Deconstructing CSSS 2009 Social Network

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Abstract—CSSS09 is a group of people interested in complex systems who are randomly chosen to attend the one month summer school. The international and interdisciplinary group spends four weeks together learning, discussing and working on projects related to complex systems.

Index Terms—Social Networks, Network Dynamics, Santa Fe Institute, Summer School

I. INTRODUCTION

THE Santa Fe Institute organizes and sponsors each year a summer school on complex systems, the Complex System Summer School (CSSS). The participants are a group of people interested in complex systems from diverse disciplines and who are selected competitively after applying for the CSSS. The international and interdisciplinary group spends four weeks together learning, discussing and working on projects related to complex systems. Due to the internationality and interdisciplinary nearly none of the participants had known each other at the beginning of the CSSS 2009 and during the four weeks and after this initiated by the related project works a social network evolved; a very unique situation regarding social network studies. The participants were encouraged to spontaneously form collaborative teams and execute a project for presentation on the final day and summarize the results in a working paper afterwards. More specifically, participants were directed to select a project and teModelam (if applicable) by the end of week two. In [2] the author describes a social network as "a set of people or groups of people with some pattern of contacts or interactions between them". Therefore a social network displays a social structure made of individuals called "nodes", which are connected by one or more specific types of interdependency, such as friendship, kinship, financial exchange, dislike, sexual relationships, or relationships of beliefs or knowledge. The patterns of friendships and business relationships or collaboration are examples for social networks which were studied in the past. Thus, the main focus of this study on the unique situation of the CSSS 2009 social network was on following questions: i) what is the social interaction network and the structure of the network; ii) how does the network change over time; iii) what other factors influence the evolution of the network; iv) how frequently was there discussion between disciplines and did that lead to productive final projects; v) is there a link between the social and final product networks? Network theory can provide not only a statistical characterization of these phenomenons, but also a better knowledge on the process forming such interactions [1].

II. METHODS

Three surveys were distributed to all the participants of the summer school (including one visiting faculty who attended most of the lectures) as well as two professors working closely with the group during a period of 3 weeks, for a total of 63 people. The surveys were conducted from the second week of the summer school to the week following the end of the school, across a period of almost 4 weeks. The first survey asked about individual attributes as well as network information. The second and third survey focused only on network information. The attribution data included areas of interest, undergraduate, graduate and postgraduate (if applicable) institution while the network data asked about friendship and potential work based collaboration.

The response rate decreased over the period (understandably because of boredom from repetition and length of the survey), from 86 percent in the first survey, 76 percent in the second to 54 percent in the third. However, no bias was observed in the decreasing response. In order to be consistent, only those respondents are included in the analysis who replied to all the three surveys. While this improves the understanding of the evolution of their relationships across time, it limits the inclusion of respondents whose relationships evolved in a manner different to those who replied to all surveys. Since the included sample of 27 respondents makes 43 percent of the original network, it is assumed to be meaningful towards drawing conclusions about the general characteristics of the network.

The network data was treated as asymmetric in order to preserve the directional aspect of ties between respondents. The survey asked respondents to categorize the strength of ties into three levels: weak, moderate and strong. For the purpose

of analysis, only strong ties are taken into consideration (binary value 1) and the weak and moderate ties are considered insignificant (binary value 0).

A. Sample

All participants in the Complex Systems Summer School 2009 were encouraged to take part in this social network analysis. The group consists of PhD students, postdoctoral fellows, recent PhD graduates, and employees of Santa Fe Institute corporate partners as well as three members of Santa Fe Institute who were very closely related to the CSSS 2009. All participants come from various nations and disciplines. Information describing the identity of the participants and project group composition is publicly available on the CSSS 2009 wiki.

B. Questionnaires and Data Collection

The surveys to analyse the social network of CSSS 2009 consisted of different parts and the participant were asked to fill in the first analogue form in week two, followed by two electronic surveys be end of week three and four. In the first survey a general part was including asking for nationality, gender, age, language (mother tongue, English fluency) scientific area and degrees (Universities) as well as social activity involvement and the accommodation regarding spatial distribution during the CSSS 2009. The investigation of friendship and potential research collaboration networks based on these surveys used the roster choice method [3]. This method where the respondents are given the list of all respondents (the roster) of which they select the people that they are friends with and would be interested in working together. The adjacency matrix are based on undirected valued data, where the cell values indicate the strength of a relation in addition to its presence. For both questions (friendship and research collaboration) the participants had to choose one of the three given levels of relation. The part of friendships and research collaborations was repeated in all three surveys.

C. Network-Model

D. Questionnaires and Data Collection

III. ANALYSIS

IV. RESULTS

It can be seen that the outward ties are on average similar to the average inward ties; however, the disagreement (standard deviation) between people over incoming ties is larger and surprisingly, grows by the end of the third survey. This is strange because as people get to know each other well, it is expected that they will have a better understanding of the symmetricity of their relations with others. However, it may be because the final survey was filled when people had left school and were no more influenced by the proximity of other respondents and therefore, more free to reflect on their ties with others.

Network graph characteristics
Vertices (n) = 63
Edges (m) = 328
Mean degree (z) = 6.83
Mean vertex-vertex distance (l) = 3
Diameter = 8
40 unreachable pairs
Clustering coefficient (C) = 0.4143

V. DISCUSSION AND FUTURE DIRECTIONS

VI. ACKNOWLEDGMENTS

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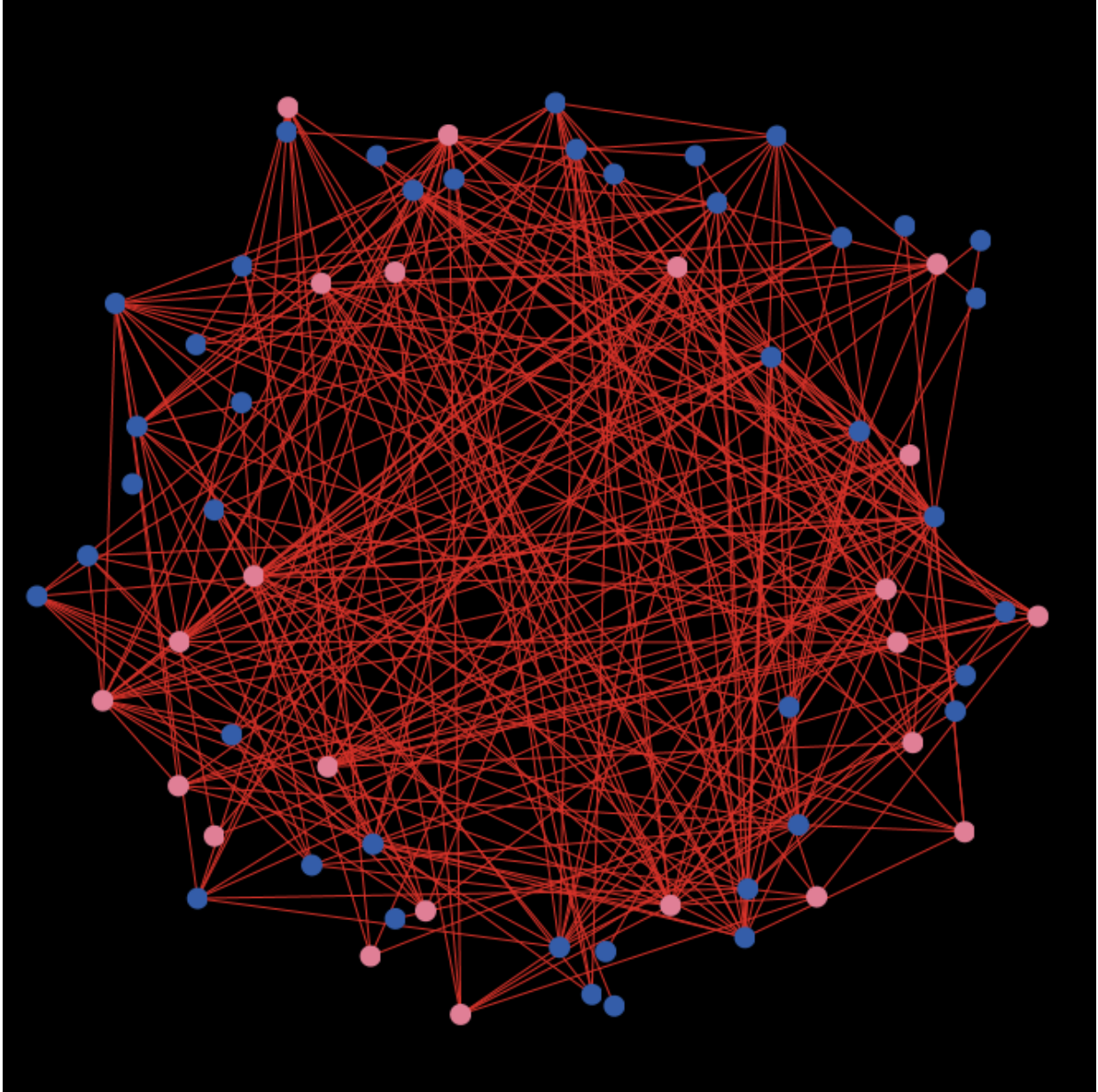[3] Scott J., (2000). Social Network Analysis. Sage Publications: London.

Fig. 1. Members in the network: Pink colors show females and blues show males
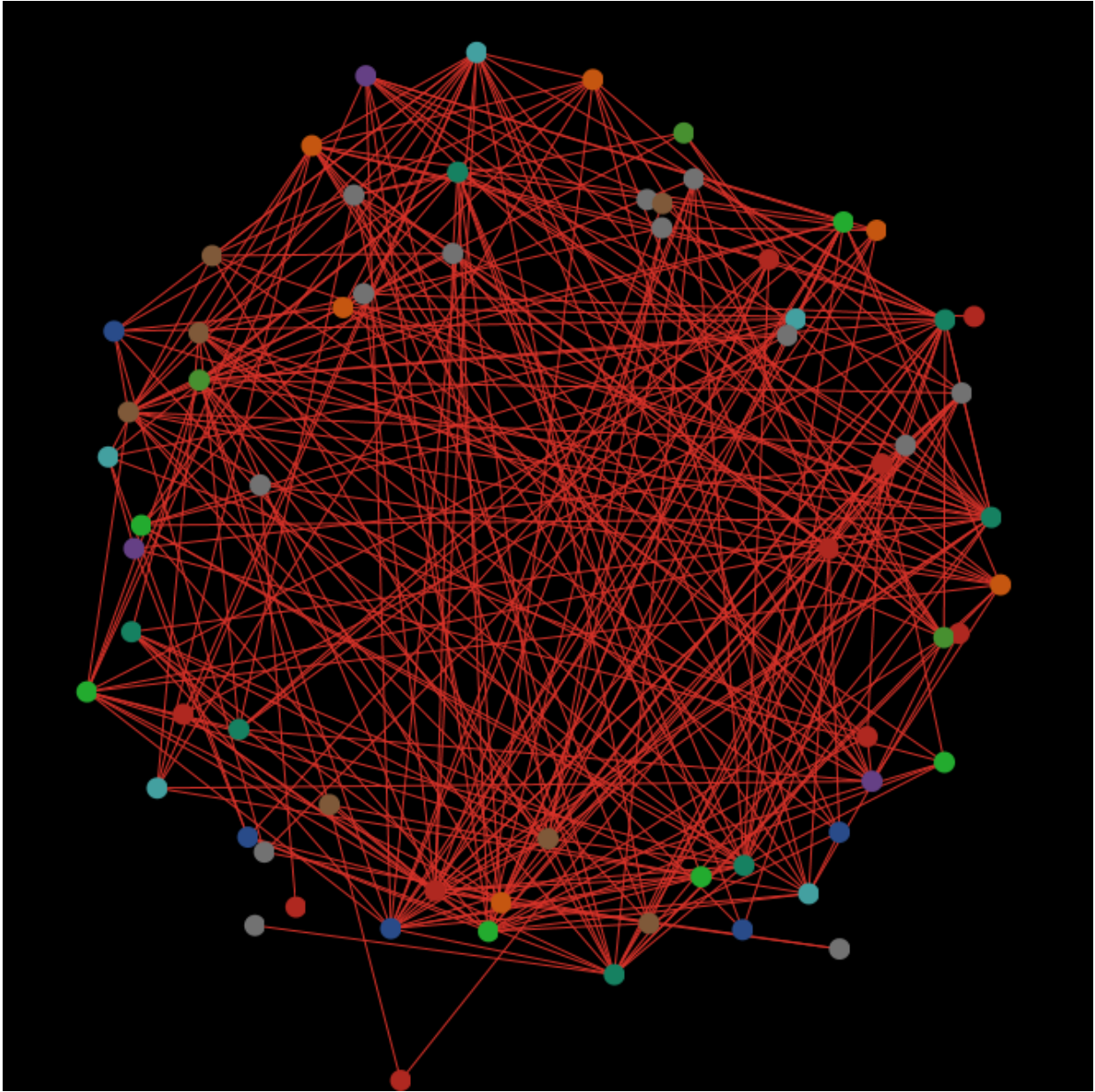
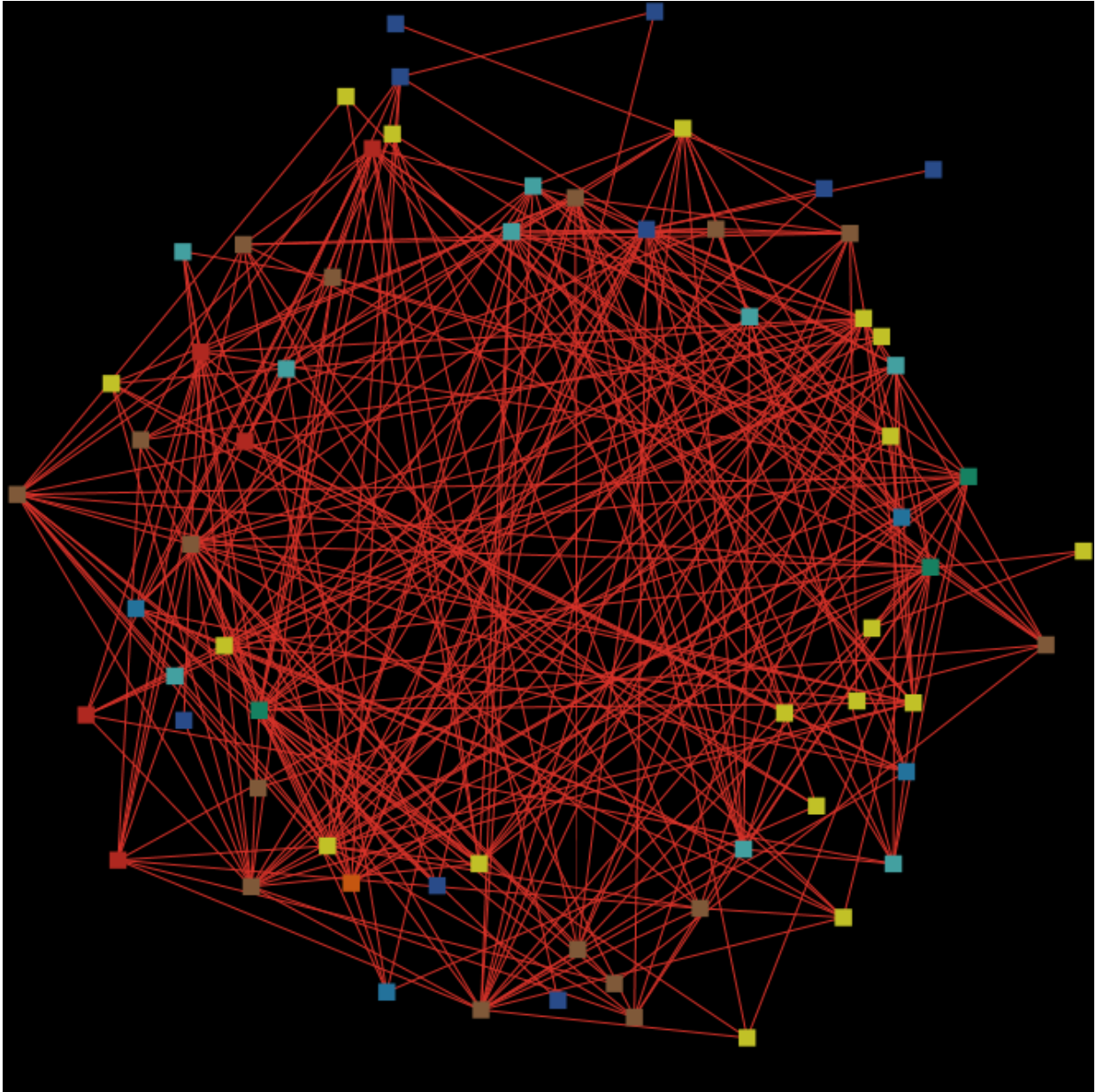Fig. 2. Members in the network: Each color shows an area of research for the individual

Fig. 3. Members in the network: Each color shows a specific dorm