

Math 381: Assignment 3: Acquaintance Graph

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In this reflection and analysis, I will share my thoughts on Stanley Milgram and Jeffrey Travers' paper, *An Experimental Study of the Small World Problem* and Frigyes Karinthy's short story "Chain Links." I will also give two examples of my own acquaintances of two chain lengths away from myself, or in other words, two generations away from myself (an acquaintance of my own acquaintance).

Before it was clarified to me, I believed the whole point of Stanley Milgram and Jeffrey Travers' experiment was to study how Nebraska and Boston populations as a whole were different. Prior to knowing the results (the average chain length), I would have predicted that Boston chains are smaller in length because of the general belief that metro populations are more concentrated and have better networking with more people versus suburban regions. Once I understood that this paper was not making an inference about general populations but rather proving the legitimacy of the method for identifying bounds for specific individuals. In other words, it was to prove how "such interconnectedness [of the] small world" ideas of social networks being "tightly woven [...] could be demonstrated experimentally" (Milgram, 426).

I found it interesting that the "simplest way of formulating the small world problem" (Milgram, 425) was almost exactly as mentioned in lecture 09 (Small World Method) of linking acquaintances as vertices and edges and had similar constraints/ definitions for connected components. However, I was newly exposed to and intrigued with their way of imagining the number of people who are mutuals between two people as a set. I was reminded that in a social setting it is not always just one person who is a mutual between two people.

Milgram/ Travers' also cite other works and tests, including Ithiel Pool and Manfred Kochen's. It was another reminder of how differently individuals could create assumptions and definitions that would greatly affect the structure of the social networks of the small world method. Whereas in theory we imagine the small world connection to be one large connected component, Pool and Kochen describe their nets as a tree that represents the connection from one person to another and that does not come back to the original person in a cycle. This definition of a tree helped orient me in the correct mindset that they are not defining social structure through their findings, rather they make assumptions

about a specific social structure to predict “chain lengths” (Milgram, 426).

Citation of Rapoport and Horvath’s test and their approach also proved that their method (similar and of a much smaller scale to the small world method) could be tested mathematically. As their population was just a single junior high school, it was a small community and not representative of the various individual demographics of the US. It was very interesting to see the implementation of asymmetric edges, which is very unlike the small world idea/method. Due to this, I question the effectiveness of their definition of an acquaintance. While it makes sense that individuals who are acquaintances might not list each other and only one of them mentions the other, it does not make sense (to me) for two people to be acquaintances if only one person knows the other. However, in their context, it is reasonable to only be watchful of one direction if they are setting up the graphs in a “departure” and destination fashion. While I was intrigued by how simplistic and applicable their method is for various predictions and “empirical outcome[s]” (Milgram, 427), I was again disappointed in the lack of completeness that Milgram and Travers describe. Due to Rapoport/ Horvath’s asymmetric nets, it is difficult to apply their method to the small world method and symmetric nets. They also continue on with the cons for the two supplemental works they cited, where I wholeheartedly agree that these models make assumptions I find difficult to connect with real society structures as their purpose was only to prove that their method works for specific individuals in a population.

While reading Milgram and Travers’ procedure, my initial thought was that the method seemed very old. However, after referring to the publication date in 1969 (and their casual use of racist terms in pg 436), I understand why such a trivial and risky method was used. It is logical why they would need information like characteristics of the individuals that go beyond just the mathematical patterns/differences (i.e also “homogeneity in demographics” (Milgram, 429), but I am still confused by their question about “what form would the distribution of chain lengths take” (Milgram, 429), i.e, what exactly they meant by ”form.” I am also curious as to why there is a specific decision to choose stockbrokers as the trial career, since they do not have any explanation as to why. Additionally, I still wonder why they believed their experiment would help to “establish a strategy for future experimental extensions of the procedure, in which the sociological characteristics of the starting and target populations would be systematically varied in order to expose features of social structure” and why they “[attempted] to discover some elementary features of real social nets” in their initial research questions and tests. (Milgram, 429). Since it was clear that the purpose of the experiment was not to gain insider knowledge on the general population but whether a variation of the small world method works with this specific population.

Given the nature of the experiment, I think there was a lot of unfair bias placed on participants selecting the next participant as people likely to extend the chain toward the target. It would not be consistent to all true acquaintances in the real world and is also not always the shortest chain of mutuals if someone

in the middle is unlikely to participate. This further justifies their word of caution that regardless of the chain completing successfully, the chain length is not guaranteed to be the shortest diameter to the target individual.

It was interesting that they explained the incentive and very detailed implied effects of providing the roster to increase chances of successful/complete chains. Their incentive was surprising to me, as I immediately thought of the bandwagon effect: someone you know has participated and was willing to share potentially sensitive/non-anonymous demographic information to this research group (or seeing so many “strangers” willingly participate), so one would be inclined to participate as well. I could not help but think how likely this experiment would seem controversial and inappropriate in the data/identification-sensitive society we have at present. However, they explain thoroughly why such identification is important and how thorough they are trying to be with their experiment despite/in defense of the risks which I can comprehend.

I believe the setting of this experiment reflects my lack of surprise in how many people actually completed the experiment. With the 3 constraints for passing on the folder to an acquaintance, it is intuitive as to why so little initiated the experiment or even reached the target individual. In a statistical mindset, it is such a small response portion that I really question the validity of the analysis as it is not even representative of the specific population described. However, they made do with the little data they had and Figure 1 answered this doubt of mine well, as Milgram and Travers acknowledge that the significant drop in frequency could be a statistical accident rather than a bimodal distribution for social structures. Given the data from other similar research in lecture 09 small world (Oracle of Bacon) that had uni-modal and right-skewed distributions, I had predicted a similar distribution for this specific population as well. The patterns of travel before reaching a destination were very interesting, especially how the folder traveled to a desired geographic location easily, but would have had trouble going straight to the target from there. This seems similar to how the small world method sometimes occurred in my own life scenarios (i.e, going a roundabout path to the someone I was targeting, and I later found a shorter chain). I also finally understand why they had portions of their populations from the same career field, as they explain a potential decrease in chain count could have “provided a natural funnel” to the target individual (Milgram, 433).

Figure 2 of the frequency of drops follows my prediction based on their explanation about incentives from viewing the roster and gaining motivation to continue, but of course with the usual exceptions. I also found it interesting that the authors make the assumption that the participants have a poor understanding of chain lengths, which they believe has a big effect on their decision to drop. My doubts of the validity of the analysis because of the low response rate were countered as Migram and Travers make an effort to understand whether the dropout percentage is statistically significant or random. It makes sense for them to be using a very small alpha if they have such a small completion rate, but I was confused what significance level they were judging their data at, as they are failing to reject the null hypothesis at a 0.05 significance.

The difference between Boston and Nebraska's average chain length due to geographical distance followed both the author's and my predictions that Boston origin would have a smaller chain length, but it was not as great of a difference as I would have expected. I believe a possible explanation for that (contradictory to my initial belief) would be that the density of people has the opposite effect. Being in Boston and in an apartment complex does not have a higher guarantee of having a first-name acquaintance as it would be having a neighbor in the house next to yours in a suburban area. Regardless, they were able to prove that, in this specific situation and population, that location of starting and target individuals is a significant dependent variable. I would also suspect that this is applicable to many other geographic locations, although that is not the main purpose of this experiment.

When we theorize the small world graph, we usually imagine it having many cycles to create one connected graph where there is at least one way 2 individuals are connected. That is why it was interesting to see how this experiment was going from many starting points to a target person, so the graph shown in Figure 3 demonstrated the common channel convergence and a more tree-like figure like Pool/Kochen's. The channeling itself seems like a very big concept that could be applied to the small world method, as it also closely follows the social science of one person having significantly more acquaintances than another that can result in "convergence of communication chains" (Milgram, 442). I wanted to see how this applied in my own social life (i.e, a very small portion of the small world method).

Application:

Imagining that I am the target individual, I reached out to 10 of my friends, family, and close acquaintances for names of people they knew well but I did not. I saw a similar difference in the number of acquaintances, as I never specified a fixed count. Others had many, many acquaintances that they were willing to identify while others had as little as 5. You could see a similar "convergence of communication chains" that Milgram and Travers identified. Whereas the convergence in the folder chain was based on real occurrences of reaching the target individual, I think those in my acquaintance who have many acquaintances have a higher chance of being the individual that would deliver the folder to me, if I was placed into the experiment.

I also asked my acquaintances for individuals who I would not know and were very different from me in various demographics. Here, imagine that I am person A, Korean American, in my 20s, a dependent student of a middle-class family, and from the greater Seattle area. One example was a second chain acquaintance (person C) who is Indonesian, older in age (in their 50s), a non-student working in the labor industry and is considered low income. The only similarity in demographics is closeness in geographical location, as their residing town is next to my hometown. This seemingly far connection is made possible by how me and person C share characteristics, but also how person C and person B share different characteristics. Person B and I share physical

closeness in Seattle, are the same age, and are students at UW. However, person B is also Indonesian and a family member of person C. Another example was from another acquaintance of mine, person D, who is acquaintances with person E. Person E lives in Missouri, is Caucasian, 19, lives in an urban city, and is a student. We have a little more in common as we are both in the same age group and are university students, but we have the huge geographical distance between me, person A, and person C did not have. I have never traveled east of Texas, so the chances of me personally knowing someone who currently lives in Missouri is slim. However, the connections that I had with person B is similar as my connections with person D, as person D used to live in Missouri and is still in touch with person E.

I must also remind myself here to not narrow down on Milgram/Travers' start and end idea, but because this is a small part of the small world method, that the one similarity I had with person C could be addressed if the starting and end vertices were Person C to person E, as they do not have any demographic in common. From the limited information I have, I know that an existing path/diameter is 4 symmetric edges between person C and person E. It also follows that, any person 2 chain lengths away from me from one of my acquaintances, there would exist a path/diameter of 3 chains to from another acquaintance of mine, or 4 if it is an acquaintance of my acquaintance. I am surprised to be introduced to this idea, because I was so focused on my personal experiences of a "small world." Whenever I felt that it applied to my life, it was when one of my acquaintances knew another of my acquaintances but did not meet them in the same setting as I did. In the 4 symmetric edge pattern above, I realized that this small world method connects those of completely different backgrounds in either direction and only with me being one of the vertices in one of the existing paths.

Return to Milgram/Travers:

Although I proved on a very small scale how it is theoretically possible to connect individuals who seem to not have any commonality demographically, I also found Milgram and Travers' analysis about the "additional characteristics of chains" to be very intuitive (440), especially sending off the folder to those who are similar to them or the target individual in demographics (i.e, similar age brackets and gender). The patterns of the folder staying in the same career field and social status also were very intuitive, especially when it was in the career field of the target individual. It did seem odd that they identified the pattern of individuals staying within the same social class, when they had started and finished the individuals in the same middle class standing and not different classes to actually analyze the significance. Therefore, I question how valid this claim is.

The study states that their method is only showing their results of a specific population and method, but they do conclude at the end that it "demonstrated the feasibility of the 'small world' technique, and took a step toward demonstrating, defining and measuring inter-connectedness in a large society"

(Milgram 441). While I like the theoretical applications of their method on a larger scale, I question their full motive to prove their method and apply this realistically when it was already so difficult to achieve on a much smaller scale. As the upper bound they identify is not the actual upper bound of all people in the US, it only shows how to find the upper bound for this specific population and that can potentially be used in connecting “widely separated Americans” (Milgram 441). Again, I personally am having trouble seeing the connection between showing a very intuitive path for acquaintances on a small scale with assumptions not applicable to the social aspect of acquaintances and on a larger scale.

After thoughts: after seeing how having the same/ similar career field did not affect the length of the chains, it made me wonder whether that really affects the chain size in a social science approach. Realistically, no matter if there seems to be an established/easier way for the folder to start off, it will not remove the fact that there are only so many people each person will personally know, so there might not be a significant difference compared to a search for an individual who is supposed to be very remote and unknown to the starting individual.

Another view on the small world method:

I can see why Frigyes Karinthy’s essay is also considered a short story as the overall tone is very casual in comparison to Milgram/Travers’ paper. They are also very different in assumptions for their model, as Karinthy sets up a lot of theoretical and emotional reasoning as to why they believe the Earth is shrinking/condensing socially, which, after reading their take, my opinion was changed. I was initially reading the story with disbelief, as I always viewed the world as ever-growing, but I now think back to many slogans and advertising to bring everyone back together and closer than ever after COVID. Technology and other general industrial breakthroughs have made it easier for us to meet with those geographically far away or keep in touch with those who have moved further away either by physically being able to move easier with transportation or talk through technology and the Internet.

While it was different people who the author and his partners were finding a chain to (famous vs random), it was interesting how they still went about their initial contacts with someone who was well-known or someone who was well connected, a similar idea of the convergence that was brought up in the Milgram/Travers’ paper and what I realized in my own mini observation/study. The author connected this with their introduction of the Earth becoming smaller, as they could not apply the same rule of at most 5 acquaintances to situations in early history due to lack of accessibility.

Afterthoughts: as a whole, the paper went too much into the abstracts of the world and other implicit effects than I would appreciate. However, it was interesting to connect the acquaintances with people to the information and emotions that we share with one another, that it is more than just a mutual connection that we materialize and quantify. It was also a little confusing but

interesting to see how the author connected this sharing of ideas and beliefs to the total links between him and acquaintances. This story has made me wonder, with the continual condensing of society, whether the rule of thumb of 5 links in this essay would actually decrease over time like it did compared to Julius Caesar, to the point that we are all mutual acquaintances with each other that technology will remember for us. Or, whether we follow the definition of mutual acquaintances as a first-name basis which would stop and vary with each person's memory capacity.