Together but not mixed: Dynamic and social networks structures in the Constitutional Convention in Chile 2021-2022

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Data Analytics

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Together but not mixed: Dynamic and social networks structures in the Constitutional Convention in Chile 2021-2022

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Abstract

Chile has been on a journey of 20 years since it started to feel the first cracks in the political system inherited by the military dictatorship. After the massive protest in October 2019, the need for a new Constitution was obvious. During 2021-2022 a group of 154 members are discussing and writing the new Constitution in Chile. The Convention is an unusual effort on political tradition in Chile and the most important process in the last 50 years. This paper is a contribution to understanding the Convention work based on the co-voting range to describe the alliances and agreements reached, and at the same time be a valuable contribution to the Computer Social Science as a academic field and the social network analysis an invaluable method for this purpose.

Key words: Computer Social Science, Political Network Analysis, Social Network Analysis, Constitution, Convention, Chile.

Contents

1 Introduction

Since the last massive protest occurred in October 2019 in Chile, the country has experienced an unprecedented democratisation process to the journey to write a whole new Constitution by an elected Convention. The Convention is very unusual because it is a collegiate body with complete freedom to define its own operative rules and members with no previous links or trust to do collective action.

In May 2021, a Conventional member election occurred. As the election result, the citizens preferred independents and people not related to any political party majorly (Fabrega; 2022). This result cracked the political parties system, new groups emerged and reduced the electoral expression of hegemonic forces during the 90s and 2000s decades. Also, the Convention was not just unprecedented, but it started with no previous formal or informal experience, and the collective action had to start with personal preferences and no shared agenda or any political acervate.

A complex brunch of questions appears in this completed new context, and many current political and social circumstances are defining the future of the political system architecture. Moreover, practices, trust and alliances of these groups represented in the Convention will be the base for new partnerships changing the composition of the political system after the process. For this reason, the relevance of studying how the Convention works is invaluable.

Using the available public information, we scraped all the votes related to decisions made in the full sessions. There are 4,708 voting instances. We obtained the particular vote per each of the 154 members of the Convention in each voting. This project goal is to answer to the question: How can social network analysis be employed to build a network using the range of co-voting to describe the alliances and agreements reached in the Constitutional Convention in Chile?

In the next section, I will present an exhaustive literature review going through the sociological and political background of the problem, the innovation using public data available and the enormous contribution of Social Network Analysis (SNA) in describing this political experience.

Finally, this research contributes to the political network analysis field and the significant implications in Chilean institutional architecture. Moreover, The Convention will set a political precedent for conflict resolution in modern democracies with high standards of inclusion and participation, becoming a standard reference for any other political dispute. Technologies and the availability of data allow analysis in situ of the most relevant socio-political event in the history of a country as a unique opportunity for researchers and a valuable contribution to the Computational Social Science (CSS) field (Lazer et al.; 2020).

2 Literature Review

2.1 Chile: the journey to a new Constitution

Chile had lost worldwide notoriety as the model by which a developing country can become developed. During the last decade, Chile has faced many political and social crises since the student social movements in 2006 (secondary) and 2011 (universitarian), but especially after the massive social protest in October 2019.

(a) GDP per capita: Chile vs. Latin America 1960 to 2016

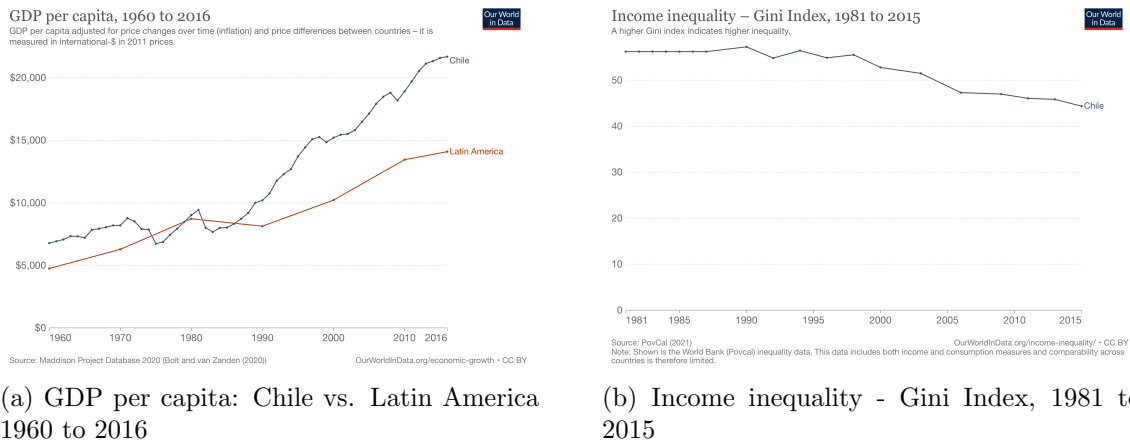(b) Income inequality - Gini Index, 1981 to 2015

Figure 1: GDP and Gini Index Chile

Source: Maddison Project Database 2020.

2.1.1 From the dictatorship to the Democracy transicion

In their history, Chile got relevance for being an example in different opportunities; such as in 1970 voting -the only democratically elected- Marxist president, 1973 a coup by Military Force and the following authoritarian military dictatorship for 18 years, but also in 1988 for rejecting in the referendum the extension of the military regime and starting the transition to democracy and presidential and parliament election held next year.

During the 80's decade, Chile was the laboratory for several liberal reforms in the economy. This model administered during the '90s, by the democratic governments made the Chilean economy perform very well. For instance, Economic growth of 7% on average between 1986-1996 and 4% 1999-2019. The main achievement was that the country reduced poverty levels from 39% to 14% (-25 points), and also improved many social services in Health, Education and Household areas. This process was called the "Chilean miracle" (see Figure 1), and placed Chile as the lead country in the region (DeGregorio; 2004).

However, the trade-off for the democratic transition and political stability was the 1980s Constitution which established the political structure after the military regime. This Constitution was designed for avoiding social change and having a rigid structure, establishing a binomial electoral system and locks to exclude other political expressions, designated parliamentarians (including militaries) and supermajority quorums in especially matters. For this reason, the democratic transition has been called a "protected democracy".

2.1.2 Big Protests: Time for a change

While the rising middle class experienced better quality of life levels than the previous generation, the "middle-income trap" has become the challenge that the Chilean society was not been able to face. If a developing country cannot improve the economy from the extraction of natural resources to a more complex economy, the economy can have a boomerang effect.

Chile had many expressions of this crisis, mainly through student movements and protests in 2001, 2006 and 2011. The student movement cracked the political order

with new leaders outside the previous binary political model. It showed the limits of the political system neutralized by a constitutional artefact that makes social change impossible into institutional boundaries.

In 2014, Michelle Bachelet had her second period as president in Chile. If the social protection programme characterized her first government, this second period promised deep reforms in the political system, especially in terms of education, political system, constitution, and inequality. During the first year, she makes essential reforms in the political system, changing the rules of the game (Gamboa and Morales; 2015), presenting the tax reform and the educational reform to the secondary level.

However, after the first summer, the political power vanished due complexity of the reforms, the difficulties in the parliament process to approval and a scandal in her family, which affected the heart of the government staff. Many other reforms were not successful, and the final failure of the government was losing the elections with a wholly broken coalition.

In October 2019, Chile experienced the biggest protest in history. People claims against the sensation that nothing will be changed and against a political class that talked about a country that was not the one people lived in. However, after the collapse of the political institutionality, many political actors such as political parties and individual parliamentarians from all political ranges agreed. The political agreement set up the rules and times that a new Constitution would have. Months later, 80% of the population said they wanted a new Political Constitution voted in the most massive referendum (Verdugo and Prieto; 2021).

2.1.3 Constitutional Convention: A new hope

In May 2021, Chile voted and chose the people member of the Constitutional Convention. From July 2021, the Convention has a year to work on a proposal for the New Constitution to sets up all the rules and the architecture of the political architecture, which will be voted in a new Referendum.

This kind of process is uncommon in the compared literature and Chile became a pioneer in facing this complex political process. The Convention is representative of Chilean diversity in society. The 155 members elected, included the indigenous population slots, and real gender equality with a system that guarantee the same proportion of males and women (Heiss; 2021).

Furthermore, this process was running in parallel to the normal political cycle and it does not affect the normal process in Chilean democracy. During this time Chile voted for the new President in November-December 2021, and the elected government inauguration was due on 11 March 2022. Finally, at the end of the process, the proposal for a new Constitutional text would have to be approved in the "exit plebiscite" on the 4th of September 2022.

2.2 Political Network Analysis

Political Network Analysis as part of the Computational Social Science framework is a synthesis of two traditions. This paper is valuable as a contribution to the social science field by using innovative methods and analytic resources to real political and social issues, especially in the Latinamerican context.

On the other hand, Social Network Analysis (SNA) has been raised as the most appropriate approach for describing society in the information era. The well-known sociological fact is that community is more than the simple sum of people and the relation between them is the emergence of reality. The exploration to research these social relations under this framework is an invaluable output for social science in the modern era (Nicoll et al.; 2018).

2.2.1   Sociological framework: the emerging dimension

From the sociology perspective, Emile Durkheim described Society as an emerging reality. This conception was essential for his theory of the Social Facts (Durkheim; 1895). However, Durkheim had a blind spot in describing Society as a whole, under this view it was impossible to describe the relations among groups or small portions of the groups and explain the interaction among people or groups, which has been one of the primary tasks of the discipline.

In summary, the influence of Durkheim established the bases of a deductive perspective and the development of an empirical approach to Social phenomena. Also, the quantitative methods have been highly improved by the development and combining interpretative skills, vast epistemological methods and techniques for obtaining information, and advanced statistical methods and software.

Nevertheless, the information era has set a huge challenge for sociology to explain the contemporary social context and how social relationships are being redefined with the uses and influence of digital devices, big data, and the internet.

2.2.2   A new context: the era of Data

Data Analytics and Data Science has been one of the most important fields in the last ten years due to the exponential production, storage and analysis capacity. The role of electronic devices in our daily lives had an unprecedented change, making our lives more effortless than ever before. However, all these changes occurred faster than the critical analysis of their consequences can be considered.

This fact opened new opportunities for understanding our social system using this data and a new field known as Computational Social Science (CSS) (Conte et al.; 2012). The CSS use concept of "digital footprint" to denote people's interaction with software running on any device. The time spent on a website or mobile app, the photograph or video that we shared or liked, and the click made or search in the engine. All use devices and technology correlate in an automated register of our actions, and it can be defined as our digital footprint.

This unprecedented context comes with many challenges that require some effort about resources, rules, incentives, and innovations to develop (1) strengthen collaborations, (2) new data infrastructure, (3) ethical, legal and social implications and (4) Reorganize the university and the public and private collaboration to solve real-world problems (Golder and Macy; 2014; Lazer et al.; 2020).

On the other side, in politics, the information era has brought the possibility of transparency levels, tracing and public scrutiny of political activity. The public accessibility of this data, official records, performance or the activity of the political system is possible be considered as a footprint of the political system. That marks the breakpoint concerning traditional methods and introduces the use of new methods to describe social phenomenons from a novelty perspective.

2.2.3 A new perspective: Social Network Analysis

Social networks such as Twitter, Facebook, or Instagram made evident that we live in networks, a very complex net of relationships. Before the social network applications that was conceptualised in the sociological field describing the interaction between humans and devices is obliged to redefine "the social dimension" from a theoretical effort like Bruno Latour Latour (1993) and his Actor-Network Theory (ANT) redefining the social condition not just among humans but among humans in relation with devices, objects, ideas and institution in a complex network.

From an empirical perspective, the definition of social networks has tried to represent relationships and the strength of the links among a human group. In the academic field, the emergence of data orientated for CSS was much slower, even when it was occurring in the big tech companies (Lazer et al.; 2009).

The link between the micro-macro link-level defines the potential of this perspective in social science (Stadtfeld; 2018). It is possible to represent dynamics and interaction between individuals with very high precision. One classic example is trying to replicate the dynamic of the "peregrine falcon" using three simple rules at the micro-level: (1) Do not collide with the neighbour, (2) follow your closest neighbour, and (3) Do not fly out of the group [1] [2].

Being inspired by Intal and Yasseri (2021) is possible to use SNA of votes considering individual interaction between members and compute pairwise similarity scores to define discipline in each votation. Other examples of uses of SNA in political describind co-voting patterns, cohesion (Cherepnalkoski and Mozetic; 2015; Cherepnalkoski et al.; 2016), polarization effects (Praet et al.; 2021) or discursive analysis using networks analysis (Leifeld; 2013; Leifeld and Haunss; 2010; Leifield; 2020).

The social network approach has been a predilect technique for CSS, with a recent interest for the appliance for evaluating policy outcomes, relations between institutions national and international, and the role of the stakeholders (Kovács; 2016; Buckton et al.; 2019; Wang; 2020).

The Constitutional Convention itself is an extraordinary case for describing a political group because it is (1) A closed and undirected network of 155 members, (2) Proportionally members represent all territories of the country, (3) has reserved slots for indigenous communities, and (4) Gender equality. Being -in theory- the best measure of the whole diversity in the Chilean society and just this characteristic itself become this group is an attractive object for research.

In conclusion, the network analysis applied to social science is a revolutionary change in how we describe society. The famous German sociologist Niklas Luhmann (Baraldi et al.; 2021) described society not as relations between people, but instead as communication and interactions. But the theoretical effort was lack of a proper method. The SNA is a candidate to fill this gap and redefine the social science research practises (Patty and Penn; 2018). Then the main objectives of this project are (1) to obtain a sources of useful information to build a network, (2) to process this information from an explanatory SNA perspective, and (3) to give insights of political alliances and agreements in the Convention work getting the main measures of the network.

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[1] The natural phenomenon `https://www.youtube.com/watch?v=8SZ07K3cg0k`

[2] And the simulation exercise `https://www.youtube.com/watch?v=zQhEGPrINJo`

3   Research Methodology

3.1   The process of research: KDD - Knowledge Discovery from Data

In this project, I will use the KDD (Knowledge Discovery in Databases) methodology to analyse the votes in the Convention **?**. That involves the following steps:

- **Selection of the target data set:** I focused on finding a data set that gives us all the information of the votes in each full session of the Convention and also personal information about each member of it.

- **Data Understanding:** At this stage, I analyse what and in which format the data is to clean and wrangle and define the set of possible variables to use in the analysis.

- **Data preparation and Exploratory Analysis:** In this step, I checked the data quality and the number of missing values or duplicates. Also, we prepared preliminary visualisations for describing some characteristics of the network as part of the Exploratory analysis.

- **Defining the feature matrix:** At this step, I could take all necessary for building the final matrix, which will be used in the final network analysis. It included the last changes to the data for producing the cosine similarity matrix, which will be the base for the network definition.

- **Modelling:** At this stage, I applied the network analysis using the library "Networkx" in Python over the cosine similarity matrix built in the last step. We are involved in an iterative process for interpretability to get the proper thresholds to visualise the network.

- **Evaluation:** At this step, I compared and evaluated all the main insights from the network analysis, which helped describe the Constitutional Convention network and apply the final adjustments before the presentation. In this step, we can observe all the potentiality of the SNA for describing the political phenomenon

- **Presentation:** In the final stage, I selected and improved the past visualisation and decided on a better way to present the new knowledge in a clear and understandable story.

A structured summary of all the above steps is depicted in the figure 2:

Figure 2: Knowledge Discovery from Databases (KDD)
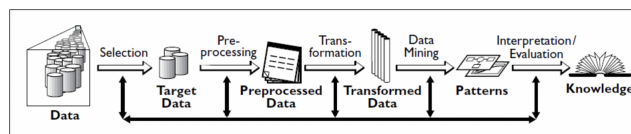
3.2 The process of obtaining the data set

I obtained the data sets using web scraping techniques using "Beautiful Soup" python's library from two different sources:

1. National Congress Library[3]: from here, I obtained all the names, biographic information and more for each of the Convention members.

2. Open Data service from the Convention website[4]: it is a public service to request information about the Convention performance, it is possible to request: a list of names, attendance and votes for commissions or get names, a list of sessions, attendance and votes of each full session. The service retrieve the request in the formats "HTTP get", "HTTP post", "SOAP" or even an excel file.

To address all ethical concerns involved in the research, I used the Active Transparency System (ID: NR009T0000619, Resolution number: 443) available to request public information. The resolution was that I could use the data as is driven by Law 20,285[5] about Transparency and Access to public information. Moreover, the Convention Regulation in articles 3 and 48 sets the principles of "Disponibility of the Information".

Furthermore, this project was inspired by other similar paper research that uses political actor's information for analysing, such as Lan and Shah (2013); Dalege et al. (2017); Brito et al. (2020); Intal and Yasseri (2021); Fabrega (2022) with no ethical issues for using the public names.

3.3 The process of analysing: Social Network Analysis

As an answer to the research question in the introduction, the main objective of this research is: to build a network using the range of co-voting to describe the alliances and agreements reached in the Constitutional Convention in Chile.

The data set obtained in the previous steps is helpful in address this goal for two main reasons. Firstly, the data set with biographic information give us many variables for improvements in the analysis, such as political party adhesion or occupation. Secondly, the data set of all the personal votes in the 4,708 full sessions of the Convention gives us 729,740 rows. After transformation, we obtained a data set with a shape of 155 rows per 4,708 columns. With the data transformation of the cosine similarity matrix, we got a data set of 155 per 155 with values between -1 for total dissimilarity to 1 for complete similarity.

The concept of similarity here is essential. It can be interpretable as the covariance between two members. In other words, as the percentage of instances in which conventionals vote the same. Looking at the network shape is possible to identify who took roles as a bridge between connections, who followed the majority, who was isolated, and who was in a central position in this network.

Finally, it is this effort to describe political events using social network analysis which endows this research with all the novelty and potential impact of the academic community.

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[3]https://www.bcn.cl/historiapolitica/convencionales_constituyentes/index.html
[4]https://www.cconstituyente.cl/datosabiertos/Pleno/getVotacionesPleno.aspx
[5]https://www.bcn.cl/leychile/navegar?idNorma=276363&idParte=8564031

4   Design Specification

The Design Specification involves four steps for the given solution to address the research question. These are Data Collection, Data Wrangling, Exploratory and Descriptive Analysis, and Social Network Analysis.

4.1   Data Collection

As it was mentioned before, the primary technique at this stage is the Web Scraping of the two public websites. Using Python's library "Beautiful Soup" I got the content of the website and later parse the data to access all the elements. The code was developed to get a list of lists in this stage, with this we are able to extract the exact elements that we need to obtain two data frames: a summary for each vote and the result (See Table 1), and the main data set with the ID session vote and particular vote of each Convention's member (See Table 2).

Table 1: Data Frame summary of results per each Vote

	id_vote	date	topic	final_result
0	0005_0866	2021-07-13T17:01:29	Obligatoriedad de practicarse examen PCR.	APROBADO
1	0005_0865	2021-07-13T16:55:58	Texto del Protocolo propuesto por el Colegio M...	APROBADO
2	0007_0901	2021-07-14T22:07:21	Colectivo Socialista.- para reemplazar, en la ...	APROBADO
3	0007_0900	2021-07-14T22:02:41	Mov. Sociales y Lista del Pueblo.- Para inter...	APROBADO
4	0007_0899	2021-07-14T21:57:14	Frente amplio +.- Reemplazar "terna" por "quin...	RECHAZADO

Table 2: Data Frame for each member vote in each session

	id_vote	name	vote
0	0005_0866	Abarca González, Damaris	AFIRMATIVO
1	0005_0866	Abarca Riveros, Jorge	AFIRMATIVO
2	0005_0866	Achurra Díaz, Ignacio	AFIRMATIVO
3	0005_0866	Aguilera Hey, Tiare	AFIRMATIVO
4	0005_0866	Alvarado Jorquera, Gloria	AFIRMATIVO

Finally, accessing the other source, we use the same technique, but in this case, the web scrapping obtained a list of names and personal profile websites for each member, and just after that a developed code is going through all the aspects of biography data (See Table 3).

4.2   Data Wrangling

At this stage, we evaluate the three data sets and checked for inconsistencies. For example, in the summary of results data frame was identified as duplicate cases in the session 82 and 85, votes 3947 and 4237, respectively.

It was not common, so I went deeper and after a visual inspection of the data sources it was identified duplicate information in the source itself, so for this research project we dropped the duplicates, this procedure had to be applied to the data frame with all the individual results as well.

Finally, the last step of this stage is to transform the data frame with all the votes in the format long to wide. The format wide is useful because it cleans up the information

Table 3: Data Frame for each member with biographic information

name	Damaris Abarca González	Jorge Abarca Riveros	Ignacio Achurra Díaz
url	https://www.bcn.cl/historiapolitica/convencion...	https://www.bcn.cl/historiapolitica/convencion...	https://www.bcn.cl/historiapolitica/convencion...
info_wiki	Damaris Abarca González (Rancagua, 27 de febre...	Jorge Abarca Riveros (Arica, 8 de enero de 196...	Ignacio Achurra Díaz (Santiago, 17 de octubre ...
family_youth	Nació el 27 de febrero de 1990, en Rancagua. E...	Nació el 8 de enero de 1967, en Arica. Es hijo...	Nació el 17 de octubre de 1979, en Santiago. E...
education_job	Realizó sus estudios básicos en la Escuela Man...	Se tituló como Profesor y Licenciado en Biolog...	Realizó sus estudios básicos y medios en el Co...
political_trayectory	Es independiente. Fue dirigenta en el marco de...	Es independiente. Ambientalista, se desempeña ...	Es militante del Partido Convergencia Social. ...
topic_interest	Los ejes de su propuesta se centran en la búsq...	Sus áreas de interés se centran en que la nuev...	Buscará cambiar el actual sistema de gobierno,...
commissions	En el proceso de discusión de los Reglamentos ...	En el proceso de discusión de los Reglamentos ...	En el proceso de discusión de los Reglamentos ...
date_birth	27 de Febrero de 1990	8 de Enero de 1967	17 de Octubre de 1979
profession	NaN	Biólogo	Actor
district	15° distrito	1er distrito	14° distrito
political_party	Independiente	Independiente	Partido Convergencia Social
twitter	http://twitter.com/damabarca	http://twitter.com/Jorgeabarcaxv	http://twitter.com/IgnacioAchurra

to 155 rows (each Convention member) and 4708 columns corresponding to all the single votes. Moreover, I replaced all the text information to numerical values 1 vote "Yes", -1 for vote "No", and 0 to "abstention" or "no vote".

4.3 Exploratory and Descriptive Analysis

This section is an effort for describing the basic insight from the three data sets, such as the number of members belonging to a political party.

However, the main part of the section was an exercise to determine who were the "winners" and "losers" of the Convention. It is defined for the number of events in which the individual vote correspond to a winner vote, in other words, it counts every time that someone vote Yes or No, and the result was Yes or No, respectively.

This simple exercise gives us an oversight idea about how was the percentage of success that members of the convention experienced during their performance. Furthermore, this analysis is substantial because it is plausible to understand the group of the winners as representants of the gravitational alliances inside the Constitutional Convention.

4.4 Social Network Analysis

This section starts from the wide version of the final data set with all the individual votes per all the instances in the full session of the convention. Given that, the next step is to build the matrix which defines the network relationship between nodes.

For this, inspired by the work of Intal and Yasseri (2021) we use the Cosine Similarity Matrix, which returns values between -1 to full dissimilarity to 1 for full similarity. It is possible to see the relation using a heatmap function from the library Seaborn. In mathematical terms, the Cosine similarity is a projection of a pair of vectors in multidimensional space (Intal and Yasseri; 2021), the result is a square matrix and the formula can be expressed as follows:

$$\frac{a * b}{||a||||b||} = \frac{\sum_{i=1}^{n} a_i b_i}{\sqrt{\sum_{i=1}^{n} a_i^2} \sqrt{\sum_{i=1}^{n} b_i^2}} \tag{1}$$

The new Cosine Similarity Matrix has a shape of 155 rows per 155 columns, which contain the values of similarity between the members (nodes) and the values of the relation (edges). This is one of the predilect formats using the API-library Networkx available for Network Analysis in Python.

Moreover, the next step is to determine the threshold of these relations (edges), in order to weigh the strongest of the relation in the matrix for better visualisation. Once, the

data set is interpreted for the library we can apply all the statistical functions available, such as centrality, robustness, and others.

5 Evaluation and Result Analysis

The distribution of the Convention composition is diverse, as was said in the Introduction (1). The novelty was the considerable presence of Independents with 86 members, and no political party or group had more than 11 members (see Table 4). Also, no political group in the classical classification left-right has more than one in third of the total members, which was a guarantee of dialogue for any deal requested.

Table 4: number of members by political party belonging

Political Party or group	N	Political Party or group	N
Independiente	86	Partido Por la Democracia	1
Unión Demócrata Independiente	11	Pueblo Diaguita	1
Partido Socialista de Chile	10	Pueblo Atacameño	1
Renovación Nacional	9	Pueblo Chango	1
Pueblo Mapuche	7	Pueblo Colla	1
Partido Comunista de Chile	6	Pueblo Rapa Nui	1
Revolución Democrática	4	Pueblo Kawashkar	1
Federación Regionalista Verde Social	3	Pueblo Quechua	1
Pueblo Aymara	2	Republicano de Chile	1
Partido Evolución Política (Evópoli)	2	Partido Demócrata Cristiano	1
Partido Convergencia Social	2	Pueblo Yagán	1

The data collected shows a total of 4,708 instances of the vote during the entire session of the Convention. There only 1,899 were approved and 2,809 rejected (see Table 5). It is important to highlight that the Convention worked with a particular rule: "all the votes approved had to be by a quorum of two in third", which means at least 103 votes of 155.

Table 5: Votes results during all sessions

|	
Rejected	2,809
Approved	1,899
Total	4,708

5.1 Winners and Losers

Although the fact that the analysis focuses on the covariance of the votes. It means how a pair o group of members vote the same in a particular instance. Therefore, it is interesting to see who can be considered the Winner or Loser of this Constitutional Convention.

It is measured as the number of times that the individual vote corresponds to the final result (2/3 of members). For example, in Figure 3 presents the performance of the political party, it is possible to note that political parties such as "Partido Comunista", "Partido Socialista", and "Revolucion Democratica" were the most influential groups with high performance with 6, 10 and 4 members, respectively.

It was plausible to think that because of the irruption of independents in the Convention, this group could have a more ordered and coordinated action. However, the

Figure 3: Political party by performance in the Convention

Political Party by perfomance in percentage
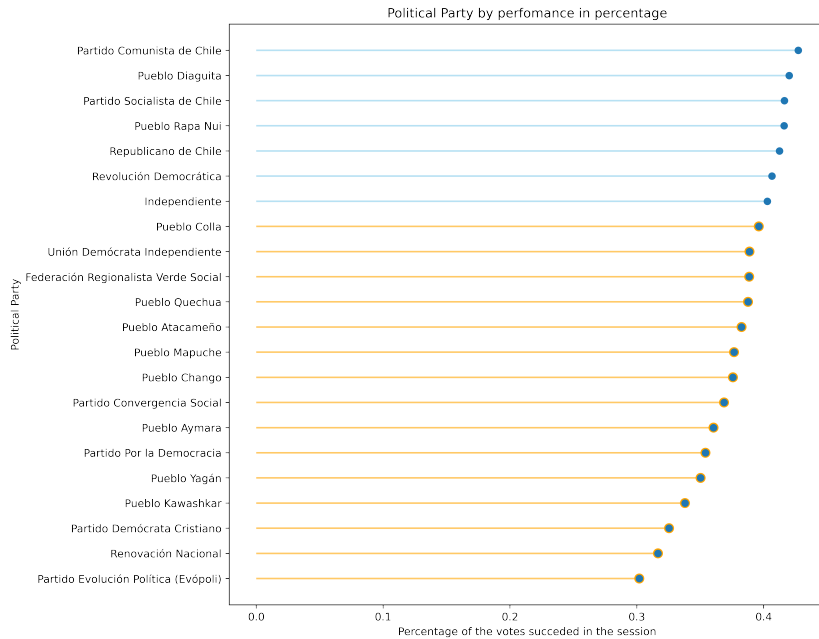
performance of the 82 independents by performance. There 39 independent members had performed below 40% of win-votes.

5.2   Social Network Analysis: Measures

Graph theory is an essential part of Complex Network Analysis. The word "complex" means that the network has a non-trivial structure (Zinoviev; 2018). For instance, every node has two neighbours in a ring network, which is considered a simple structure. However, the Convention's network structure is complex in shape and strength of connections that define the relationships among members as co-voting similarity measure. There closer nodes are higher correlated and the transparency of edges represent the strength of the link.

The figure 4.1 is probably the most important as it shows the network structure of the Convention. Because the Convention Network is undirected, in theory, every member is related with all the other, but for constructing the network was considered only the edges over 0.3 in the cosine similarity measure.

The central insight is the shape itself, there is possible to identify -by visual inspection- the intensity of the links with dark edges and two poles of dense cores with relations among conventionals, a third group of people in the centre of the network connecting these two extremes and the fourth group of people in the borders of the densest core from a visual inspection. So then the four groups shown are:

1. Gravitational/Majoritary group

2. Opposition

3. Bridge

4. Satellite

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Other option is clusterise using an algorithm available for this purpose, as shown in the figure 4.2, using the "Greedy modularity" which use the Clauset-Newman-Moore greedy modularity maximization to find the community partition with the largest modularity, which is a measure of the strength of division of a network into modules (Hagberg et al.; 2008). The result shown that the network can be described as only three groups or communities operatives in the Convention. However, I have chosen an interpretative approach based in the visual inspection and political knowledge.

Figure 4: Network graph of Constitutional Convention

(1) Network clusterisation by visual inspection

(2) Network clusterisation by Greedy modularity
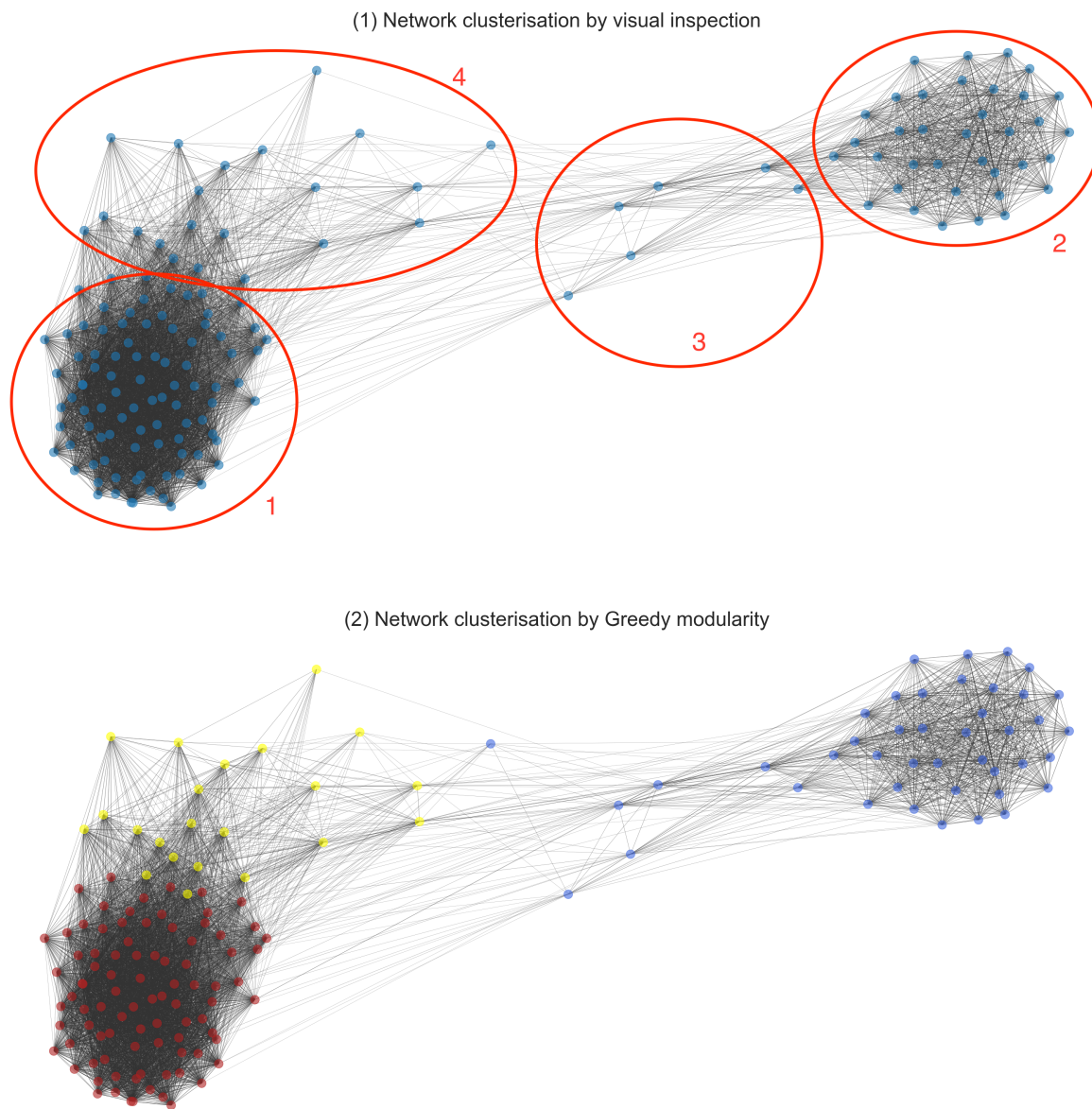
As general description, the Convention has 154 nodes and a total of 6,070 edges, with a density of 0.515. The density is the fraction of existing links out of all possible edges, it means that only half of all possible interactions between members had 30% or over in the co-voting similarity.

An important measures is the centralities of the network. The degree of centrality is the number of edges a particular node has. A node with a high degree of centrality may

be capable of affecting a lot of neighbours at once (see Figure 5 - 1). It confirmed the presence of two poles: the gravitational and the opposition.

The harmonic centrality is defined as the reciprocal mean distance from a node to all other reachable nodes in the network. Values closer to 1 mean that the node is a hub of the global star and is one hop away from any other node (see Figure 5 - 2).

Betweenness Centrality is the measure of the fraction of all possible geodesic that passes through a node. If the betweenness is high, the node is potentially a crucial go-between and has a brokerage capability. The removal of such a node would disrupt communications (see Figure 5 - 3). There is no many nodes with the characteristic of brokerage, which confirms the polarisation of the network.

Finally, the eigenvector centrality defines nodes surrounded by other nodes with high eigenvector centrality. This measure helps identify groups of interconnected nodes with high prestige (see Figure 5 - 4).

Figure 5: Centrality measures of the Convention network
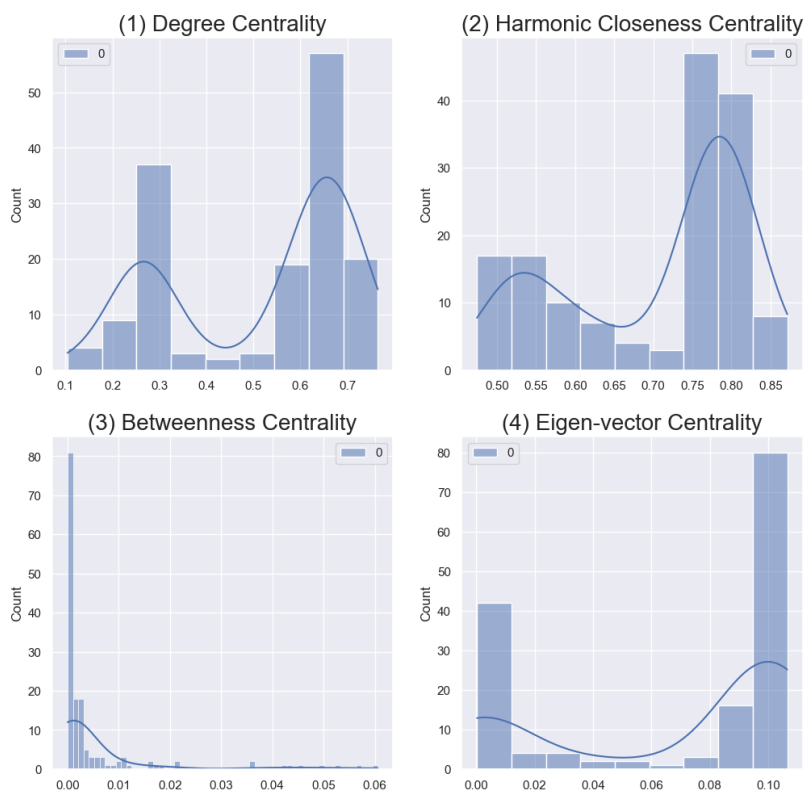
5.3 Social Network Analysis: 4 examples

This section presents four examples of an extension of the network analysis to particular members of the Convention. As shown the Figure 6, I have chosen one member of each group previously mentioned. The idea es to explore the particular network under the concept of neighbourhood.

The elements such as node, edges or density are aspects of the macro level network properties. Still, the relations at the micro level -at the level of the individuals- focus on individual nodes and their neighbours. Then, the neighbourhood is the set of all nodes adjacent to a particular node. This concept is particularly relevant in SNA because it is the level of relatives, close friends and colleagues (Zinoviev; 2018).
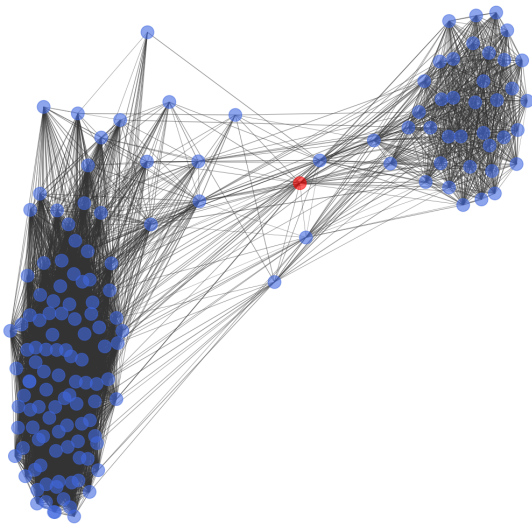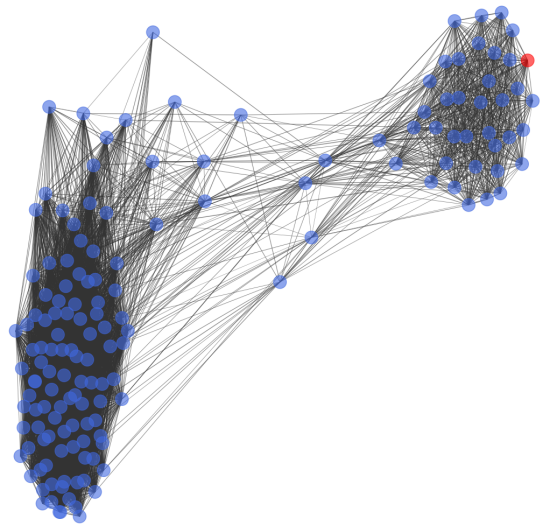
Figure 6: Position of case selected in the network
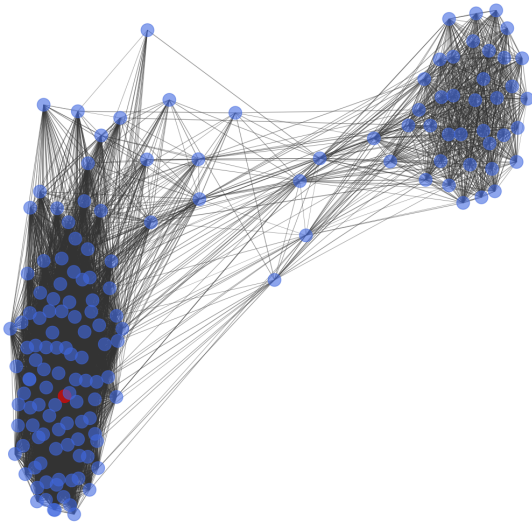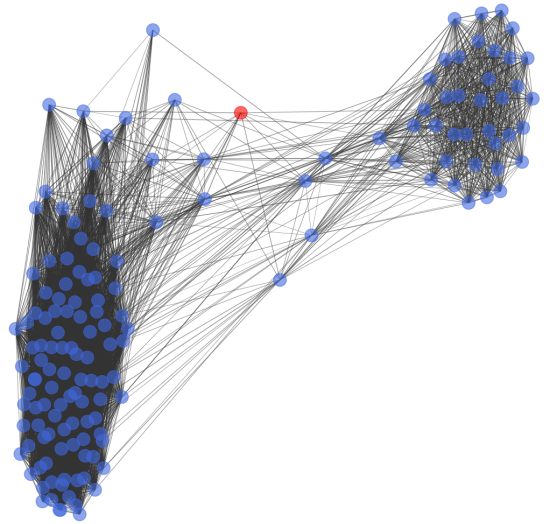
The results in Figure 7 show a clear difference in neighbourhoods for each member (ego network). The member "Adriana Ampuero" has a central position in the densest area of the network, fully connected. However, it is not possible to say that she plays a gravitate role in the network, rather than she is in the majority position as part of the mass.

On the other hand, the member "Agustin Squella" has far less dense links and also fewer connections with others in the Convention. This isolated position diminished the possibility of a play a significant role in the network.

Thirdly, "Fuad Chahin" seems to be very well connected with two other groups in the network. However, the position of the bridge in the network is fragile as he does not have many connections with the densest part of the network that concentrate the political majority.

Finally, the member "Martin Arrau" is a perfect exponent of the fourth group, which is dense among itself but has no relation with nodes outside this primary network (neighbourhood). Therefore, it can be easily interpretable as a pole of opposition to the political forces of the Convention.

Figure 7: Neighbourhood of Ego-Network

(1) Adriana Ampuero

(2) Agustin Squella

(3) Fuad Chahin

(4) Martin Arrau
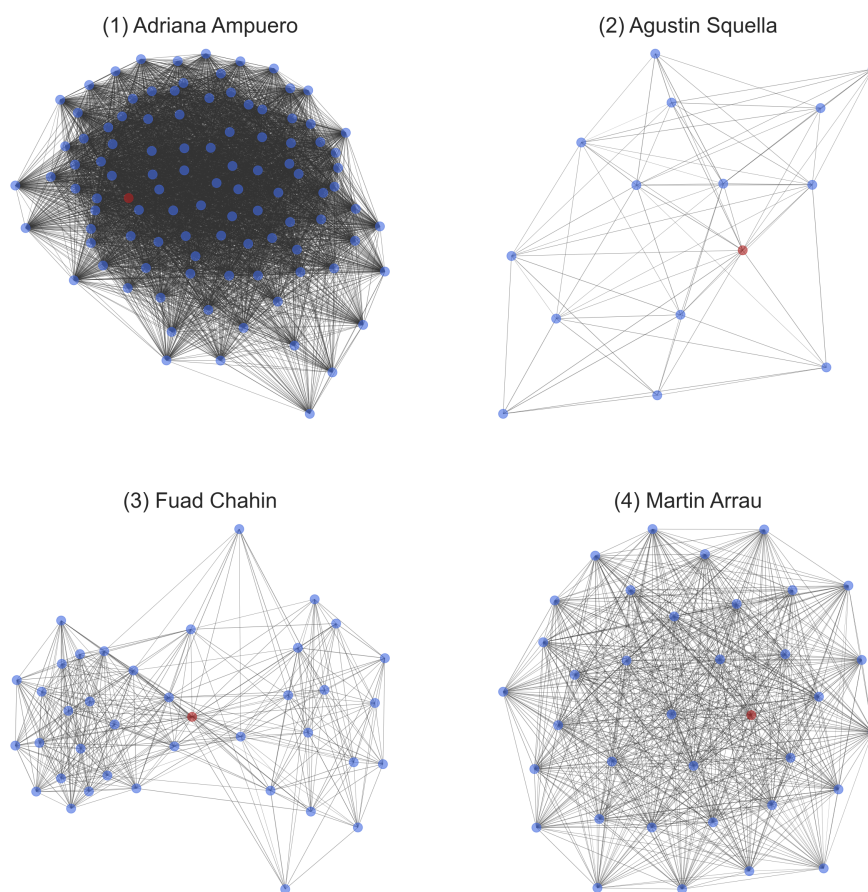
6 Conclusion and Discussion

This project was presented as an effort to join two traditions, such as sociology and political science and the effervescent fields in the information era facing the challenge to use Network theory to describe a political phenomenon.

Describing the Constitutional Convention in Chile using Social Network Analysis is not only possible. If not that, valuable and fruitful. The flexibility and set of tools available under social network analysis are fully applicable.

The graphical analysis showed that the dynamics and the correlation of political forces were synthesized in four groups:

- Gravitational/Majoritary: this group is characterized by the core with strong links among members, being a gravitational force in the structure of relationships in the Convention.

- Opposition/Endogamic: the group is the opposite pole of resistance to the gravitational force of the Convention. This group is mostly endogamic with no relations outside itself.

- Fake Bridge: a third group is located in the middle of the network. However, they do not have an important role as suggest the position as political bridge between two extremes. It is a middle position between two groups, but weak influence to the core of the network and lack of political influence, reducing the influence just to few members of the Convention.

- Periphery or Satellite: there is the group surrounds the gravitational group, which supposed a important position. But the links among them are not closer enough to belong the gravitational group and no significant influence neither. This satellite position gives to this group some autonomy, but at the same time the focus of their relationships is absorbed by the gravitational group.

In conclusion, the Convention is a very unusual collegiate body that defined the operational rules and procedures by itself. The election cracked the political parties system with almost half of the members being outsiders, with preferential slots for indigenous communities and gender equality. These elements were the source of hope for a new Constitution written in democracy, but the data shows that the dynamic of alliances and political loyalties were polarised and unproportioned. A big group of the members had gravitational control and used this position, while other groups had to take the role of satellite, outsider or opposition.

Describing the Convention in these terms gives an interpretative framework to understand the polarised public opinion around the new referendum. On 4th September, the Chilean people have to vote to approve or reject the proposal. However, whichever will be the result seems to be far from the 80% of people's support at the beginning of the process. And this research helps to understand the reasons for that.

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