

Communities of competitors : The social network of french Go players

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ABSTRACT

The french community of Go is a highly interconnected world, where everyone is on average only 2 relations away from any other player. Composed of 10 communities with various number of players scattered throughout the country, those communities are mainly formed due to two factors : The geographical location and level of the players, but a third and less obvious factor seems to be involved, as some communities are sometime composed from two or more regions which are on opposite parts of the country. While some communities will extend to wide geographical area with multiple go clubs, some other are composed of only one or two clubs on very restricted area. However, although there is 10 defined communities, those are not segregated as there is a lot of interactions between the different communities, with some communities more sociable and other more reclusive.

1 Introduction

1.1 The game of go

Amongst the hardest of ancient board games, there is the famous game of chess (aka : the game of kings), which is probably the most famous board game in France, with the reputation of requiring a lot of strategy and thinking. But there is another one which is considered even more complex : The game of Go.

Also called "The surrounding game", it is known as "Baduk" in Korea, "Weiqi" in China or even "Igo" in Japan. The game of Go is a very old board game (Papineau, 2000) where two players (white and black) fight on a goban, not for the capture of a king, but for territory. While computers were able to defeat professional human players at chess since 1997 (Pandolfini, 1997), Go professionals were still stronger than the best computers as it is supposed to require a lot of instinct and no computer had the capacity required to get the upper hand with go complexity. It took 19 more years and the arrival of artificial intelligence for a computer to win against professional players of Go, when Google's AlphaGO defeated Lee SEDOL in 2016 (Silver et al., 2016).

Even though it is still not as famous as chess in France, Go increased in popularity among the recent generations, mainly due to two factors :

- The release of a famous manga about Go (*Hikaru No Go*) between 2002-2007 in France
- The media success of google's AI victory in 2016,

It is now quite a famous game, with a lot of clubs in most countries, where player can learn, improve or just gather and play for the fun of it. Lots of tournaments are also planned within and between countries for players of different regions, countries or continent to meet each other and allow a great variety of opponents with different styles and strategies.

1.2 The french go network

The French Federation of Go (FFG) is a big community of Go players spread across France and split into 77 clubs and local branches (93 officially, but some of them no longer existing, as for example the club of "Charleville-Mézière", still referenced on the website of FFG, but with 0 members, and the person in charge being registered in another club for the year 2022). During the year 2021-2022 there was a total of 1417 persons who played in tournaments registered on the [FFG website](#) (including some non-french players registered in another country), with 66 french clubs involved out of the 77, for a total of 16082 games played in tournaments. Those clubs and local branches are grouped into 10 districts (Figure 1) : 9 geographical districts with each multiple club and local branches (Ligue Rhône-Alpes, Ligue Île-de-France, Ligue de l'Ouest, Ligue de Normandie, Ligue du Sud-Ouest, Ligue du Centre, Ligue Méditerranée, Ligue de l'Est, Ligue du Grand Nord), and an online district (Ligue de Go en Ligne) with the online go club. The world of Go is often perceived as a small world in the way that a major part of the players all know each other due to the many tournaments and other events organized throughout the year. However, no study to date has been performed on Go populations, and the dynamics of this network is yet still unknown.

1.3 Social network studies

In social network analysis, a community is a set of elements or individuals that have close interactions with each others. Different metric are observed, such as the closeness centrality, the degree centrality and the betweenness centrality (Zhang and Luo, 2017). The closeness centrality is a distance (or degree of separation) referring to the number of people needed to connect two persons who don't know each other, also called the shortest path of individuals between 2 persons. In the outside world, it is theorized that all humans are separated from any other person on the planet by an average of 6 relationships, more famously known as the 6 degrees of separation, popularized by Duncan Watts (Newman, 2000). Some more

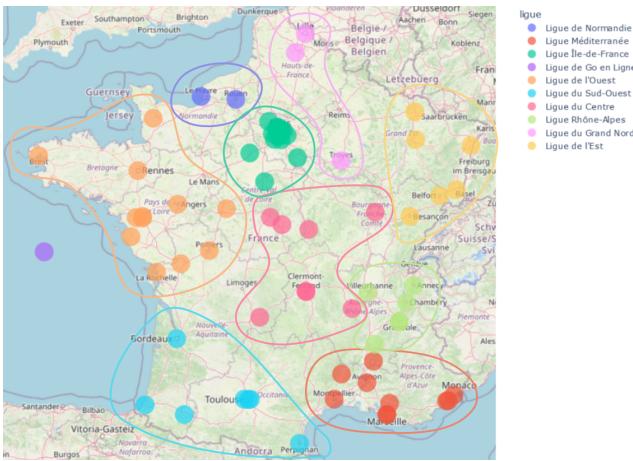


Figure 1. Geographical representation of the 10 districts with the club that form them. Each circle represents a club or local branch. More clubs are officially registered but here are represented on the map only those for which a player engaged in an official tournament during the year 2021-2022. The club of Troyes is referenced as part of the Ligue du Grand Nord on FFG website, while the city belongs to the "Grand-Est" region that is covered by the "Ligue de l'Est" district. The online district (Ligue de Go en Ligne) is represented in the middle of the Atlantic ocean, as it is linked to no geographical place.

recent studies on twitter users indicate that people on twitter are on average separated to every other users by only 4 degree of separation (Ediger et al., 2010). The lower this number, the higher the people are connected to each other.

The most obvious division of Go players communities would be the different go clubs scattered throughout the country. Every club forming a community where its members interact with each others almost every week, and have less interactions with people from other clubs. However, this is not the only interaction people have in Go, and some other representations might give a different vision, and probably an even better representation of Go players interactions in the country.

Because go players interact with people across the whole country in officials tournaments, it would be interesting to investigate the social network of players from different cities to have a better visualization of what the network of Go players really looks like.

In this study, we will investigate the structure of this network through the interactions people have in tournaments, whether there is specific communities of players that do not interact with each other or if Go really is a small community where everyone is tightly linked in the network.

2 Results

2.1 Dynamics of french Go tournaments

Before digging into the soical network of Go and the relations between players, it is interesting to note that this network has been increasing in the last decades. As we can see Figure 2A, the number of official games played, gradually increased over the years, with the exceptions of the infamous covid years. It is noteworthy to underline that the number of players involved in tournaments registered by the FFG increased progressively until it stabilized around 1800-2000 players on the years 2007-2008, which correspond to the years the manga *Hikaru no go* ended. In 2022 (from 09-2021 to 08-2022) a total of 16082 game were played, which is similar to the pre-covid years. However despite there are as many official tournaments game played as before, the number of individual players stayed quite low after covid (1417 in 2022) when those numbers were above 1900 the 2 consecutive years before covid, and were never seen below 1500 since the year 2003-2004 (date of arrival of *Hikaru no go* in France). Thus, this indicates a great rebound from the go population who engaged in more tournaments than before despite fewer players being officially registered.

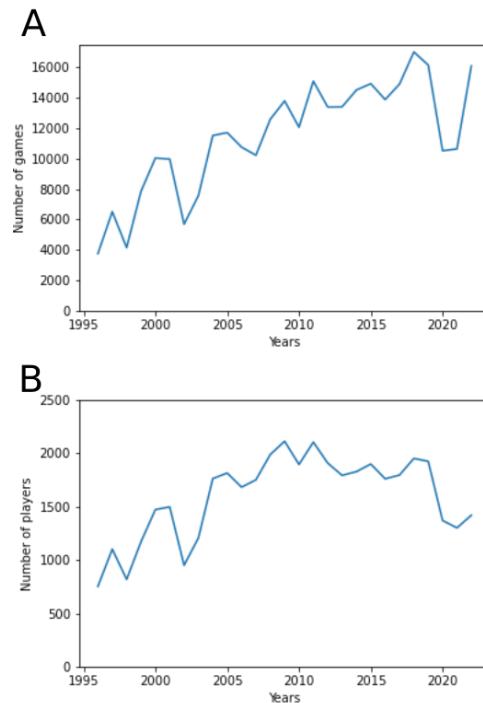


Figure 2. A) The number of officials match played and registered by the FFG increased along the years, while **B)** the number of players kept increasing until 2007-2008 then stabilized until covid. The number of players represent the number of person recorded for which the game was recorded by the FFG each year (including some player registered in other countries if they played in tournament present on FFG website)

2.2 Distance between players

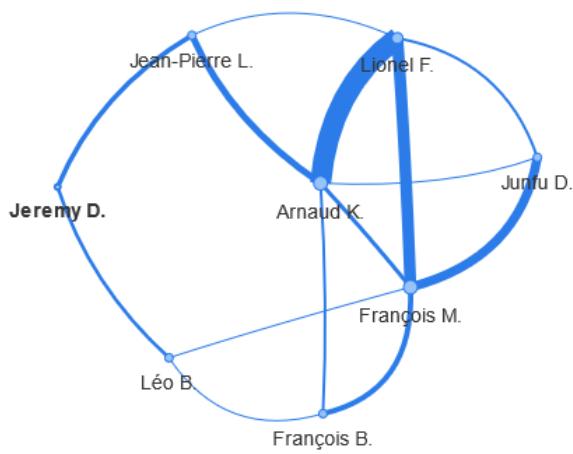


Figure 3. Pathways leading a low level player located in the south of France (Jeremy D.), to a famous champion of go in Paris (Junfu D.). Each circle represent a player. The width of the link between two players indicate the quantity of games played in tournament between those 2 players.

Using the shortest paths between people, we can assess the average distance that separates each player from the other members.

We can see Figure 3 that the player Jeremy, 9-kyu in the club of Montpellier (south of France) is only 2 relations away from the 8-dan¹ champion and writer of the book "*Chûban, La stratégie au jeu de go*", Junfu DAI (Paris). Indeed as we can see Jeremy played against Jean-Pierre L. (in 2021), who himself played against Lionel F. (in 2002), and Lionel F. was competing against Junfu DAI (in 2004). That path is the shortest as it requires only 2 other persons to connect the player to the champion. Other paths also exists, as Jérémie played against Léo B. (From Montpellier go club) on March 13th 2022, who played against François M. (from Antony go club) on March 19th 2022, who himself played 7 times against Junfu DAI (from Orsay go club), the latest encounter being in 2014. In both case the distance was very short as there is only 2 degrees of separation.

This degree of separation is then calculated between Jérémie and every other player registered on the FFG website, which gives an average distance of 2.135 players to connect him to any other players despite playing a total of 22 matches against 17 different players. On the other side, Junfu DAI which played 365 matches against 158 different opponents, has an average degree of separation of 1.714 to connect him to any other player. Following the same process we can calculate this average distance between each player against every other players, for everyone and we get the average distance of 1.979

¹8-dan is the highest rank in non professional go, ranking goes from 30-kyu to 1-kyu then from 1-dan to 8-dan

(≈ 2), to connect all the players of go who've participated in a tournament. The person which is the further away from every other players has an average distance of 3.962 (and belong to the 38GJ go club), meaning that there is an average of almost 4 persons to connect her with any other player. On the contrary, the most central player is a 1 kyu player located in the 92An go club, and has an average distance of 1.079. This person played 315 official matches with 221 different players.

The number of opponents is not the only factor decreasing your degree of separation, as a person who played against lots of individuals who all come from the same community will have a higher degree of separation than a player who played less tournaments but played with people from different communities.

2.3 Players gather in communities through preferential interactions

If everyone is connected through a short path, no one is directly connected to every other player, and people tend to play more often against some players than others. The preferential interaction between groups of people will define some communities, while some people inside the communities will also interact with players from other communities, linking two different groups. People acting as a bridge between communities by having a lots of interactions with other people, are called Hubs.

In Figure 4, we took the members of 2 geographically opposed clubs, one in the north of France (Rouen), and one in the south of France (Montpellier). As we can see, everyone is linked to each other by a short path (without separate group that would be disconnected from the others), but people are not all directly connected to each other. Using Louvain algorithm for community detection, we can see that there are some preferential interaction resulting in the creation of 4 different communities. There is 2 obvious communities : One on the left, which is mainly made of people from the go club of Montpellier, and the community on the right, which is almost entirely made of people from the go club of Rouen. This means that people from each club interact preferentially with members of their own club, but some of the members from Rouen and Montpellier interacted with each other, linking the two communities. This is the case of Fabien V. (Rouen) which played against 5 different persons of Montpellier club, some of them multiple times, but also Arnaud K., Jean-Luc G. and Jérémie D., which belong to the Rouen go club community (according to the algorithm of community detection), and played against people from Montpellier go club community.

However, in these two communities, appears another level of segregation. According to the algorithm, the two communities seems each split into 2 sub communities, In blue we have the high-level players of Rouen (with a lot of interactions inside this sub-community), and in yellow we can find the high-level players of Montpellier who also interact a lot with each other, but with fewer connections with the players of lower level.

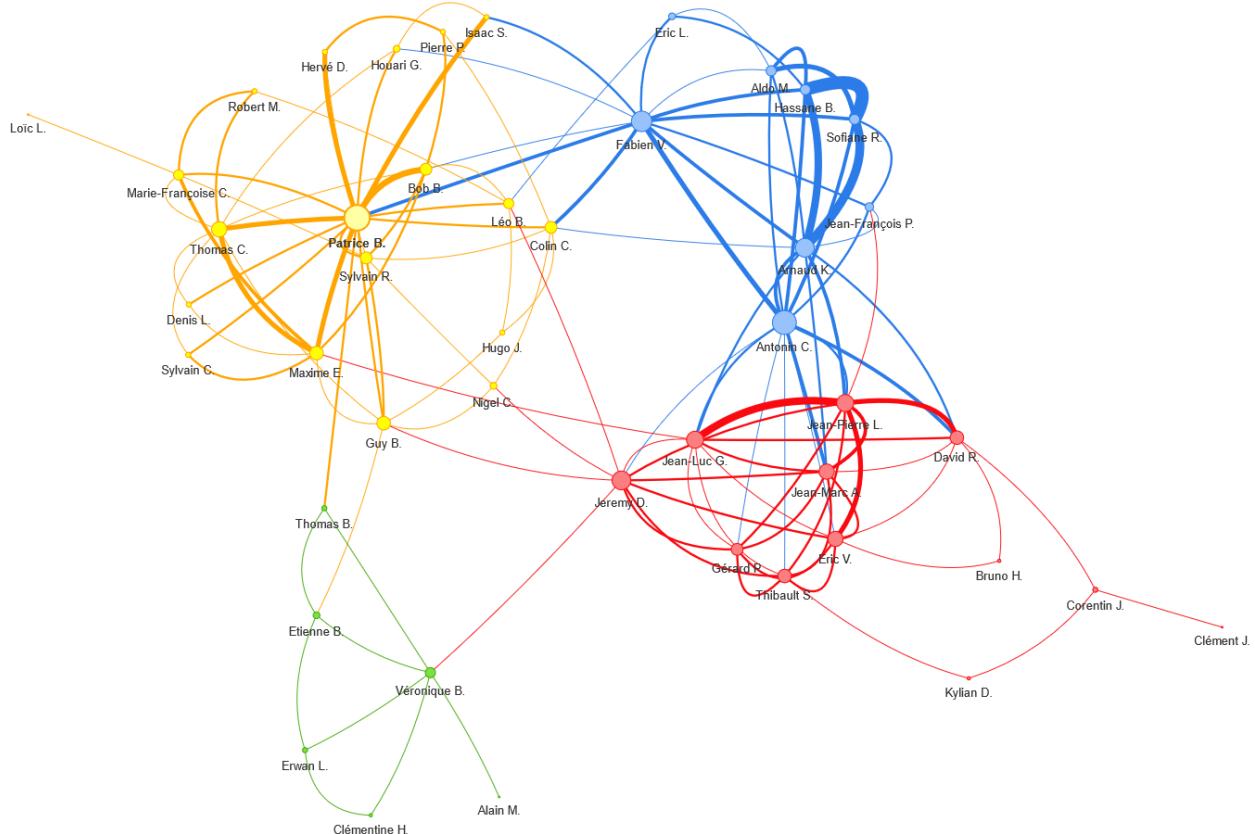


Figure 4. Network of relations between players coming from 2 geographically opposite go club : Rouen and Montpellier. While most of the players have relations inside their club, some players (called hubs) are connected to much more player and assure the connection from one population to an other. The different colors indicate the different group according to their interactions in tournaments, the community detection was performed using Louvain's algorithm.

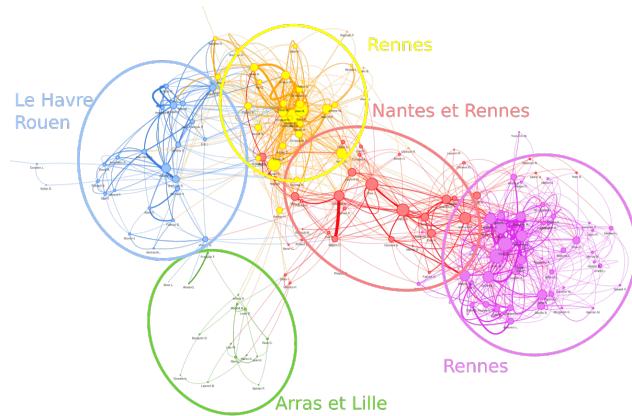


Figure 5. Relations among players from 6 of the main cities from the upper part of France. (Arras, Lille, Rouen, Le Havre, Rennes and Nantes)

Despite representing greatly the level of the players, the

communities do not necessarily describe this feature. It only represents the interactions people have with each other. For example, we can find some players in the yellow community (composed mainly of high level players from Montpellier) which are actually low level players (Marie-Françoise C., Thomas B. and Robert M.), but interact preferentially with people of social network mainly made of high ranked players. While there is another group, smaller, composed of six player of low rank who mainly interacted with each other but with very little interactions with players represented in yellow.

Of course, such geographical distinction can also be seen with clubs from neighbour regions. If we look at the cities of Lille, Arras, Rouen, Le Havre, Rennes and Nantes, (Figure 5) which are all on the upper part of the country, and perform a community detection based on the interaction they had in tournaments, we can see that the cities which are the closest are also interacting more (sometime even belong to the same community, like Arras and Lille or Rouen and Le Havre). However some cities sometime harbour multiple communities who don't interact much despite players being from the same city (Like Rennes, split into 3 different communities).

2.4 The social network of french go players, a rank segregation

Using all the games that have been played in those 10 last years, amongst the members registered to the FFG in 2022, we can establish a social network linking every players of 2022, and group them by communities. Go players are separated into 10 different communities (Figure 6). However, all those communities are connected, and no group exist disconnected from the others.

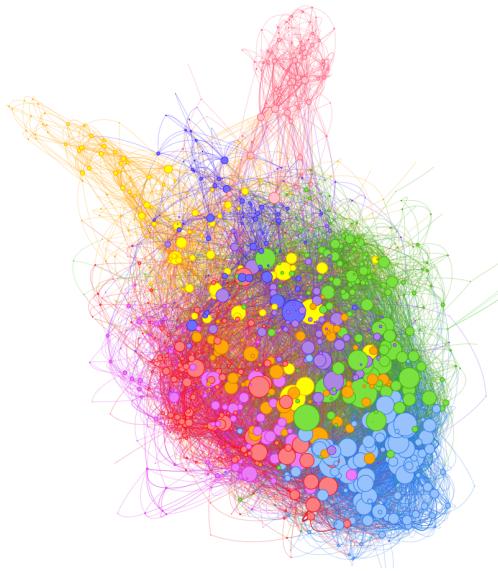


Figure 6. The network of french go players in 2021-2022.
Ten communities of players are found in France. Each circle represent a player, the size of the circle represent its importance in the network.

At the top of this heart-like structure (Figure 6), two communities (in yellow and pale red) seem further away from the rest of the players, and don't seem to interact with other people outside of their community. Only few members of those 2 communities will interact with people from other communities, while much of the others are almost outside of the world of French Go. On the contrary, the orange community (in the center) seems to be the one interacting the most with other communities, closely related to every group, even in contact with the extremely polarised (pale-blue) community at the bottom-right of the figure.

We can see that the network graph indicates some very polarised interaction relatively to the level of the players. Indeed, despite high and low level players can play fair games in tournaments by giving the weaker players some additional stones in the beginning of the game, we see that high level and low level players don't seem to interact, as the bottom-right (pale-blue) community is mainly composed with people between 1-8 dan (Figure 7J), while the yellow and pale red communities (top) are composed of low ranked players (Figure 7A,B) ranking mainly between 10-30 kyu. In the middle, the red, orange and violet communities are very tightly linked

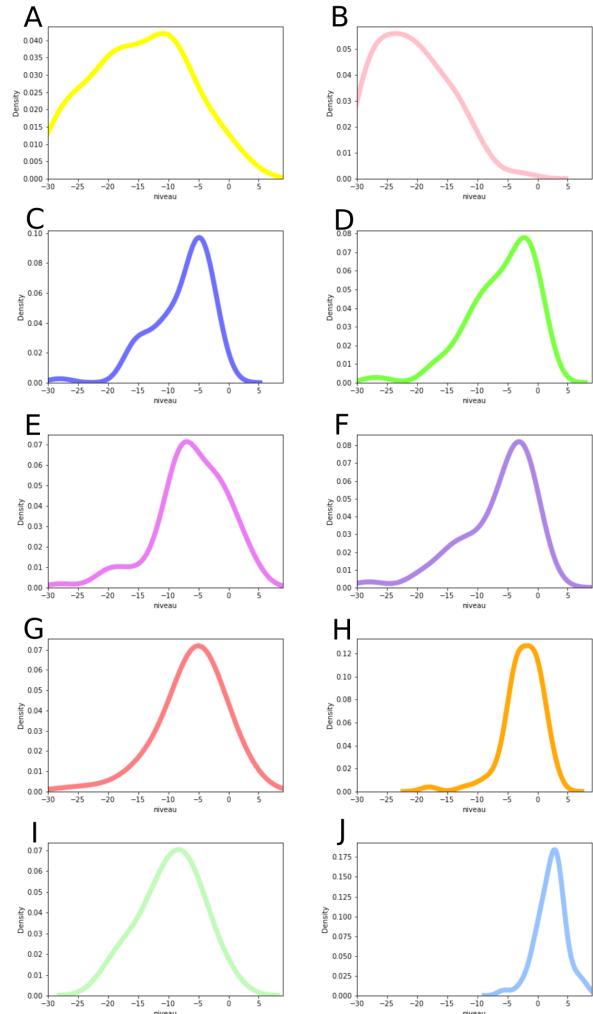


Figure 7. Distribution of level's players in each community. Colors match the communities found in the network of 2022 french go players (Figure 6), and show that the most outside communities that we can find at the top and bottom of the network are the very low and very high ranked players. $-29 \text{ to } 0 = 30 \text{ kyu to 1k}$, $1 \text{ to } 8 = 1 \text{ dan to 8d}$

to the pale-blue community, and they are mainly formed with people between 6 kyu and 2 dan which is intermediate-high.

In addition we can see that people from a single club do not necessarily all belong to the same community. Indeed, after closer analysis, the majority of the club of Rouen belongs to the green community, while some of its players belong to the pale-blue community (Figure 6).

2.5 Geography of the communities

Looking at the geographical division of the Go social network, it seems that players tend to play tournaments outside of their own cities, as there are communities that extends to more than 200-300 km (Figures 8,9), however the 10 main communities do not geographically match the 10 district (Figure 1,8,9). Though communities don't represent the district

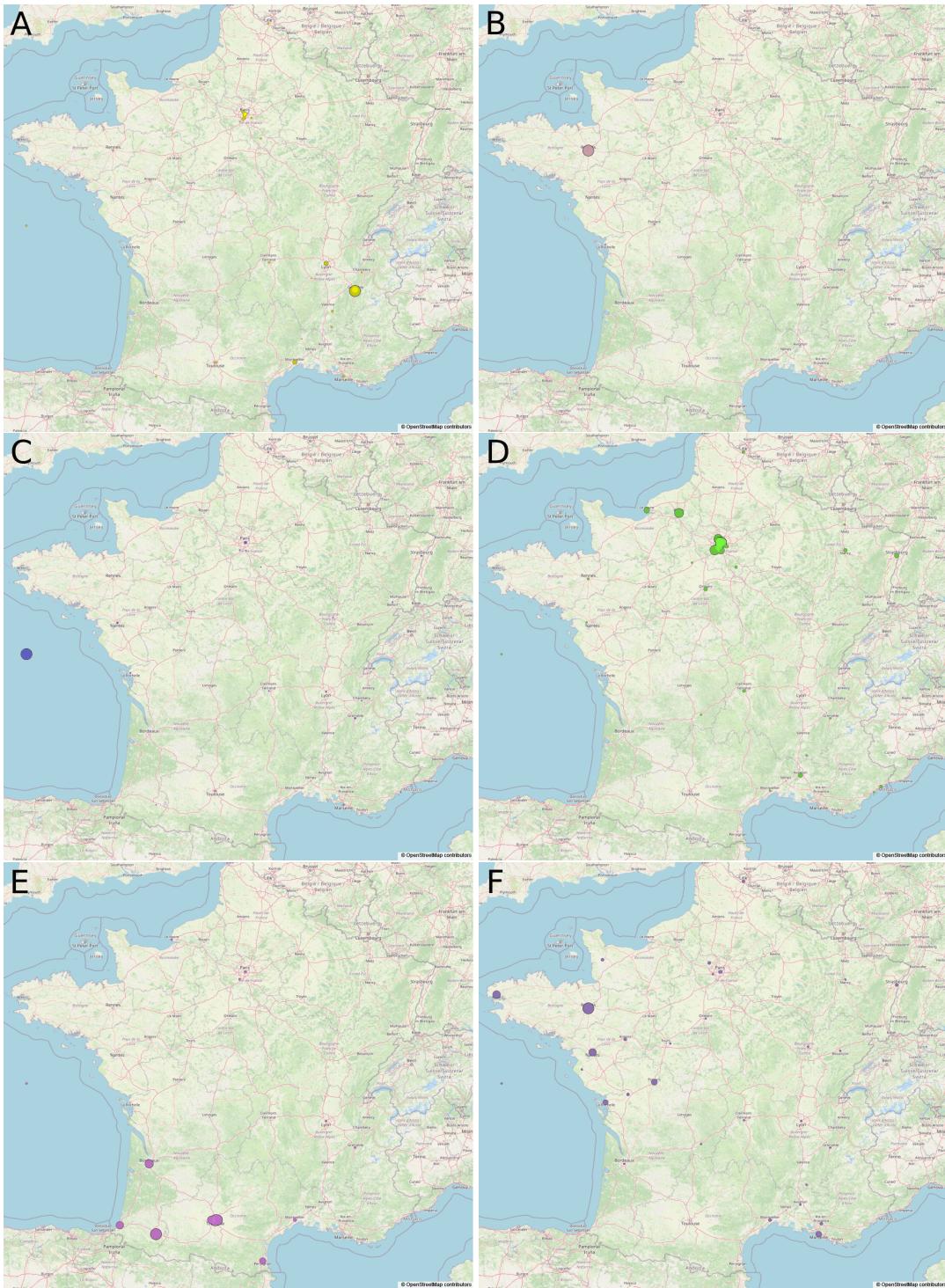


Figure 8. Part. 1 – Geographical representation of the different communities in french go. A) yellow community belongs mostly in the south east, with most of the members in the Go club of Grenoble as well as the Go school of Grenoble, plus in some lesser extent, Lyon, Marseille, Montpellier and few people from Paris. B) Unlike most of the communities, the Pale-pink community belong to one city, with more than 95% of the members being from Rennes. C) Another single club acting as a whole community is the online SITS club, forming itself the Dark-blue community, while D) the Green community is composed of more than 10 club interacting, mostly found in Paris, Rouen and Le Havre. Two other communities are very geographically defines, the E) Dark-pink community in the south west, and the F) Violet community on the west.

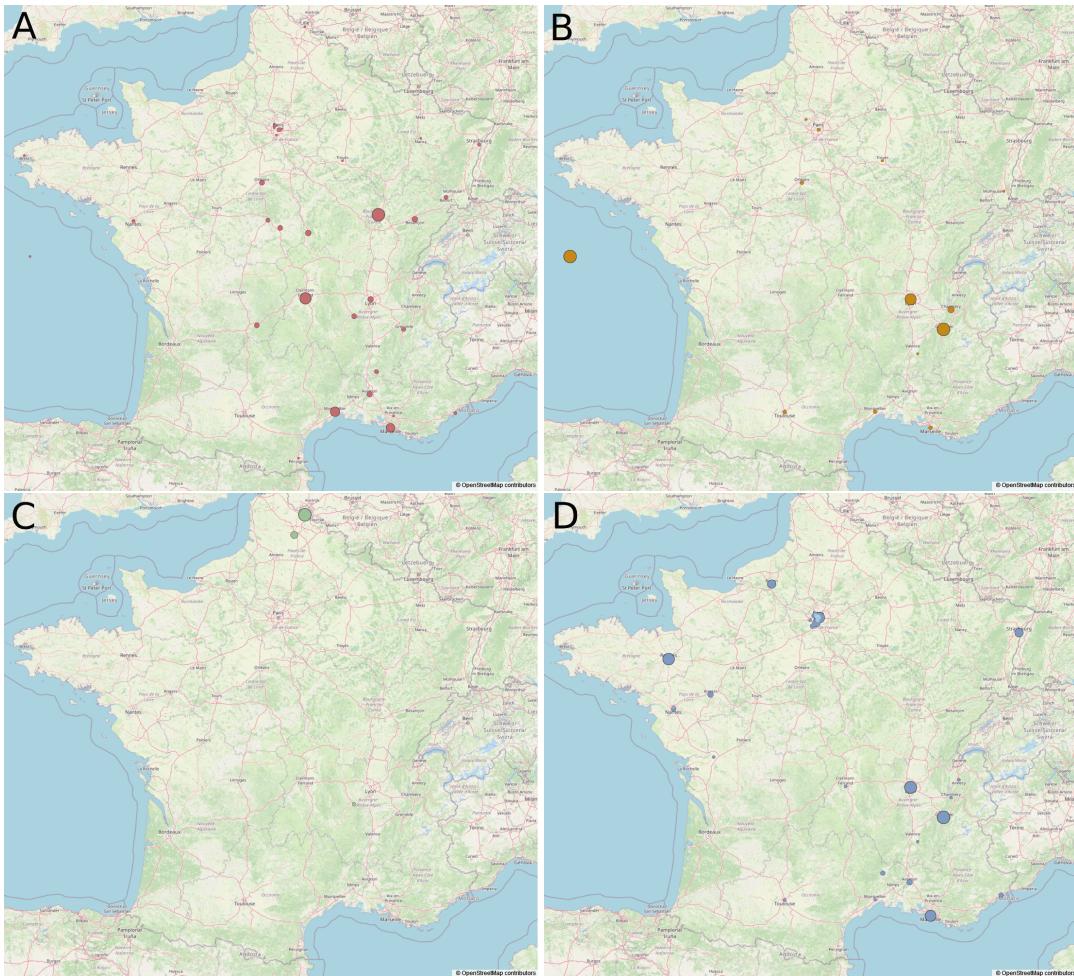


Figure 9. Part. 2 – Geographical representation of the different communities in french go. A) Red community is the widest and extend from Paris to Marseille, B) Orange community however is a very restricted community located almost only composed of Grenoble, Lyon and SITS club, C) Pale-green community is also very restricted and group only people from Arras and Lille, D) Pale-blue community is the most spread community with players from almost everywhere in France.

they belong to, it seems that people tend to stick to their region of origin and only few communities have members across the whole country. For example, the dark-pink community is mainly composed of people coming from Pau, Balma, Toulouse, Colomiers, Bordeaux, Bayonne and Perpignan (Figure 8E), which are all cities from the south-west and part of the same district (Ligue du Sud-Ouest).

The yellow community is mainly mainly from Grenoble (61 members), but also Valréas, Crest, Lyon, Montpellier, Marseille and few people from Paris (Figure 8A). Aside the few people from Paris, the community is confined in the south east (Ligue Rhône-Alpes, and in lesser extent, some people from Ligue Méditerranée). However, despite being two different communities (dark-pink and yellow communities), those two tend to interact with each other (in some lesser extent) as they are closely related in the social network (Figure 6), this, might be favored by the fact that they are southern communities, and it is easier to interact than with the northern communities. On the opposite, a third geographically defined community would be the green one, localized mostly in the north (Paris, Rouen, Le-Havre, Orleans) and part of the East (Nancy, Strasbourg) (Figure 8D), creating another community distributed on 2 main districts (Ligue de Normandie and Ligue Île-de-France).

The violet community is made of people from the west of France, (Rennes Brest, Nantes, Poitiers, Mans), but interestingly, this community also extend to the south-east (Montpellier, Marseille, Avignon, Aix), implying that there is more to it than just the geographical location (Figure 8F). It is noteworthy that another community exist in the West (Figure 8B), not closely interconnected to the one already existing in the West, showing that a district (Ligue de l'Ouest) can harbour multiple communities. While this community (Composed of 63 persons all of them from Rennes) is the only one to form an isolated community without any member outside of the city, there is two other communities made of almost one club of Go, represented in pale-green and dark-blue. The first one, in the north, (pale-green, Figure 9C) is a small community of only 12 players located in Arras and Lille, while the second one, shown in the middle of the Atlantic ocean (Figure 8C), is almost exclusively made of players coming from the SITS (Stones In The Shell), an online club of go (49 members of this community belongs to SITS against 16 from other clubs). However, not all of the SITS members belong to this community as 18 of them belong to the orange community (Lyon, Grenoble and Chambéry, Figure 9B). The fact that these clubs are considered each a community almost by themselves means that they are quite active, and organize lots of internal events, probably reserved only for their members. This can be a good option and the sign of a very active club if the members still interact with other communities. This is actually true for the SITS club which is at the center of the network (Figure 6), meaning they are in close contact with the other players from all the other communities of the country, but also have an average degree of separation with the full Go community of 1.872 (Table 1). They also seem to favor the inter-level

Community	Average distance	Average level
Yellow	2.054	-14.585
Pale-pink	2.423	-20.726
Dark-blue	1.872	-7.708
Green	1.659	-5.949
Dark-pink	1.699	-6.155
Violet	1.658	-6.597
Red	1.6361	-6.133
Orange	1.581	-2.40
Pale-green	2.440	-9.538
Pale-blue	1.484	2.280

Table 1. Characteristics of Level and sociability of each community. The higher the level of the community, the closer its member will be of the other players. Level represent the average rank of every player of the community, -29 to 0 = 30k to 1k, 1 to 8 = 1d to 8d

tournaments as some low level players also have interaction with high level players (Figure 10) like for example David A. (17 kyu) et Matthieu C. (1 kyu) on 24/04/2021 in an online tournament. However the other communities not only form a community from a single or two cities, but also don't seem to be interacting much with other communities (Figure 6), and have an higher average degree of separation (2.423 and 2.440, Table 1). While it is not always feasible due to geographical limitations, those community could benefit from participating in more diverse tournaments and interact more with the other communities of Go.

All of these communities mentioned are mostly geographically defined (sometime with 2 or 3 different areas). Even the red community (Figure 9A) which extend quite well, seems mostly located in the center area. However, one community defy this principle, with almost as many members coming from the north, the west, the south-east, and in lesser extents, also from the East of France (Figure 9D). Interestingly, this pale-blue community is the one we can find ex-centered at the extremity of the network (Figure 6), therefore, not mixing too much with the other communities. By looking at the levels of the players in this community we can notice that it is composed of the best players of France (Figure 7J), meaning they might have to travel more to get people their own level, making them part of an "elite community" spread across the country, and meeting regularly to be challenged in tournament where they can find stronger people challenging them, or to play the finals of some National tournaments. However, despite being lightly on the outside part of the network, they are also the ones with the lowest degree of separation with the other players, with an average of 1.484 player to connect them to any other member of the FFG.

2.6 Sociability of the communities

As seen above, the community with the highest closeness (thus, the lowest average degree of separation), is the blue community. This can easily be explained due to the fact that

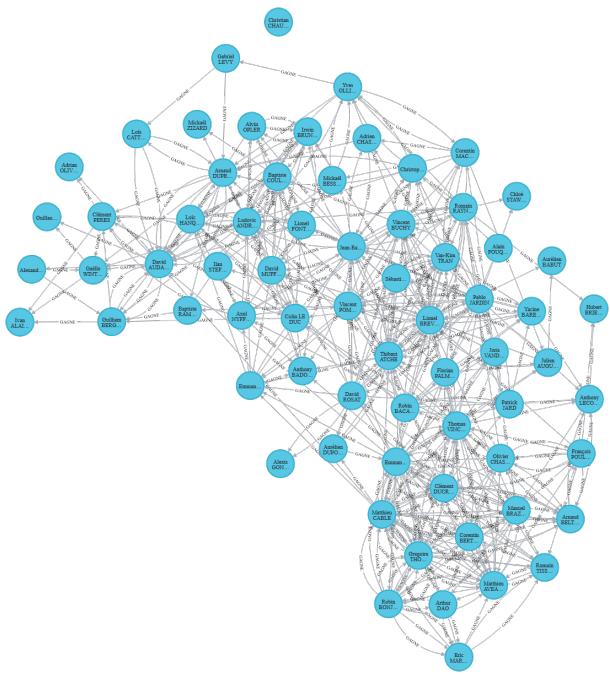


Figure 10. Network of interactions in tournaments for the players of SITS club among the 69 members who played at least one tournaments

it contains the best player, therefore with more experience they probably played more games and met a lot of diverse players, but the fact that it is at one extremity of the network (Figure 6) means that they don't interact much with the other communities. However they do tend to interact a lot with the orange community, which is at the center, interacting with most of the other communities. those close interaction with the orange community shorten the distance with other communities as between a blue player and a pink or yellow player, there is probably few intermediate due to the orange population which rank second in centrality. Also, the fact that the blue community is coming from all over the France bring it closer to the other members as even if they don't interact a lot with the other community, they probably have each at least one or two match against someone of their own city/region that would act as a short path to this other community, even if it's due to only one individual, but is enough to bring them closer to the other members. Orange community is very close behind the blue community. despite being a small community with most of the members in only 3 clubs, they are on average, only 1.581 person away from any other player. A similarly restricted community exists in the north, with the pale-green community restricted to only 2 clubs, Arras and Lille, however their proximity to other players is way below, being the most isolated community in Go, with an average proximity of 2.440, very similar to the pale-pink and yellow communities, with an average distance of respectively 2.423 and 2.054.

3 Discussion

Go population in France is subdivided into 10 main communities. Each of these communities will interact mainly with the other members and less with the players outside of the community. However, it is important to note that out of all the players, there is a 1.979 average degree of separation, which makes go a very close network, with a lot of interaction between its members. This is favored by a big number of hubs, present in all of the communities.

Despite of being grouped on wide geographical surfaces (200-300km) communities of players are still limited by distance, and overcoming those geographical limitations is only favored for the very high level players.

Low level players however, barely interact with other communities, and also tend to stick to their community or even to their club, with almost no interaction with players of higher level. While some club really seem to encourage their players to participate in tournaments, some of them could benefit from participating in more diverse tournaments and interact more with the other communities of Go to face more diverse players with different approach of the game and strategies.

The club SITS probably is the most active club of France, having lots of internal events giving life to the club, making it a single community despite the difference of level, and also having tight relations with all the communities, meaning that they probably promote national tournaments to their members, and mix high and low level players, which is an important feature for helping the low level players to improve. However due to the fact of organizing many of the events through internet tournaments, it is probable that the interaction are limited to the match they play and we can assume players probably know the other members way less than communities who participate mainly to tournaments which are not online. While the geography plays an obvious role in the creation of Go communities, this is not the only factor, as it happens that two different regions can be part of one community (like the violet community, at the West of France with the south-East of France) implying that relationships between clubs are more complex. Such connection might be linked to the philosophy of the various clubs, Some favouring a friendly approach of tournaments, while some other would tend to be more formal and scholar, forcing members to overcome geographical limitations to join tournaments that suits best to their philosophy of the game. Altogether, Go is a highly interconnected network where geographical limitations are less of a barrier than could have been thought. However we only focused here in the interactions through the games played during tournaments, but not including all the other kind of interactions that would happen during the same tournaments (game reviews, advice given, teaching from the Dan players to the Kyu players...), making it an even more interconnected population where players do know a large part of the population and where the barrier through the different communities is actually quite thin, leading toward a population made of an almost single community who mainly all interact with each other, with the

only exceptions of some rare isolated communities.

4 Methods

4.1 Data

All of the data is public data collected from the official website of the FFG and represent matchs that have been played in tournaments along the years. All of the games available on the website were scrapped and ordered in a NoSQL (Neo4J) graph database for downstream analyses (performed mostly with cypher and python).

All the players refusing their name to appear on the website of FFG were grouped under the name Unknown, and were therefore discarded as different people playing against "Unknown" did not play against the same person

The whole dataset comprises 151 963 matchs played by 14 152 players. The number of registered players who played in a tournament in 2021-2022 was 1417 (767 with a club located in France). The other players are foreign players that played against FFG members.

The analysis of the degree of distance was performed on the whole dataset to understand the proximity of all the players (present and past). As communities evolve through time, community detection was performed on the current community, meaning all the players registered to a french club for the year 2021-2022. All the matches played by those players registered in 2022 during the 10 last years were taken into account (as long as both opponents were registered in 2022). Involving players who played more than decades ago would have biased the analysis and would be more suitable for a time-based analysis of the changes in the population of go throughout the years.

4.2 Community detection

Division of the populations into communities was performed using Louvain algorithm which allow to extract communities for large network (Blondel et al., 2008), implemented in the "community" package, and represented with NetworkX package on python.

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