

ARTICLE

Longitudinal Analysis of the Spread of Happiness in Social Networks

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INTRODUCTION

In 2004, the World Health Organization (WHO) expressed an increasing emphasis on recognizing happiness as a vital component of health (Pronczuk-Garbino, 2005). However, there is a stark lack of research investigating how happiness is affected by those around them. It has long been known that emotions such as happiness and sadness can be easily transferred between individuals in close social contact (Hatfield et al., 1994). While the exact mechanism of this transfer and the timeframe over which this takes place is lesser understood (Fowler & Christakis, 2008). Fowler and Christakis (2008) conducted a study investigating the spread of happiness in social networks. They followed 4739 individuals over a 20 year period (1983-2003) and assessed their happiness using a validated four item scale and mapped the relationships amongst individuals. Over time they found visible happiness “clusters” and that those surrounded by happy people were more likely to become happy in the future. Statistical testing suggested that this relationship was due to the spread of happiness and not the tendency of similar individuals to associate with each other. Our group sought to add knowledge to this topic by working collaboratively to examine how happiness varies within social networks and the factors which influence happiness at both an individual and social level.

METHODS

We constructed a social network in NodeXL on Windows 8.1 comprised of 50 individuals that were close friends or family of at least one of the group members. In NodeXL, we characterized all individuals by age (15-24, 25-34, 35-54, 55+) as well as characterized the relationships between individuals (classmate in SPPH 302, classmate not in SPPH 302, relative, roommate/significant other, non-UBC friend, and other). To preserve participant privacy, each member was assigned a code name in the data analysis. Our method for assessing happiness follows closely to previous research done in the field (Fowler et al., 2008, Burt, 1987). We randomly sampled a total of 20 individuals to complete paper surveys about their happiness level. Each individual gave informed consent prior to participation. The survey consisted of four questions that were rated on a scale from 0 to 3 based on the participant's subjective opinion at the time of survey.

The questions asked were as follows:

1. I felt that I was just as good as other people
2. I felt hopeful about the future
3. I was happy
4. I enjoyed life

A rating of 0 corresponded to an answer of “rarely, or none of the time (less than one day)”; a rating of 1 corresponded to an answer of “some or a little of the time (1-2days)”; a rating of 2 corresponded to an answer of “occasionally or a moderate amount of time (3-4 days)”; and a rating of 3 corresponded to an answer of “most or all of the time (5-7 days)”. To assess the longitudinal variations in happiness, all 20 selected participants were approached to be surveyed twice. The first survey was completed between October 9th - October 13th, and the second between November 16th - November 20th.

We assessed the happiness of individuals by adding the scores of the participants for the 4 constructs to obtain a total happiness score out of 12. Using NodeXL and Microsoft Excel 2013, we plotted the total happiness score for all individuals surveyed at both timepoints. To assess how happiness varies over time, we calculated the change in happiness between the two time points for all individuals surveyed and plotted the results using NodeXL. The changes in happiness were separated into 5 qualitative categories for the purposes of our analysis: large increase (increase of 4 or more points), small increase (increase of 2-3 points), no change, small decrease (decrease of 2-3 points), and large decrease (decrease in 4 or more points).

RESULTS

Of the individuals surveyed in our network, 100% of those approached responded to all the questions in the survey. Additionally, all participants (n=20) completed the survey for the second time point. The mean happiness score out of 12 after the first survey was 9.25 (n=20), and 8.75 (n=20) after the second survey. Figure 1 illustrates the absolute score for the first survey, while Figure 2 illustrates the scores of the second survey.

survey. The mode score out of 12 after the first survey was 10 ($n=20$), and after the second survey it was 9 ($n=20$). The range of the happiness score after the first survey was 7-11 and after the second survey it changed to 6-12. There was a mean difference of 2 points between the two survey time points (Fig. 3). We found that 50% of participants surveyed decreased in their happiness score, 25% increased, and 25% remained the same. These number of individuals increasing or decreasing in their happiness score are represented in Figure 3.

DISCUSSION

In this study, most of the participants' level of happiness decreased while a smaller proportion had no change or an increase in their happiness. A general decrease in happiness was the most prominent trend. We suspect that this relationship was not due to chance or other unpredictable individual factors for a number of reasons we will discuss. Rather, we believe that the changes in happiness seen were due to interactions between those who are part of the same social network.

According to Fowler and Christakis (2008), happiness is, to an extent, contagious and is not simply due to the tendency of similar individuals to associate with one another. They also found that those who are central within a social network of mainly happy people are likely to be happier themselves. Our results were in accordance with these findings; as the happiness of those within a social network decreased, the happiness level of the group member who was central to those relations also decreased. We noted that this relationship was especially apparent between participants who presumably spend a lot of time together, such as relatives or roommates. Feelings of happiness and joy can be transmitted between individuals through the expression of emotion (Hatfield et al., 1994). Therefore, we postulate that analogous feelings of unhappiness can also be easily spread through similar mechanisms involving close social contact.

Some explanations for an increase in happiness even when the central member of a network showed a decrease in happiness include geographical separation or professional relationships. This is supported

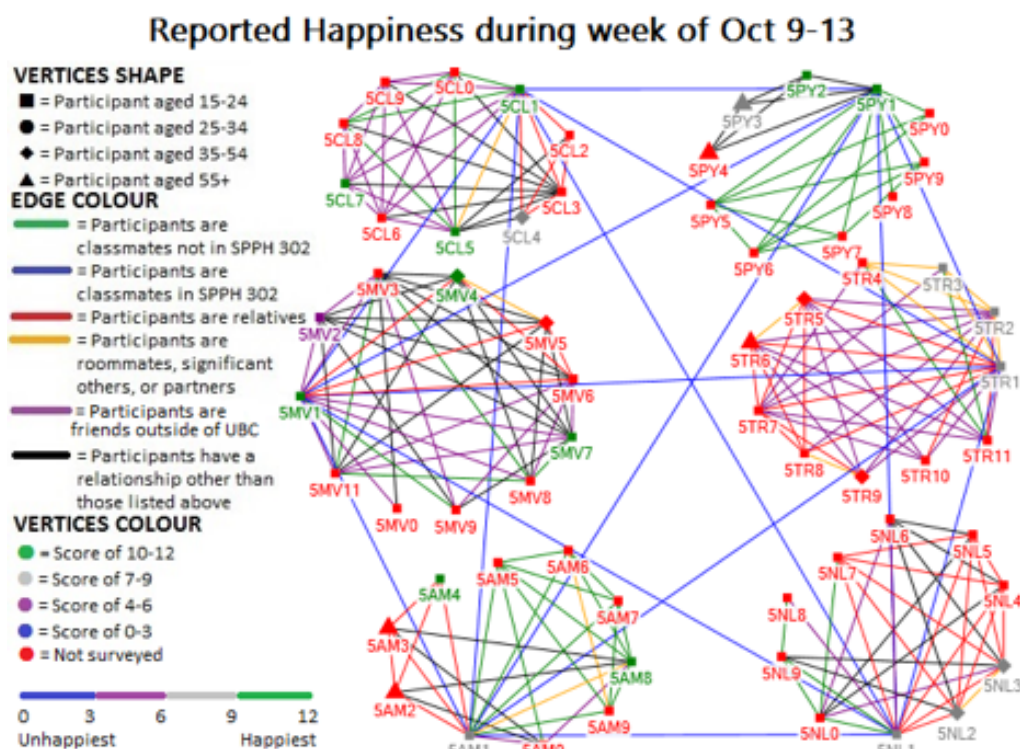


Figure 1. Happiness clusters in the social network constructed ($n=60$) of students in SPPH 302 and their close friends and family for the week of October 9th 2015. Each node represents one person while lines between nodes indicate relationship. Node colour denotes level of happiness as indicated by the survey. Colour of vertices indicate the types of relationships between individuals.

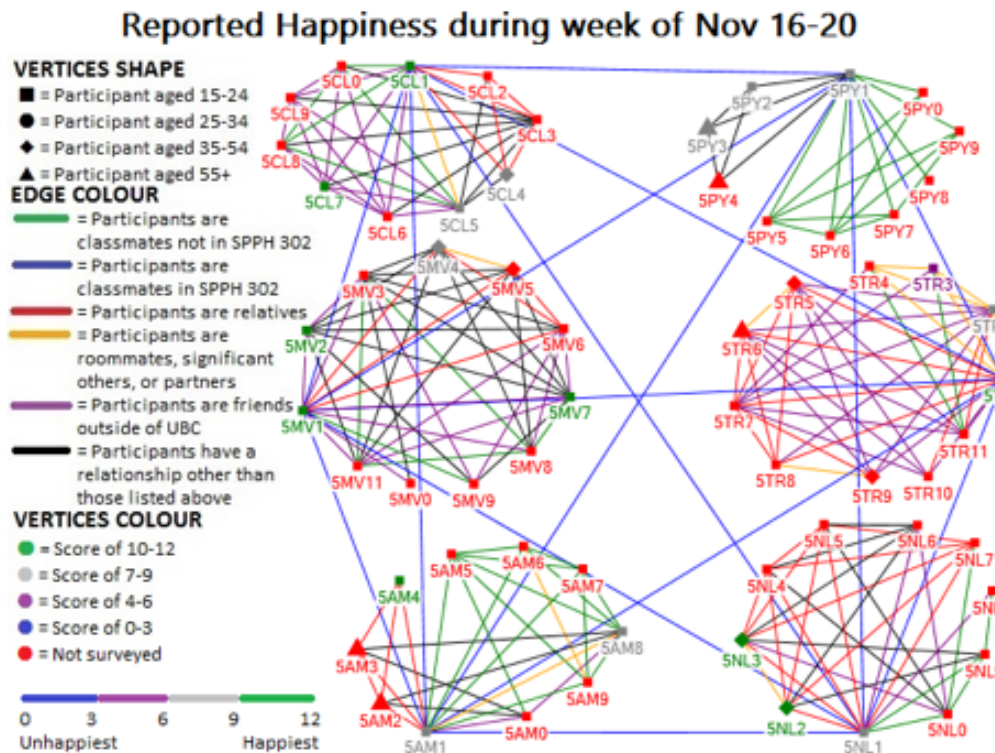


Figure 2. Happiness clusters in the social network constructed ($n=60$) of students in SPPH 302 and their close friends and family for the week of November 16th 2015. Each node represents one person while lines between nodes indicate relationship. Node colour denotes level of happiness as indicated by the survey. Colour of vertices indicate the types of relationships between individuals.

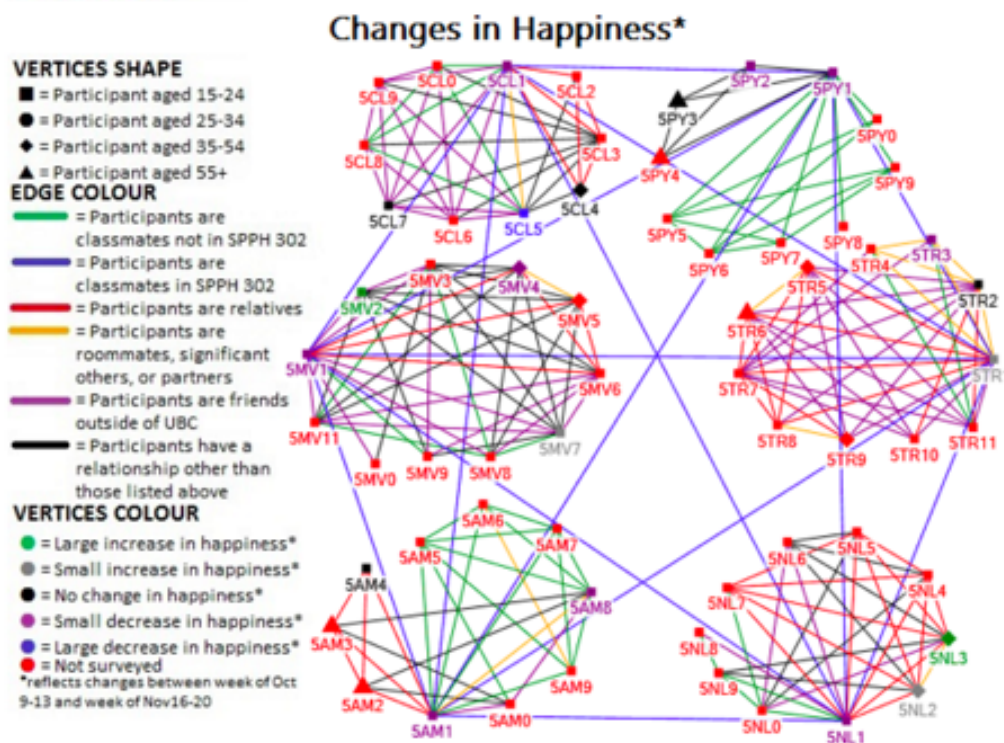
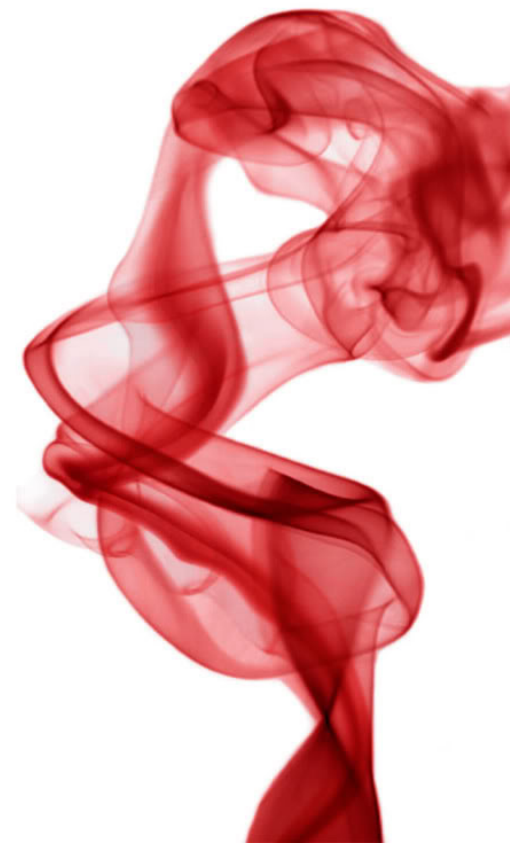


Figure 3. Changes in happiness reported in the social network constructed ($n=60$) of students in SPPH 302 and their close friends and family between the weeks of October 9th and November 16th 2015. Each node represents one person while lines between nodes indicate relationship. Node colour denotes level of happiness as indicated by the survey. Colour of lines indicate the types of relationships between individuals.



by Fowler and Christakis (2008) who showed that co-workers do not seem to have any significant effect on each other's happiness. Ronald Burt (1987) also found that in some cases a negative impact from strangers can play a larger role on an individual's happiness than the positive impact of significant relationships. His findings could explain why there were some disparities in happiness clusters amongst some social networks, some discrepancies could be due to an external negative impact from a stranger.

All in all, we learned that there is a relationship between happiness and one's social network, and that happiness clusters within a social network are not simply coincidence, but are a result of the relations within said network. Similar to Smith and Christakis (2008), we saw that health is not independent of the health of those around you, but is actually interconnected. This study could have been improved by recruiting a larger sample as it could have resulted in a more representative mean and smaller standard deviations. Depending on the relationships between the participants, the descriptive statistics would likely change because a sample of 20 people is likely not representative of a whole population. In future studies, the survey could be more comprehensive to gain a greater insight into one's happiness. Participant's could also be surveyed more than twice and over a longer period to better elucidate the changes in happiness. It would be interesting to conduct further studies on whether other emotional characteristics such as stress can diffuse through social networks as well. The methodology to study stress may be similar to the methods used in this study to measure happiness, since they are both subjective measures of individual experience. A proposed way to alter the experiment in order to investigate social trends such as frequency of using verbal slang may be to take baseline measures of frequency of use, and then over a time frame of months, have the investigator use specific slang more often around the participants and see if frequency of use increases in the participants. The same method can be applied to investigate lifestyle choices.

The conclusions and patterns drawn from this study on social networks undoubtedly have implications for public health. Our study demonstrates visible clusters of happy and unhappy people. Illness may lead to individuals or groups of individuals to be unhappy. We

postulate that clusters of unhappy people could be correlated to clusters of ill or unhealthy people. This may expose patterns in health status and help solve the issues of certain disease pandemics such as obesity. Additionally, a treatment that improves the health and happiness of one person might have an effect on others, thus leading to an overall healthier population.

As defined by the WHO, public health is all organized measures, both public and private, to prevent disease and promote health among the population as a whole. In this sense, our project very clearly fits with the goals of public health. In studying these networks and connections we can create programs or target clusters of people who are at high risk of being unhappy or unhealthy. These network analyses study the majority of the population and with increasing sample size may accurately reflect the needs of the entire population. Other definitions of public health include monitoring of health. We believe that monitoring is an exceptionally important part of public health since it allows for a direct observation of the needs of the public. Social network analysis becomes a useful tool in reviewing public data and the applications in public health hold great potential.

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