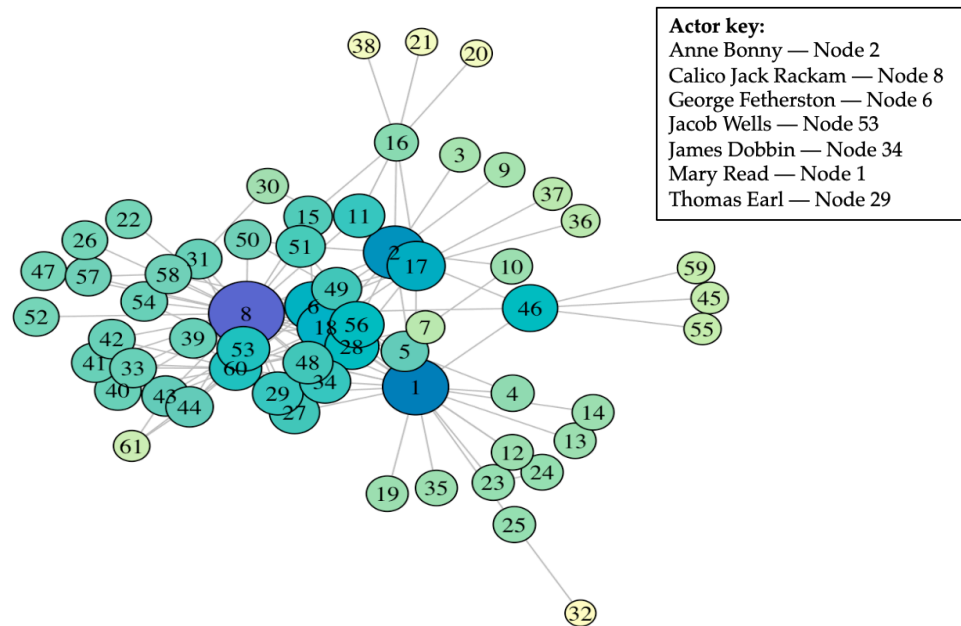
Under contrasting circumstances, the role of brokerage can be characterised by its qualities. Positive brokers aid in the interactions they stimulate. Negative brokers act malignantly by, for instance, casting the parties in an unfavourable light or promoting the flow of distorted gossip. Thus, in *The Only Life That Mattered*, Sir John Norris (Node 60), the Register, can be interpreted as a positive broker based on his interactions with his work colleague — the Lord Chief Justice, William Nedham (Node 7) — during the trial. He acts on his behalf in recording the testimonies of the accused in the proper fashion. Captain Jonathan Barnet (Node 46), by comparison, can be considered a negative broker between Captain Jack Rackam and Captain Paul Bonevie (Node 59), with whom he sails. Commissioned by the Governor of Jamaica for the suppression of pirates, Barnet is tasked with capturing Rackam, which defines their interaction. In the novel *Captain Blood*, to name a few instances, malice permeates the bridge connecting John Wolverstone and Colonel Bishop. In his

business dealings with Captain Gardner, William Bishop would be an example of a neutral broker who reinforces slave trade on the coast.

### 3.3 CLOSENESS

As its name connotes, closeness centrality relates to the proximity of a particular node to other vertices. The actors that can be located in areas of a graph with high density would, conventionally, also have higher closeness measures, whereas in realms of low density with several dependent actors that are only connected through one or two nodes, there would be less closeness. Principally, this statistic indicates the length of time necessary to transmit information from one node to all the others sequentially. (cf. Chen, 2014: 22) In general, this could be a means of assessing the actual degree of structural closeness or distance of individual actors, which can subsequently be geared towards identifying consequential clusters. For this reason, it can signal the extent to which a network is enmeshed and well-integrated.

The first visualisation in Figure 6 computes the closeness of the characters in the novel *The Only Life That Mattered*, which is not only indicated by a colour scale from yellow (low centrality score of an actor) to purple (indicative of a high measure), but which also affects the node size.



**Figure 6:** Closeness in *The Only Life That Mattered*

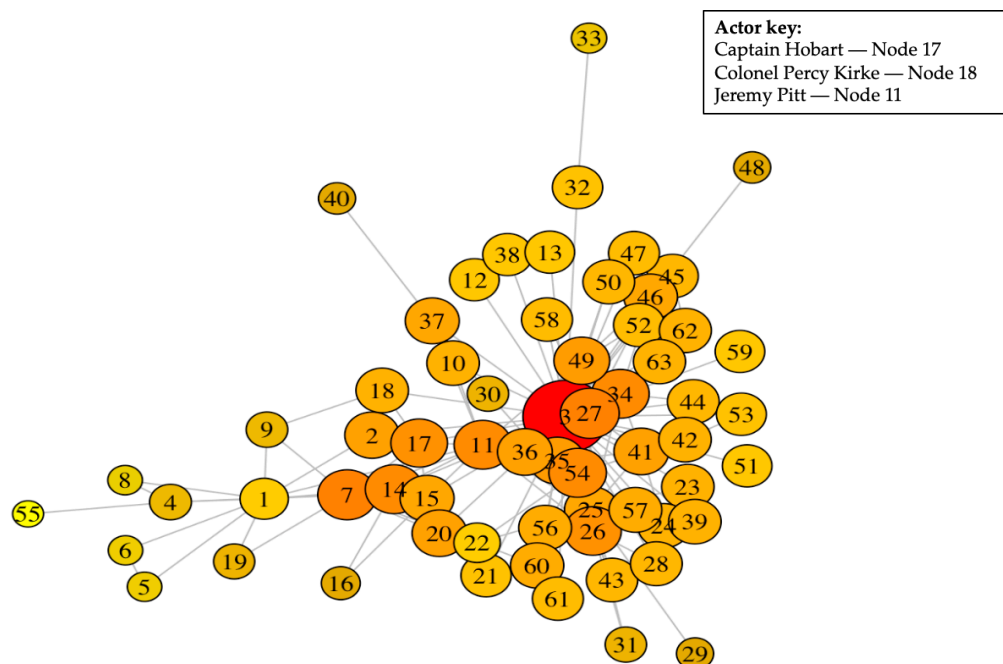
Jack Rackam occupies a class of his own with the greatest attainable closeness centrality, demarcating the captain from the remaining buccaneers and female pirates alike. The sea-green shade that encompasses his crewmen Thomas Earl (Node 29), James Dobbin (Node 34) and George Fetherston (Node 6), to name but a few, makes plain the criminal collaborations. Onboard the *Pretty Anne* with Rackam at the helm both literally and figuratively, information is disseminated the most speedily between the protagonists: Rackam himself, as well as Mary Read and Anne Bonny, depicted in turquoise.

The fact that the three are as thick as thieves renders any form of secrecy well-nigh impossible. As shown in the literary text, the moment Anne Bonny seeks to seduce Mary Read and in so doing unmask Read for what she is, namely a woman in the guise of a man, Jack Rackam discovers the state of affairs nearly immediately. Following this astounding revelation, however, they maintain the masquerade — the deception persists until the clash with Billy Bartlett on the beach when Read is severely (and publicly) injured. Their confidential matters are not publicised. The

lives of Rackam, Bonny and Read are integrally intertwined with minimal information leakage to parties outside the innermost circle.

Overall, a correlation can be observed between the actors that are emphasised based on their closeness and the brokers premised on the betweenness calculations. The same nodes tend to be prioritised. Nonetheless, in Figure 6, a certain Jacob Wells (Node 53) increases in importance. Initially sailing with Captain James Larson, he is compelled to join the ranks of Rackam’s crew. The popularity of the violinist Wells grows as he gradually becomes integrated into their group. His propensity for enlivening every gathering with music guarantees him an audience, which could, at least partly, explain Wells’ ability to easily spread pieces of information.

With regard to the *Captain Blood: His Odyssey* source material, the computed closeness centrality range from yellow to red. The designated measurements reflecting the channel of information span from yellow to red.



**Figure 7:** Closeness in *Captain Blood: His Odyssey*

Without question, there is a highly connected area of the graph in the centre of Figure 7 with a large amount of completeness, which is contrasted against a manifestly less dense section on the left from Node 18 (Colonel Percy Kirke) and Node 17 (Captain Hobart) onwards, whereby the latter happens to be linked to the rest of the graph through Jeremy Pitt (Node 11). It can be concluded that Mr Pitt has the dual role of uniting the pirates superintended by Blood and bringing Captain Blood into contact with political personages. Thus, the structural holes that segregate segments in the network underline the noteworthiness of brokers who cement the various parts of the graph.

### 3.4 POWER CENTRALITY

Having calculated the classic centralities of the individual brokers in the two historical fiction novels, it would be reasonable to take the nature of power into closer consideration. According to an article published by Philip Bonacich in 1987, the supremacy of an actor is inextricably linked to the influence of its alters (the individual's contacts) since in certain trading situations "power comes from being connected to those who are powerless". (Bonacich, 1987: 1171) Each of the pirate networks involve trade of sundry sorts. The buccaneers partition plunder among themselves, they exchange hostages, they gather and share intelligence with local residents and high-standing politicians.

Bearing this in mind, the power centrality approach was applied to portray the repercussions of being surrounded by other influential individuals. The values produced for the nodes in *Captain Blood* and *The Only Life That Mattered* are two-facetted. A positive numerical value signifies that a node increases in power as their alters' potency grows. Whenever rivalry (or friction) enters the picture, however, the alters are expected to be weaker for a node to procure greater power.

In Sabatini's novel, Peter Blood (with a power centrality measurement of -0.61) profits from interactions with inferiors, as does the broker Jeremy Pitt (evidenced by

a score of -0.26). John Wolverstone exploits the lower rank of his subordinates as well; his measure constitutes -0.57. Colonel Bishop, on the contrary, benefits from the powerful positions of the nodes in his association due to the fact that the Bonacich score in his case is 0.11.

Selecting a sample of brokers from the book *The Only Life That Mattered* provides an understanding of their interplay in the network. Ben Hornigold's positive measurement of 0.45 implies that as a gatekeeper continually exposed to the criminal underbelly and charged with reporting his findings to the governor, he banks on the official (and major) support of Rogers, yet prefers not to burn any bridges with high-powered pirates either. Logically, Captain Jonathan Barnet's score of -1.54 is a reflection of his mission — in order to apprehend the convicts on the *Pretty Anne*, their degree of authority has to diminish. Captain Jack Rackam's sway over his shipmates has to be sabotaged, his grasp on power has to slacken for Barnet to overthrow him, seizing control of the malefactors.

## CHAPTER 4

### POLITICS, PACTS, AND PIRACY

Proceeding from singular node entities to aggregations that are not, by any means, inferior in power structures, political alliances that shape piratical activities swiftly come into play. It has already been posited that the outlines of subgroups can be discerned by placing the privateers on their corresponding vessels, but there can also be allegiances to different nation states. Information does not cease to be a valuable commodity in political circles. In practice, it epitomises a “tool and resource used by political actors in a strategic or psychological sense, its characteristics and qualities help define political actors themselves”. (Bimber, 2003: 231) Realistically, a paucity of political enlightenment can present a grave detriment.

One such situation is encapsulated in a conversation that takes place between Captain Peter Blood, Lord Willoughby and Admiral van der Kuylen. Having been, as he avowed “[o]ut of touch with the world for the last three months”, Blood is altogether astonished that during that time the entire political landscape of his homeland had metamorphosed. (Sabatini, 1922: 337) Besides obtaining a tacit pardon for his past piratical transgressions, his prospects of returning to his beloved Ireland instantaneously alter from being non-viable to more than conceivable. It is not until he broaches the subject of societal changes and the new status quo with members of another group (and nationality, in the case of the Dutch Admiral van der Kuylen) that he becomes cognisant of the lay of the land.

Naturally, the vast majority of social networks can conform to a division into discrete communities or modules once the rudimentary configurations have been detected and characterised in their own manner. (cf. Newman, 2006: 8577) Neither the *Captain Blood: His Odyssey* nor *The Only Life That Mattered* networked systems are an exception in this regard. By exploring the community structure that is generally considered to be a fairly complex network property, a comprehensive picture of complicated political commitments was acquired. This chapter aims to demonstrate that communities undergird brokerage.

From a technical point of view, communities pertain to subsets of actors such that the internal interrelations “are denser than connections with the rest of the network”. (Radicchi et al., 2004: 2658) Developing upon this principle, a certain hierarchy — both regarding the interactions and the nodes themselves — begins to materialise. Prior to producing any network visualisations of the two novels, a precursory study of the communities contained in the data sets was conducted. In the given instance, the favoured methodology was bottom-up hierarchical clustering, which models dendrograms. In effect, this approach divides communities in conformity with the distance between them; inversely, similarities stimulate communities to merge. (cf. Orman and Labatut, 2009: 242) Essentially, the two hierarchical trees (displayed in Appendix 1) provided a baseline for further community analyses. They set a benchmark for the number of clusters. The agglomerative algorithm created partitions at each level of the dendrogram. For the novel *The Only Life That Mattered* by James L. Nelson, the dendrogram was split into eight communities. Sabatini’s *Captain Blood: His Odyssey*, by comparison, was dissected into a total of six sizeable communities.

By and large, one of the three cardinal advantages of the detection of communities in this fashion is that such a data analysis technique manifests particular partnerships, permitting the motivations for alliances and control mechanisms to be unearthed. Alternatively stated, the discovery of clusters unveils

“the existence of a non-trivial internal network organisation at coarse grain level”, addressing the power structures in social networks in a holistic manner. (Yang et al., 2016: 1) Moreover, the approach serves as reminder that the dynamic process of information exchange occurring within the web of social ties impacts and is impacted by the construction of communities.

## 4.1 COMMUNITY DETECTION

For the purposes of capturing the core communities in *The Only Life That Mattered* in conjunction with *Captain Blood: His Odyssey*, the igraph package in R, which has several community detection algorithms on offer, was employed to plot a series of graphs. The principal divergence between community detection algorithms on one side and clique and k-core algorithms on the other can be attributed to their internal arrangement of ties. In a k-core analysis (derived from the notion of degeneracy in graph theory), by way of example, all the members belonging to the subgroups would have a homogeneous level of connectivity within the graph.

Community detection algorithms do not merely reflect how a cluster or a subgroup may be connected in and of itself; they also model the links to other groups, thereby defining them according to external relationships. Clusters are positioned in a larger framework. The ensembles of pirates can be categorised as aggregates united by an influential leader (the self-proclaimed captain of the campaign), yet their mightiness would remain somewhat meagre if they were limited to their ships alone. The flip side of assimilating outsiders in illicit networks such as these is deception, which can precipitate information leakage. A succession of successful raids spearheaded by Captain Jack Rackam brings new blood to the company. Even so, it is no other than the newly affiliated Frenchmen Peter Cornelian and John Besneck who categorically denounce the *Pretty Annes* during the court hearing. On the grounds of this facet of illegal networks, the status of brokers is

elevated in double measure — they encourage the maintenance of “social distance and a buffer [...] that can enhance security”. (Bright et al., 2018: 241)

There are a number of approaches that could be implemented for community detection, which can be subsumed under the following broad categories: traditional methods (as alluded to earlier, this would include hierarchical clustering, but also graph partitioning and spectral clustering, neither of which are treated in this thesis); divisive algorithms (the most notable being Girvan and Newman’s edge betweenness, the effectiveness of which is demonstrated in one of the upcoming subsections); lastly, modularity-based methods (such as the greedy techniques) that launches the evaluation. Other techniques that could be applied in future studies but are not covered in this one are based on statistical inference, such as blockmodelling.

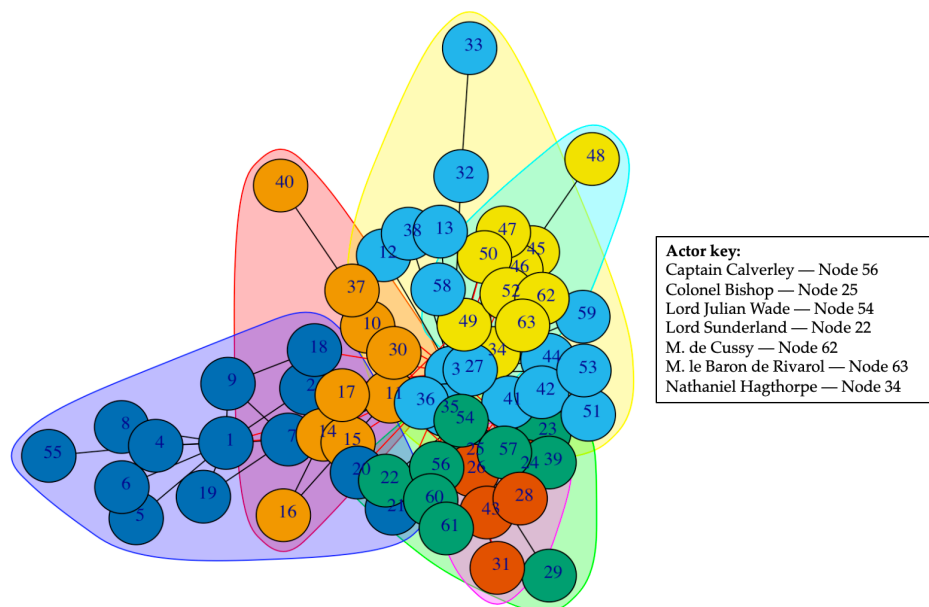
Each of the algorithms relies on disparate heuristics to place the actors into subgroups. (cf. Smith et al., 2020: 598) Nonetheless, they share a common ground since the primary objective is “improving the identification of meaningful communities, while keeping as low as possible the computational complexity of the underlying algorithm”. (Yang et al., 2016: 1) This thesis has recourse to a three-pronged procedure that was put into practice to compare and contrast algorithmic methods: the modularity-based Louvain technique, the dynamic Walktrap algorithm, and the divisive edge betweenness algorithm. The number of communities that were computed by the approaches are explicitly specified.

### **4.1.1 MODULARITY-BASED CLUSTERING**

Iteratively merging pairs of communities that yield the utmost increase in a specified performance measure is the guiding principle of agglomerative clustering approaches. Modularity maximisation, which computes the density of connections within modules, is “the most popular class of methods to detect communities in graphs”. (Fortunato, 2010: 27) Bearing this in mind, the Fast Greedy and Louvain algorithms, which proceed in a ground-up fashion, were practical alternatives. They

are both based on greedy techniques where nodes are added one at a time to the subgraphs, so the findings would be akin. At any rate, a decision was made in favour of the Louvain procedure that displayed fractionally more overlaps.

The *Captain Blood* network inserted further on in Figure 8 was produced by the biphasic Louvain algorithm — it repeatedly performed a local optimisation of the modularity by searching a smaller subgroup before combining the nodes attributable to the same community. (cf. Bakhthemmat and Izadi, 2021: 25) For comprehensibility, the individuals assigned to one of the six communities share the same node colour and are encircled by bubbles. Generally, the denser web of ties in the green community can be indicative of cohesion. There would typically be substantial information flows towards this area. But there is also the matter of political undercurrents to be considered. Lord Sunderland (Node 22), Captain Calverley (Node 56), Lord Julian Wade (Node 54) are devout supporters of His Majesty, accumulating intelligence on his subjects and promoting sanctioned political ideals. One of the most momentous identity traits in the political arena is therefore nationality, which is referenced at regular intervals in the novel due to the utter impact it has on the characters' courses of action, attitudes, and alliances.



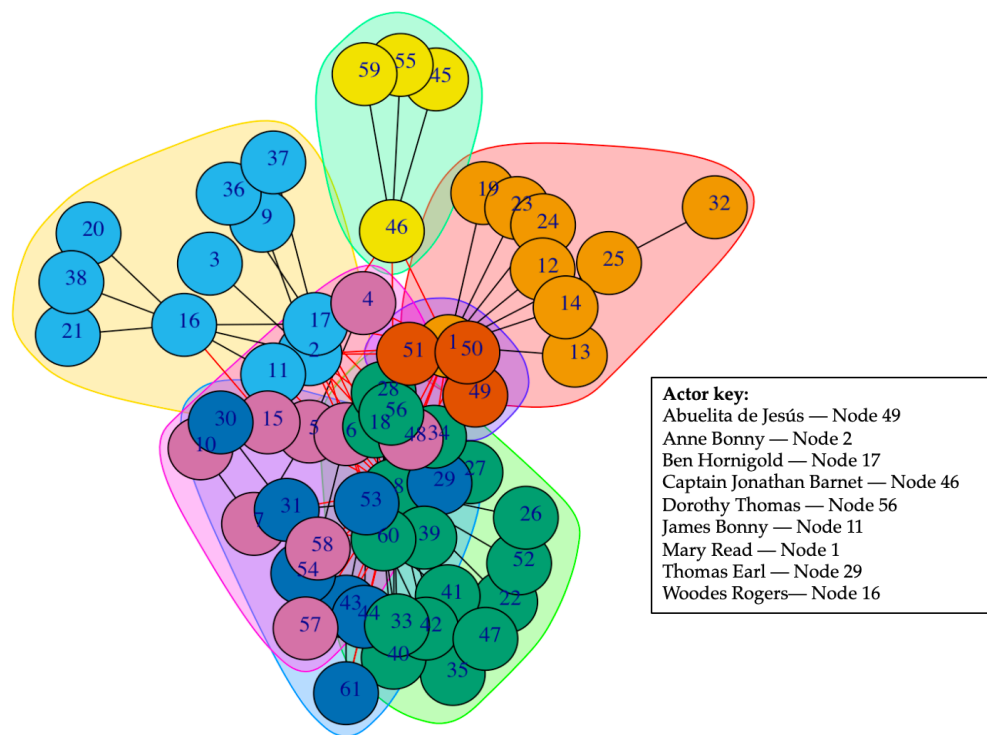
**Figure 8:** Louvain communities in *Captain Blood: His Odyssey*

On the subject of political affiliations among the brotherhood of the coast, almost the entirety of the yellow community embodies French nationals, from the d'Ogeron family to the treacherous Levasseur and his undependable second, Cahusac. The actor in Blood's crew who is incorporated among the Frenchmen is Nathaniel Hagthorpe (Node 34), giving the impression that he stands to benefit from international informational arbitrage.

On the basis of the Louvain method, Lord Julian Wade is, in effect, at the intersection of three communities: the red one subjugated by Colonel Bishop, the green where he acts as an emissary for Lord Sunderland, and Blood's light blue congregation. Pursuing a politicised agenda, this highly central node that is, coincidentally, marginal to clusters, can be regarded as the quintessence of an actor actively involved in propagation in the midst of a structural hole. This form of an information infrastructure affects his "strategies of recruitment, advocacy, and mobilisation". (Bimber, 2003: 4) He enlists the services of Captain Blood, persuading him to become a member of his political clan by being a spokesman for Lord Sunderland. Also, he vindictively provokes Colonel Bishop to precipitate the subversion of the notorious pirate, to no avail, by lending him a helping hand in the furtherance of his private interests.

For a wholly unrelated motive, Peter Blood becomes embroiled in political turmoil between France and Spain when he assents to the proposal of M. de Cussy, the Governor of French Hispaniola (Node 62), enrolling his ships and force under the flag of M. le Baron de Rivarol (the yellow Node 63 in the predominantly French-speaking community). (cf. Sabatini, 1922: 300) Hence, the community detection algorithm validly positioned Blood at the border of the cluster enclosed in the light blue bubble. To be sure, the captain "whose networks bridge the structural holes between groups" thrives from "developing rewarding opportunities", which "provides a vision of options otherwise unseen". (Burt, 2004: 354) Blood's fluid civil allegiance makes him adaptable to geopolitical instabilities.

The seven communities in *The Only Life That Mattered* are no less interwoven. Excepting Captain Jonathan Barnet's social circle portrayed in the mint green gathering, the remainder of the clusters are difficult to disassemble. Ironically, even though Anne Bonny was placed in the care of Abuelita de Jesús (Node 49) and her relatives, the Cuban community of red nodes is actually formed around Mary Read, conveying the impression that Read is more adept at bridging structural gaps in the network displayed in Figure 9.



**Figure 9:** Louvain communities in *The Only Life That Mattered*

It is a little wonder that the characters' immediate environs dictate their affiliations. The nomadic lifestyle of Anne Bonny before teaming up with Jack Rackam places her in the Bahamas-based community on an equal footing with the likes of Ben Hornigold (Node 17) and Governor Woodes Rogers. As an individual with pronounced competitive advantage whose relationships span the structural hole, Bonny can be a strong buffer, disjoining the lawbreakers in Captain Rackam's

company from the authorities. (cf. Burt, 1999: 45) The strategic alliance with her husband, James Bonny (Node 11) aided her in sustaining constructive connections in the Caribbean.

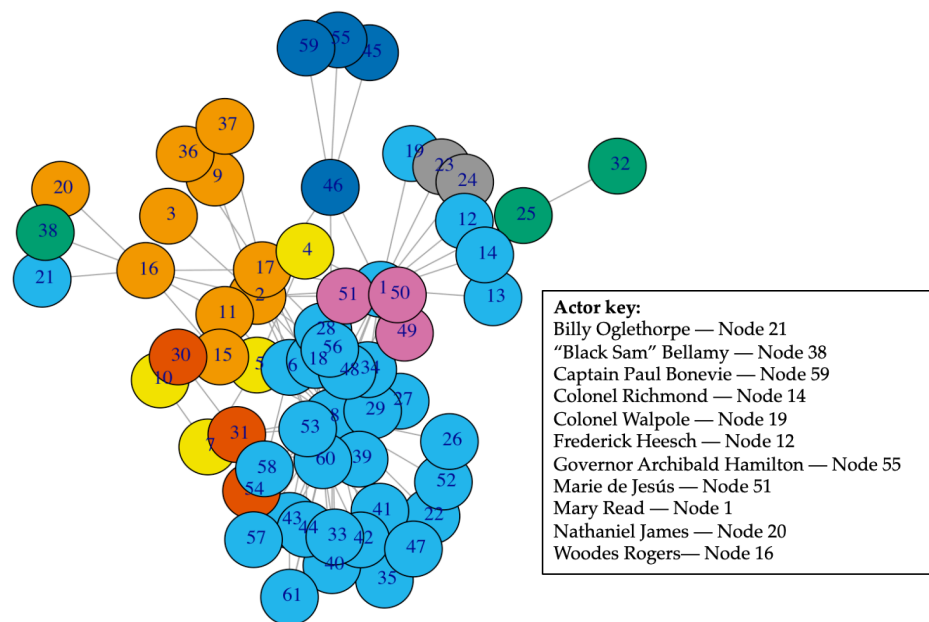
A compelling element of differentiation between the *Captain Blood* data set and *The Only Life That Mattered* is the potpourri of actors that have links to Jack Rackam's pirate vessel. If Captain Blood's crew members were chiefly assigned to the same cluster, then Captain Rackam's rotation of associates throughout his voyages is reflected in the overlapping communities. Whilst the green nodes encompass his trusted companions George Fetherstone and Noah Harwood, Dorothy Thomas (Node 56) is no more than a fleeting acquaintance who, upon release, seeks vengeance by resolutely condemning them all to the gallows. Similarly, the community of blue nodes is interspersed with the loyal Thomas Earl (Node 29) alongside Peter Cornelian and John Besneck, notwithstanding the Frenchmen's abhorrence of the criminal underworld.

In summary, the Louvain algorithm underestimated the number of communities in *The Only Life That Mattered*. The modularity was more or less equal in both data sets. Network size had no impact on the accuracy of the technique, which likewise applied to the Walktrap algorithm introduced in the following subsection. (cf. Yang et al., 2016: 8)

#### **4.1.2 WALKTRAP**

Developed by Pascal Pons and Matthieu Latapy in 2005, the hierarchical agglomerative method measures the distances between nodes as random walk processes. (cf. Orman and Labatut, 2009: 246) Looking under the bonnet, the "random walker moves from a vertex to another in a fixed number of steps", allowing them to be "grouped into communities" in a bottom-up approach comparable to fast greedy, for instance, or Louvain. (Fortunato, 2010: 118) Thus, the intra-community distances are significantly smaller than those joining communities.

Among the obvious pros of this algorithm that detects dense subgraphs within sparse graphs was its unquestionable computational efficiency and the ability to function at various scales. (Pons and Latapy, 2006: 200) The fly in the ointment, however, was that Walktrap assigned one community per node on more than one occasion, boosting the amount of clusters modelled in the novel *The Only Life That Mattered* to eleven, which may have oversimplified the subtleties of subgroup memberships.



**Figure 10:** Walktrap communities in *The Only Life That Mattered*

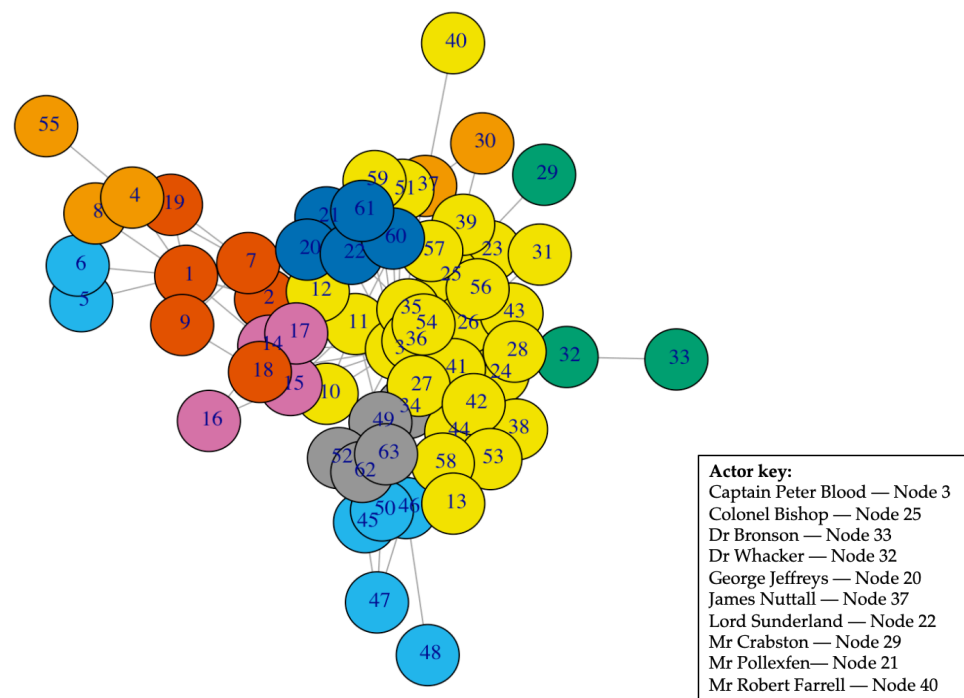
A point of particular interest is the presence of three detached communities around Woodes Rogers (Node 16) on the left. Billy Oglethorpe (Node 21) contrasts starkly against the subgroups of “Black Sam” Bellamy (Node 38 in dark green) and Nathaniel James (Node 20). They do not associate with one another in any capacity. The pertinence of this to the governor’s policy is that he is thoroughly disinclined to put all of his eggs in one basket in his web of informers. Rogers variegates his acquaintances.

Also, a sizeable proportion of the population is depicted in pale blue. The liaison point in the largest community is Mary Read (Node 1, the thread interlacing different individuals), enlarging it by capitalising on human relations that she can singlehandedly control. On account of the “high density of internal edges and consequent number of paths that could be followed”, a random walker requires an extended period of time to travel in the depths of the community. (Fortunato, 2010: 118) As a result, the contention that this community structure is strong can be reinforced.

Mary Read’s former comrades-in-arms discernible in the right sector of the graph including Colonel Walpole (Node 19), Frederick Heesch (Node 12), Colonel Richmond (Node 14) and so forth were not compounded into one sub-structure of the graph, underscoring their differing backgrounds as well as a deficiency in cohesion between the troops in the infantry unit. As opposed to the melting pot of privateers in the light blue community, the tradesmen aboard the *Hoorn* trading vessel, which is where Mary Read was recruited before becoming entangled with Anne Bonny, are relatively autonomous. The algorithm assigned the duo Hans Franeker (Node 25) and Ratten (Node 32) together while Captain Dirk Bes (Node 23) and Claude Waalwijk (Node 24) were arranged as a separate team shaded in grey. A probable interpretation would be that the population aboard the Dutch merchantman is fractured without proper leadership, a vulnerability that cannot be found in Jack Rackam’s crew, despite the captain’s blatant cowardice that irremediably tarnishes his reputation in the eyes of Mary Read and Anne Bonny.

On a different note, Walktrap produced a distinct community stemming from and counting Captain Jonathan Barnet (Node 46). The dark blue conglomeration at the top of the network containing Captain Paul Bonevie (Node 59), Governor Archibald Hamilton (Node 55) and James Spatchears (Node 45) labels the actors as outsiders. Even though they are peripheral to the networked system, their ascendancy should not be underestimated.

Finally yet importantly, communities can be kept within the boundaries of their geographical localities, capping their social interactions with the world at large. The Cuban territory isolates Abuelita and Abuelito de Jesús, as well as their daughter, Marie de Jesús (Node 51), allowing Jack Rackam to preserve his multiple identities in the ports he visits, dissociating his diversions from his occupation. Instinctively, the captain maintains a policy of divide and rule to preserve his power.



**Figure 11:** Walktrap communities in *Captain Blood*

On average, the ten subgroups depicted in the *Captain Blood* network are comprised of a greater quantity of nodes, whereby Peter Blood and his arch-foe Colonel Bishop are both placed in the nucleus of the largest one. The majority of the graph is predominated by the yellow community but it seems appropriate to emphasise that Node 40 at the top is independent. As Blood's proxy, James Nuttall (Node 37) concludes a business transaction with Mr Robert Farrell by purchasing his wherry.

According to the Walktrap algorithm, there is no ground for incorporating Mr Farrell into a larger subgroup .

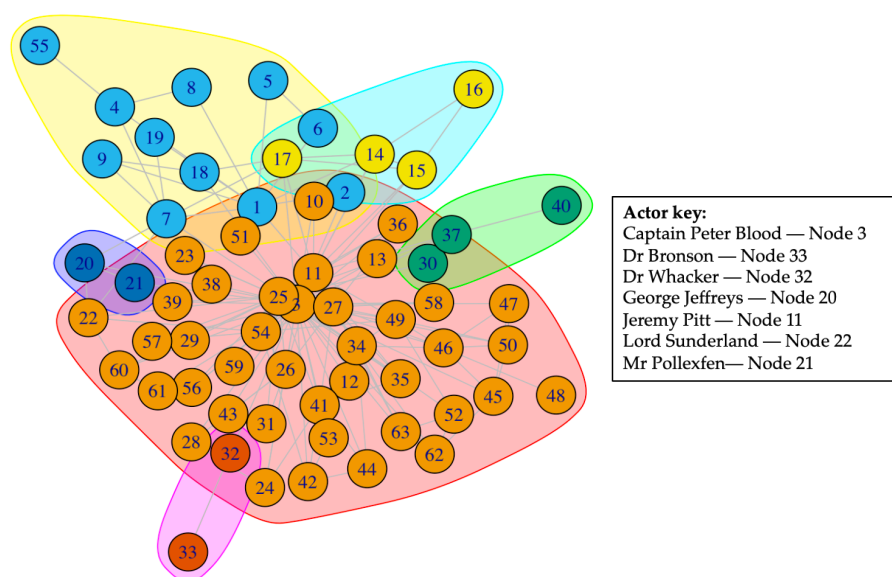
Interestingly, this visualisation delineates Mr Crabston (Node 29) from the rest of the graph. This peripheral character exemplifies one of the “centrifugal threads” of the network by denoting a wide world beyond the main plot line. (Moretti, 2011: 92) He forms a distinct community from that of Colonel Bishop, which could imply that there is a bisection of Barbados between the pair of slaveowners. Monopoly in their separate sectors does not brook competition. Indeed, walks of life are conditioned by vocation. The two medical practitioners, Dr Whacker (Node 32) and Dr Bronson (Node 33) are intimate friends, as evidenced by their green community. They are incredibly wary of newcomers to the island such as Peter Blood, even more so when they deduce his superior professionalism and take note of the preferential treatment he receives from the local administration personified by Governor Steed. Peter Blood poses a growing menace, which forces their hand. The two doctors conspire against Blood.

Comparable to *The Only Life That Mattered*, the conceptualisation of territory as a dividing line applies in Figure 11 as well, as manifested in the dark blue community closer to the top of the graph regarding Lord Chief Justice George Jeffreys (Node 20) and Mr Pollexfen (Node 21), the Judge Advocate, with the Secretary of State Lord Sunderland (Node 22) into the bargain. Location shapes this community. There is not a single episode when either one of these individuals operates beyond their courtroom in Taunton Castle.

### **4.1.3 EDGE BETWEENNESS**

Michelle Girvan and Mark Newman’s metric is the reverse of agglomerative clustering in the sense that edge betweenness commences with one cluster of the data, which is partitioned stepwise. Operating under the assumption that the influence of nodes is best gauged by measuring the flow of information down the

shortest available paths in the network, it is the unique representative of a top-down divisive algorithm in this methodology compilation. (cf. Girvan and Newman, 2002: 7822) Originally, as many as seventeen communities<sup>4</sup> were marked in the resulting visualisation of the *Captain Blood* source material by virtue of computing numerous subgroups that contained no more than one actor. A redefinition of the subdivisions was imperative.



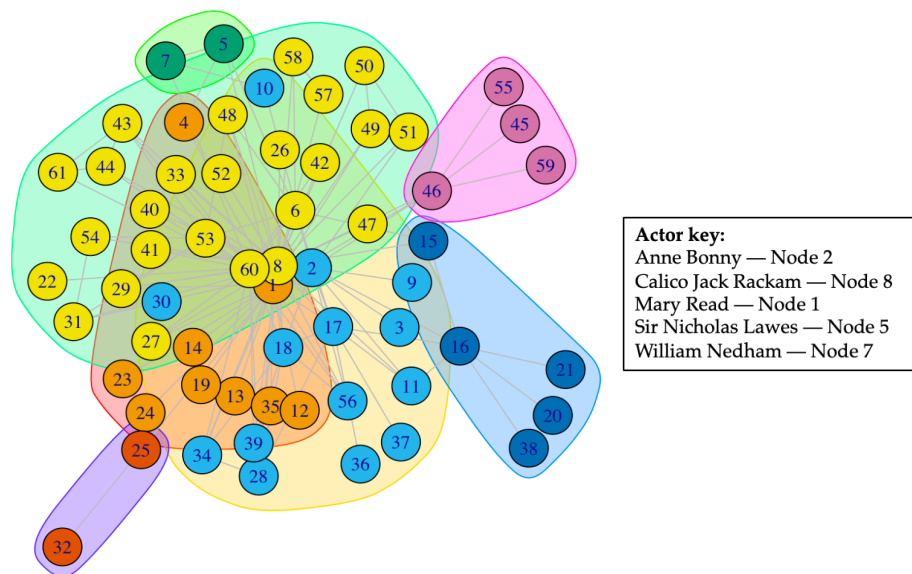
**Figure 12:** Edge betweenness communities in *Captain Blood*

As evidenced in Figure 12, the emended graph that was limited to six communities is dominated by the one in orange with Peter Blood at the heart of the aggregation alongside Jeremy Pitt. This structurally central position of the eponymous protagonist and the aforementioned broker is consistent with the visualisation produced by the Walktrap algorithm in the previous subsection, which insinuates that “they stand between others and can therefore facilitate, impede or bias the transmission of messages”. (Freeman, 1977: 36) Predictably, the doctors Dr Whacker

<sup>4</sup> The edge betweenness computational method for delimiting communities created an excess of subgraphs at the outset, the results of which can be found in Appendix 2.

and Dr Bronson appear to compose a self-contained community in red. Despite the inclusion of Lord Sunderland (Node 22) into a larger cluster, however, George Jeffreys and Mr Pollexfen (Node 20 and 21, respectively) are unwaveringly fenced off from it.

With regard to the second network, as visualised below in Figure 13, the edge betweenness algorithm promptly classed the actors into eight (overlapping) clusters. Compared with the Walktrap algorithm that situated Mary Read and Jack Rackam together in the same community, in the case in question the infamous threesome can be located at the centre of the graph, yet every single main character was allocated to their own community. On top of that, another discrepancy between Walktrap and edge betweenness is that according to the latter algorithm, Anne Bonny rises in the ranks. The female adventurer's community numbers a grand total of thirteen actors besides herself, suggesting that she has quite a following.



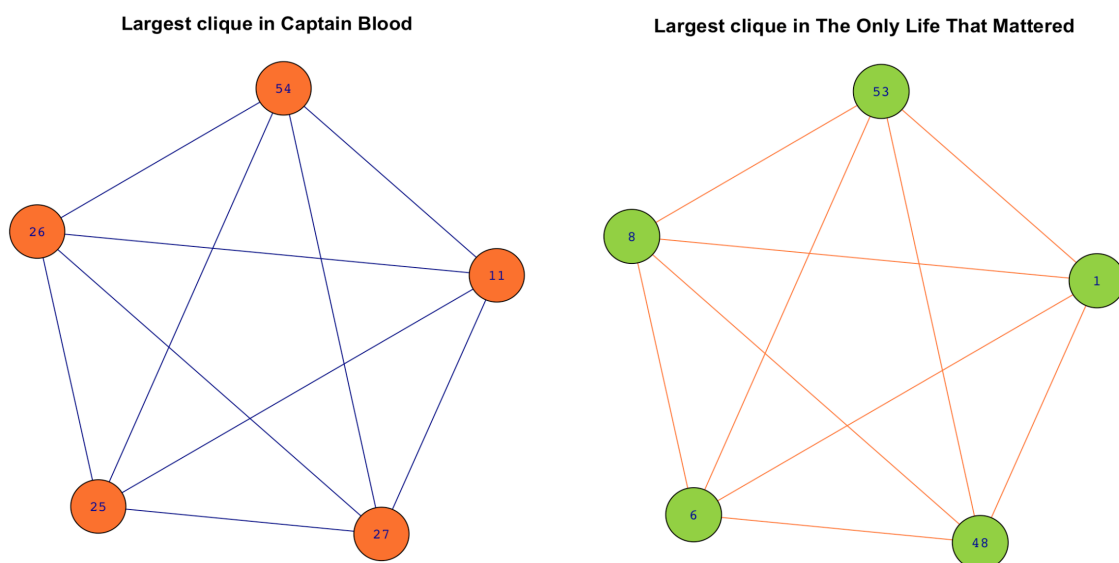
**Figure 13:** Edge betweenness communities in *The Only Life That Mattered*

In conclusion, it would appear that there is as good as no preponderance in influence or access to information concerning Mary Read, Jack Rackam and Anne Bonny in the network of piracy. They are the three pillars of the criminal society and the

obliteration of one member would cause irreparable damage to the ongoing piratical activities. Besides, matching two-person communities of enforcement powers can be distinguished in both of the novels. In *The Only Life That Mattered*, William Nedham and Sir Nicholas Lawes administer punishment for the pirates' many misdeeds. In *Captain Blood*, the same function is fulfilled by the Lord Chief Justice and the Judge Advocate. They are "loosely connected by a few intergroup edges", hence, the information that they gather piecemeal is regulated. (Girvan and Newman, 2002: 7822)

## 4.2 CLIQUES

In the previous sections, it has been established that a single network can be composed of subgroups, one of which has not been expounded upon. Referred to by its somewhat conservative term, cliques require all its members to share a bond amongst themselves. In contradistinction to the community detection algorithms, these types of subgraphs are maximally connected, hence, complete. A function in the R igraph package enabled the largest cliques in the two networks to be located.



**Figure 14:** Collation of cliques

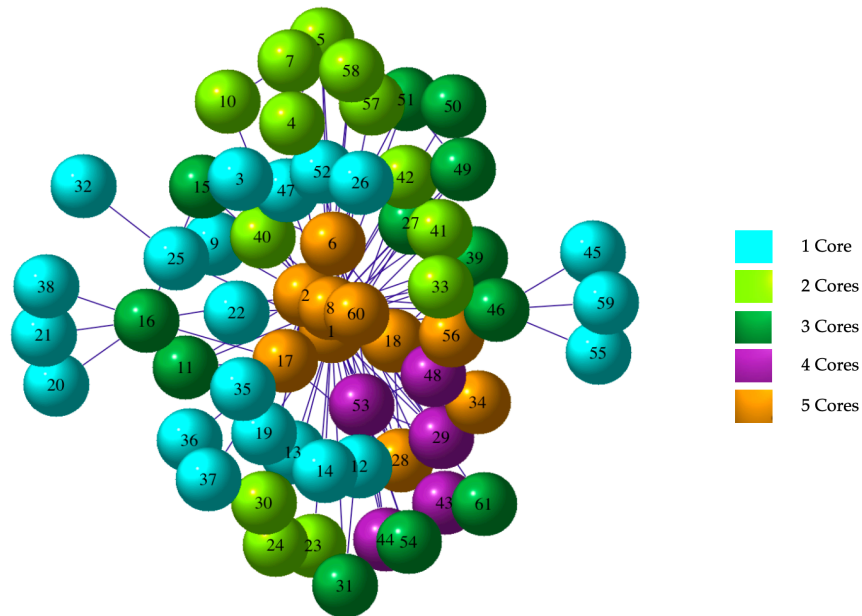
As evidenced, cliques consisting of five individuals are the largest in both data sets. Remarkably, the protagonist is absent from the totally mutual *Captain Blood: His Odyssey* clique on the left of the visualisation, in spite of the fact that all and sundry are brokers of diverse magnitudes. The paths of the prominent Jeremy Pitt and Colonel Bishop intersect with Lord Julian Wade and John Wolverstone. By definition, the act of belonging to more than one such subgroup causes incompatibility — “membership in two cliques would require that all the relationships be mutual and result in the collapse of the two into a single clique”. (Kadushin, 2012: 47)

Two out of the three main characters (Jack Rackam and Mary Read) are represented in the largest clique in *The Only Life That Mattered*. There is a great degree of social cohesion between the first officer George Fetherston, Billy Bartlett and Jacob Wells due to their “frequent, strong, and direct ties”. (Luke, 2015: 106) Additionally, antagonistic relations are made manifest in the cliques that are rife with fissures. The polarity of Mary Read and Jacob Wells on one end counteracts the belligerent (and recurrent) assault of Billy Bartlett (who purveys anarchy, planting the seed of dissent with Read’s reasoning) on the other extremity of the spectrum. In accordance with the opposition in the *Captain Blood* subgroup, neither harmony nor goodwill are mandatory for the high cohesiveness in the above cliques.

### 4.3 K-CORES

A more abstract form of a subgroup would be a  $k$ -core decomposition of a network. It makes an allusion to the maximal set of nodes where each vertex has at least  $k$  neighbours; ergo, the algorithm recursively removes the nodes with fewer than  $k$  connections, enabling the influential spreaders to be ranked. (cf. Malvestio et al., 2020: 1) In the previous sections, both the Louvain and edge betweenness algorithms allocated the three protagonists of the novel *The Only Life That Mattered* into three distinct clusters, in compliance with the hierarchical clustering dendrogram. The Walktrap algorithm placed Jack Rackam and Mary Read in the same community,

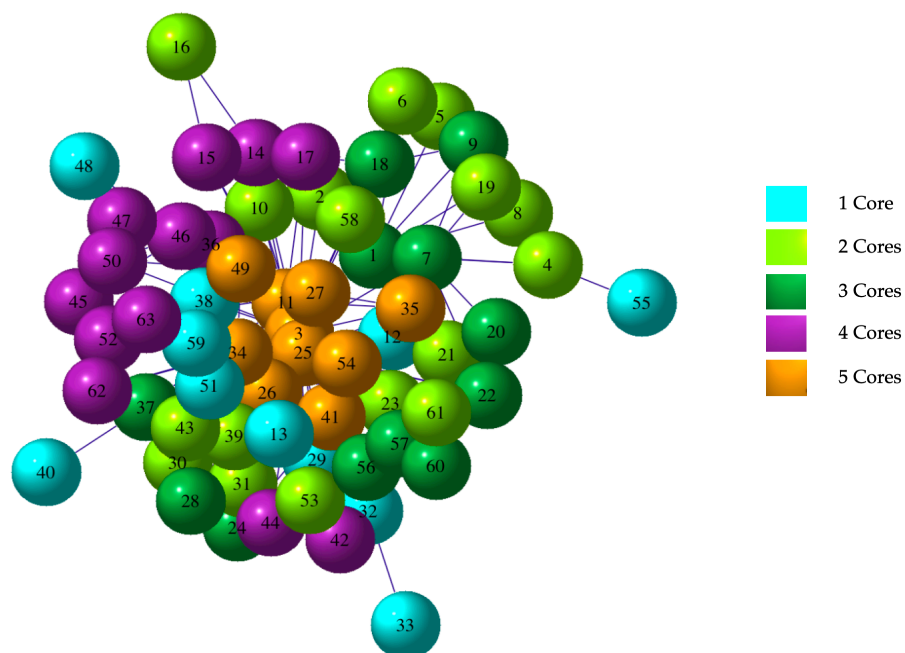
whereas the k-cores visualisation in Figure 15 departed the farthest from the benchmark. Basically, it proposes a new reading with Nodes 1, 2 and 8 crowded at the centre of the red community.



**Figure 15:** K-cores in *The Only Life That Mattered*

Layers can be peeled away from the overall graph for a more thorough review. Filtering out the most outstanding brokers while concurrently running the algorithm on k-cores greater than 3 supplies conclusive evidence of the influence of Ben Hornigold (Node 17), Richard Corner (Node 18) and Mr Norris (Node 60). Thus, Hornigold is granted “control and power [...] by being able to play off others who are more constrained” to their subgroups, but it is Sir John Norris, the Register, who gains access to the concealed knowledge of Jack Rackam’s vendetta against Mary Read, securing his undoing. (Kadushin, 2012: 104) They were all placed in the same central red k-core.

In the *Captain Blood: His Odyssey* k-cores visualisation, the copious contacts cultivated by Blood communicate through him, enabling him to “adjust his image with each contact”. (Burt, 1999: 49) The social structures that define the main character’s latitude in resource acquisition and social control is more than appreciable. As a natural outcome of this room for manoeuvre, the choices that Peter Blood makes within his social world have a ripple effect across the board. As a powerful broker, he has a fair amount of impact on the wider network.



**Figure 16:** K-cores in *Captain Blood: His Odyssey*

Sieving through the brokers and k-cores greater than 3 in this instance as well, two of Blood’s close allies, Nathaniel Hagthorpe and John Wolverstone are recognised as opinion leaders. Although Lord Julian Wade (Node 54) appears to be surpassed by other brokers in terms of betweenness centrality, his k-core score is sufficiently high on account of his role as a “*tertius gaudens*, the third [...] party who draws advantage

from the conflict of the others". (Merton, 1968: 430) By pitting Colonel Bishop and Peter Blood against one another, Lord Wade strives to eliminate the competition. In Figure 16, these notable characters are located in the inner red circle, suggesting that the farther away from the epicentre, the less probable it is for actors to receive news firsthand and without delay — not only are they secondary to the decisions being made by the puppet masters, but their knowledge has to penetrate (a few) middlemen before it becomes even remotely actionable.

#### **4.4 ACHILLES HEEL OF BUCCANEERS**

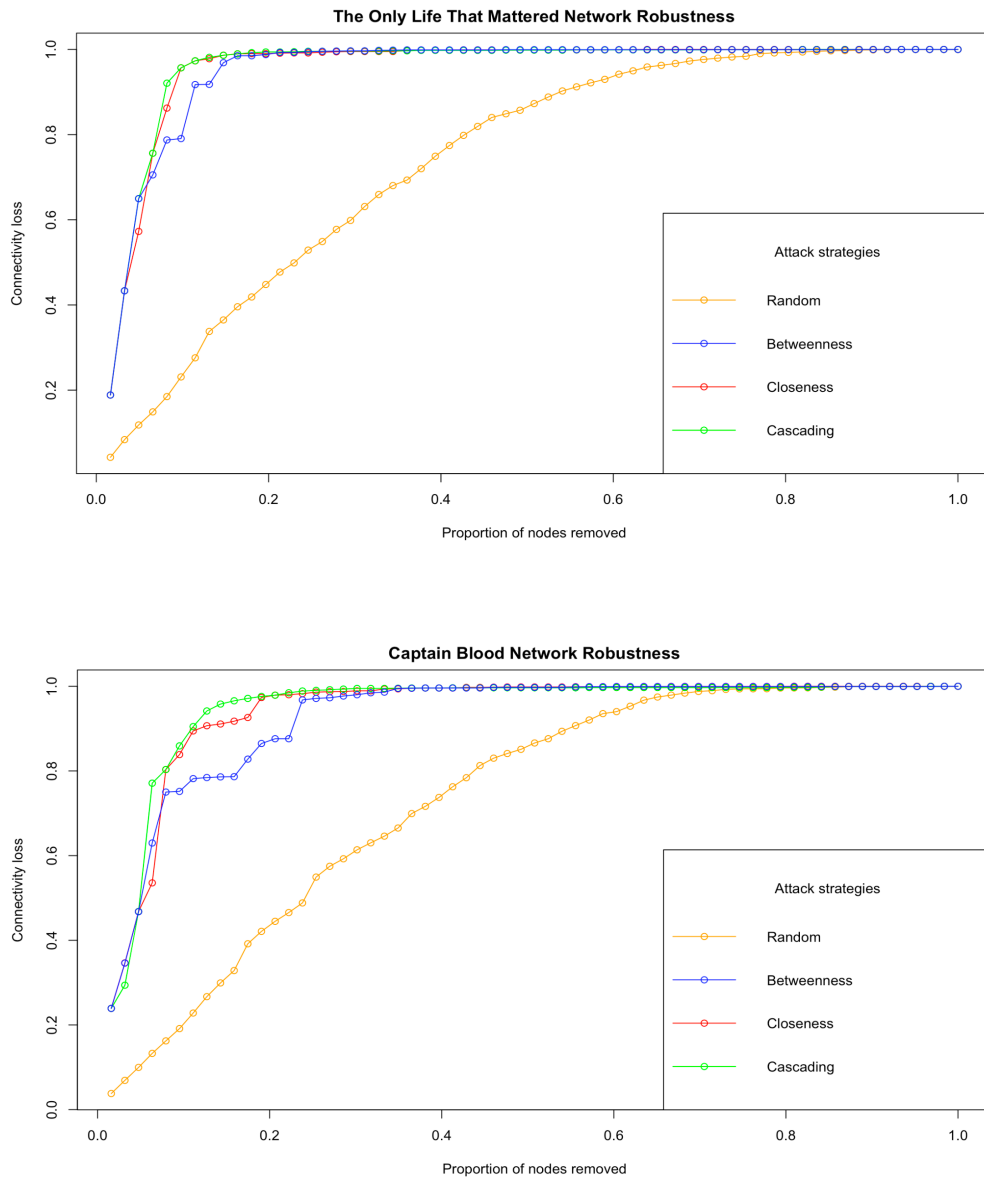
Both of the literary works *Captain Blood: His Odyssey* and *The Only Life That Mattered* can be fundamentally reviewed through the prism of network structures. The two essential elements in this respect are the following: nodes and communities. Whilst the preceding Chapter 3 inspected the predominant individuals acting as brokers in each of the graphs, the fourth chapter assessed communities as elaborate building blocks of social interchanges.

The strength of these dual organisational components serve as a reflection of network robustness, which "is commonly defined as the capacity of the network to maintain functionality (or connectivity) when a sequential node removal strategy (attack) is performed". (Tejedor et al., 2017: 1) Hence, node-based metrics such as degree, betweenness, and closeness centrality effectively highlight the "vertices that most crucially affect the function of a networked system" since high centralities are indicative of great network robustness. (Iyer et al., 2013: 1) The removal of such nodes deranges the structure of the graphs by, for instance, obstructing the smooth circulation of resources, information, along with power. The generated line charts showed, beyond a shadow of a doubt, that node-removal strategies can be employed to affect the robustness of the two networks, signifying that there is a definite order of importance of the actors. The degradation and eventual disintegration of these criminal networks of piracy was modelled.

An algorithm available in the NetSwan (Network Strengths and Weaknesses Analysis) package in R was utilised to perform the robustness appraisal. The methodology behind measuring robustness is that of percolation theory. Network resilience (as well as, to all intents and purposes, robustness) can be evaluated by percolation theory by concentrating on the structural qualities, namely the connectivity of the assorted components. (cf. Dong, 2018: 6911)

In the case of the two complex social networks, four divergent attacks were chosen for the percolation process, which can be found in the plot in Figure 17 below. Expanding upon the concisely outlined attack strategies demonstrated in the legends, the orange lines represent random removal (each node is attacked with equivalent probability); the blue lines correspond to node removal based on betweenness centrality; the red lines designate nodes targeted based on closeness centrality. The green lines labelled as ‘cascading’ synthesise betweenness and random node removal. The loss of connectivity alludes to the absence of a path between actors.

Regardless of the dissimilarities in the two piracy networks, an analogy can definitely be made in terms of the robustness. The connectivity loss indices, which reflect a decline in the quantity of relationships that exist between the nodes when components are sequentially deleted, exhibit a rapid decline after a critical value of approximately 20% of the nodes are removed by three attack strategies (betweenness, closeness, and cascading) in the *Captain Blood* network. The proportion of nodes that can be excluded before the onset of a drastic effect on *The Only Life That Mattered* network is even lower. Succeeding this pivotal point, three of the attack strategies attain a complete loss of connectivity, implying that the actors in the two novels fracture into several isolated constituents.



**Figure 17: Comparative network robustness**

Conversely, when a random attack is applied, both of the networks remain rather robust in the face of node failures. The line graphs illustrate that absolute connectivity loss only occurs in the range of 60% to 80% of nodes removed. Ergo, the destruction of what may, on the surface, appear to be a negligibly small portion of nodes lies at the root of irreversible damage to the networks. Brokers and characters with a high closeness metric represent the finite fraction of nodes that can be

removed before high-priority links are broken, before information fails to be transmitted, before resources can no longer flow as freely as feasible. The elimination of a handful of powerfully influential brokers and sustained network robustness are mutually exclusive. On the other hand, when viewed from the perspective of law enforcement (or rivals, for that matter), the pirate networks can be counterpoised by targeting the commanders and the captains. A calculated and deliberate strike against the most active members of the pirate crews will have dire consequences for the integrity of the networks, seriously impairing their ability to wreck havoc on the high seas.

## 5 CONCLUSIONS

To summarise, the data sets gathered from the two literary sources were, in the first place, examined through the lens of graph cohesion, inclusivity, and completeness. Having established that the social networks in question generally exhibited a lower density owing to a combination of factors — the finite social capital at the actors' disposal as well as the hefty population size amounting to upwards of 60 characters — the basic building blocks were considered. Triads were calculated by the local clustering coefficient. Transitivity detected the structural holes that were entirely unaffected by closure in order to get a first impression of actors of note.

All in all, an inspection of the influential characters revealed that a high degree of centrality is virtually synonymous with brokerage potential. Three centrality measures were computed: degree centrality, betweenness, and closeness. In *Captain Blood*, the protagonist exerts the greatest dominance on the network due to his leadership qualities and social bonds. Nevertheless, it would be unwise to underrate the potentialities of William Bishop and Jeremy Pitt. Power is not equally distributed among the main characters in *The Only Life That Mattered*. Ben Hornigold is an *éminence grise* on the governor's tight leash, whereas legal proceedings emphasise the involvement of the Register Sir John Norris in the latent campaign for control over crime.

By and large, brokers not only act within their social world, but also actively shape it by benefiting from the bridges they contrive. Brokerage is paramount for perceiving the transmission of ideas (as in the case of a pirate expedition or political alliances) in conjunction with the formation of new relationships that can impact an individual's actions in the foreseeable future. Intermediaries are able to spur on an unabated confrontation between adversaries whilst facilitating various interactions and linking otherwise disparate communities, as demonstrated by the actor Jeremy Pitt, who was identified as a proficient broker.

John Wolverstone and Nathaniel Hagthorpe, who may have remained unnoticed during a close reading, emerged in the social network analysis as opinion leaders consolidating Peter Blood's command. A point in common is that in both networks, women such as Arabella Bishop and Mary Read are vital for the general cohesiveness of the graphs. Brokers in *The Only Life That Mattered* opt for a division of their spheres of influence. Financial incentive is proffered by officials in exchange for information supply, as exemplified by Woodes Rogers. To sum up, the structural distance between actors sets the stage for the organisation of subgroups and the dissemination of news. Information leakage is reined in by the closeness of actors.

Overall, the promulgation of political agendas leave an imprint on community structures. A benchmark in the form of agglomerative hierarchical clustering was introduced for the models. Community detection algorithms that analyse the internal and external connections in networks were put to the test. Thus, the Louvain method (a modularity-based greedy technique) unveiled the political unions where nationality played a decisive part in inclusion. As a result, brokerage flourishes on this testing ground for informational arbitrage among political supporters, yet territorial principles impinge on the interaction between communities. It was likewise validated that protean membership aboard the vessels makes or breaks piratical careers: in the case of Jack Rackam, the absence of a cluster of trusted crewmen that would be set in stone places both him and his partners in crime in jeopardy. They are assailable from the outside, whereas Blood's impenetrable core of sailors is his copper-bottomed guarantee against perfidy. Despite the underestimated number of communities, the Louvain method accurately plotted the three protagonists in *The Only Life That Mattered* into three disparate clusters, as per the hierarchical clustering approach. Edge betweenness grossly overestimated the quantity of communities in the Blood network, but aligned with the Louvain algorithm on the second try.

With respect to the outcome of the Walktrap algorithm, the derived communities differed from the rest. By comparison with the hierarchical clustering dendrogram, the dynamic approach caused an overestimation. In *The Only Life That Mattered*, the communities reflected the diametrically opposite backgrounds of certain individuals. As demonstrated in both of the networks, the key to productive pirate raids is not steadfast loyalty, but firm leadership present within the community. It can be deduced that the brokers ride on the coattails of their associates.

In conclusion, the strength of the main characters in the novels can emanate from their embedding in local and, perhaps more importantly, distinguishable communities. This is best demonstrated in *The Only Life That Mattered*, where the three protagonists (who are each powerful in their own right) were classified into distinctive subgroups by two out of the three community detection algorithms, which was in sync with the hierarchical clustering benchmark. They are not confined to their social spheres but are free to roam in several, providing these actors with a trump card that is second to none.

Finally, the maximally connected five-person cliques of the two data sets were modelled, underlining the role of brokers in the two novels anew. It should be stressed that the ties within these subgroups are perfectly compatible with disputes. By taking a marginally different approach to identifying influential spreaders in the networks, the k-core visualisations can be regarded as rings of enlightenment, with the inner circles of brokers, protagonists, and powerful personages micromanaging the outlying actors, for whom the spread of information can run the risk of becoming a game of Chinese whispers through repetition, repression, revision.

Though the data sets were curated by the authors' intentional narratives, the social network analysis visualisations illuminated the role of specific characters in pivotal exchanges, alongside the partitioning of the pirate crew into unexpected partnerships. Homogenous tendencies and trends could be observed in the behaviour of pirates in both of the literary works, which were likewise unforeseen.

In a nutshell, the robustness of the networks based on percolation theory was computed by subjecting them to specific node-removal strategies, allowing the deterioration of criminality to be envisioned. According to the connectivity loss indices, the elimination of brokers and characters with a high closeness centrality catalyses the irremediable ruptures of piracy networks.

In summary, this thesis can serve as a backbone for future studies. A thorough examination of hubs can further expose the immanent vulnerabilities in criminal webs while the strategic positioning of actors in networks can likewise be inferred from visualisations of so-called articulation points. Last but not least, blockmodelling can be applied for distinguishing regular equivalence from structural equivalence based on the actors' similar positions and roles.

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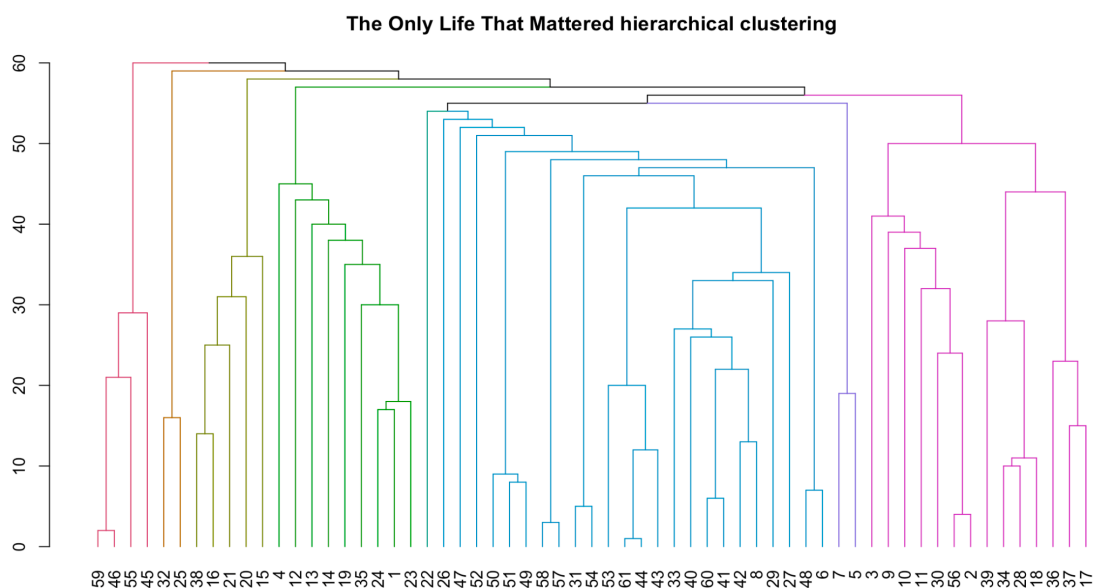
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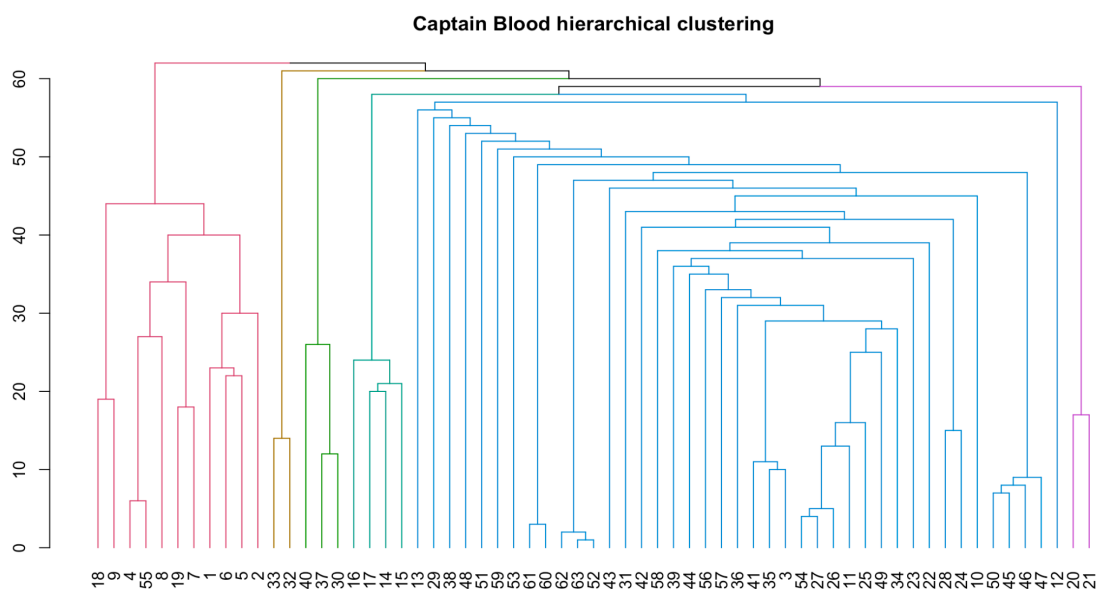
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## APPENDICES

### APPENDIX 1



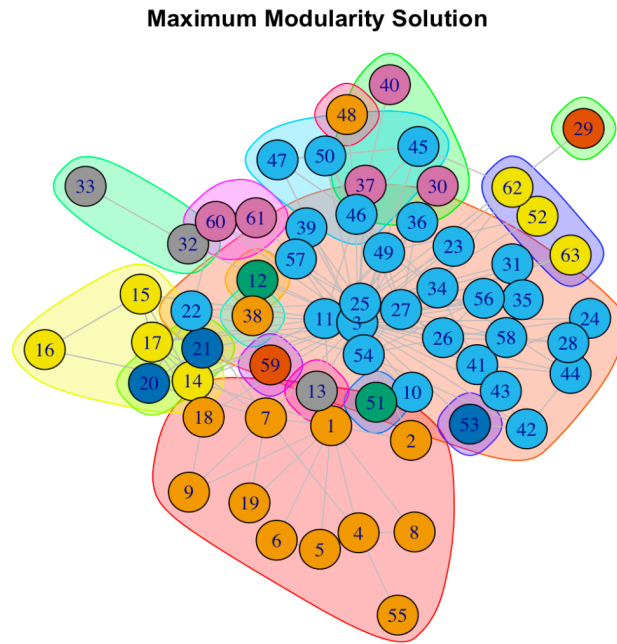
**Figure A.1:** Agglomerative hierarchical clustering of *The Only Life That Mattered*



**Figure A.2:** Bottom-up hierarchical clustering of *Captain Blood: His Odyssey*

## APPENDIX 2

The first attempt at detecting communities in the *Captain Blood: His Odyssey* data set using the agglomerative edge betweenness algorithm produced seventeen subgroups, as presented below.



**Figure A.3:** Edge betweenness trial run of *Captain Blood: His Odyssey*