Social Network Analysis of the Global Game Jam Network

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ABSTRACT

The *Global Game Jam*® is an annual game jam event promoting on-site and collaborative game development experiences. It attracts tens of thousands of participants, called "game jammers" or "jammers", from all around the world developing games at the same weekend to the same theme. The key characteristics of this event can be described on the one hand as social and communal, and on the other hand, as global and international. In this work, we analyze the social connections between the jammers with social network analysis and discuss the potential of social network analysis for this field. Our results indicate that jammers are most likely to work on teams between two and five members and often work together with the same colleagues. Also, while the game jam is a highly international event, jammers barely change their geographical locations. The Global Game Jam location graph is thus barely connected but divided into subgraphs.

CCS CONCEPTS

•Human-centered computing → Social networks; *Social network analysis;* **•Social and professional topics → User characteristics;**

KEYWORDS

game jam, global jam jam, game development, social network analysis

ACM Reference format:
Johanna Pirker, Foaad Khosmood, and Christian Gütl. 2016. Social Network Analysis of the Global Game Jam Network. In *Proceedings of International Conference on Game Jams, Hackathons, and Game Creation Events, February 26 2017, San Francisco, CA, USA, February 26 2017 (ICGJ),* 5 pages.
DOI: http://dx.doi.org/10.1145/3055116.3055117

1 INTRODUCTION

Game jams have great potential as educational frameworks [6, 8, 11], to build local communities [15], and to strengthen connections between academia and industry [4, 13]. While the main motivation of attending game jams often differs between participants, community building and social values of such events were identified by several studies as key elements [15]. Thus, it is crucial to get a better understanding of values, interactions, and moods of the jammers in a social context.

One way to study the social connections is by representing social interactions in the form of social networks that form between game jammers. Social network analysis (SNA) can be used as a tool to get a deeper understanding of aspects such as social dynamics, community structures, or key persons. To understand better the social dynamics in jammer networks in an international context, the basis of our analysis is data from the international game jam event *Global Game Jam*® (GGJ) over several years.

The annual GGJ is a key event in the context of on-site and social game jam events [5] and puts the game jam into an international setting. In comparison to several other game jam events, both local collaboration and the global setting are essential to the whole experience.

In this paper, we focus on investigating the jammer in a (1) social context and look at the jam experience through a (2) global context through social network analysis. Based on previous work by [21] and [9] we get an understanding of the community based on the official GGJ surveys.

To understand better the importance of social interactions, we investigate different types of connections between jammers who have developed games together within GGJ events in the past three years. Social network analysis in the context of game jam research is a new way of modeling this community. This paper only forms a first basic pass for this research and gives directions for potential research questions for further studies with SNA as main analysis tool.

In the final section we discuss ways to strengthen the community and the event structure based on our findings.

Contribution

In this paper, we construct social networks based on information of jammers working together in teams. The networks are based on jammers who developed together games at the GGJ within the time span of 3 years.

To summarize the main contributions of this paper:

- First construction of social jammer networks within GGJ
- Discussion of potential of social networks for the GGJ and future game jam research

ICGJ, February 26 2017, San Francisco, CA, USA

978-1-4503-4797-6/17/02…$$15.00
DOI: http://dx.doi.org/10.1145/3055116.3055117

2 RELATED WORK

Game Jams are known as social and collaborative events [6]. In their study, Reng et al. demonstrated that social aspects are one of the key motivators for jammers to participate in such events. Study participants mentioned that developing games and meeting new people are the main motivational factors of jammers [17]. Another important finding is that collaborative experiences are often more important in jam settings than competitive experiences. In game jams, jammers are engaged to work together in teams in a collaborative and not in a competitive setting [19]. Collaboration is both an important motivator, and also as a skill jammers gain while jamming [11].

Compared to traditional on-site game jams, the GGJ additionally adds international aspects to this development event. Local sites all over the world give jammers the possibility to jam on various locations and connect more easily to new development networks. Such international collaborations and networks are becoming more and more important for the jammers' learning experience, for their future career, and also as part of their resume [12]. Additionally, "mega-region game jams" create major social awareness [24] across a larger geographic region. In summary, GGJ presents one of the best opportunities to investigate social and international aspects of jams together.

In [6] the authors discuss various potentials of the GGJ as research platform. This includes aspects such as research on culture, motivation, and skills of game developers, communication, collaboration, and development processes, skill learning, or regional variations of the processes. While many authors have described the importance of collaboration and international aspects as important factor for jammers through qualitative studies and surveys, it is still challenging to demonstrate social dynamics on a large scale.

Social Network Analysis (SNA) has been shown to be a valuable tool used to investigate collaborations and social experiences between people. In recent years, SNA has become an important tool to investigate large-scale massive social networks such as Facebook or Twitter, which offer direct networks of people connected with "friends" or "followers", to analyze and understand user behavior, but also as tool to create predication or recommendation systems [18]. In recent years, SNA has also become more popular to analyze multi-player games, open worlds or massively multi-player online games such as Second Life [20], World of Warcraft [23], or Destiny [16]. Through social network analysis, a correlation between player engagement and strong social connections, such as strong friendships can be demonstrated (e.g. [3, 16]).

While the social connections among gamers have been the focus of recent research, an anaylsis of social connections between game developers in game jams is still open. The impact of social connections and collaboration efforts on jammers is also a key question in game jam research. There is still a lack of data-driven research to investigate correlations between social behaviour and measures such as engagement or retention. One way to investigate this field is SNA. Following, we describe the basics of SNA in the context of game jammers to understand better their social behavior. To the best knowledge of the authors this paper introduces the first representation of game jammers as a social graph.

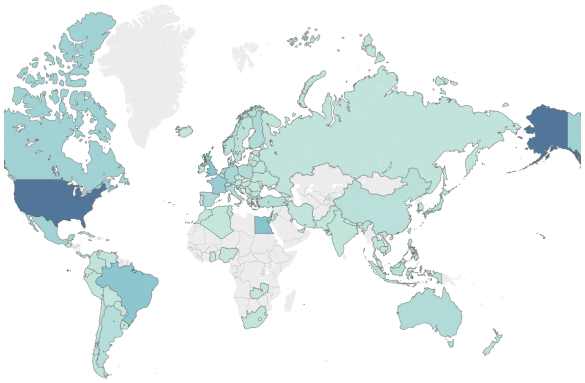

Figure 1: Game jammers in the world 2016.

Table 1: Overview of the dataset

Year	2016	2015	2014
Countries	93	75	69
Sites	632	517	488
Jammers	35.075	27.893	22.419
Games	6.530	5.277	4.137

3 DATASET DESCRIPTION

The GGJ is described as the *"world's largest game development event taking place around the world at physical locations"* [1]. It usually starts on a Friday afternoon in January with the keynote and announcement of a theme, which is the same for all participating locations (sites). Jammers will work (most likely in teams) on games taking into account the theme in a 48 hour development cycle. Each game is then uploaded to the official globalgamejam.org website and linked to the profiles of the jammers involved in the development of the game. In 2017 over 7200 games in 700 locations (95 countries) were registered. Figure 1 illustrates the countries with registered jam sites of the world in 2016.

We constructed a GGJ dataset with information on the game jam locations (sites), developed games, and jammers by crawling the archives of the GGJ website [1] spanning from 2014 to 2016. Overall, the crawled collection of the three years consists of 1637 registered jam sites, information on 85,387 jammer entries, and information on 15,944 uploaded games (including duplicates over the three year time-span). Details on the dataset are described in Table 1.

Based on the information on the website, We have collected the following features for the years 2014, 2015, and 2016:

- Sites: location, country, jammers, uploaded games
- Jammers: name replaced by ID for this research, location, skills, uploaded games
- Games: name, platforms, tools, description

4 JAMMER NETWORK

Social network analysis (SNA) describes the use of graphs to analyze social structures in networked environments, such as social media sites, collaborative environments, or multi-user games. Structures

[1] http://globalgamejam.org/

are described through nodes (actors, v) and connections between the nodes (edges or links, e) [18].

4.1 Network Relationship

The network relationship describes the connection between nodes through links. We can use explicit information to create connections (e.g. based on friend or follow information) or implicit information (e.g. shared interests). Since the GGJ information system does not offer users to create direct connections to other user, we rely on implicit information.

To create the network to represent the social interactions within the GGJ activities we can use different strategies and create various networks:

- **Jammer Network**: describes connections between jammers through the games they have developed together (v = jammer, e = developed games together)
- **Location Network**: demonstrates the connectivity between various locations or nations through (moving) jammers (v = location, e = jammers developed games together)
- **Game Network**: represents a network of all games developed connected through jammers (v = games, e = common jammers in the development process)

In this paper we use a *Jammer Network* to describe the relationship between the jammers based on team information. The network with a subset of the crawled data with removed outliers and was created based on the three-year span information of the games the jammers created together. Jammers are displayed as nodes (v); edges (e) between jammers are created if they have developed a game together. We represent the jammer network as undirected (all edges are bidirectional) weighted graph. Weights on edges represent how many times jammers have worked on games together (e.g. a weight of 3 on an edge would indicate that jammers have developed three games together).

This network was analyzed with the open graph visualization platform *Gephi* [2] [2]. Figure 2 illustrates the created network. Compared to other graphs, this graphs has many components (small subgraphs), which are not connected to the main graph. Figure 3 illustrates this in a closer view. This figure illustrated that many jammers only have developed games with the same groups or have attended the global game jam only in one year. Bold connections show stronger connections through weights between jammers, who have already worked with each other (Note: no labels are used for the graphs to preserve anonymity).

4.2 Network Structure

To understand the community it is crucial to analyze the network's typical characteristics. In the following sections we discuss basic network measures, which are used to understand the structure of the network and its population. Table 2 gives an overview of the network. Unfortunately, since this graph is not well connected and many nodes are not connected to other nodes at all, many typical SNA values are not representative for the analysis, including path lengths and diameter.

[2] https://gephi.org/

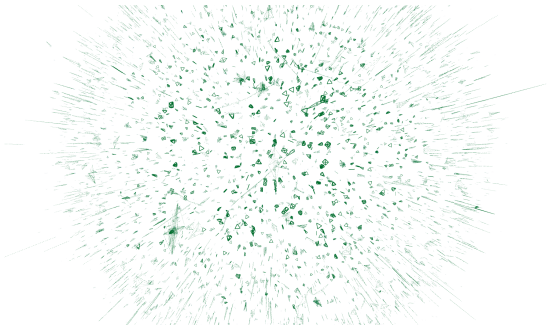

Figure 2: Overview of the jammer graph 2014-2016.

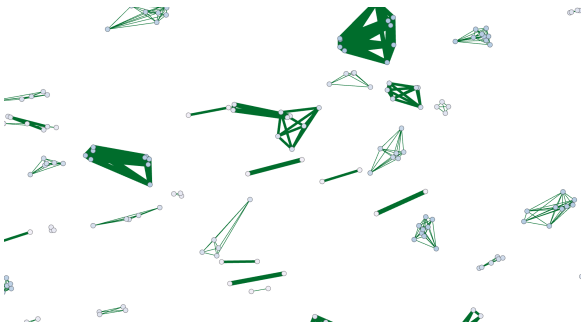

Figure 3: Zoom into the jammer graph 2014-2016.

4.2.1 Average Degree. The *average degree* of the network describes the average number of connections jammers have to other jammers. The average degree of this network is 4.335. Figure 5 gives an overview of the degree distribution. As illustrated in the graph, most jammers are connected to 2 - 6 other jammers. Almost 1,500 jammers are barely connected with others and have a degree of 1. Only a few have more than 9 connections. Often, jammers with a high degree are jammers who were involved in the development process of several games at the same jam, such as sound/audio engineers.

The weighted degree distribution additionally takes into account edge-weights. Weights are added to an edge as a jammer works on project with the same person in more than one project. Figure 6 gives an overview of the degree distribution of the weighted graph. The average weighted degree is 5.515. Comparing this to the smaller not-weighted average degree, one can see that jammers are likely to work with again with jammers they have already worked with before.

Of 39,939 edges, which represent the collaboration through games, 8,631 (21.61%) collaborate more than one time with the same jammer, 1,998 (0.50%) more than twice, and 233 (0.58%) more than 3 times. 29 (0.07%) even worked together 4 or more times with the same partner (e.g. working on two games at the same jam).

4.2.2 Largest Component. The *largest connected component (LCC)* in this graph is very small (56 nodes and 194 edges), which indicates a graph, which is not well connected. Figure 4 demonstrates the largest component of this network. It illustrates a subgraph

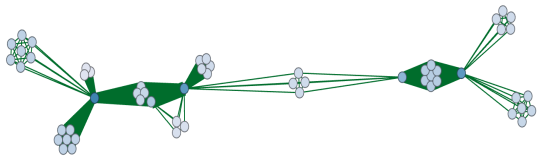

Figure 4: The largest component in the graph.

Table 2: Overview of the network

Nodes	18,426
Nodes in LCC	56
Avg. Degree	4.335
Avg. Weighted Degree	5.515
Edges	39,939
Edges in LCC	194
Diameter	6
Avg. Path Length	1.257
Avg. Clustering Coefficient	0.991

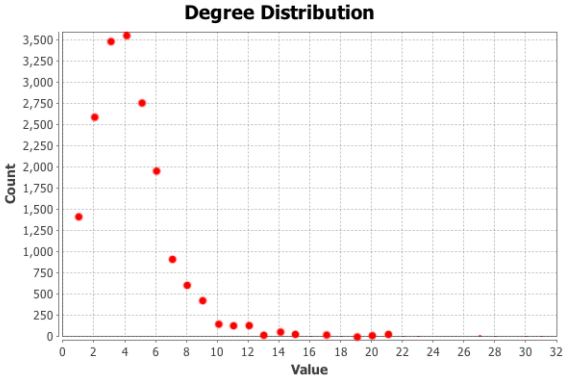

Figure 5: Degree distribution of the jammers.

of 56 Brazilian jammers who are connected through the game development process. The average degree in this subgraph is 6.929, the average weighted degree is 12.786, which shows that many participants worked in the same teams over the last years. Many of these jammers have participated every year, some have even worked on more than one game per year. Figure 4 illustrates clearly how a few subgroups, which work together very often (bold edges), are connected through just a few jammers. These jammers can be described as "bridges" and are a key element to for the connectivity.

4.2.3 Diameter. The *diameter* describes the size of the network in form of the largest distance (through paths) through the network. The diameter of this network is 6. However, since the graph is not very well connected, this number might be misleading, since many nodes can't be reached at all from various starting nodes.

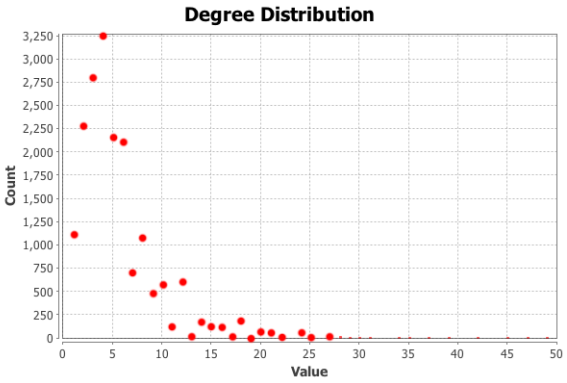

Figure 6: Weighted degree distribution of the jammers.

5 DISCUSSION AND FUTURE WORK

Social development events are becoming more and more important to build and strengthen game communities. However, social communities and groups are often complex and challenging to understand. Social network analysis is a promising tool to analyze such collaborative settings. SNA can be used to describe the network, find important and interesting nodes, but also weak nodes. This paper only forms the basis and introduces SNA as tool for jam network analysis and explores the network only based on standard graph metrics. In future work, the developed network can be used to correlate the social metrics with aspects such as retention rates and engagement.

Based on our network analysis, we find that the jammer graph does not describe the entire network, but consists of several subgraphs representing various locations. While jammers within the same site are often well-connected, the sites are barely connected to jammers of other sites. This is consistent with the rules and conditions of the jam which make inter-site collaboration very difficult if not impossible during the same event. While the GGJ can be described as international event, the event does not focus on group work among individual jammers of different countries.

Metrics of the analysis such as the average degree could be also used to predict the jammers' task in the team. A high average degree refers to jammers who have worked on many projects. This often refers to sound and audio engineers.

Specifically, the GGJ network could be further analyzed as follows:

- **Social Networks to Strengthen the Community:** Social network can be used to identify weak ties and important nodes, which are "bridges" or "hubs" and are connecting many other nodes and components. This knowledge can be useful to avoid drop-outs. Additionally, SNA can be used to identify "strong" nodes (with a high degree). These nodes are often very experienced with game jams and can be used as "experts" to create new jam sites or to help organizing events, or as part of a group, which is not very experienced yet.
- **Social Networks for Dynamic Group Formation:** Graph-based recommendation tools are already popular in various

fields, such as games, recipes and products[16, 22]. Forming proper and meaningful groups can be a struggle in large game jam settings[14], as no widely adopted methods exist. Using social networks in a tool for group formation could be a fast, easy, and interesting replacement of traditional methods.

- **Collaboration Graph as Engagement Tool:** Based on the social network measure a new form of social engagement can be created. Similar to the Small World Problem [10] or the Erdos number [7], the collaboration graph can be used to engage jammers, to collaborate with new jammers, or jammers at different locations. As gamification tools, jammers could be motivated through their "degree", or the path length to another person (e.g. a famous game developer, the "Romero number") to collaborate with new jammers.

6 CONCLUSIONS

As the GGJ is an event with focus on collaborative and social experiences, it is crucial to identify new ways to investigate social behaviour and social connections in jam environments. In this paper, we have analyzed the GGJ with social network analysis to be able to describe and compare the structure of the community in an analytic way. It is to the best knowledge of the authors, the first social network analysis of the jammers of the GGJ. This work only gives a first overview of the potential of networks as tool to understand this community and moving forward we will advance this work by adding experiments to understand correlations between network metrics and critical aspects such as retention rate or motivation.

Additionally, we have discussed potential applications to use the network as a tool not only to understand the community but also to support the community, or make some of the typical processes more interesting. In Summary, jammer networks can be used to overcome various typical issues of game jams, and to improve the collaboration and internationalization of the events through (1) providing recommendations for group partners, (2) identifying and promoting engaged and well-connected community members, and (3) enabling a gamified tool to strengthen game jams through formation of more diverse groups.

7 ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to the Global Game Jam, Inc.

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