Slovenian visual artists throughout history: A network analysis perspective

Petja Grafenauer, Andrej Srakar and Marilena Vecco

Abstract

Slovenian art history has received very little attention from the viewpoint of network theory. There were several examples of artists co-working or working in groups, collectives or even loosely organized clusters and it seems this was a way to acquire better positions in the art circles and on the market. In our article we firstly present the history of Slovenian art historical movements with particular focus on groups of artists through 19th and 20th century. In the second part, we use web-based dataset of *Slovenska biografija* which contains data on notable persons throughout Slovenian history and is operated by the Slovenian Academy of Sciences and Arts. On the basis of dataset we present an analysis of centrality of individual artistic figures/movements throughout history. Finally, we analyse the influence of network centrality on cultural production controlling for endogenous relationships using a new instrumental variable correction. Main research questions of the chapter are: (1) which were the main central figures with most social capital in Slovenian art history and did they form part of larger networks; (2) what is the relationship between network centrality and cultural production. In conclusion we provide some groundstones for further research work in the area.

1. Introduction

Slovenian art history has been researched in numerous publications and is one of the fields in Slovenian humanities with longest tradition. Yet, surprisingly little attention has been provided to the perspective of the network theory and groups of artists throughout history. Are the artists more productive when forming and working in groups? Is there any special influence of the confounding variables, such as gender, age, occupation, income? Are there any spillovers between artistic sectors — do the 'transdisciplinary' groups such as Dada and Bauhaus show that not only is connectedness within one art sector important, the key is to connect with artists from as diverse fields as possible. Such questions have been posed and answered in previous years, yet also in the scientific literature in general, the question on the effects of networking on productivity has been solved by means of predetermine clusters while

neglecting the possibilities of social network analysis in providing the answer to this question.

Although our chapter will (at this point) not be able to answer to all of those questions, it will provide answers to several of the above dilemmas. Using a previously unused web-based database of *Slovenska biografija*[1] it will demonstrate that networking is indeed beneficial for the artistic productivity, yet to a slightly smaller scale/significance as was speculated in some previous studies. We will be able to control for the apparent reverse causal relationship in the model using an innovative, new instrument and will also estimate the empirical effects of other confounding covariates. Finally, we will provide Slovenian art history with its first network analysis and empirical description of the main artistic groupings of the 19th and 20th century. The chapter will be structured in the following manner. In the next section, we will provide a short literature review and theoretical underpinnings. In the third section, we will present the dataset and used methods. In the fourth section, we will present the results from the social network analysis. In the fifth section, we will present the econometric results. In conclusion, we will briefly reflect on the findings and possibilities for future research.

2. Art historical overview

Slovenia only became a federal republic in the framework of the Socialist Federal Republic of Yugoslavia. It seceded and became an independent country in 1991. Slovenia spent all the previous centuries under foreign rule, mainly under Austria-Hungary and — on its Western border — under Italy. Therefore, it stands to reason that up to around the end of the 20th century, we mainly refer to art on Slovene lands, since the fine arts were generally the purview of foreign artists which the local gentry hired to furbish and construct houses, palaces, churches and altars; they also commissioned portraits and imported increasingly cheaper reproductions from abroad. The Turkish raids, social upheavals, religious battles and occasional epidemics, which plagued the 16th century, prevented these lands from developing further. However, in the 17th century, baroque, in addition to gothic art, left a deep imprint on Slovene lands (Stele, 1966; Höfler, 1999). At the time, the Church, especially the Society of Jesus and Tomaž Hren, the Mayor of the Slovene capital city of Ljubljana, represented an integral part

---

[1] For more details see http://www.slovenska-biografija.si/.

Slovenian visual artists throughout history: A network analysis perspective ■ Petja
Grafenauer, Andrej Srakar and Marilena Vecco

23

of the social network. Since Hren could not afford his own opulent court, he made due with part-time artists, while the other rare commissions were also done by foreign artists, mainly from Lombardy, Venice and Friuli.

The other important circle of people was the so called *Academia Operosorum Labacensium* (Academy of the Industrious Residents of Ljubljana). It was founded in 1698 by the Carniolan intelligentsia and patriots, the three most important founders being members of the Dolničar family (a cathedral cleric, a jurist and his son). This circle set out to culturally reform the lands, where artists were still mainly being imported from Venice, establishing important ties with the Italian city of Udine. The construction boom in Ljubljana also turned out to be a great opportunity for local fresco painters and builders (e.g. Franc Jelovšek and Gregor Maček), who belonged to the Venice School. At the other end of the country, in Styria, the circle around the house of Attems, a noble aristocratic family which set out to refurbish their castles in Styria. The presence of foreign fresco painters proved to be an opportunity for local artists.

The rule of Empress Maria Theresa was marked by austerity, making it a less than propitious time for the fine arts. At the same time, ties with Vienna grew ever more important, while those with Italy languished — it was this route, passing through impoverished Ljubljana, a city unable to provide enough work for more than a brief stay, which was taken by builders, painters and other artists. Local artists, in their battle for a larger slice of the pie, relied on institutions, protecting their privileges from foreigners. At the turn of the 20th century, national consciousness and the awareness of belonging to a community of similarly-speaking nations mainly gave rise to new literature. The Slovene intelligentsia had no particular interest in the fine arts. Even writers and poets would usually adorn their homes with only one or two holy cards bought at the village fair, and not with expensive oil paintings and sculptures (Stele, 1966; Höfler, 1999; Trenc-Frelih, 1998).

The 19th century gave rise to academies of fine arts in political and urban centres, which replaced the role of painting and holy card workshops. They were attended by local artists who first travelled to Vienna (among them were Franc Kavčič, who even became a lecturer and director of the Academy of Fine Arts, the first Slovene career artist, Lovro, Valentin and Anton Janša, as well as Carl Sütz), then Bologna, Rome, Mantua and Venice; afterwards, Munich started becoming ever more popular, while in the countryside, holy card workshops continued to operate, the most important being the Layer House in Kranj.

The giant of Slovene poetry, the romantic poet France Prešeren, struck up a friendship with painter Matevž Langus. After 1829, the latter became the central figure of artistic creation in Ljubljana, leaving behind not only portraits of his contemporary important local patrons, but also furnishing the majority of Ljubljana churches with art produced in his workshop. He was joined by painter Mihael Stroj. Anton Karinger and Marko Pernhart, two landscape artists belonging to the Vienna School, were also important for Ljubljana. Pernhart came from the Klagenfurt area. Then there was Ivan Zajec, the first academy-educated Slovene sculptor. He was later joined by Alojz Gangl. During this period, the Littoral region was marked by artist Franc Tominc, who belonged to the School of Rome, while Styria was greatly influenced by strong ties with the Austrian city of Graz. Local and oftentimes amateur painters also began to work in smaller Slovene towns, for example in Ptuj, Novo Mesto and Celje. The Venice-educated Janez Wolf, the central representative of religious art at the time, founded an important painting workshop which produced two important painters of the next generation, the brothers Janez and Jurij Šubic. Both had strong ties to Vienna.

The turn of the 20th century turned out to be pivotal for Slovene art:

> The fine arts assumed the central role in society's civilizational identity and were fully in line with European currents (…), catching up with literature and music, even completely surpassing them when it came to architecture (Jože Plečnik and Maks Fabiani), meaning artistic language became a reputable herald of the modern conceptual and representational orientation of Slovene society. Not unlike literature's role in Slovene national development, the fine arts also became a constitutive part of national identity, intellectually ennobled to the rank of *artes liberales*. At the same time, it claimed the characteristics and elements of its own proper institutional organization (exhibitions and galleries), professionalization (school of art, plans for an academy, the formation of professional societies and 'secessions'), and reception (art criticism, aesthetics, and theory of art). (Brejc, 1998: 217).

For the first time, artists became true professionals. During this period, the art school founded by Anton Ažbe in Munich played a decidedly prominent role. Ljubljana was also home to two professional societies: the Society for Christian Art (from 1894) and the Slovene Art Society (1899–1904). The first was mainly dedicated to religious art and followed the philosophy of Neo-Scholastic idealism, which had numerous followers among philosophers in the region, while the second was a trade union organization, dedicated to representing the social and professional interests of its members; in 1900, it organized the 1st art

Slovenian visual artists throughout history: A network analysis perspective ▪ Petja Grafenauer, Andrej Srakar and Marilena Vecco

25

exhibition. However, it was dissolved soon afterwards due to infighting. The central role was quickly assumed by the artist Rihard Jakopič and three other fellow painters — all impressionists going against traditional artistic currents. They simultaneously established an important social network, which to a certain extent enabled them to professionally work and develop their artistic system. This tactic was significant enough as to enable art historian Beti Žerovc to write the following opening lines in her aptly titled book, Rihard Jakopič: Artist and Strategist (*Rihard Jakopič, umetnik in strateg*):

> When examining the fine arts during the first half of the previous century, Rihard Jakopič crops up in all manner of places, especially at 'intersections' where art is embedded in its environment — more so than any other Slovene artist. He was regularly involved in various 'non-artistic factors and endeavours' in art, such as the market, cultural policy, politics, history, ideology, etc. In other words, in areas all too often ignored by the fine arts. If not taboo, they are generally as limited as possible, since their non-artistic nature makes them undesirable or seen as trivial, perceived as not taking part in the canonization of artists, the construction of history and hierarchy in the artistic field, etc. They are seen as being limited to the present, while history is bound to show the true nature of art, justly — and solely based on looking at works of art — separate the wheat from the chaff. (Žerovc, 2002: 9).

The paper presented below seeks to ascertain how social connections influence the degree to which artists are recognized.

The second exhibition of Slovene art, which was presented in 1902, already acquired a much more professional air. The already mentioned four impressionist painters were already on the scene: Rihard Jakopič, Matija Jama, Ivan Grohar and Matej Strnen. This group would henceforth set the pace and steer the development of Slovene art (Brejc, 2004; Trenc-Frelih, 1998; Kržišnik, 1979). In 1904 and on the occasion of the exhibition in Vienna, they named themselves the Sava Club, therefore separating themselves from the other members of the Society of Slovene Artists. Their work was lauded by Slovenian writers (Ivan Cankar and Oton Župančič) and they quickly took over the artistic scene (especially Jakopič). Their artistic output was featured by exhibitions in Belgrade, Trieste, London and the Vienna Secession (see e.g. Mikuž, 1995, 1979). In 1909, they exhibited their art in the newly-opened Jakopič Pavilion, managed by Rihard Jakopič. The other group at the time, the more extensive Vesna, which was based on an ethnographic character, couldn't hold a candle to them (among others, it included artists such as Šantel, Gaspari, and Smrekar). The impressionists became the torch bearers of 'folk' Slovene art, despite the fact

their paintings were based on French and later other international influences (see Kranjc, 2001, 2004, 2005–2006).

In the 19th century, architecture was in search of its own 'national identity' mainly through the work of a trio of architects educated abroad: Jožef Plečnik, Maks Fabiani and Ivan Vurnik. Not unlike Vesna's members, the latter occasionally drew inspiration from folk motifs. Once again, the Mayor of Ljubljana (this time Ivan Hribar) played a pivotal role. Through his studies, he was attached to the more developed city of Prague and searched for Slavic sources; the other two architects were doing much the same in Vienna, but on a much grander scale. Especially Jože Plečnik developed important ties with Prague with the help of President T. G. Masaryk.

When it came to painting, the Youth Club proved to be especially important for the next generation (see e.g. Gabrič, 1995). First known as a gathering place for writers and musicians (Anton Podbevšek, Josip Vidmar and Marij Kogoj), it soon attracted the attention of artists. After its dissolution, France Kralj founded the Club of Young Artists which would later become the Slovene Society of Art, bringing together arts, mainly expressionists (Tone and France Kralj, Božidar Jakac). With the founding of the Academy of fine arts and the Museum of Modern Art immediately after the second world war, the posts at the museum and the academic positions became important networking positions, a situation that remains valid well into our times (Božidar Jakac, Gojmir Anton Kos, Marij Pregelj, Gabrijel Stupica).

3. Data and method

In our analysis we used dataset of *Slovenska biografija*, which is a web based encyclopedia, provided by the Research Centre of the Slovenian Academy of Sciences and Arts. The encyclopedia includes information on numerous important figures in Slovenian history, grouped under 15 headings: Social sciences and services; Public Administration; Spiritual Occupations; Humanities; Agriculture and similar areas; Museums, libraries and archives; Natural and mathematical sciences; National advantageous; Craftsmen; Business persons and landlords; Entertainment and sports; Technical and technological sciences; Arts; The Army; Health care. To our knowledge, although rich in content, it has never been used before for the purpose of network analysis which provides our

Slovenian visual artists throughout history: A network analysis perspective ■ Petja
Grafenauer, Andrej Srakar and Marilena Vecco

27

analysis a special importance. To our analysis, we use data for the visual artists (Table 1).

Table 1: Data of the visual artists, including the occupations

Painting	Graphics	Sculpture
Academy painters (6)	*Ex-Libris* (1)	Academy sculptor (4)
Aquarel (1)	Coppercutting (12)	Sculptors (56)
Church Painter (1)	Graphic workers (1)	Sculptors — self-made (3)
Fresco (1)	Graphics (35)	
Illuminates (3)	Lithographs (2)	
Illustration (19)	Lithograph painters (1)	
Caricature (3)		
Landscape painters (2)		
Miniature (2)		
Navy painter (1)		
Drawing (17)		
Scene painters (2)		
Silhouette (1)		
Painters (297)		
Painters — self-made (5)		
Total: 361	**Total: 52**	**Total: 63**

Design	Restoration	Other visual artists
Designers (6)	Model makers (1)	Decoration (1)
Graphic Design (1)	Restoration (6)	Ceramics (2)
		Modelers (1)
Total: 7	**Total: 7**	**Total: 4**

Note: In parentheses are numbers of included cases of the specific occupations.
Source: Slovenska biografija.

The following variables, constructed by hand from the web based encyclopedia are used in our analysis: *Century of birth* (we include data only on the visual artists from the 19th and 20th century); *Gender*: binary variable, taking the value of 1 for females and 0 for males; *Age*: for living artists their current age, for the already passed-away ones the age at their death; *Multiple roles*: number of different occupations the respondent is listed at the database; *Occupation*: the main occupation the respondent is listed at (the first on the list in the biography); *Productivity*: length of the biography, excluding authors name and

references — such usage is justified by previous analyses of e.g. O'Hagan and Borowiecki (2010) and Borowiecki (2013)[2].

Some descriptive statistics of the above variables are listed in Table 2. We list only the results for those respondents, included in our later network and econometric analysis, which limits our sample to 214 cases. We see that the productivity variable is skewed with clear outliers at the right end of the distribution. Median length of the biography amounts to 342 words. In our analysis, there are significantly more artists born in 19th century, slightly above two thirds. Also, females are extremely underrepresented in the sample, amounting to only about 13% of all respondents. Also, more than 85% of respondents are/were of age higher than 50 years. About one half of them are listed in multiple roles. Among the occupations, painters are in the large majority, followed by sculptors and illustrators.

Table 2: Descriptive statistics of main used variables

	Mean	Median
Productivity/word count	478.19	342.00
	%	**n**
19th century	69	148
20th century	31	66
Female	13	29
Age (>50)	86	182
Multiple roles (>1)	46	98
Illustrator	7	14
Sculptor	13	29
Drawer	3	7
Painter	71	152
Other	6	12
Total	**100**	**214**

Source: Slovenska biografija.

The main variable we use in the analysis relates to network centrality, defined as measure of connectedness with other artists in the sample. Our

---

[2] It is of course possible that the measure is biased. We, therefore, take great care in our interpretations of results of econometric testing.

Slovenian visual artists throughout history: A network analysis perspective ▪ Petja
Grafenauer, Andrej Srakar and Marilena Vecco

29

methodology mainly springs from the social network analysis (see e.g. Barnes, 1954; Bott, 1957; McAndrew & Everett, 2014), controlling for endogenous network formation (see e.g. Goyal & Joshi, 2003; Soramaki *et al.*, 2007; Hiller, 2015). Social network analysis has emerged as a key technique in modern social sciences, as demonstrated in largely growing literature in the field. It has gained a significant following in sociology, anthropology, biology, communication studies, economics, geography, information science, organizational studies, social psychology, and sociolinguistics. In 1954, J. A. Barnes started using the term social network analysis systematically to denote patterns of ties, encompassing concepts traditionally used by the public and those used by social scientists: bounded groups and social categories. Scholars such as Berkowitz, Borgatti, Burt, Carley, Everett, Faust, Freeman, Granovetter, Knoke, Krackhardt, Marsden, Mullins, Rapoport, Wasserman, Wellman and White expanded the use of systematic social network analysis.

In cultural economics, several usages can be noted. In the economics of music, studies by Becker (1982), Faulkner (1983), Finnegan (1989), Crossley (2008) and Bottero and Crossley (2011) led the development in the field. In recent years, a notable study by McAndrew and Everett was presented, studying the case of British classical composition, both as an example of a music network, and to contribute to debates in music history. It demonstrated that for the British composers, access to elite networks depended both on ability and personality; while many talented marginal figures were undoubtedly simply unlucky in that they possessed all the 'right' attributes but somehow did not break through, others were marginal partly through personal choice and self-imposed isolation. Some composers chose more commercial paths with less need for network support; others chose to compose music which was difficult to program or publish (McAndrew and Everett, 2015: 20).

In our analysis we will use models from endogenous network analysis, trying to answer to two key questions: (1) which were the main central figures with most social capital in Slovenian art history and did they form part of larger networks; (2) what is the relationship between network centrality and cultural production, after controlling for the apparent endogeneity in the model: the ones with better connectedness will likely be more productive, while the ones more productive will also likely be more connected. We answer the latter question using instrumental variable empirical strategy, using one of the measures of centrality apparently unrelated to production as an instrument.
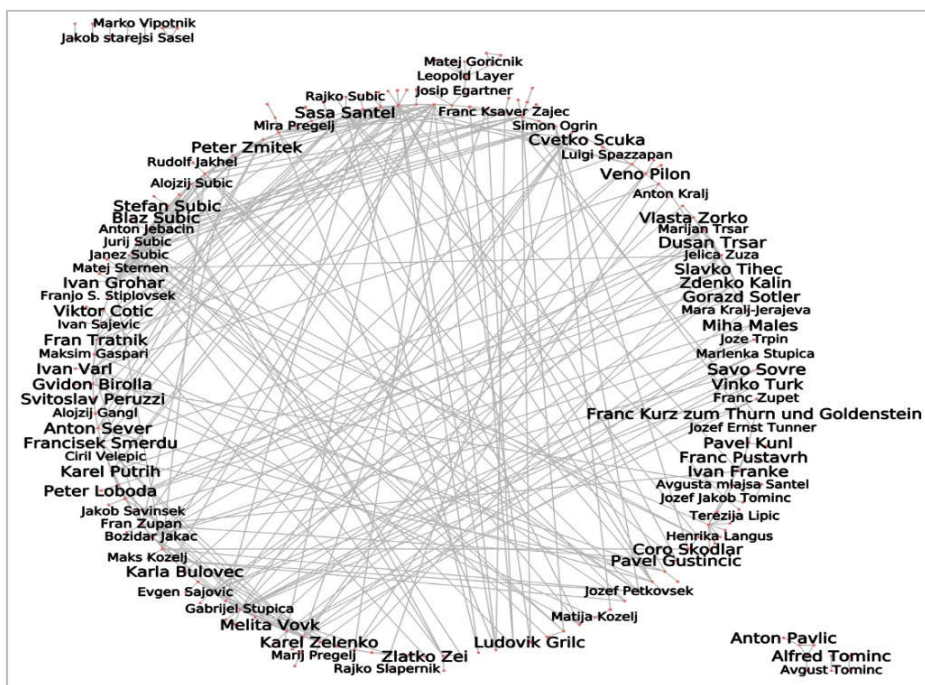
In the network analysis we use four main parameters defined below: *Degree centrality*, an example of radial centrality, placing centrality from walks of length one; *Eigenvector centrality*, placing centrality from walks of infinite length; *Betweenness centrality*, an example of medial centrality, denoting the number of shortest paths which pass through the given vertex; *Closeness centrality*, the total geodesic distance from a given vertex to all other vertices.

4. The network representation of Slovenian visual artists

In Figure 1 we present results of the circular network representation of our sample. When clustering the artists by network characteristics (connectedness and centrality in all four senses), we obtain six large groups which are related to the general historical artistic movements (The Impressionists, The Modernists), historical time (The Old Masters), Slovenian-specific art scene (The 'Vesnans', The Layer's workshop), and, finally, genres and types of visual art (The 'Sculptors'). Some artists belonged to different groups at the same time (e.g. A. Karinger to The Old Masters; Al. Gangl to The Sculptors; most of 'The Sculptors' to 'The Modernists', some Vesnans also to Impressionists and reverse, etc.). Nevertheless, we consider the obtained groups very well match the actual positions of the artists in the existing Slovenian art history, which were explained in more detail in the previous section.

- **The Impressionists:** Edvard Wolf; Anton Karinger; Valentin Šubic; Pavle Šubic; Štefan Šubic; Rudolf Jakhel; Anton Ažbe; Pavle Šubic Jr.; Jurij Šubic; Janez Šubic Jr.; Janez Wolf; Janez starejši Šubic; Roza Sternen; Ivana Kobilca; Matej Sternen; Maks Koželj; Ferdo Vesel; Ljubo Ravnikar; Ksenija Prunk; Jurij Jurčič; Julij Lehmann; Anton Jebačin; Jožef Petkovšek; Simon Ogrin; Josip Macarol; Ivan Grohar; Rihard Jakopič; Janez Borovski; Peter Žmitek; Matija Jama; Matija Bradaška; Franc Rojec; Fran Zupan; Pavel Gustinčič; Zdenko Skalicky; Anica Zupanec-Sodnik; Mirko Šubic; Čoro Škodlar; Blaž Šubic; Anton Cej; Aleksander Roblek; Alojzij Šubic.

- **The Modernists:** Zvest Apollonio; Gabrijel Stupica; Walter Bianchi; Veno Pilon; Vladimir Stoviček; Ivan Kos; Božidar Jakac; Karla Bulovec; Vinko Turk; France Kralj; Gojmir Anton Kos; Marlenka Stupica; Marjan Vojska; Lucijan Bratuš; Maksim Sedej; Klavdij Ivan Zornik; Alojzij Šušmelj; Karel Zelenko; Marij Pregelj; Miha Maleš; Jakob Savinšek; Tinca Stegovec; Jože Trpin; Jean Vodaine / Vladimir Kavčič; Ive Šubic; Janez Sedej; Ivan Seljak; Francè Slana; Savo Sovrè; Anton Kralj; France Slana; France Ahčin; Franc Zupet; Anton Sigulin; Evgen Sajovic; Mara Kralj-Jerajeva.

Slovenian visual artists throughout history: A network analysis perspective ▪ Petja
Grafenauer, Andrej Srakar and Marilena Vecco

31

Figure 1: Circular network representation of Slovenian visual artists

Source: Slovenska biografija.

- **The 'Vesnans':** Vladislav Pengov, Franc Sterle, Alojzij Repič, Celestin Mis, Viktor Birsa, Luigi Spazzapan, Cvetko Ščuka, Valentin Kos, Saša Šantel, Rajko Šubic, plemenita Elza Kastl, Hinko Smrekar, Fran Tratnik, Julče Božič, Jože Srebrnič, Ivan Žnidarčič, Anton Sever, Maksim Gaspari, Janez Povirek, Ivan Varl, Ivan Sajevic, Anton Perko, Gvidon Birolla, Franc Klemenčič, Svitoslav Peruzzi, Alojzij Gangl, Matija Koželj, Gabriel Justin, Franc Mrčun, Elza, plemenita Obereigner.

- **The Old Masters:** Viljem Künl, Pavel Künl, Terezija Lipić, Matevž Langus, Jožefa Struss, Mihael Stroj, Jožef Jakob Tominc, Josip Batič, Frančišek Caucig, Avgusta Šantel Jr., Jožef Ernst Tunner, Franc Kurz zum Thurn und Goldenstein, Josip Kogovšek, Janez Avguštin Puhar, Franc Pustavrh, Melita Rojic, Henrika Šantel, Henrika Langus, Ivan Frankè, Amalija Hermann von Hermannsthal, Alojzija Marija Jožefa Petrič.

- **The 'Sculptors':** Vlasta Zorko, Slavko Tihec, Zdenko Kalin, Boris Kalin, Karel Putrih, Marijan Tršar, Melita Vovk, Dušan Tršar, Janez Weiss, Janez Vidic, Gorazd Sotler, Frančišek Smerdu, Marko Šuštaršič, Lojze Dolinar, Drago Tršar, Peter Loboda, Ciril Velepič, Avgust Andrej Bucik.

▪ ***The Layer's workshop*:** Leopold Layer, Matej Goričnik, Anton Hayne, Jurij Miškovič, Janez Potočnik, Andrej Janez Herrlein, Josip Egartner, Jurij Tavčar, Ludovik Grilc, Jernej Jereb, Jakob Mikše, Gašpar Luka Goetzl, Franc Serafin Goetzl.

In Table 3, we also list some basic characteristics of the analysed network. There are seven connected components which could be an approximation for the number of clusters noted above. The graph density is very low, indicating a large number of very weakly connected vertices.

Table 3: Characteristics of the analysed network

Connected Components	7
Single-Vertex Connected Components	0
Maximum Vertices in a Connected Component	433
Maximum Edges in a Connected Component	453
Graph Density	0.0045
Maximum Geodesic Distance (Diameter)	9
Average Geodesic Distance	3.16

Source: Slovenska biografija.

In Tables 4 we see the rankings of the main central figures, according to degree, betweenness and eigenvector centrality parameters. The key figure in degree and betweenness centrality is Alojzij Repič, an academy sculptor, being the educator of many key figures in the visual arts of that time. Also, several key impressionist figures can be noted (to no surprise): Rihard Jakopič, Anton Ažbe, Matej Sternen, Ivan Grohar, Matija Jama and Ferdo Vesel. Furthermore, among the modernists, Gabrijel Stupica, Božidar Jakac and France Kralj stand out as key connected/connecting figures. Among the older artists, Janez Wolf is surely the key figure. Several 'Vesnans' are also on the list, most notably Saša Šantel and Hinko Smrekar. Finally, Leopold Layer, the leader of the noted workshop of the 19th century also stands out as one of the key figures.

Slovenian visual artists throughout history: A network analysis perspective ■ Petja Grafenauer, Andrej Srakar and Marilena Vecco

33

Tables 4: Rankings of main central figures

Rank	Artist	Degree centrality
1	Alojzij Repič	19
2	Rihard Jakopič	16
3	Anton Ažbe	14
4	Gabr. Stupica	14
5	Janez Wolf	14
6	Saša Šantel	13
7	France Kralj	12
8	Matej Sternen	12
9	Božidar Jakac	11
10	Hink. Smrekar	11

Rank	Artist	Betweenness centrality
1	Alojzij Repič	3606.72
2	Rih. Jakopič	3509.46
3	Saša Šantel	2574.43
4	Jurij Tavčar	2140.04
5	Mat. Sternen	2000.26
6	France Kralj	1924.99
7	Jos. Egartner	1629.00
8	Janez Wolf	1558.44
9	Matej Langus	1515.87
10	Leop. Layer	1481.00

Rank	Artist	Eigenvector centrality
1	Rihard Jakopič	0.0406
2	Anton Ažbe	0.0399
3	Ivan Grohar	0.0301
4	Matej Sternen	0.0300
5	Janez Wolf	0.0251
6	Matija Jama	0.0235
7	Jurij Šubic	0.0230
8	Ferdo Vesel	0.0222
9	Alojzij Repič	0.0209
10	Janez Šubic Jr.	0.0203

Source: Slovenska biografija.

Next, we perform econometric testing to answer also to the question on the relationship between network centrality and productivity. To this end, we firstly use basic Poisson models, taking into account the apparent count nature of the productivity variable. The results of basic models are presented in Table 5, where we present marginal effects of the used independent variables to the level of productivity. The results show that women tend to have lower productivity, as expressed by word count of their biographies (this could also be a consequence of their under-representedness in the sample and/or of the prevailing discrimination to women artists throughout the 19th and 20th century). As compared to men, women tend to have on average approximately 100 words shorter biographies. The coefficient on age is significant and shows the expected

inverted (U-shaped) effect. In general, each additional year of age of the artist provides approximately 10 more words in his biography. Furthermore, those born in the 20th century tend to have on average approximately 100–180 more words in their biography. Furthermore, illustrators, sculptors, drawers and painters tend to be significantly more productive than other visual arts occupations. Finally, three of the four centrality parameters are strongly statistically significant and of the positive size. Due to their different construction it is hard to make any sensible conclusions on the basis of their marginal effects. On the other hand, the degree centrality has an ambivalent and insignificant effect to the productivity of the artist.

Table 5: Results of econometric testing

	Poisson regression - marginal effects			IV Poisson		
	Model I	**Model II**	**Model III**	**Model I**	**Model II**	**Model III**
Female	-101.371***	-136.326***	-93.212***	-0.196+	-0.183	-0.209*
Age	11.692***	10.306***	23.040***	0.034**	0.026	0.048***
Age square	-0.083***	-0.072***	-0.160***	-0.000*	0	-0.000**
Born 20th century	104.686***	131.188***	182.952***	0.230**	0.317**	0.362**
Multiple roles	33.154***	34.903***	68.530***	0.092+	0.054	0.124**
Illustrator	160.454***	174.013***	168.749***	0.399*	0.408*	0.403*
Sculptor	120.141***	136.054***	179.543***	0.419**	0.404**	0.424**
Drawer	343.875***	400.526***	326.040***	0.706**	0.728**	0.616*
Painter	171.555***	167.756***	137.786***	0.376***	0.352**	0.350**
Degree c.	60.050***			0.086*		
Betweenness c.		0.262***			0.001+	
Eigenvector c.			27566.950***			41.983+
N	**214**	**214**	**214**	**214**	**214**	**214**
Likelihood Ratio test	32201.29***	22822.04***	30831.06***			
Log Likelihood	-19684.7	-24374.3	-20369.8			
Pseudo R-square	0.4499	0.3189	0.4308			

Notes: Significance: ***1%; **5%; *10%; +15%.
Source: Slovenska biografija.

To this end, we use closeness centrality as an instrument to control for the possible effects of reverse causality. As it shows up, the closeness centrality is a valid (uncorrelated to the error terms of original regression) as well as a strong (strongly correlated to all other three centrality parameters) instrument. Using it as an instrument can provide a solution, improving the measures previously used by e.g. O'Hagan and Borowiecki (2010) and Borowiecki (2013), such as distance of the birth place to the place of living. The results below confirm the positive and (weakly) significant effect of the network centrality on artists' productivity even after controlling for the endogeneity. All three centrality parameters are in the level of significance of approximately 10%. This serves as another strong argument in the debate on the supposedly positive effects of networking on artists' productivity and also serves as a confirmatory answer to our second research question: networking/connectedness indeed positively affects artists' productivity, particularly related to the degree centrality.

Also, all the other control variables don't change in sign, although slightly lose in the level of significance.

5. Discussion and conclusion

In conclusion, let's briefly try to summarize the main findings. Firstly, we presented a theoretical overview of groups of Slovenian visual artists throughout the 19th and 20th century. We pointed to some initial groupings, with the predominant role of the impressionist movement of the end of the 19th century with several key figures. Secondly, we demonstrated the existence of six key 'empirical' groups of artists throughout the 19th and 20th century: The Impressionists; The Modernists; The 'Vesnans'; The Old Masters; The 'Sculptors'; The Layer's workshop. We also pointed to its key central figures, carrying the representatives of all six groups, with slight difference in regard to the measure of centrality under consideration. Finally, we estimated the effect of network centrality on artistic productivity, using a newly chosen instrumental variable to take into account the endogeneity in the model. We confirmed the positive effect of network centrality on artistic productivity, yet with a significantly lower effect in significance as is pointed out in some of the current literature. We also estimated the effects of confounding covariates, and found the negative effect for women, positive for age, positive for the 20th century birth occurrence and positive for several of the chosen occupations.

In finish let's point to some of the limitations of the study and questions for future research which can be mostly studied with the use of the same dataset. One obvious limitation is in the sample. Not only are we limited in the possibilities of the web-based database, also there is a real possibility of selection bias. The artists selected to be presented at the website of course represent only a small minority of the artists throughout history. The conclusions in our article, therefore, cannot hold in general, without verification on the full dataset of all artists: the successful and well known's as well as the less successful ones. Although we don't expect the main direction of the findings could change, there could be changes in the size and significance of the findings. Furthermore, we didn't take into account the 'spillovers' across sectors. The database of *Slovenska biografija* allows a rich perspective on networking across multiple disciplines, not just across the arts but across all other fields of the society. By this, we would be able to answer to another still open question in the literature waiting for a proper study and approach.

Finally, dataset could be extended in multiple other ways. We could include the data from other (printed) encyclopedias which would surely complement our dataset in significant ways. Also, we could include also the artists from previous centuries, which are not supported by sufficient data in the current web-based database. Finally, some galleries collect the data of all their exhibitions, cooperating artists, performance, etc. throughout history. We plan to collect such a database on a larger scale from one of Slovenian galleries and here lies another important pathway of future research. We hope that the approach developed in this article will provide a sufficient foundation for such endeavors in future.

References

Barnes, J. A. (1954). Class and committee in a Norwegian island parish. *Human Relations*, 7, pp. 39–58.

Becker, H. S. (1982). *Art worlds*. Berkeley: University of California Press.

Borowiecki, K. J. (2013). Geographic clustering and productivity: An instrumental variable approach for classical composers. *Journal of Urban Economics*, 73, pp. 94–110.

Bott, E. (1957). *Family and social network*. London: Tavistock.

Bottero, W., & Crossley, N. (2011). Worlds, fields and networks: Becker, Bourdieu and the structures of social relations. *Cultural Sociology*, 5(1), pp. 99–119.

Brejc, T. (1998). *Začetki modernizma: impresionizem, secesija, simbolizem, Umetnost an Slovenskem*. Ljubljana: Založba Mladinska knjiga.

Slovenian visual artists throughout history: A network analysis perspective ■ Petja Grafenauer, Andrej Srakar and Marilena Vecco

37

Brejc, T. (2004). Umetnostna zgodovina ob koncu modernizma. In B. Murovec (Ed.), *Slovenska umetnostna zgodovina, Tradicija, problemi, perspektive* (pp. 107–114). Ljubljana: Založba ZRC.

Crossley, N. (2008). Pretty connected: The social network of the early UK punk movement. *Theory, Culture and Society*, 25(6), pp. 89–116.

Faulkner, R. (1983). *Music on Demand*. New Brunswick, NJ: Transactions.

Finnegan, R. (1989). *The hidden musicians: Music-making in an English town*. Cambridge: Cambridge University Press.

Gabrič, A. (1995). *Socialistična kulturna revolucija*. Ljubljana: Cankarjeva Založba.

Goyal, S., & Joshi, S. (2003). Networks of collaboration in oligopoly. *Games and Economic Behavior*. 43(1), pp. 57–85.

Hiller, T. (2015). *Peer effects in endogenous networks* (October 4, 2015). Retrieved from Social Science Research Network: http://ssrn.com/abstract=2478975.

Höfler, J. (additions Klemenčič, M.) (1999). *Uvod v slovensko umetnostno zgodovino z bibliografskim pregledom*. Skripta, Ljubljana: Faculty of Arts. Retrieved from: http://www.ff.uni-lj.si/oddelki/umzgod/teksti/uvod.doc.

Kranjc, I. (2001). *France Kralj*. Ljubljana: Slovenska matica.

Kranjc, I. (2004). *Umetnost tridesetih let iz zbirk Moderne galerije Ljubljana, Prvi študijski zvezek, 1928–1934*. Ljubljana: Moderna galerija.

Kranjc, I. (2005–2006). *Umetnost tridesetih let iz zbirk Moderne galerije Ljubljana, Drugi študijski zvezek, 1935–1937*. Ljubljana: Moderna galerija.

Kržišnik, Z. (1979). *»Slovenska likovna umetnost 1945–1978«, Slovenska likovna umetnost 1945–1978 I*. Ljubljana: Moderna galerija *et al*.

McAndrew, S., & Everett, M. (2015). Music as collective invention: A social network analysis of composers. *Cultural Sociology*, 9(1), pp. 56–80.

Mikuž, J. (1995[1982]). *Slovensko moderno slikarstvo in zahodna umetnost. Od preloma s socialističnim realizmom do konceptualizma*. Ljubljana: Moderna galerija.

Mikuž, J. (1979*). »Slovensko povojno slikarstvo«, Slovenska likovna umetnost 1945–1978 I*. Ljubljana: Moderna galerija, Ljubljana.

O'Hagan, J., & Borowiecki, K. J. (2010). Birth location, migration and clustering of important composers: Historical patterns. *Historical Methods: Journal of Quantitative and Interdisciplinary History*, 43(2), pp. 81–90.

Soramaki, K. *et al*. (2007). The topology of interbank payment flows. *Physica A*, 379, pp. 317–333.

Stele, F. (1966). *Oris zgodovine umetnosti pri Slovencih. Kulturnozgodovinski poskus*, Ljubljana: Mladinska knjiga.

Trenc-Frelih, I. (Ed.) (1998). *'Od socrealizma do analitične abstrakcije', Umetnost an Slovenskem: od prazgodovine do danes*. Ljubljana: Mladinska knjiga.

Žerovc, B. (2002). *Rihard Jakopič – umetnik in strateg*, Ljubljana: *cf.