A BEHAVIORAL STUDY OF FRIENDSHIP AND SOCIAL NETWORKS

by

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A Thesis
Submitted to the
Graduate Faculty
of
George Mason University
in Partial Fulfillment of
The Requirements for the Degree
of
Master of Arts
Psychology

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Date: _____ Fall Semester 2018
George Mason University
Fairfax, VA

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Bachelor of Arts
George Mason University, 2018

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DEDICATION

This is dedicated to my loving mother, Dr. Tammy Webster.

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ABSTRACT

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This current study aimed to explore the association between friendship and social networks by analyzing the possible linkage of two well-known phenomenons, Homophily and Triadic Closure. Previous research supports social networks being learned through triadic closures. Humans are more inclined to associate a stronger bond between novel individuals (B and C) if we are aware of a common friend both share (A). Research also suggests that humans tend to strongly associate those who look similar to them as being closer in social networks – homophily. This two-part study examined the linkage of these theories by creating a triadic closure task involving a paradigm designed with similar and non-similar face shape(s). The study utilized an online experiment environment, Millisecond. Part one assessed similarity and non-similarity among face in a judgement task. In part two, participants were randomly assigned to either a control or rating triadic closure task. The results of these tests were analyzed using a series of ANOVAs, and trends compared. The results of this study are hypothesized to support that humans

associate a closer social network among individuals that possess similar face shapes. This research contributes to our understanding of homophilic characteristics as a determinate for social networks.

INTRODUCTION

Homophily

We live in a highly social society that permeates our everyday lives. Whether we care to interact with others, social relationships strongly support human behavior. Research strongly supports the theory of homophily, or the tendency to relate more closely with individuals that resemble ourselves (Brechwald & Prinstein, 2011; Dehghani, Johnson, Hoover, Garten, Parmar, Iliev, Sagi, Vaisey & Graham, 2016).

McPherson, Smith-Lovin, & Cook (2001) view homophily as a basic organizing principle that allows people to identify where one may belong in society. Historically, we have often based societies on homophilic characteristics such as socioeconomic statues, race, and religion. At the core of many of these characteristics, appearance (facial features, skin tone, etc.) often became the way in which we determined one's belonging (McPherson, Smith-Lovin, & Cook, 2001). In this sense, concepts of homophily have been ingrained in human cognition and behaviors. Syed & Juan (2012) posit that humans tend to make assumptions that individuals who are more physically similar form closer relationships (friendships). The social networks that we most closely identify with are usually comprised of individuals that share common characteristics. Although we do not like to think of ourselves as one who "judges a book by its cover," our first impressions mostly involve appearance (Zebrowitz & Montepare, 2008).

Many studies have identified that humans are more apt to associate with individuals that share similar physical features. We are also more likely to develop romantic relationships with those that are genetically like us (Little, Burt, & Perret, 2006). Mackinnon, Jordan, and Wilson (2011) ran four observation studies that assessed seating preference of novel individuals. Each observation revealed that individuals choose to sit with or in closer proximity to unknown individuals that shared more common characteristics (i.e., glasses wearing, sex, hair length, and race). The more physical similarities between the two participants, the higher their likelihood of proximity.

Face Shape

What is less understood by research to date is to what extent physical features influence one's likelihood of associating novel friendship. The question remains, if we inherently are a physically-driven culture, what physical features do our friends tend to share? In this study, we aim to assess homophily from a purely physical aspect; that of face shape.

A study by Wallraven (2014) used face shape to evaluate visual similarity. In this design, participants viewed a total of 19 morphed faces (a composite set of averaged "normal faces") across 50 trials. Face "A" then Face "B" was presented, and participants were then instructed to key in a similarity rating between one (totally dissimilar) and seven (totally similar). The study found that visual representations of faces morphed along the same average were viewed as more similar than the others (Wallraven, 2014).

Hehman, Flake, and Freeman (2017) observed how facial appearance influences group formation. In this six-part study, researchers examined whether individuals in preexisting friendship groups resembled one another. Researchers asked six fraternities at a Midwestern U.S. university to provide photos of all willing members. All photographs where standardized, with a uniformed background, pose, and attire. A total of 198 individuals were asked to rate these photographs on six traits. All photographs were analyzed against target photographs that averaged the characteristics of the six fraternities. The results revealed that 52.5% of the participants accurately classified photographs into the proper fraternity, further indicating that individuals within social groups possess social perceptions more like their group members, as opposed to out groups (Hehman, Flake, & Freeman, 2017).

Friendship and Social Networks

Hafen et. al. (2011) analyzed homophily in both stable and unstable adolescence friendships, finding a high, positive correlation existing between friends with more similarities and stable friendships. In other words, those who continued to remain friends year after year were more similar than not. Similarities enhanced the duration of friendships, while more non-similar individuals reported shorter or no duration of friendship.

Brent (2015) emphasized the importance of social networks involving both direct and indirect connections. Direct connection being those individuals that we call our friends, and indirect being those not in our immediate circle, or the friends of friends (Brent, 2015). The connection between novel individuals (indirect) is equally as

influential to our social behaviors as direct connections. Social networks are broad and complex; often calling us to rely on schemas to predict future social behaviors and acting appropriately within those situations (Janicik & Larrick, 2005). These schemas are built on past interactions—both direct and indirect in nature.

Triadic closures are described as a composite of direct and indirect connections - where an indirect relationship becomes a result of a direct relationship. A 2013 study published by Lou, Tang, Hopcroft, Fang, and Ding confirmed that triadic closures serve as effective linking tools developed in reciprocal (two-way) relationships. By using a Triad Factor Graph (TriFG) model, the researchers analyzed the relationship between triadic closures and reciprocal networks. Twitter was used as the platform for observing social networking and interactions at a large scale. The model identified that the most common forms of relationships are reciprocal. Where a "follow" leads to another "follow," a reciprocal relationship; leading to an exchange of common "followees," a direct triadic closure.

Klimek and Thurner (2013), classified triadic closure as a "fundamental dynamical principle" of social network formations. In this study, researchers developed a model for network formations by tracking the actions of more than 370,000 players in a virtual futuristic game universe. The objective of the virtual game was to acquire more wealth and influence over others. Players were able to establish friendship links, exchange messages and trade goods. These categories were used to track frequency of interaction within the universe. For each interaction, a "node" was developed if a friendship link, exchange or trade was established between two players. The trends

explained that new nodes join the network as a function of the existing linkage. The probability of a new linkage between player closing a triad was higher than the probability of connection between any two nodes.

Based on the culmination of research provided thus far, enough evidence exists to support possible linkage between face shape (homophily) and social networks (triadic closure). In this current study, we approached both theories by presenting artificial "friendships" fostered between the groupings of non-similar ("original") and similar ("averaged") faces. The artificial "friendships" establishes commonality; which is naturally formed between friends and friends of friends in the real world. We examined if triadic closure for these artificial friendships is stronger for faces that are similar ("averaged") compared to those who were non-similar ("original").

We created face pairs by averaging the face shape of all individuals in the face database and applied the average face shape to each face, creating homophily in face shape. The original faces differed in their face shape. Previous studies have identified that the more physically similar we are to one another, the greater the chance of friendship. Therefore, in having "original" versus "averaged" faces, we aimed to analyze the extent which facial similarities contribute to the strength of perceived friendship, measured as the strength of triadic closure.

Figure 1: Example of Original Face Pair

Figure 2: Example of Average Face Pair

METHOD

Participants

A total of 120 participants over the age of 18 with normal or corrected-to-normal vision were recruited from George Mason University's campus. A total of 44 participants were recruited for the Face Similarity Judgment Task, and 76 participants were recruited for the Triadic Closure Task. The demographic of participants in Face Similarity Judgement Task were: 35 females, 8 males, and 1 unspecified gender; mean age was 20.5 (*SD* = 3.37); while White, East Asian, South Asian were the most frequent races, 40.9%, 15.9%, and 11.4%, respectively. The Triadic Closure Task demographic were: 61 females, 14 male, and 1 unspecified gender; mean age was 21.2 (*SD* = 4.67); while White, South Asian, and East Asian were the most frequent races, 44.7%, 15.8%, and 11.8%, respectively.

The recruitment was established through the University's SONA system and flyers. The restriction of "normal or corrected-to-normal vision" was necessary for the visual stimuli of the study. Any differences in socioeconomic status, ethnicity, or gender will be dependent solely upon the individuals that are recruited. Informed consent was obtained prior to the beginning of each study.

Materials

Materials necessary for this study included an introductory script, consent form, brief demographic survey, Face Similarity Judgement Task, Triadic Closure Tasks (Control v. Friendship Tasks) and debrief script. The introductory script informed participants about the study before consent was obtained. The demographic survey asks for gender, age and race. Participants were not required to complete the demographic survey.

All faces were obtained from The Face Research Lab London Set database (citation). The "original" stimuli are the standard (non-averaged) faces and "averaged" stimuli are derived from face averages developed with PsychoMorph software. All group totals plan to be equally divided by sex. All faces presented had a neutral expression. The Face Similarity Judgement Task was used to establish a baseline of perceived facial similarity among the "original" and "averaged" faces. The Triadic Closure Control Task assessed the difference between "original" and "averaged" faces without reference to similarity or friendship. The Triadic Closure Friendship Task tested the linkage between facial similarity and perceived friendship. The debrief presented to each participant at the conclusion of the experiment described the purpose of the study with full disclosure of facial alterations and provided additional information for contacting the researcher should the participant have any questions, comments or concerns about the study. The entire experiment was conducted with Millisecond software, an online experiment platform. Millisecond was used to host, run and collect the data necessary for this study.

Procedure

Participants completed a consent form and an optional demographic survey. The demographic survey collected information on age, sex, and race/ethnicity for each participant. Following the conclusion of the above, participants completed either the Face Similarity Judgment Task or the Triadic Closure Task.

Part 1: Face similarity judgement task. The Face Similarity Judgement Task was conducted first. This task involved a simple side-by-side comparison of face pairs; participants rate whether the pair appears to be similar or not. The rating was a 5 point-scale; 1 = Not at all similar, 2 = Not similar, 3 = "Neutral", 4 = Similar, 5 = "Extremely similar." Participants were randomly assigned to an "original" or "average" facial condition and presented an equal distribution of sexes. This task was used to conclude a baseline for the subsequent task. The duration of the Face Similarity Judgement Task was approximately 20 minutes. At the conclusion, participants were debriefed on their experience.

Part 2: Triadic closure tasks. In Part 2 of the study, participants were randomly assigned to either the Triadic Closure Control or Triadic Closure Rating Task. The description of both tasks are as follows:

Triadic closure control task. For each trial, participants were randomly presented a set of "originals" and "averaged" faces. Before the faces were presented, participants read the given prompt: "The following individuals are all competing in a tennis tournament this weekend. Before the matches begin, players are randomly assigned opponents and will play several matches. Your job: By using your best judgement, rate

the likelihood of the unknown opponent selection occurring." Each set included the labels "A," "B" or "C" for each assigned face and display the relationship each individual stimulus has with the next. Participants were simultaneously shown faces "A" and "B" with the prompt: "A and B are opponents." Subsequently, faces of "B" and "C" with the prompt: "B and C are opponents." Finally, faces of "A" and "C" with the prompt: "What is the likelihood of A and C being opponents?". The rating is a 5 point-scale: 1 = "Very unlikely", 2 = " Not likely", 3 = "Neutral", 4 = "Likely", 5 = "Very likely." We compared the task to the control, ensuring the effects seen are independent. This took approximately 20 minutes to complete. A debrief occurred immediately at the end of participation for each subject.

Triadic closure friendship task. For each trial, participants were randomly presented a set of "originals" and "averaged" faces. Each set included the labels "A", "B" or "C" for each face and displayed the relationship each individual stimulus had with the next. Before the faces were presented, participants read the given prompt: "It's the weekend and people are getting together with their friends to hang out. We have knowledge about certain friendships among the group, but not all. Your job: By using your best judgement, rate the likelihood of the unknown friendships within the group." Participants were simultaneously shown faces "A" and "B" with the prompt: "A and B are friends." Subsequently, faces of "B" and "C" with the prompt: "B and C are friends." Finally, faces of "A" and "C" with the prompt: "Please rate the likelihood of friendship between A and C". The rating is a 5 point-scale: 1 (very unlikely) to 5 (very likely), as

stated above. This task will take approximately 20 minutes to complete. A debrief occurred immediately at the end of participation for each subject.

RESULTS

The findings of Part 1 (Face Similarity Judgement Task) and Part 2 (Triadic Closure Tasks) were collected via online instrument administered by Millisecond. The Face Similarity Judgement involved a side-by-side comparison of face pairs; participants rate whether the pair appears to be similar or not. The Triadic Closure Tasks assessed participants perception of friendship among similar and non-similar face shapes utilizing that same skin tone. Statistical significance for this study is defined as a p-value less than 0.05, $p<.05$. All rating of similarity and friendship were presented in a five-point scale. The results are as follows:

Part 1: Face Similarity Judgement Task

An Independent Samples T-Test was run, which examined the rating of similarity among both trial conditions -- original (non-similar) and averaged (similar) faces pairs (N = 44). The results of Sample T-Test revealed no statistical significance between ratings response across trial conditions t (42) = 0.829, p = 0.412. The original faces had a slightly higher mean rating response (M = 2.567, SD = 0.366), than average faces (M = 2.469, SD = 0.528). The ratings of both conditions were significantly close, indicating that there was little difference between the two conditions. As noted, ratings were conducted on a 5-point scale, 1 = Not at all similar, 2 = Not similar, 3 = “Neutral”, 4 = Similar, 5 = “Extremely similar.”

Part 2: Triadic Closure Tasks

A Repeated Measures design examined main effects and interactions among between-subjects factors of treatment conditions (control and friendship task) and within-subject factors of stimuli face categories (type – original and average; sex – male and female) on ratings of friendship.

Results indicated no statistical significance among face type (original and average) on rating of potential friendship, F (1, 74) = 0.501, p = 0.481. However, statistical significance was found between face sex (male and female) and rating scores, F (1, 74) = 8.164, p = 0.006, with an effect size of 0.099 and observed power of 0.805. Mean ratings of male faces (M = 3.291) were higher than woman faces (M = 3.185). These rating were averages on a 5-point scale: 1 = “Very unlikely”, 2 = " Not likely”, 3 = “Neutral”, 4 = “Likely”, 5 = "Very likely.” Results of treatment conditions (control and friendship tasks) showed statistical significance on ratings, F (1,74) = 8.378, p = 0.005 with an effect size of 0.102 and observed power of 0.815. Of the treatment conditions across all face categories, average mean ratings were higher among the control task (M = 3.395) than friendship task (M = 3.081) (see table 1).

Interactions of all the above factors displayed no statistical significance on rating of friendship. The interactions were as follows: face type and treatment conditions, F (1, 74) = 0.276, p = 0.601; face type and face sex, F (1, 74) = 0.334, p = 0.599; face sex and treatment conditions, F (1, 74) = 0.683, p = 0.411; and a three-way interaction of face type, face sex, and treatment condition, F (1, 74) = 0.015, p = 0.902. All interactions presented low effect sizes ($\eta^2 > 0.08$) and observe power.

Table 1: Treatment Conditions Mean Ratings

Dependent Variable	Treatment	Mean	Std. Deviation	N
Female Average	Control	3.50	0.55	43
	Task	3.13	0.49	33
Male Average	Control	3.34	0.59	43
	Task	3.04	0.49	33
Female Original	Control	3.43	0.59	43
	Task	3.11	0.56	33
Male Original	Control	3.32	0.53	43
	Task	3.05	0.52	33

DISCUSSION

This current study tested the association between friendship and social networks by analyzing the possible linkage of face-shape and friendship associations. We examined this by presenting facial stimuli and asking participants to rate the likelihood of friendship among novel individuals. The hypotheses were:

1. Participants will associate a higher similarity rating among the "averaged" faces than "original" faces.

2. A higher rating of friendship will be attributed to "averaged" face pairs than "original" pairs.

These hypotheses were based on previous research explaining that humans tend to attribute stronger bonds between similar-looking individuals (McPherson, Smith-Lovin, & Cook, 2001; Brachwald & Prinstein, 2011; Dehghani, Johnson, Hoover, Garten, Parmar, Iliev, Sagi, Vaisey & Graham, 2016; Hehman, Flake, & Freeman, 2017). We were further supported by studies that emphasize the importance of social networks forming a result of direct and indirect connections, triadic closures (Lou et al., 2013; Brent, 2015). Our hypotheses were rooted in the assumptions -- if friends have been found to be more physically similar, the friend of a friend should be just as similar. The second assumption was the more similar individuals appear to be, the higher the

likelihood of friendship. The results collected did not statically support either of the hypotheses.

The analysis of Part 1 demonstrated no statistically significant difference among similar and non-similar face shapes. Additionally, the "original" face shapes were rated by the participants (although not significant) to appear more similar than the computerized "averaged" face shapes, suggesting that humans do not visualize alteration of face shape alone and it had little to no effect. The intention of Part 1 was to identify whether a difference exists between the two facial types, and participants could not find a difference when the only change was shape and all other factors remained constant.

The analysis of Part 2 concluded no statistically significant difference between the ratings of similar and non-similar triadic friendships. Which proposes that face shape is not a sole influencer of friendship, or as addressed in Part 1, the difference between the averaging of the similar faces and the originality of non-similar faces did not aesthetically differ. However, statistical significance was presented between face sex and friendship ratings, which infers that participants rated male faces (despite the face type – original or average) higher than female faces. The possible reasons of why the male faces were rated higher, were not examined in this study. Furthermore, statistical significance was observed between the mean ratings of friendship between the Triadic Control condition and Triadic Friendship condition. The Triadic Control condition asked participants how likely individuals were to be opponents in a tennis competition, while the Triadic Friendship condition explicitly asked the likelihood of friendship. The conditions

independently tested different questions, which allowed for greater confidence in the mechanism tested.

Across both studies, effect size and observed power were an issue. We cannot confidently say that the chosen paradigms entirely captured the intention of this study. With such low effect sizes our paradigms may not be meaningful in determining similarity or friendship; which chiefly effects statistical power. A lower power explains that any effects we may have detected (similarity and friendship ratings) cannot be deemed statistically significant. If a larger sample size was used in this study, perhaps the effect size and observed power may have been higher. The measure may not be tuned to accurately detect small effects or have a large enough sample size to generate signal for detection. Previous studies that influenced our current design, had sample populations upward of 100 participants and observations occurred over a longer period (Mackinnon, Jordan, & Wilson, 2011; Lou et al., 2013; Wallraven, 2014).

Further Implications

The results of the study are not conclusive that face shape is a single factor that individuals use in association of friendship. However, there were limits to this study that may have yielded a different outcome. For example, in this study the only factor was the shape of the face, no other factors were changed. Other individual factors or combinations of factors may yield a statistically significant variance to support that friendships are based on similar physical characteristics. To further this research, we need to continue to review the physical factors that affect people perception of friendship candidates. We should examine face color as a possible determinate of friendship

candidates. Perhaps, only changing face shape does not yield complete representation of the difference among people. There could be additional facial characteristics (such as eye color or ear size and placement) that are statistically significant to alter physical characteristics that associate for participants potential friendship candidates.

The voluntary participants may not align with the population sample, which may yield different result. There were proportionately more females than males. Additionally, the ethnicity demographics could have altered the results, there were more Caucasian participants than any other ethnicity. The fact the population was skewed to a specific age group (18-19) and in a university setting (higher education level), could also be factors that should be looked at in the future. The results do support that face shape is not a factor for 18-19-year-old Caucasian females in a diverse university setting. Significantly altering any of these factors could result in different outcomes. Future research should begin to delve into the factors of the instrument or the demographics of the population sample.

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BIOGRAPHY

Alexia Webster received her Bachelor of Arts in Psychology from George Mason University, in 2017.