Social Networks in the Polish Revolution

By Kien Nguyen

Advisor Dr. Kelly Bodwin

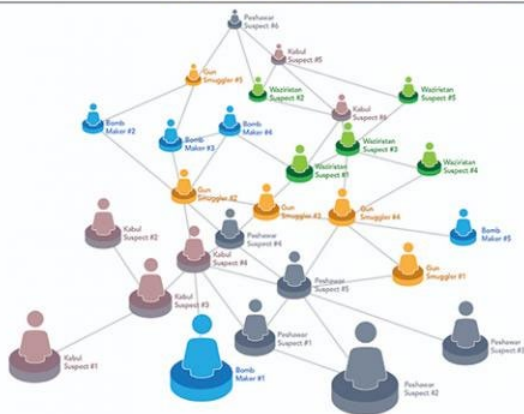Collaborator Dr. Gregory Domber

Figure 1. Social network analysis

In 1989, Poland underwent a Democratic Revolution. Since every revolution is followed by an attempt to explain its outcome, we were curious: What factors lead to this crucial movement? Is it the beginning or the end of the Cold War? We wanted to analyze data on social networks between key members and organizations on the Polish political scene. Our goals were first to create visualizations of social networks in Shiny app form, and to perform statistical inference on the change of these networks over time.

Social network analysis, as explained by data scientist like Valdis Krebs, is the mapping and measuring of relationships and flows between people, groups, organizations, and other connected information/knowledge entities. The nodes in

the network are the people and groups while the links show relationships or flows between the nodes.

Our data collected by my collaborator, Dr. Domber – which has not yet been published – contains information about Polish political institutions and information of members of these institutions from 1924 to 1989. The focus is Polish people who participated in the 1989 Round Table on the side of the opposition. This means everyone in the data set voted for Democratic Revolution in 1989. Our long-term goal is to collect info about the people that voted against the Revolution.

To fully understand the data set, I first designed two basic Shiny applications to help us explore the data and answer data questions without help. The first app displays shared members in selected institutions. Given a date range between 1924 and 1989, the data table shows members who were in two institutions selected at the same time. The app also allows user to filter out the profession of members. The second app is similar to the first one; however, instead of shared members, this app shows shared institutions of two selected members.
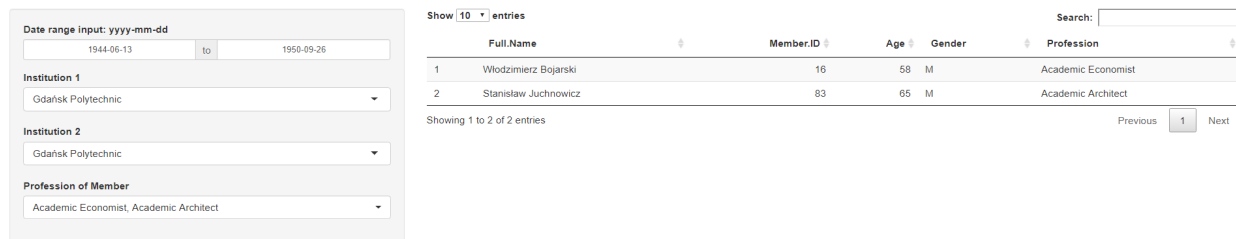

Figure 2. Explore app 1
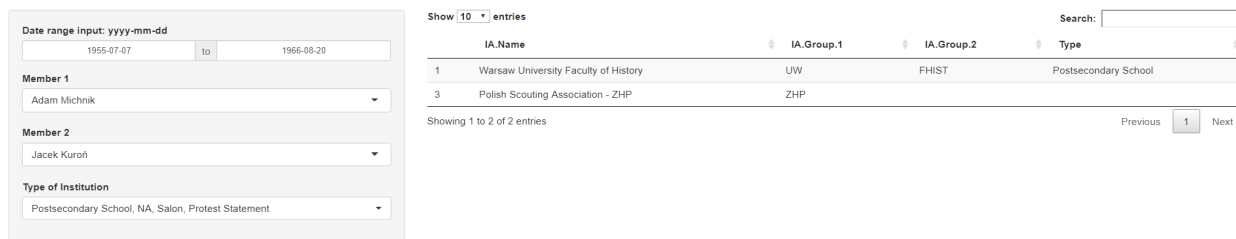
Figure 3. Explore app 2

With good knowledge of the data set, I then created the social network app.
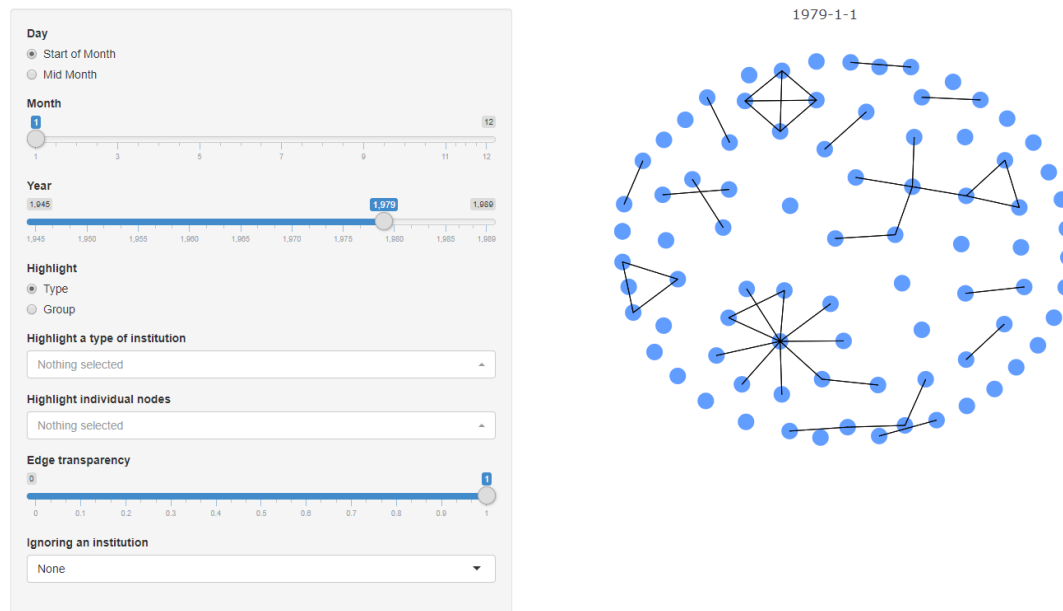
Figure 4. Network app with year 1979

In this network, nodes represent institutions and edge exists if there are one or more shared members between two institutions. We can highlight individual nodes and the edges connected to the nodes will also be highlighted. The ignoring function lets us remove one specific institution out of the network, so we are able to see the impact of that institution on the network.

The most interesting thing about this app is that it changes over time. When a different time is chosen, the app recalculates the network which could makes the network look completely different.
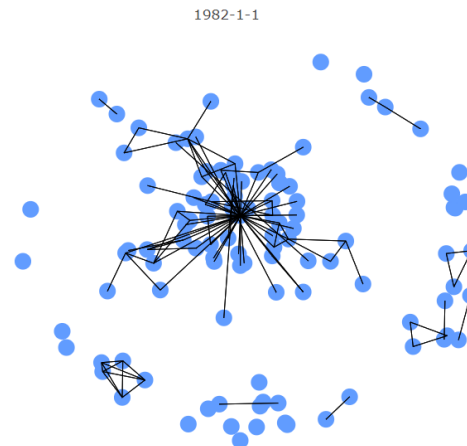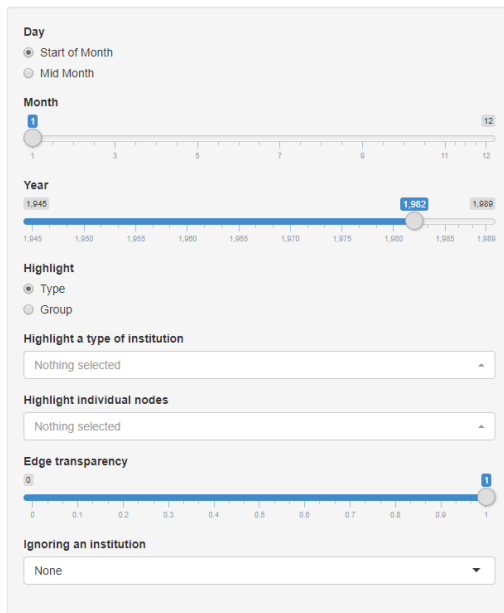
Connections between Polish institutions

Figure 5. Network app with year 1982

The findings were telling. The more connected an institution has, the more impactful that institution is. After investigation of the network over all years in the app, we found that there were two most influential institutions before the Polish Revolution: NSZZ Solidarność (NSZZ) and Polish United Workers' Party (PZPR).

Figure 6.NSZZ logo

NSZZ is a Polish labor union that was founded on 17 September 1980 under the leadership of Lech Wałęsa. It was the first trade union that was not controlled by a communist party. It was founded as a result of worker protests and it supported the revolution.

Figure 7. PZPR logo

On the other hand, PZPR was the Communist party which governed Poland before 1989. It also controlled the armed forces, the Polish People's Army.

In the 1980s, NSZZ was the driving force behind democratic revolution. The government attempted to destroy the union by imposing Martial Law in Poland, which lasted from December 1981 to July 1983. The law basically declared that NSZZ was illegal. This event affected the popularity of NSZZ and PZPR tremendously and played an important role in the Polish political scene.

Figure 8. Martial Law

In order to compare the popularity of institutions of the network, I performed centrality measurement. In social network analysis, centrality is a vital tool for understanding the behavior of networks and graphs. These algorithms use graph theory to calculate the importance of any given node in a network. It helps us identify the most important nodes within a graph. There are many types of centrality such as degree centrality, closeness centrality, eigenvector centrality, … Each of them uses a different algorithm to measure the node connectivity. In this research, we utilized degree centrality and betweenness centrality.

Degree centrality's score is based on the number of edges held by each node. It tells us how many direct, 'one hop' connections each node has to other nodes within the network.

Betweenness centrality assigns an important score by measuring the number of times a node lies on the shortest path between other nodes. It tells us which nodes act as 'bridges' between two other nodes in a network.

After calculating NSZZ and PZPR centrality, I found that the patterns given by two methods above are not much different and we wanted to focus more on the ability of acting as a bridge of NSZZ and PZPR. We only used betweenness centrality for analysis.
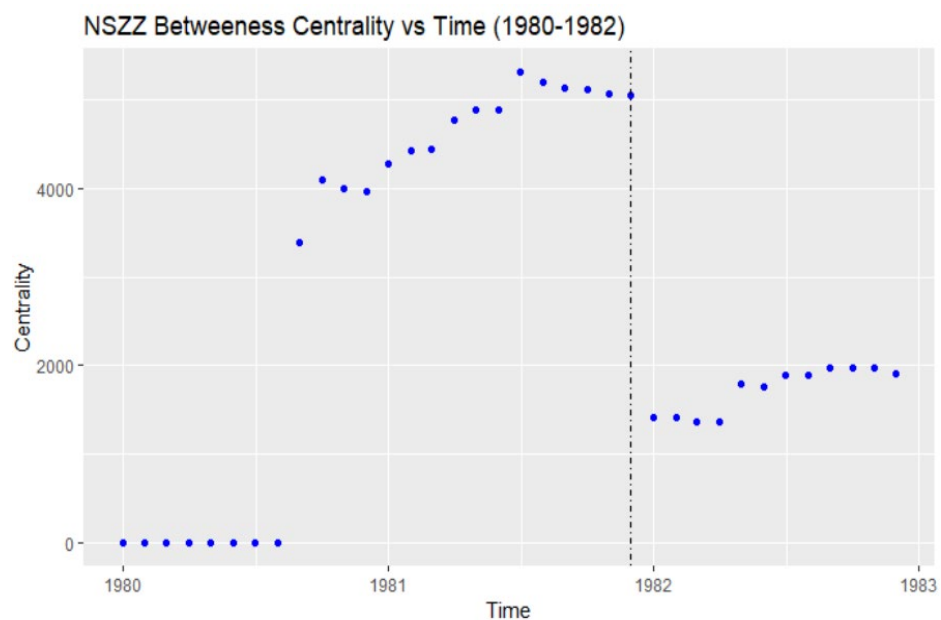

Figure 9. NSZZ Centrality vs Time

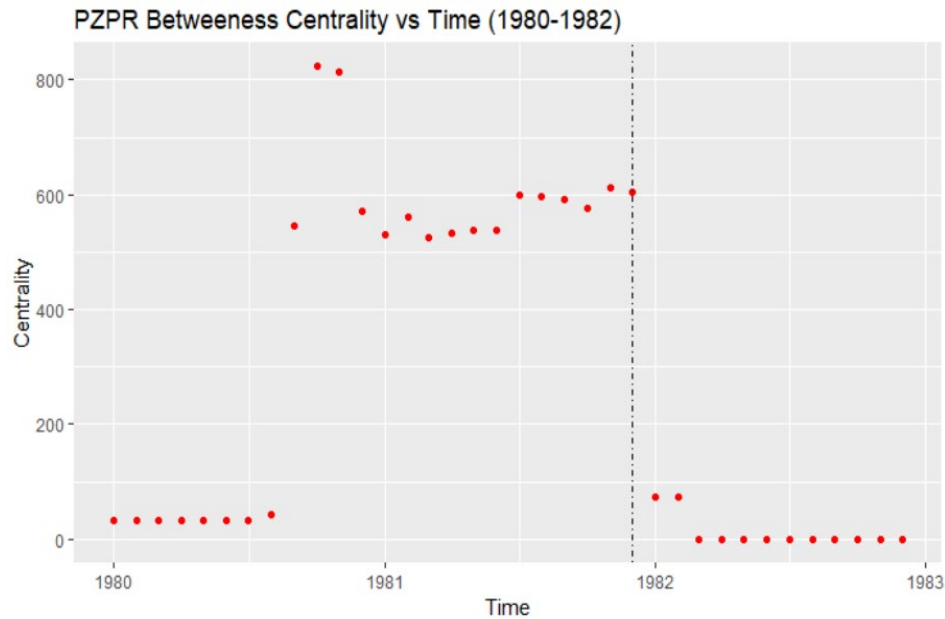PZPR Betweeness Centrality vs Time (1980-1982)

Figure 10. PZPR Centrality vs Time

The information we were most interested in are NSZZ and PZPR centrality right before and after Martial Law. Based on our findings, when NSZZ came into scene in 1980, it gains so much popularity and quickly surpasses PZPR. Then Martial Law makes NSZZ centrality dropped greatly; however, its centrality gradually goes up high again. This raise questions about why people decided to join NSZZ even though they knew they could go to jail.

PZPR centrality spikes in 1980 when NSZZ was created and drops significantly when Martial Law was declared. After meetings with my advisor and collaborator, we figured out educational reasons for these. We believe there were many members in PZPR who were lawyer and workers in the academic profession also joined NSZZ. Since NSZZ had connections to a large amount of labor unions, it acted as a bridge between PZPR and these unions. On the other hand, PZPR also acted as a bridge between NSZZ and the academic institutions. This answers the question why PZPR became more important when NSZZ was introduced.

To answer another important question of why PZPR centrality tanks after Martial Law although it was meant to put PZPR in power, we are certain that joint members of both institutions decided to pick one side only when Martial Law was declared. Because of unknown reasons, they all quit PZPR and participated in NSZZ. It was probably the moment of heroic, the members thought and acted for their country.

At the end of the day, our research study has created exploration apps that allow non-technical collaborators to independently explore data and network app that create visuals for telling the story of one of most significant revolution in the history. Moreover, we found interesting observations about NSZZ and PZPR popularity before the Polish Democratic Revolution and we will be examining these effects further. Interpreting the Polish Revolution will be central to the way people think about history. And the story of what lead to the revolution will likely be always a hot topic for historians.

References

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