Collective Threat for STEM Women Predicts Friendship and Academic Integration

by

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I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Members of stigmatized groups commonly confront collective threat: concerns that fellow group members' stereotypic behavior may reflect negatively on one's group and, by extension, oneself. If other ingroup members threaten the group's reputation, individuals may hesitate to affiliate with and integrate these ingroup members into their social and professional network. Two social network studies investigated how women in male-dominated STEM majors respond to a female target who possessed either STEM-stereotypic or nonstereotypic interests. Compared with two control groups - men in STEM and women in female-dominated (non-STEM majors) - women in STEM showed less willingness to affiliate and work with the STEM-nonstereotypic (vs. STEM-stereotypic) target, and to introduce her to their closest friends, especially when participants identified strongly with their major or held a low-brokerage (i.e., less influential) position within their network. These behavioural patterns have implications for understanding psychological mechanisms that underlie persistent friendship homophily and segregation between groups.

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Chapter 1 Introduction

People negotiate their social identities and group memberships to satisfy underlying motivations to belong and maintain a positive self-image (Baumeister & Leary, 1995; Cohen & Garcia, 2005; Tajfel & Turner, 1986). Belonging to groups enhances well-being and health, and people report strong desires and needs to belong (Baumeister & Leary, 1995). Social groups can satisfy a person's belongingness need based on the connection formed between that individual's self-esteem and their group membership: Identifying strongly with positively regarded groups is theorized to yield psychological benefits for the individual (Tajfel & Turner, 1986). Therefore, people will adopt aspects of their group that reinforce positive self-views and they are motivated to maintain these positive representations of the self and group in the presence of a threat.

People align their actions with the norms of their group in order to achieve a sense of stability in their social identity. If an ingroup member decides to behave in a manner that reflects negatively on the group by fulfilling a group stereotype, other ingroup members may feel threatened by that individual's actions, a phenomenon termed *collective threat* (Cohen & Garcia, 2005). This threat results in the dissociation of the group from the individual, whether it be physical or psychological. Dissociation is a way for ingroup members to distance themselves from any negative stereotypes that could be activated by any affiliation with a deviant ingroup member (Cohen & Garcia, 2005). Known as the *black sheep effect*, the goal of maintaining a positive social identity skews ingroup favouritism in the direction where individuals promote likeable ingroup members and derogate unlikeable ingroup members (Pinto, Marques, Levine, & Abrams, 2010; Schmitt & Branscombe, 2001). Therefore, when an ingroup member behaves in a manner that reflects on his or her group negatively, the group's positive identity will be protected by rejecting the undesirable ingroup member. In addition, the how much a person identifies with

their group exposes that individual to a special form of psychological discomfort when members of that shared identity transgress group norms. Termed *vicarious dissonance*, individuals experiencing the discomfort of watching a deviant ingroup member often change their attitudes in order to reconcile their beliefs with their ingroup member's behaviour, especially if these individuals are highly identified with their group (Norton, Monin, Cooper, & Hogg, 2003). Individuals who are less identified with the group show the opposite effect, polarizing their own attitudes to be especially discrepant from the deviant ingroup member. As an additional mechanism to further dissociating from the deviant ingroup member, vicarious dissonance motivates less-identified ingroup members to present themselves as more prototypical of their group than the isolated member. These individuals may go to great lengths to ensure that the attitudes of the ingroup member who displays these behaviours are not reflective of their own attitudes. Since these inconsistent behaviors are considered a threat to other ingroup members, the closer an individual feels with those ingroup members, the greater that individual's vicarious dissonance (Norton, Monin, Cooper & Hogg, 2003). Therefore, the presence of an ingroup member who appears to deviate from the norm will evoke the salient group goal of maintaining a positive group image, which may be served by shifting one's own attitudes and behaviours to align with that person (if the person cannot be excluded from the group, as was the case in studies of vicarious dissonance) or may be served by excluding this person from one's social and academic circles, which may occur when individuals experience collective threat.

Defining Collective Threat

For members of stigmatized social identities, the attentiveness to situations that threaten the group's image can lead to a perpetual concern for that negative stereotypes will be made salient in those contexts. Cohen and Garcia (2005) define *collective threat* as the concern that an ingroup member may confirm negative stereotypes associated with one's group and, thus, undermine one's attempts to present the group (and the self) in a positive light. Because of a self-serving bias, people who suffer from collective threat believe that other ingroup members are more susceptible to confirming stereotypes than they are (Semyonov & Gorodzeisky, 2012).Therefore, individuals have greater stereotype activation and self-stereotyping when observing an ingroup member's stereotypic behaviour or traits, relative toboth individuals who do not perceive an ingroup member to show stereotypic traits or who perceive outgroup members to display stereotypic traits (Cohen & Garcia, 2005). Concerns that other ingroup members are confirming group stereotypes will negatively affect impressions that others form of their group and may lead stigmatized group members to avoid associating themselves with ingroup members who appear to confirm negative group stereotypes. For example, female engineers may avoid affiliating with female colleagues who display traits that would confirm a belief that women are not competent in this field. This level of selectivity in whom one associates with is a defensive response that an individual exercises to salvage the fragility of the reputation surrounding their social identity.

Members of stigmatized groups who are in domains where their stigmatized identity is made salient manage the environment by attuning to indicators of identity threat. Because their identification with the group is pitted against their identification with the domain, this attention bias serves as a means of detecting the presence of traits displayed by other ingroup members

that are atypical of people in that domain and that reinforce the negative stereotype of their group. For example, a female engineering student may feel that another woman who performs poorly on tasks requiring math or technological skills is a threat to other women in engineering because her performance may give the impression that women are less competent and not as capable of thriving in male-dominated quantitative fields. Prior research has shown that when highly math-identified women are exposed to negative stereotypes about women in math, they downplay the extent to which they report having traits that are typical for women but that do not fit the prototype of students majoring in math, such as flirtatiousness or desire to have children (Pronin, Steele, & Ross, 2004). Extending this bifurcation of individual personal identity to the collective interpersonal level, we predict that women in science, technology, engineering, and math (STEM) majors may hesitate to associate themselves with other women who display traits that would incur stigmatization by their friends in STEM. However, at present, there has been no investigation into how the choice to integrate an ingroup member into one's existing social and academic circle can be influenced by the extent to which that individual evokes the feeling of collective threat. Therefore, the present studies investigate how collective threat can be made manifest in a social and academic context for members of a traditionally marginalized group.

Performance of Women in STEM

The perilous effects associated with identity conflict are relevant to the understanding of gender differences in STEM fields. Globally, women are under-represented in engineering programs and are expected to be a minority in STEM programs (Fernando, 2011). In the United States, women earn fewer engineering degrees overall relative to men. Between 1982 and 1993, 41.9% of women enrolled in engineering earned their bachelors degree, whereas 61.6% of men completed theirs. Approximately 40% of women who began their school careers in engineering

dropped out of the program before completing their degree, relative to approximately 20% of male students, yet both shared nearly the same grade point averages: 2.98 for women and 2.88 for men (Bell, Spencer, Iserman, & Logel, 2003). Why do fewer women enrol in and successfully complete engineering programs relative to men, despite comparable academic performance? Proposed reasons include women's loss of confidence in doing well in engineering (Seymour & Hewitt, 1997), cold or hostile learning environments for women (Murphy, Steele, Gross, 2007), gender-role socialization (Meece, Eccles-Parsons, Kaczala, Goff & Futterman, 1982), and women's supposedly innate inability to perform as well as men in science and mathematics (Benbow & Stanley, 1983). Additionally, there are issues both with recruiting and retaining women to engineering professions, because women tend to exit this field earlier than their male co-workers (Fernando, 2011). Women may exit because they are dissatisfied with their pay or because the lack of promotional opportunities for them (Fernando, 2011); however, many researchers believe that an important and often overlooked problem is with stereotype threat.

Prevalent stereotypes about women's quantitative abilities convey that they are not skilled in math and science because of their gender (Richman, vanDellen, & Wood, 2011). As stated previously, stereotype threat occurs when an individual is at risk of confirming a negative stereotype about his or her group (Spencer, Steele, & Quinn, 1999; Steele & Aronson, 1995). Steele and colleagues have also found that stereotype threat creates many barriers such as self-handicapping, lower performance, and distancing the self from stereotypical groups. Because of this persistent threat, some women may respond by avoiding this field, a phenomenon termed *disidentification* (Aronson, Lustina, Good, Keough, Steele, & Brown, 1999). As another option, women may choose to engage in a process known as *identity bifurcation* whereby they

selectively disidentify with stereotypical feminine traits and endorse traits that will not incur devaluation from other people in STEM fields (Pronin, Steele, & Ross, 2004). However, less is known about whether this coping response is evoked in the context of collective threat and its consequence for the friends and colleagues with whom STEM women choose to affiliate. At present, there has been no research on how this coping mechanism of bifurcation is manifested within the structure of one'spersonal network of friends.

Furthermore, no study has accounted for the effect that the role STEM women routinely play in their personal network of friends impacts this decision to integrate or exclude other women. People fulfill different roles in this network and these roles are a function of their structural position. Indeed, the role that a person plays in his or her friendship network and the nature of relations between friends have implications for the behaviours that he or she chooses to enact (Llopis & Este, 2014). Therefore, two studies investigate the structure of STEM women's friendship network for patterns consistent with a bifurcated identity and to understand how STEM women's position in that network can influence their choice to integrate other women.

Chapter 2: Collective Threat and Decisions to Integrate into One's Social Circle

The present study investigates the nature of collective threat within the framework of one's friendship network. More specifically, the study inquires into whether STEM women will distance themselves from a woman who presents stereotypical-feminine traits due to collective threat. Will STEM women be less eager to integrate another woman into their friendship circle, compared with two control groups (female non-STEM and male STEM students), when that woman does not conform to the prototype of a typical STEM student? This study primarily tested whether female STEM students experience collective threat, and whether this threat has an effect on whom they integrate into their friendship circle.

Study 1

The present study is a 3 (Participant Type: STEM women, STEM men, non-STEM women) x 2 (Target Stereotypicality) between-subjects design that will investigate participants' level of inclusiveness towards a potential female friend. Response from three participant groups (i.e., STEM men, STEM women, and non-STEM women) were collected after being exposed to one of two fictive Facebook profiles of a female student that differed in degree of STEM-stereotypicality. On the basis of past research, we predicted that STEM women, relative to non-STEM women and STEM men, will be more willing to integrate the female target into their friendship circle to the extent that she displays STEM-stereotypic traits and will reject the target who presents no STEM-stereotypic traits. Because non-STEM women and STEM men do not experience collective threat in this context, we expected that this pattern of inclusion preferences would be much weaker or absent for these two groups, possibly even reversing for women in non-STEM majors.

Because our study includes a novel extension of the research on collective threat into the domain of social networks, this portion of our work was more exploratory in nature. Given the absence of prior research investigating the implications posed by the demographic topography of stigmatized group members' friendship network, our primary prediction was that STEM women would be more likely to report having a demographically bifurcated network of friends through greater diversity and segregation within that network. Therefore, the study we conducted served to test the validity of these speculations.

Method

Participants

We recruited 307 undergraduate students from the University of Waterloo to participate, of whom 287 successfully completed the study. Participants were recruited via a departmental participant pool and announcements in STEM classes for a $5 gift card or partial course credit.

Our intended sample included three types of participants: women in designated STEM majors (the focal group), as well as men in these STEM majors and women in designated "non-STEM" majors (the two control groups). Because these control groups already enable isolating effects of gender (holding major constant) and effects of major (holding gender constant), men in non-STEM majors were not needed as an additional control group. Eligible STEM and "non-STEM" majors were determined using the proportion of women within each major. Participants were sampled from STEM majors for which University enrolment statistics for the past 5 years indicated that women represent less than 20% of students in those programs: Mechatronics Engineering (10%), Computer Engineering (8%), Mechanical Engineering (10%), Electrical Engineering (11%), Software Engineering (12%), and Pure Mathematics (13%). To obtain a control group of majors in which women were clearly not marginalized or underrepresented, we sampled participants from majors designated as "non-STEM" if they contained a representation

of women over 65%. To recruit only eligible STEM or non-STEM majors, participants were required to report their gender and major to enter the study. To facilitate assigning photos carefully calibrated for comparable attractiveness and friendliness to match the self-reported race of each participant, we recruited participants only from the two largest racial groups represented at this University: Whites and East Asians.

Exclusions. Prior to analysis, we excluded any cases in which participants withdrew consent (n = 4) or that met two or more of the following criteria: failed or non-response to manipulation checks, shorter (less than 25th percentile) or longer (greater than three times the average) than expected completion time, listed few friends, reported high distraction, or reported low seriousness. Of the 307 people who completed the study, 253 were retained for analysis (M_{age} = 19.82 years, SD = 2.41, *range* from 16 to 42 years; 111 men, 152 women; 151 White, 102 East Asian), leaving 102 non-STEM women, 41 STEM women, and 110 STEM men (see Table 1).

Procedure

Participants completed the study over the Internet for approximately 15-20 minutes. STEM participants who were recruited during their lectures received an email with a link to the survey while non-STEM participants had access to the survey link through the SONA website. As a cover story, they were informed that the study investigated how people form friendships using Facebook. To bolster the cover story, participants were asked closed-ended questions at the beginning of the survey that pertained to Internet and Facebook usage. At the end, participants were probed for suspicion about the study purpose.

After consenting to participate, all participants completed demographics questions on race, gender, major, and age to confirm their eligibility to participate (see Appendices 1 and 2).

(Ineligible participants were redirected out of the survey.) Participants were randomly assigned to view either the STEM-stereotypic target profile (n = 185) or the non-STEM-stereotypic target profile (n = 122). Prior to viewing the profile, participants were asked questions about their Internet use (see Appendix 3). They were then asked to provide a list of their close friendship network of friends who attend the University of Waterloo using a *name generator* approach (Wellman, 1979). Participants' friendship network was further assessed through a procedure called *name interpreter* in which they reported demographic information (gender, race, major) about each listed friend, as well as reporting and the relationship between each friend measured via a novel self-report sociomatrix (see Appendices 4 and 5).

Subsequent to answering these questions, participants were instructed to view the (race-matched) profile for 3-4 minutes to familiarize themselves with its content. After participants viewed the target profile, participants completed the measures of friendship integration (i.e. perceived similarity, suggestion to friendship network, perceived fit, accepting friend request).

Next, participants were given three manipulation check questions (e.g., "What is Jamie's last name?") to determine if they examined the fictive Facebook profile closely. They were also asked how seriously they took the survey and how distracted they were during the survey (see Appendix 9). After completing these questions, participants were debriefed and given the option to permit the use of their data for analyses. Participants choose their preferred remuneration (i.e., Amazon or Starbucks $5 gift card), or were redirected to the SONA website for credit.

Materials

Pilot study. Yearbook photos from a university outside of Ontario were collected to be incorporated in a pilot test. The purpose of the pilot test was to determine the appropriate photos to be used for creating a fictive Facebook profile. Because East Asian and White students

represent a significant proportion of the undergraduate populace at the University of Waterloo, and men are not considered a stigmatized group in STEM fields, photos of East Asian and White women were selected for the study. The pilot study included 112 participants recruited from Mechanical Turk web service. Approximately half the participants rated the photos' attractiveness and half rated their apparent friendliness.

From the photos tested, four (two White and two East Asian women) were selected for the Facebook profiles. All four photos were chosen because they were rated as moderately attractive (M = 4.5) and moderately friendly (M = 5.1) on a 10-point response format from 1 (*not at all*) to 10 (*extremely*). Comparisons between photos revealed no significant main effect of race across attractiveness, $F(1, 51) = 0.58$, $p = .45$, or friendliness $F(1, 54) = 2.99$, $p = .089$. Additionally, the four photos were scored on a measure of suitability for a Facebook profile (M = 1.6) which ranged from 1 (*not suitable*) to 2 (*suitable*) and had a threshold cut-off of 1.5. The people contained in the chosen Facebook photos appeared to be in the same age-group as the average undergraduate student who attends the University of Waterloo. Participants classified the White and Asian target photos as White and Asian, respectively, with almost perfect accuracy.

Facebook profile. Fictive Facebook profiles were created in Adobe Photoshop CS6. Across all profiles, the target was assigned the name Jamie Lee in order to remove any potential influence of ethnically stereotypic first or last names on the participants' responses. The target was given a gender-balanced major (i.e. biology; 50% women) that could not be categorized as STEM or non-STEM. To prevent participant responses from being influenced by romantic interest, the relationship status of the target was presented as "In a Relationship". Controlling for any additional socially-relevant influences, the hometown, high school, and graduation year of

the target were held constant across profiles with only variations pertaining to the target's ethnicity (matched to the participant) and interests (high or low in STEM stereotypicality).

As part of the experimental manipulation, the interests of the target were changed to represent those of either a stereotypical STEM student or a counter-stereotypical STEM student. Popular books, movies, and TV shows were selected at the top tier of interests reported by STEM and non-STEM students in a mass-testing survey. For each topic, four interests were selected to be incorporated into the Facebook profile. Finally, the Facebook profile was integrated into the other study materials in Qualtrics.

Measures. Participants reported the demographics of their personal friendship network and their degree of willingness to integrate the female target (Jamie) into that network. To operationalize friendship integration, participants completed multiple measures of friendship integration capturing the extent to which they would accept a friend request from Jamie if they met her, her perceived fit with one's friendship network, and the degree to which they were suggest her as a friend to individuals in their network. Participants indicated, using on a continuum from 1 (*definitely not*) to 4 (*definitely yes*), whether they would accept a friend request from the target, if they had met her, and (on the next page) whether they would suggest the target as potential friend to each of their own friends. Participants also rated the target's perceived similarity to themselves and each of their friends, from 1 (*very dissimilar*) to 5 (*very similar*), as well as how well she would fit into their friendship circle overall from 1 (*not at all well*) to 5 (*extremely well*). Correlations between each dependent measure were significantly positive and ranged from small ($r = .19$, $p = .002$) to moderate ($r = .58$, $p < .001$).

Results

Descriptive Statistics

Data screening was implemented to ensure that the scores across the predictor and dependent measures satisfied the assumptions germane to the general linear model. Table 3 reveals the descriptive statistics for each continuous measure. Across all friendship integration (i.e., suggestion, perceived fit, similarity, acceptance), identification (i.e. major, gender), and network measures (i.e., ego-betweeness, normalized brokerage), the scores were distributed along a normal curve with the reported skew and kurtosis within the adequate range. The data contained no univariate or multivariate outliers, and normality was reaffirmed by non-significant tests of normality across all continuous measures, so no further exclusions were necessary.

Friendship Integration

The independent and interactive effects of the manipulated variable, the Participant Types, Target Stereotypicality, and the Friend Types (i.e., STEM male, STEM female, and non-STEM female friends) were analyzed across each dependent variable using a generalized estimation equation procedure (GEE; Liang & Zeger, 1986), which controlled for the non-independence of scores reported for each friend within a participant. To avoid inappropriately assuming independence of repeated (i.e., within-participant) observations, our GEE model used an unstructured covariance matrix that estimates the correlations between within-subject responses (Fitzmaurice, Laird, & Rotnitzky, 1993). Furthermore, effects codes were computed for each of the categorical predictors in order to detect possible deviations in responses from the sample mean. With the exception of target stereotypicality, two effects coded were created for each categorical predictor. Codes for the participant type predictor were created to detect possible significant differences between STEM women (coded 1) or STEM men (coded 1) and

the average response (coded -1) in the sample. Similarity, codes for the friend type predictor were created to detect differences between STEM male (coded 1) or STEM female (coded) friends and the average score (coded -1) across all friend types. From these procedures, we constructed a model composed of main effects, two 2-way, and two 3-way interactions between the independent variables.

Manipulation check. The strength of the manipulation check was determined by applying our model to the measure of perceived similarity. A significant main effect of Target Stereotypicality, B = -0.26, SE = 0.06, $\chi^2(1) = 18.99$, $p < .001$, indicated that the STEM-stereotypic female target was perceived to be more similar to participants' friends. A significant 2-way interaction emerged between Participant Type and Target Stereotypicality (see Table 4), such that STEM women differed from everyone else in the degree to which they perceived both the STEM-stereotypic and STEM-nonstereotypic female target to be similar to their friends, B = 0.22, SE = 0.09, $\chi^2(1) = 6.41$, p = .01. Averaging across Friend Type, STEM women perceived the STEM-stereotypic target to be more similar to their friends than the STEM-nonstereotypic target, B = -0.22, SE = 0.09, $\chi^2(1) = 6.41$, p= .011 as highlighted in Figure 1. Furthermore, Figure 1 reveals that this interaction was qualified by a 3-way Participant Type X Target Stereotypicality X Friend Type interaction, B = 0.23, SE = 0.08, $\chi^2(1) = 7.47$, p = .006, where STEM women showed this pattern of differential similarity to a lesser extent for their male STEM friends compared with other friends

We conducted additional simple interaction testing which type of friends were considered more or less similar to the STEM-stereotypic and non-stereotypic target. A 2-way Participant Type x Target Stereotypicality interaction was present within both ratings of perceived similarity to one's female STEM friends, B = -0.32, SE = 0.12, $\chi^2(1) = 7.28$, p = .007, and female non-

STEM friends, B = -0.35, SE = 0.16, $\chi^2(1) = 4.37$, p = .04, but not male STEM friends, ($\chi^2 < 1$). Within participants' male STEM friends, the STEM-stereotypic target was rated to be more similar to STEM men than the STEM-nonstereotypic target. Relative to the STEM-nonstereotypic target, the STEM-stereotypic target was rated more similar to the female STEM friends of both STEM women, B = -0.57, SE = 0.13, $\chi^2(1) = 18.14$, $p < .001$, and STEM men, B = -0.23, SE = 0.09, $\chi^2(1) = 5.78$, p = .02, but (surprisingly) not non-STEM women, B = 0.06, SE = 0.22, $\chi^2(1) = 0.08$, p = .77.. Therefore, the results indicated partial support for the effectiveness of our manipulation by influencing the perceptions of the participant group of interest, STEM women.

Accepting a friend request. The second dependent variable and first measure of participants' willingness to integrate the female target as a friend, Facebook friend acceptance, was tested with a simplified model that removed the Friend Type as a predictor because this variable was collected at the participant level, not the friend level (i.e., each participant made only one rating). The predicted interactions of Participant Type and Target Stereotypicality were not significant,($\chi^2 < 1$).] Follow-up analyses assessed whether differences in friend acceptance emerged when participants' gender identification or major identification were introduced as moderators (see Tables 5 and 6). Only a marginally non-significant Participant Type x Target Major x Gender Identification interaction predicted the extent to which participants accepted a friend request from the female target, B = -0.13, SE = 0.08, χ^2 (1) = -1.72, p = .087. Probing further, our simple interaction tests found a non-significant trend wherein STEM men differed from everyone else in their response to both targets when they reported being highly identified with masculinity, B = -0.13, SE = 0.09, χ^2 (1) = 2.33, p = .13. Within STEM men and STEM women who did not identify strongly with their gender, no significant trends emerged in our

data, ($\chi^2 < 1$). No significant effects emerged when major identification was used as a moderator ($t < 1$). Subsequent analyses tested whether our hypotheses were supported through other measures of friendship integration.

Introduction to friends. We extended the tests of our model's predictive power toward the estimation of participants' level of willingness to introduce the STEM-stereotypic or STEM-nonstereotypic target to their friends. Additionally, we were interested in the friend-relevant conditions under which this tendency to recommend the target was evidenced. Therefore, we ran the original model containing participant type, target stereotypicality, and Friend Type as predictors.

The results of our analyses provided support for the hypothesis of collective threat shown in STEM women when presented with a female target who displays STEM-nonstereotypic characteristics vs. STEM-stereotypic characteristics. A significant three-way interaction was noted wherein STEM women differed from everyone else in their level of eagerness to suggest either female target to their STEM female-friends, $B = -0.12$, $SE = 0.08$, χ^2 (1) = 2.33, $p = .13$, follow-up analyses indicated that the simple effect of Target Stereotypicality was significant for STEM women, $B = -0.26$, $SE = 0.10$, χ^2 (1) = 6.47, $p = .011$, , but not for STEM men, ($\chi^2<1$) , or non-STEM women, $B = -0.11$, $SE = 0.10$, χ^2 (1) = 1.21, $p = .27$ (see Figure 2).

Interestingly, significant effects emerged to suggest that this experience of collective threat was conditional on STEM women's willingness to recommend the target to a certain friend type (see Figure 2). This pattern was reflected in a 3-way Participant Type X Target Stereotypicality X Friend Type interaction, $B = 0.15$, $SE = 0.06$, $\chi^2(1) = 6.26$, $p = .012$. To probe this interaction, we conducted a simple 2-way interaction test within each participant type. This 2-way Target Stereotypicality X Friend Type interaction was not significant for STEM men, $B =$

-0.03, SE = 0.05, $\chi^2(1) = 0.47$, p = .49, or non-STEM women, B = -0.13, SE = 0.11, $\chi^2(1) = 1.48$, p = .22, but was significant for STEM women, B = 0.14 , SE = 0.07 , $\chi^2(1) = 4.48$, p = .034, indicating that they were more likely to suggest one target over the other only when asked to recommend them to a certain friend type. We then tested which type of friends STEM women more versus less likely to introduce to the STEM-stereotypic versus STEM-nonstereotypic target. Within each Friend Type (i.e. male STEM friends, female STEM friends, and female non-STEM friends), we observe the effect that the target's stereotypicality imposed on the decision of STEM women to introduce the female target to their friends. Our analyses showed that STEM women were significantly more likely to introduce the STEM-stereotypic (vs. STEM-nonstereotypic) target to their fellow female STEM friends, B = -0.23, SE = 0.11, $\chi^2(1) = 4.18$, p = .041, and their female non-STEM friends,B = -0.43, SE = 0.16, χ^2 (1) = 7.24, p = .007 . For their male STEM friends, a trend in the hypothesized direction emerged but was not significant, B = -0.12, SE = 0.09, $\chi^2(1) = 1.82$, p = .18. Therefore, our results provide support for this experience of collective threat within a friendship-integration context for STEM women. Interestingly the results seem particularly strong for introductions to STEM women's female friends who are in the same program, whereas introduction to male friends were relatively unlikely across the board.

***Similarity as a moderator*.** Because perceived similarity may influence decisions about incorporating a new friend into one's friendship circle, we decided to alter our working model to include participants' responses of the female target's similarity to their friends as a moderator. Thus, we tested for the presence of a 4-way interaction which would determine whether the target's perceived similarity would moderate the extent to which STEM women experienced collective threat. Our results showed two significant Participant Type X Target Stereotypicality

X Friend Type X Similarity interactions within STEM women's STEM male, B = -0.11, SE = 0.05,χ^2 = 4.72, p = .03, and STEM female friends, B = 0.17, SE = 0.05,χ^2 = 11.04, p = .001. Therefore, additional analyses were conducted to decipher the nature of this interaction.

We sought to conduct two simple 3-way interactions at both high and low levels of similarity as a means of comprehending the moderating effects of this variable. When participants rated the female target as very similar to their friends (a standard deviation above the mean similarity score), there was a significant Participant Type X Target Stereotypicality X Friend Type interaction present, B = 0.23, SE = 0.07, $\chi^2(1)$ = 10.48, p = .001. This 3-way interaction was replicated within participants who rated the female target as very dissimilar to their friends (one standard deviation below the mean similarity score), B = 0.26, SE = 0.08, $\chi^2(1)$ = 10.33, p = .001.

To probe this interaction, we tested the simple 2-way interaction between participant type and target major at low levels of similarity and within each of the Friend Types. At low levels of similarity, our analysis revealed a significant interaction between Participant Type and target major within the suggestion scores participants reported for both their female non-STEM friends, B = -0.32, SE = 0.14, $\chi^2(1)$ = 5.33, p = .02, and female STEM friends, B = -0.31, SE = 0.13, $\chi^2(1)$ = 6.14, p = .013, but not their male STEM friends, B = 0.08, SE = 0.1, $\chi^2(1)$ = 0.60, p = .44.

In the final part of this series of analyses, we conducted simple slopes analyses reporting the effect of target stereotypicality within each participant type. Within STEM women who had rated the target to be very dissimilar, we observe that they were significantly more open to introducing the STEM-stereotypic vs. STEM-nonstereotypic target to both their STEM female, B = -0.41, SE = 0.15, $\chi^2(1)$ = 6.80, p = .009, and non-STEM female friends, B = -0.39, SE = 0.18, $\chi^2(1)$ = 4.64, p = .031. In contrast, both STEM men and non-STEM women failed to evince a

significant differences in preference for STEM-stereotypic vs. STEM-nonstereotypic target to both their STEM and non-STEM female friends (χ^2s <1). The same simple interaction procedure was also conducted at high levels of similarity. Our analysis of participants who rated the female targets as highly similar to their friends, we found that STEM women differed from everyone else in the pattern of responding to both targets when asked whether they'd introduce either female target to their non-STEM female, B = -0.36, SE = 0.11, $\chi^2(1) = 9.82$, p = .002, but not their STEM male and female friends (χ^2s <1). At high levels of similarity, we tested whether compared to the two control groups, STEM women were more likely to introduce the STEM-stereotypic vs STEM-nonstereotypic target to their female non-STEM friends. Our results revealed that STEM women were more willing to introduce the STEM-stereotypic target vs. STEM-nonstereotypic target to their non-STEM female friends, B = -0.54, SE = 0.15, $\chi^2(1) = 13.29$, $p < .001$. This pattern was not witnessed in both STEM men and non-STEM women (χ^2 <1)Overall, the results of our analyses provide cogent support for the importance that perceived similarity holds in evoking the presence of collective threat in STEM women.

Perceived fit with friends. The final dependent measure of friendship integration, perceived fit, was regressed on our model of predictors. Because the data collected on this measure were analyzable at the level of the participant, and not each friend, we removed the friend-major-type predictor from our model for this analysis. Therefore our basic model contained participant type and target steroetypicality as our predictors.

Preliminary analyses revealed that STEM women differed from everyone else in the extent to which they reported perceiving the STEM-stereotypic vs. STEM-nonstereotypic target to be more or less of a fit to their friendship circle, B = -0.23, SE = 0.10, $t(1) = -2.41$, p = .022. Furthermore, across all participant groups, the STEM-nonstereotypic target was perceived to be

less of fit to one's friendship circle, B = -0.13, SE = 0.06, $t(1)$ = -2.20 p = .03. Simple effects analyses within each participant group revealed that STEM women, B = -0.36, SE = 0.14, $t(1)$ = -2.62, p = .009, and STEM men, B = -0.21, SE = 0.10, $t(1)$ = -2.04, p = .04, but not non-STEM women, B = 0.13, SE = 0.08, $t(1)$ = 1.58, p = .11, perceived the STEM-stereotypic target to be a better fit to their friendship circle more than the STEM-stereotypic target.

We added participant's level of gender identification or major identification as a third predictor in the model. Tables 5 and 6 show that a significant 2-way interaction was found between participant type and target major when gender identification was used as a moderator in the model, B = -0.21, SE = 0.10, $t(1)$ = -2.04, p = .04, but as well as a marginal interaction when major identification was used, B = -0.17, SE = 0.10, $t(1)$ = -1.71, p = .09. No significant 3-way interactions were found in our overall test (ts <1); therefore, the continuous predictors were removed from the analyses. Therefore, the results of these analyses did not support our hypotheses.

Network Analysis

The structure and composition of the friendship network were collected through sociomatrix and demographic data, respectively, in the service of extricating further specificity as to the conditions under which collective threat impacts decisions to integrate a potential friend. Despite the variation in the number of friends listed, an average of 8 friends were reported across all participants. Across participants' sociomatrices, we found that most ties between friends were bidirectional (94%), a finding that contrasted with previous research investigating the structure of ties between friends in one's friendship network (Wellman, 1979). Demographic data collected from friends who were categorized under one of the three gender-major combinations (i.e. STEM male friends, STEM female friends, and non-STEM female friends)

were focal to the analysis because of the theoretical relevance it had to our notion that identity bifurcation is translated from the self-concept into one's friendship network. Though it provided a restriction on the number of cases to be analyzed, the results would be easily interpretable in reference to our hypotheses.

Upon observation of the personal-network composition, Table 2 provides the proportion of friends from each of the three categories across each Participant Type. Because previous studies that have observed the commonalities of personal communities across people have reported a high degree of *homophily* wherein friends are of the same demographics as the person of interest (Degenne & Forse,1999; Smith, McPherson, & Smith-Lovin, 2014), we sought to test this hypothesis within our sample. Consistent with the findings of Degenne and Forse (1999), only participants who were STEM men or non-STEM women showed a significant degree of homophily in their friendship network, $\chi^2(4, N = 1426) = 910.09$, $p < .001$. However, subsequent analyses, which document the impact a participant's friendship network structure, consider the between-participant variation in these parameters.

Participants' friendship network structure was gauged through a UCINET software program (Borgatti, Everett, & Freeman, 2002) designed to compute statistics indicative of the relationships between the *ego* (i.e., person of interest) and its *alters* (i.e., friends).Relevant to the notion of identity bifurcation being represented in the friendship network of friends, we speculated that ego's position within their network would provide a proximate measure of this phenomenon. To test the validity of our speculation, we computed scores measuring the density of participants' network, participants' normalized level of brokerage in their network, and their degree of ego-betweeness. Normalized brokerage scores provide the extent to which an ego is a bridge between two disconnected alters, given the number of possible connections in the

network. Higher levels of brokerage reveal a less dense network of ties. Conceptually similar to brokerage, ego-betweeness measures the frequency at which alters within a friendship network are only connected to each other through ego. These statistics were used as proxy measures in testing whether STEM women are more often positioned as brokers within their friendship network in comparison to the other two participant groups.

To test this hypothesis, un-weighted effects codes were computed to compare the normalized brokerage scores of STEM men and of STEM women to the mean brokerage score of the sample. Contrary to our expectations, STEM men evinced significantly lower brokerage scores compared to the sample mean, $B = -0.045$, $SE = 0.02$, $t(195) = -1.901$, $p = .06$; however, STEM women did not show brokerage scores that significantly differed from the sample mean, $B = 0.004$, $SE = 0.03$, $t(195) = 0.14$, $p = .89$. Furthermore, a comparison of STEM men and STEM women's ego-betweeness scores to the sample mean revealed non-significant differences. Therefore, we sought to investigate whether these two variables were important predictors and moderators of participants' decision to integrate one of the targets (i.e., STEM vs. non-STEM).

As an initial step to unravelling possible interactions, an omnibus test was conducted to test the presence of a 3-way interaction with the participant effects codes (i.e. STEM men and STEM women) and target major effects coded as categorical predictors and participants' normalized brokerage score as a continuous predictor. The model's predictive power was tested on two of the primary friendship integration measure: Facebook friend acceptance and suggestion to one's friends. The model showed no significant predictions as it pertained to participants' ratings of the target's perceived similarity and fit. The following results are reported in accordance with the first two dependent measures.

Friend accept. We tested the predictive power of the model in estimating the scores participants gave expressing the likelihood at which they would accept a friend request from the female target. Table 7 reveals a significant 3-way interaction between the Participant Type, target stereotypicality, and normalized brokerage score that predicted Facebook acceptance scores, $B = 1.01$, $SE = 0.41$, $t(195) = 2.46$, $p = .015$. Additionally, a significant 2-way interaction between Participant Type and target stereotypicality was evidenced in this analysis, $B = -0.55$, $SE = 0.23$, $t(195) = -2.42$, $p = .017$. From these significant findings, we sought to extricate the direction of this complex interaction.

To understand the structural conditions that produce differential levels of acceptance of the STEM-stereotypic target vs. the STEM-nonstereotypic target across the participant groups, a simple 2-way interaction test was conducted in both participants with low levels of brokerage (i.e., one standard deviation below the mean) and participants with high levels of brokerage (i.e., one standard deviation above the mean). Our results revealed that a significant Participant Type X Target Stereotypicality interaction was significant at low, $B = -0.30$, $SE = 0.19$, $t(195) = -2.13$, $p = .04$, but not high levels of brokerage, $B = 0.19$, $SE = 0.13$, $t(195) = 1.48$, $p = .14$. In conjunction with this test, a simple slopes analysis was conducted to compare acceptance scores between the STEM and non-STEM target within each participant group. STEM women revealed differential levels of acceptance of both targets, $B = -0.38$, $SE = 0.19$, $t(195) = -1.96$, $p = .05$, in which they were less accepting of the STEM-nonstereotypic target. We did not witness a similar pattern across the our participant groups [i.e., STEM men, $B = -0.07$, $SE = 0.1$, $t(195) = -0.73$, $p = .46$; non-STEM women, $B = 0.22$, $SE = 0.14$, $t(195) = 1.57$, $p = .12$]. Therefore, the level of acceptance shown to female target was determined, in part, by the stereotypicality of her profile,

the major that participants reported being in, and the degree to which they were broker in their friendship circle.

As an additional test of the consistency of our findings, we observed whether ego-betweeness was a significant moderator to include in our model. Therefore, we substituted in this continuous measure for normalized brokerage and conducted the same omnibus analysis. It was noted that the Participant Type X Target Stereotypicality X Ego Betweeness interaction was a significant predictor of the acceptance scores given by the participants, $B = 0.01$, $SE = 0.005$, $t(195) = 2.02$, $p = .03$. Additionally, we tested for the presence of a simple 2-way interaction at low and high levels of ego betweeness and found a marginally significant Participant Type X Target Major was present when participants showed low, $B = -0.26$, $SE = 0.14$, $t(195) = -1.93$, $p = .06$, but not high levels, $B = 0.15$, $SE = 0.13$, $t(195) = 1.19$, $p = .24$.In order to further test the consistency of our findings, we conducted a simple slopes analysis of the data. Our results indicated a different pattern than what was noted in the previous moderation analysis. The findings revealed a significant difference in levels of acceptance between targets only within the non-STEM women, $B = 0.29$, $SE = 0.14$, $t(195) = 2.12$, $p = .04$. Therefore, this discrepancy may provide an indication of a distinction between the two measures of ego's network position.

Friend suggest. We used the second measure of friendship integration, friend suggestion, for the purpose of considering whether the structure of one's friendship network would moderate the extent to which the different participant groups suggested the STEM-stereotypic vs nonstereotypic target. Because people consider the characteristics of their friendship network when deliberating whether to suggest a potential candidate into their circle, we expected that this measure would provide greater clarification as to how significant certain idiographic and

contextual factors are in determining people's habits of inclusion/exclusion. Therefore, we conducted the same sequence of tests to observe the model's predictive power.

Table 8 reveals that the omnibus 3-way interaction between the Participant Type, target stereotypicality, and normalized brokerage variables was statistically significant, B = -0.64, SE = 0.29, t(195) = -2.23, p = .03. To further extricate the nature of this interaction, a simple interaction test was conducted. Results showed a 2-way Participant Type X Target Stereotypicality interaction was significant at high, B = -0.25, SE = 0.09, t(195) = -2.57, p = .02, but not low levels of brokerage,B = 0.06, SE = 0.1, t(195) = 0.65, p = .52. Upon conducting a simple slopes analysis, STEM men scoring high on brokerage reported greater suggestion scores given to the STEM-stereotypic target compared to non-STEM target, though it was a marginally non-significant trend, B = -0.20, SE = 0.11, t(195) = -1.86, p = .06;however, this pattern was not evidenced in the other participant groups [i.e, STEM women, B = 0.20, SE = 0.17, t(195) = 1.12, p = .24; non-STEM women, B = 0.15, SE = 0.11, t(195) = 1.43, p = .15]. Furthermore, Figure 3 shows that STEM men showed a non-significant trend whereby they were more willing than average to suggest the STEM-stereotypic target to their friends at high levels of brokerage, B = 0.26, SE = 0.13, t(1) = 1.97, p = .051. We conducted a second omnibus test of the model to observe if our results were replicated using the second network measure; however, there was no significant Participant Type X Target Stereotypicality X Ego-Betweeness interaction present, B = 0.002, SE = 0.005, t(195) = 0.40, p = .69.

Discussion

Collective threat reflects the predominant concern held by members of stigmatized groups that pertains to the group's integrity within the realm of social relations. Given the negative implications associated with being a member of a stigmatized group, an individual is motivated to protect the reputation of the group in the face of threats to their social identity. Relevant to the present investigation, women in STEM fields are a numerical and stigmatized minority within a traditionally male-dominated domain and they frequently contend with persistent threats to their group's image through negative stereotypes of their logical-mathematical abilities. To protect the group's integrity, women in STEM have to attend to the attributes and behaviours of their fellow female colleagues and make judgments as to the stigma-relevant consequences of those features. The judgments made regarding the stereotype-relevance of the traits evident in an ingroup target will factor into STEM women's interest in affiliating with that ingroup member and introducing them to their friends. The results of the present study not only provide evidentiary support for the presence of collective threat in STEM women but also contextualize this phenomenon in the realm of friendship formation with implications that will incite further study.

Moderating Effect of Similarity

The results of the present study illustrate the notion that people gauge their level of similarity to others that extends beyond shared group membership. People assess the salient attributes and behaviours displayed by others and evaluate them based on a predetermined set of criteria for affiliation. An important criterion that people use to evaluate attributes and behaviour is assessing the prevalence those traits and behaviours within their existing friendship circle. From this assessment, an individual may gauge how similarity a target is to their friends.

The results of the present study present a noteworthy pattern that warrants interpretation. As expected, STEM participants (men and women) perceived the STEM-stereotypic target to be more similar in features to their friends than the STEM-nonstereotypic target. However, contrary to our initial hypothesizing, non-STEM women did not perceive the STEM-nonstereotypic target to be more similar to members of their friendship circle than the STEM-stereotypic target. These patterns contributed to the overall main effect of target condition on similarity where the STEM-stereotypic target was perceived to be more similar to participants' friends.

Although this pattern partially supported the effectiveness of our manipulation, one plausible explanation for this result draws on an assessment of the overlay of social relations at the university as a function of the program students are enrolled in. Because students in STEM majors often encounter ingroup members via shared classes and exclusive social organizations, they are more likely to learn and create a culture centred on the competitiveness of and shared characteristics among students in STEM. Consistent with the optimal distinctiveness paradigm, the creation and maintenance of a distinct STEM culture within the overarching university would serve benefits both personally and collectively. However, this circumstance may explain STEM students' attuning to and differentiation of students who display STEM-stereotypic qualities from those who do not, resulting in the patterns of similarity ratings in our present study. In contrast, students in non-STEM majors are frequently exposed to peers from both non-STEM and gender-balanced majors and would have greater opportunities to forge friendships across group boundaries through classes and less-exclusive student organizations. Therefore, these results may reflect a by-product of the current social milieu that partially determines when students choose to integrate each into their friendship circle.

However, more specific to STEM women, the current findings to the unique role collective threat plays in their decision to integrate a female target who is perceived as unique compared to one's friendship circle. Because STEM women may contend with negative stereotypes about women's competence by selectively dis-identifying with feminine-stereotypic traits (Pronin, Steele, Ross, 2004), this coping mechanism may extend to the choices they make as to whom they would want in their social network when they look to make friends with other women who are perceived to be different from them. The study found that STEM women were less willing to integrate the STEM-nonstereotypic target , especially when she was perceived to be less similar their STEM female friends and that this pattern was specific to this participant group. Considering past research on responses to ingroup members who pose a threat to the group image (Pinto, Marques, Levine, & Abrams, 2010), this finding isn't novel in its relation and may reflect an overall disdain for ingroup members that taint the reputation of a group. Although the current study did not assess participants' ratings of friendship quality for each friend, a further inquiry into the possible moderating role of existing friendship dynamics may provide unique insights toward understanding the friendships forged by stigmatized groups.

Friendship Characteristics

Although research on collective threat has been extant, the present study extends scientific knowledge on this phenomenon into the realm of friendship dynamics and decision-making as a manner of determining the implications of collective threat. The results of the study advocate for the importance of understanding existing friendship characteristics and how the reputational concern held by stigmatized groups may be embedded in their decisions to affiliate and form certain social networks. In particular, the demographics of STEM women's friends were shown to play a unique role in the process of suggesting a female target to members of their

existing friendship circle. STEM women preferred to suggest the STEM-stereotypic target over the STEM-nonstereotypic target when asked to indicate their level of eagerness to introduce the targets to both their STEM and non-STEM female friends. Furthermore, STEM women's suggestion of the STEM-stereotypic target to the friends with whom they share group membership (i.e., STEM female friends) was confirm to be a pattern unique to this group when compared to the other two.

Although STEM women did not show this preferential treatment of the STEM-stereotypic target when asked about their STEM male colleagues, a group to whom STEM women's reputational concerns are derived from, the results not only authenticate the presence of collective threat but also present a broader picture as it pertains to its impact on motivation to preserve the integrity of one's stigmatized identity. Women in STEM benefit from scenarios that exemplify the competence displayed by their ingroup members and their fit within a competitive male-dominated field. One noteworthy scenario is the exposure to successful counter-stereotypic women who redefine femininity beyond traditional gender roles and stereotypes (Asgari, Dasgupta, Cote, 2012; Dasgupta & Asgari, 2004). Exposure to these women would challenge implicit associations that STEM women make about their gender in the domain of math. Logically, however, the counter-stereotypic traits of a female friend would not only reduce implicit stereotyping but also mobilize additional strategies to further challenge negative stereotypes about women. As demonstrated in the results, one initiative may be to introduce counter-stereotypic female targets to one's existing circle of female friends while avoiding stereotypic female targets. This strategy would serve the purpose of developing a cohesive network of female friends whose interests contest societal assumptions and provide coping

benefits for STEM women. Therefore, these results provide further insight into the practical consequences that experiencing collective threat poses for friendship integration.

Demographic Network Bifurcation

The present study extends the knowledge about stigmatized individuals' strategies of coping with various forms of social identity threat (i.e., stereotype threat and collective threat) into the realm of personal communities by investigating how the interplay of collective threat and identity bifurcation are contextualized within existing personal communities. We hypothesized that, as a method of preventing opportunities to be judged by others based on negative stereotypes, women in STEM fields would bifurcate their personal communities through having a diverse set of friends. Furthermore, we analyzed the structural position held by individuals in their friendship network in order to understand whether stigmatized individuals may be situated into a specific role because of their choice of bifurcating their friendship network. Through these procedures, we obtained results that are reviewed in relation to our initial speculations.

Our initial analyses provided a litmus test for the presence of non-random diversity within STEM women's personal communities, and the results supported our hypotheses. STEM women showed greater friendship diversity than what would be expected from random estimation. This level of variety is contrasted with the high degree of homophily evident within the friendship circles of their male STEM counterparts and women in non-STEM majors. STEM men and women are exposed to each other more often than to people in other majors due to take many degree-relevant courses, this pattern of heterogeneous friendship circles in STEM women may be a by-product of being aware of their status as a visible minority within their program. Thus, STEM women may forge friendships with people from other majors as a way of avoiding

continued exposure to situations of threat within academic settings (e.g. studying with male STEM colleagues). Additionally, the high level of homogeneity within STEM men's personal communities not only reflects the inclination towards homophily but also reflects the inequalities produced by such demographic patterns in the university STEM majors (Degenne&Forse, 1999; Ferrand, Mounier, & Degenne, 1999; Lin, 2001). Therefore, the low number of friendship ties that STEM men have with women in their program serves to maintain gender differences in status within these competitive, male-dominated fields.

Women in STEM must manage the dynamics of their friendship circle to prevent their reputation as a female within a male-dominated program from being jeopardized by their choices. The choice of whom to associate oneself with is a concern that people hold because of the implications it has for their reputation. Insofar as the structure of friendship ties (e.g., density) vary across people and each individual differs in their position within the network, the decision to integrate a friend into their friendship network will vary. Based on this knowledge, we tested the effect that participants' friend-network density and their level of brokerage within that network had on their willingness to integrate a potential female friend.

Our results revealed support for the experience of collective threat for STEM women who were embedded in a particular network structure. More specific, STEM women who reported having a dense network of friends were less likely to accept a Facebook friend request from the female when she presented STEM-nonstereotypic traits. In comparison to this group, STEM men and non-STEM women did not show this trend. STEM women's differential willingness to accept STEM vs. non-STEM target reflect the impression-management concerns that are heightened by knowing that any choices they make pertaining to friendship integration will be noticeable by their friendship network. Because Facebook friends have access to ego's

friendship network through updates, the question of whether to become friends with another female may be made with caution by STEM women who have a tightly-knit group.

Our analyses uncovered an unexpected finding that does not refute nor support our initial speculations yet has implications relevant to the study of gender relations within an intergroup context. STEM men who were position as a broker in their network tended to show greater willingness to suggest the STEM-stereotypic target to friends in their network than everyone else, and they were more likely to suggest her over the STEM-nonstereotypic target. In contrast, STEM and non-STEM women did not show this trend when they had comparable brokerage scores. Thus, the brokerage position that some STEM men hold is a moderating factor in their choice to associate with certain women who display feminine vs. STEM stereotypicality. Because this structural position requires coordination at the level of ego, STEM men who occupy this role may be willing to integrate women into their friendship circle as long as they display similar STEM interests and are joining a sparsely knit network of friends.

Although people have a degree of autonomy in choosing whom to associate with and the extent to which their friends know each other, the environment can also place people in situations where they develop a friendship network of a certain constellation. For example, the creation of environments that afford opportunities to develop connections with female engineers may position more male engineers within a brokerage role if they socialize with them across a variety of contexts (e.g. academic clubs, social events). The role that these men occupy may perpetuate greater willingness to form additional ties with women in their field. Indeed, such outcomes are not foreign to research on the impact of cross-group friendships (Mendoza-Denton & Page-Gould, 2008, Page-Gould, Mendoza-Denton, 2011; Page-Gould, Mendoza-Denton, Alegre, &Siy, 2010). Additionally, encouraging women in STEM fields to participate in settings

where their minority status does not subject them to feeling threatened would supplement the efforts to reduce hierarchical differences between genders in their programs. These procedures are some of the various avenues to diminishing the experiences of threat that plague stigmatized groups.

Limitations and Future Directions

Despite the breadth of support the results lend toward our hypotheses, the study is not without limitations. Relevant to the framework of social network analysis, the statistical procedures and parameters measured constrained the inferences we could make. Because we analyzed the social network data at the level of a single participant and did not further specify how the network data of participants' friends impacted their decision, our inferences are limited to participants' average response across all friend types. This approach to social network analysis removes the unique effect of other moderators such as the effect that different friend types and the connections between major cliques (e.g. STEM clique, non-STEM clique) have on participants' willingness to integrate potential friends into their personal communities. It is quite possible that STEM women, who serve as a broker in their friendship network, may be willing to integrate both female targets into cliques that are sparsely connected to each other. Future research will seek to extricate more specified patterns of decision making.

Furthermore, the study presents limitations that are a product of assumptions made about participants. In particular, we assumed that the names whom participants listed as their closest friends also viewed the participants, themselves, as friends. Given the resource-related costs associated with testing the validity of that assumption, we did not ask participants' friends whether they viewed the participant as one of their closest friends. Thus our assumption prevented us from analyzing measures of participant's level of popularity (i.e., indegree) or

sociability (i.e, outdegree) in order to further understand how such parameters would impact the decision-making process. Additionally, the high degree of density in the majority of participants' friendship networks dissuaded us from conducting analyses of the ties between alters. Therefore, additional research is needed to understand the type of influence that these measures of network relations have on participants.

Finally, the inferences made from the present study are limited to the sphere of social relations where norms surround people's choice to forge friendships. Although STEM women showed patterns consistent with our hypotheses, the question remains whether these patterns will replicate when they are given the choice of incorporating another female within a more academic setting (i.e., study group). In a second study, we sought to observe whether our findings are replicated in this context where collective threat may be more salient. Furthermore, the second will seek to account for these limitations and observewhether the type of support (e.g. social vs. instrumental) already provided by one's existing social contacts may influence STEM women's choice to forge friendships with women who present stereotypical feminine vs. STEM characteristics.

Chapter 3: Exploring Collective Threat in Both Social and Academic Relations

Study 2

In the second study, we sought to both address the limitations of the first study and to assess the effect of collective threat on other relevant measures of integration. Noteworthy in this study, we extended the information provided about the female target through creating both a Facebook and LinkedIn profile to assist in participants' judgments of whether to incorporate her into their social or academic circles. To further promote the unique effect that collective threat has on STEM women's decision to affiliate with stereotypic ingroup members, we chose to conceptually equate the Facebook profiles on similarity by pre-selecting interests (e.g. movies, TV shows, music) frequently or rarely endorsed by university students enrolled in STEM and non-STEM majors as well as interests of matching endorsement that are specific to STEM or non-STEM students. Furthermore, we added academic-related questions to our existing array of dependent measures in order to assess participants' willingness to integrate the female target into their academic circle. Finally, we extended our participant pool to include another control group (i.e., non-STEM men) to assess whether the collective threat is specific to stigmatized minority groups and not a function of being in a numerical but non-stigmatized minority. Currently, no research has investigated whether men within non-STEM career fields incur negative stereotypes about their competence. Therefore, the current study investigates the interactive effects that collective threat and the context of integrating ingroup target (i.e. social, academic) have on STEM women's decision-making.

Methods

Participants

We recruited 298 undergraduate students from the University of Waterloo to participate, of whom 280 successfully completed the study. Participants were recruited via a departmental participant pool and announcements in STEM classes for a $5 gift card or partial course credit.

Our intended sample included four types of participants: women in designated STEM majors (the focal group), men in STEM majors , women in designated "non-STEM" majors (the two control groups), and men in "non-STEM" majors. Like Study 1, eligible STEM and "non-STEM" majors were determined using the proportion of women within each major. Furthermore, to facilitate assigning photos carefully calibrated for comparable attractiveness and friendliness to match the self-reported race of each participant, we again recruited participants only from the two largest racial groups represented at this University: Whites and East Asians.

Exclusions. Prior to analysis, we excluded any cases in which participants withdrew consent (n = 4) or that met two or more of the following criteria: failed or non-response to manipulation checks, shorter (less than 25th percentile) or longer (greater than three times the average) than expected completion time, listed few friends, reported high distraction, or reported low seriousness. Furthermore, due to the paucity of non-STEM men who completed the study (n = 15), their data were excluded from analysis. Of the 298 people who completed the study, 258 were retained for analysis (M_{age} = 20.86 years, SD = 3.72, *range* from 16 to 42 years; 125 men, 116 women; 148 White, 93 East Asian), leaving 64 non-STEM women, 52 STEM women, and 125 STEM men (see Table 1).

Materials

Facebook profile. For the purposes of consistency, the four photos that were piloted in the first study were subsequently used for the second study. From these photos, eight fictive

Facebook profiles were created through taking a screenshot of an existing Facebook profile; however, the profile page was altered in Adobe Photoshop CS6 to prevent recognition. Across all four profiles, the target was assigned the name Jamie Lee in order to remove any potential influence of ethnically stereotypical first or last names on the participants' responses. Additionally, her profile was updated to reflect the current format of Facebook profiles. The target was given a gender-balanced major (i.e. biology; 50% women) that could not be categorized as STEM or non-STEM. In order to prevent participant responses from being influenced by romantic interest, the relationship status of the target was presented as "In a Relationship". Controlling for any additional socially-relevant influences, the hometown, high-school, and graduation year of the target were updated and held constant across profiles with only variations pertaining to the target's ethnicity and interests.

As part of the experimental manipulation, the interests of the target were changed to represent those of either a stereotypical STEM student or a counter-stereotypical STEM student. In contrast to the original selection procedure within Study 1, interests were selected and matched on their level of endorsement by both STEM and non-STEM students. However, in addition, the STEM-stereotypic profile contained interests that were endorsed solely by STEM students while the feminine-stereotypic profile contained interests that were endorsed solely by non-STEM students (see Appendices 10a and 10b). It is through this procedure that we hoped to match both profiles on similarity. For each topic, four interests were selected to be incorporated into the Facebook profile. Finally, the Facebook profile was transposed into a Qualtrics survey to be used for the study.

LinkedIn profile. As an extension of the Study 1 layout, four LinkedIn profiles were created for each picture so that participants would be exposed to information about the female

target suggesting that she was a moderately competent UW student. In order to maintain consistency with the Facebook profile, the LinkedIn profile displayed the female target as a biology major and contained pre-selected volunteer and work experience that was consistent with her program of study. The LinkedIn profile was altered through Adobe Photoshop to remove any miscellaneous information (e.g. ads) that would distract participants from the content of the profile (see Appendix 11). Across all four profiles, the information was held constant with variations in only the photo used.

Measures. Participants completed a variety of measures that pertained to the girth and demographics of their friendship network and their degree of willingness to integrate the target into that network. Similar to Study 1, participants completed multiple measures of friendship integration capturing the extent to which they would accept a friend request from Jamie if they met her, perceived fit with one's friendship network, and the degree to which the target would be suggested to one's friendship network. Participants rated the target on her perceived similarity to themselves and each of their friends on a 5-point response format from 1 (*very dissimilar*) to 5 (*very similar*). On a 4-point response format from 1 (*definitely not*) to 4 (*definitely yes*), participants reported the degree to which they would suggest the target to each friend. Furthermore, participants rated the degree to which they believed the target would fit well into their friendship circle on a 5-point response format from 1 (*not at all well*) to 5 (*extremely well*). Finally, participants were asked to rate the extent to which they would accept a friend request from the target, had they met her, on a 4-point response format from 1 (*definitely not*) to 4 (*definitely yes*).

In addition to completely measures assessing friendship integration, multiple measures of academic integration were included in Study 2 (see Appendices 12a and 12b). Participants rated

the extent to which they would accept a LinkedIn request from the target, had they met her, on a 4-point response format from 1 (*definitely not*) to 4 (*definitely yes*). Additionally, participants were provided an academic scenario where they, two of their friends, and the female target were taking a course together. Participants were asked to report their eagerness to invite the female target to be a part of their group on a class project on a 4-point response format from1 (*definitely not*) to 4 (*definitely yes*). Participants were instructed to indicate what percentage of work they would allocate to the target, their friends, and themself, had they invited the female target to be part of their group. This served as a behavioural measure of participants' willingness to incorporate the female target. Finally, participants were asked to indicate the extent to which they would borrow course notes from the female target and whether they would invite her into their study group of friends. Through these measures, we expected to detect variations in participants' willingness to integrate the target into their academic circle.

Procedure

Participants completed the study over the Internet for approximately 20-30 minutes. STEM participants who were recruited during their lectures received an email with a link to the survey while non-STEM participants had access to the survey link through the SONA website. As a cover story, they were informed that the study investigated how people develop social and professional connections with other students through virtual networks. To bolster the cover story, participants were asked closed-ended questions at the beginning of the survey that pertained to their usage of social media (e.g. Facebook and LinkedIn). At the end of the study, participants were given the opportunity to report their level of suspicion as to the true purpose of the study.

All participants completed demographics questions on race, gender, major, and age in order to determine if they were eligible to participate in the survey (see Appendices 1 and 2).

Participants were consider eligible if the identified themselves as East Asian (e.g. Chinese, Korean) or White (e.g. British, Canadian), enrolled a STEM or non-STEM major, and reported their gender. Ineligible participants were redirected to the end of the survey and were not given remuneration for the study. Upon meeting the eligibility criteria, participants were directed to an information and consent letter.

After consenting to participate in the study, participants were randomly assigned to one of two conditions in which they would view either the STEM-stereotypic target Facebook profile (n = 185) or the STEM-nonstereotypic target Facebook profile (n = 122). Prior to viewing the profile, participants were asked questions about their Internet use (see Appendix 3).They were then asked to provide a list of their close friendship network of friends who attend the University of Waterloo using a *name generator* (Wellman, 1979).Participants' friendship network was further assessed through a procedure called *name interpreter* in which they were asked to provide demographic questions about each friend they listed and the relationship between each friend via a sociomatrix (see Appendices 4 and 5). To test the validity of assuming mutual friendships, participants were also instructed to note which of the friends they listed considered them as a friend.

Subsequent to answering these questions, participants were instructed to view the profile for 3-4 minutes in order to familiarize themselves with its content. The profiles were organized to match the target's ethnicity with the participant's. After participants viewed the target's Facebook profile, they were directed to the LinkedIn profile of the same target. Participants were instructed to familiarize themselves with the content of the profile. Subsequent to viewing both profiles, participants completed the measures of friendship and academic integration for each friend they listed and for themselves.

Next, participants were given three manipulation check questions (e.g., “What is Jamie’s last name?”) to determine if they examined the fictive Facebook and LinkedIn profiles closely. They were also asked how seriously they took the survey and how distracted they were during the survey (see Appendix 9). After completing these questions, participants were debriefed and given the option to permit the use of their data for analyses. STEM participants were given the option to choose one type of remuneration for their participation (i.e. Amazon or Starbucks $5 gift card), and non STEM participants were redirected to the SONA website where they automatically received research participation credit directed towards their course grade.

Results

Similar to study 1, we conducted a test of the 3-factor model containing participant type, target stereotypicality, and friend type as predictors of how similar the target is to participants’ friendship circle. We analyzed the main and interactive effects of these predictors using the generalized estimation equation procedure (GEE; Liang &Zeger, 1986) implemented in Study 1.Similar to study, we assumed an unstructured matrix to represent the nature of covariances between friends’ scores (Fitzmaurice, Laird, &Rotnitzky, 1993). Furthermore, effects codes were computed for each of the categorical predictors in order to detect possible deviations in responses from the sample mean. With the exception of target stereotypicality, two effects coded were created for each categorical predictor. Codes for the participant type predictor detect possible significant differences between STEM women (coded 1) or STEM men (coded 1) and the average response (coded -1) in the sample. From these procedures, we constructed a model composed of main effects, two 2-way, and two 3-way interactions between the independent variables.

Descriptive Statistics

Data screening was implemented to ensure that the scores across the predictor and dependent measures satisfied the assumptions germane to the general linear model. Table 90 reveals the descriptive statistics for each continuous measure. Across all friendship integration (i.e., Facebook acceptance, LinkedIn suggestion, perceived fit, similarity), academic integration (i.e. LinkedIn acceptance, LinkedIn suggestion, class project, course notes, percentage work, study group),identification (i.e. major, gender) measures. The scores were distributed along a normal curve with the reported skew and kurtosis within the adequate range. The data contained no univariate or multivariate outliers, and normality was reaffirmed by non-significant tests of normality across all continuous measures, so no further exclusions were necessary. Finally, Table 10 indicates the counts for each friend type (STEM male, STEM female, non-STEM female) within each participant group.

Manipulation Check

Similar to Study 1, we assessed the strength of the manipulation check by predicting whether, on average, the female targets differed in similarity across participants. A significant 2-way interaction between the Participant Type and the target's stereotypicality was detected, wherein STEM women differed from the average in their differentiation of both female targets when reporting how similar they were to their STEM female friends, (see Table 11). Our results noted a non-significant main effect of target stereotypicality across the participant groups in predicting levels of similarity to their friends, B = -0.04, SE = 0.14, $\chi^2(1) = 0.08$, p = .78.

We conducted additional simple interaction tests to decipher the type of friends in which participants believed the STEM and non-STEM target to be similar to. A 2-way Target Stereotypicality x Friend Type was present within STEM women, B = -0.32, SE = 0.12, $\chi^2(1)$ =

7.28, p = .007, and non-STEM women, B = -0.35, SE = 0.16, $\chi^2(1)$ = 4.37, p = .04, but not STEM men. Simple slopes analyses determined that the STEM-stereotypic target was perceived to be more similar to STEM women's male STEM friends, B = -0.84, SE = 0.31, $\chi^2(1)$ =6.99, p = .008, and female STEM friends, B = -1.08, SE = 0.48, $\chi^2(1)$ = 5.11, p = .02, than the STEM-nonstereotypic target. Surprisingly, non-STEM women did not evidence this pattern of results, B = 0.16, SE = 0.15, $\chi^2(1)$ = 1.21, p = .27, and did not perceive the STEM-nonstereotypic target to be significantly more similar to their female non-STEM friends. Therefore, the results indicated partial support for the effectiveness of our manipulation by influencing the perceptions of the participant group of interest, STEM women.

Friendship Integration

Accepting a Facebook friend request. At the level of the participant, we applied a 3-factor model containing participant type, target stereotypicality, and level of gender or major identification towards predicting the first dependent measure of friendship integration: Facebook friend acceptance. Consistent with Study 1, there were no significant main effects or interactions across the predictors; however a non-significant trend between participant type, target stereotypicality, and level of major identification was detected in the analysis, B = -0.155, SE = 0.10, $t(225)$ = -1.595, p < .112. This 3-way interaction was not replicated when gender identification was used as a covariate (t <1). Therefore, the subsequent analyses served to test whether our hypotheses were supported through other measures of friendship integration.

Introduction to Facebook friends. We further tested the 3-factor model on our second dependent measure of friendship integration: introducing the female target to one's Facebook friends. Prediction of the scores required the addition of our friend-type predictor in order to understand whether the demographic characteristics of the friend moderated participants'

decision to introduce the female target. Therefore, like Study 1, we ran a 3-factor model containing participant type, target stereotypicality, and friend type as predictors.

Similar to study 1, we found two significant 3-way Participant Type X Target Stereotypicality X Friend Type interactions predicting the extent to which participants suggested the female target to their friends on Facebook. STEM men differed from everyone else in their responding to both female targets when deciding whether to suggest either target to their STEM male, $B = 0.166$, $SE = 0.06$, $\chi^2(1) = 7.493$, $p = .006$, and female friends, $B = -0.1$, $SE = 0.05$, $\chi^2(1) = 3.23$, $p = .07$. Furthermore, we conducted a simple 2-way interaction test within each participant type to detect the patterns of suggestion. Noted in Figure 5, our results indicated a significant 2-way Target Stereotypicality X Friend Type within both STEM women, $B = -0.162$, $SE = 0.06$, $\chi^2(1) = 7.22$, $p < .01$. and non-STEM women when referring either female targets to their STEM male , $B = -0.37$, $SE = 0.12$, $\chi^2(1) = 10.34$, $p < .01$, or STEM female friends, $B = 0.31$, $SE = 0.08$, $\chi^2(1) = 13.65$, $p < .001$. STEM men, $B = 0.01$, $SE = 0.07$, $\chi^2(1) = 0.02$, $p = .88$, did not produce such a pattern of responses. Therefore, we sought to test whether the interactive patterns in STEM women were indicative of collective threat and were distinct from non-STEM women.

We conducted tests to observe which group of friends were STEM and non-STEM women more likely to be selective when making introductions of the female target. Across each friend type, we conducted a simple slopes analysis predicting the level of willingness to integrate the female target based on her perceived stereotypicality. Our analyses showed that STEM women showed a pattern consistent with our hypothesis when recommending the target to their fellow STEM male friends. STEM women were more willing to introduce the STEM-stereotypic female target to their STEM male friends versus introducing the STEM-nonstereotypic female

target, B = -0.50, SE = 0.18, $\chi^2(1) = 8.12$, $p < .01$. However, a similar main effect of target stereotypicality was revealed within non-STEM women when expressing the degree to which they would recommend the target to their male STEM friends, B = -0.37, SE = 0.18, $\chi^2(1) = 4.45$, $p < .05$. Additionally, we found a significant main effect of target stereotypicality when non-STEM women were asked to report their willingness to introduce the female target to their STEM female friends. Non-STEM women were more willing prefer the STEM-nonstereotypic over the STEM-stereotypic female target, B = 0.32, SE = 0.13, $\chi^2(1) = 5.75$, $p < .05$. STEM women, however, showed a non-significant trend whereby they were more willing to introduce the STEM-stereotypic target to their STEM female friends, B = -0.31, SE = 0.19, $\chi^2(1) = 2.64$, $p = .10$. Therefore, our results did not provide support for this experience of collective threat when STEM women are met with the choice of introducing another female to STEM male colleagues.

Similarity as a moderator. By reason of the importance that similarity held as a moderator of collective threat in Study 1, we decided to include participants' responses pertaining to the female target's similarity to their friends as a covariate. Our results revealed a non-significant 4-way interaction predicting particpants' willingness to introduce the female target to their friends, B = 0.08, SE = 0.04, $\chi^2(1) = 3.72$, $p = .05$. However, additional analyses were conducted to decipher the nature of this interaction.

We conducted two simple 3-way interactions at both high and low levels of similarity to observe the interactive effects our previous 3-factor model produced at varying levels of similarity. Within participants who rated the female target as very similar to their friends (a standard deviation above the mean similarity score), there was a significant Participant Type X Target Stereotypicality X Friend Type interaction present. STEM men were shown to differentially respond to both female targets in a manner that deviated from the average response,

especially when suggesting either targets to their STEM male, $B = 0.16$, $SE = 0.06$, $\chi^2(1) = 7.53$, $p = .006$, and STEM female, $B = -0.14$, $SE = 0.06$, $\chi^2(1) = 5.45$, $p = .02$, Facebook friends. This 3-way interaction was replicated within both STEM women, $B = -0.13$, $SE = 0.06$, $\chi^2(1) = 5.27$, $p = .02$, and STEM men, $B = 0.18$, $SE = 0.06$, $\chi^2(1) = 10.21$, $p < .01$, who rated both female targets as dissimilar to their STEM male Facebook friends.

Further extracting the nature of this interaction, we tested the simple 2-way interaction between participant type and target major at low levels of similarity and within each of the participant type.. At low levels of similarity, our analyses revealed a significant interaction between target stereotypicality and friend type within only STEM women, $B = -0.24$, $SE = 0.05$, $\chi^2(1) = 26.48$, $p < .001$. Non-STEM women, $B = -0.23$, $SE = 0.12$, $\chi^2(1) = 3.55$, $p = .06$, and STEM men, $B = 0.04$, $SE = 0.05$, $\chi^2(1) = 0.45$, $p = .50$, revealed a non-significant pattern of responding when they rated the targets as highly dissimilar to their friends.

We conducted simple slopes analyses reporting the effect of Target Stereotypicality within participants' STEM male friends. We chose this friend type because we hypothesized that the group-image concerns that STEM women would display, when deciding to introduce another female to their friends, would be pronounced when their friendship circle contained STEM male friends. Within participants who had rated the target to be very dissimilar, we found evidence in support of this hypothesis such that STEM women preferred to introduce the STEM-stereotypic female target over the STEM-nonstereotypic female target to their STEM male friends, $B = -0.36$, $SE = 0.12$, $\chi^2(1) = 9.59$, $p = .002$. In contrast, non-STEM women showed a non-significant pattern when they perceived the target to be dissimilar to their friends, $B = -0.21$, $SE = 0.15$, $\chi^2(1) = 2.06$, $p = .15$. Therefore, when participants perceived the target to be unique compared to their

existing friendship circle, STEM women attempted to salvage their reputational concern by suggesting the STEM-stereotypic over the STEM-nonstereotypic female target.

Finally, the same simple-interaction procedure was conducted at high levels of similarity. We analyzed participants who rated the female target as highly similar to their friends. We found a significant Target Stereotypicality X Friend Type interaction was present within both STEM and non-STEM women. Particularly, STEM women reported varying levels of eagerness to select one female target over the other when it pertained to introductions to their STEM male friends, $B = -0.24$, $SE = 0.05$, $\chi^2(1) = 17.13$, $p < .001$, while non-STEM women showed this pattern for both their STEM male friends, $B = -0.79$, $SE = 0.19$, $\chi^2(1) = 16.43$, $p < .001$, and STEM female friends, $B = 0.48$, $SE = 0.13$, $\chi^2(1) = 13.44$, $p < .001$. STEM men did not show a significant Target Stereotypicality X Friend Type interaction for both their STEM male, $B = -0.06$, $SE = 0.05$, $\chi^2(1) = 1.54$, $p = .22$, and STEM female friends ($\chi^2<1$).

At high levels of similarity, we tested whether STEM women displayed a distinct pattern of responding to both targets that differed from non-STEM women and revealed the same reputational concern. Both STEM women, $B = -0.49$, $SE = 0.12$, $\chi^2(1) = 18.36$, $p <.001$, and non-STEM women, $B = -1.08$, $SE = 0.29$, $\chi^2(1) = 13.22$, $p <.001$, were found to be less willing to introduce the female target to their STEM male friends when her profile contained STEM-nonstereotypic content. Overall, these results specify the conditions whereby STEM women display a distinct concern for maintaining a positive group image.

Academic Integration

As an extension to the first study, Study 2 tested whether collective threat would be manifested in STEM women when given the decision to integrate the female target into their academic circle. Because this context facilitates the emergence of questions and stereotypes of women, particularly in the domain of math, we anticipated that collective threat's effects would be more pronounced for STEM women relative to the social context of friendship formation. To probe this effect, we tested how STEM women would respond to a LinkedIn request and a variety of academic scenarios involving the presence of the female target.

Introduction to LinkedIn network. Our Participant Type X Target Stereotypicality X Friend Type model was applied towards the prediction that STEM women would display greater concern when contemplating whether to integrate a female target into their professional network via LinkedIn. To test this prediction, we analyzed our repeated-measures dependent variable, which asked participants to indicate whether they would introduce the female target to each of their friends on LinkedIn. The results revealed non-significant main effects and interactions in our model ($\chi^2 < 1$), lending no credence to the model's predictive power.

Similarity as a moderator. However, in congruence with previous tests in Study 1 and the current study, we sought to test the moderating role that the targets' perceived similarity to participants' friends played in our predictions of collective threat. Two significant 4-way interactions emerged in the prediction of participants' responses to the possibility of integrating the female target into their professional network. STEM women significantly differed from everyone else in their responses to both female targets when asked whether they would recommend either target to their STEM female friends, with ratings of perceived similarity playing a moderating role, $B = 0.189$, $SE = 0.04$, $\chi^2 = 17.961$, $p < .001$. Furthermore, STEM men

significantly differed from everyone else in how they responded to the female targets when asked the same question about their STEM male friends, with ratings of perceived similarity also moderating the results, $B = -0.10$, $SE = 0.03$, $\chi^2 = 9.46$, $p < .01$.

Probing further, we tested whether the three-factor model revealed significant predictions when the female targets were perceived to be highly similar or dissimilar to participants' friends. When participants rated the female targets to be highly dissimilar to their friends, STEM women's scores deviated significantly from the other participants as it pertained to introducing either target to their STEM female friends, $B = -0.18$, $SE = 0.07$, $\chi^2 = 7.42$, $p < .01$. Similarly, a non-significant trend revealed that STEM men's scores differed from everyone else when recommending either female target to their STEM female friends, $B = 0.10$, $SE = 0.06$, $\chi^2 = 2.71$, $p = .10$. From these results, we continued our analyses to detect any evidence of collective threat in an academic context.

The simple two-way interaction test allowed us to answer the question of whether collective threat would be manifested in STEM women's decision to exclude a female target, who displayed STEM-nonstereotypic traits, from being a part of their professional network. Furthermore, we observed the nature of this two-way interaction in order to detect if this reputational concern would be most pronounced in STEM women's choice to recommend either target to their STEM male friends. The results of this test supported our speculations in that a significant two-way interaction was detected within STEM women, $B = -0.18$, $SE = 0.08$, $\chi^2 = 4.24$, $p = .04$, but not within STEM men, $B = -0.01$, $SE = 0.06$, $\chi^2 = 0.02$, $p = .87$ and non-STEM women, $B = -0.02$, $SE = 0.08$, $\chi^2 = 1.82$, $p = .80$. Therefore, this finding provides support for our hypothesizing of the effects of collective threat on STEM women's decisions.

Further testing the validity of our hypotheses, we conducted an analysis for the presence of a significant 2-way interaction within STEM women at the opposite end – high similarity – of the spectrum. Our findings revealed a non-significant trend whereby both STEM women, B = -0.09, SE = 0.06, χ^2 = 1.82, p = .18, and STEM men, B = -0.08, SE = 0.06, χ^2 = 2.06, p = .15, differentially responded to both female targets when it came to the choice of introducing them to their STEM male colleagues. In contrast, non-STEM women showed a significant two-way interaction when introducing the female target to both their STEM male, B = 0.62, SE = 0.20, χ^2 = 9.30, p = .002, and STEM female colleagues, B = -0.63, SE = 0.30, $\chi^2(1)$ = 4.66, p = .03. Although the simple two-way interaction test did not support our hypotheses, we uncovered additional support from further probing of the simple effect that target stereotypicality had across the three participant groups when recommending the female target to their STEM male colleagues.

Results from our simple slopes analysis revealed a significant effect of target stereotypicality, within STEM women, in the direction we hypothesized collective threat to predict. STEM women were significantly less willing to introduce the STEM-nonstereotypic target to their STEM male friends, B = -0.31, SE = 0.13, χ^2 = 5.61, p = .02. In contrast, both STEM men (χ^2 <1) and non-STEM women, B = 0.61, SE = 0.23, χ^2 = 7.21, p = .007, did not produce the same pattern of responding. Therefore, these results provide additional support as to the conditions under which STEM women display hesitancy toward integrating certain female targets.

Academic scenarios. The additional measures of academic integration served to gauge the behavioural strategies that STEM women employ when faced with a female target who evokes collective threat. By providing common academic-related scenarios that involve

integrating others, we maintained the consistency in our purpose of observing patterns of integration and exclusion in the university setting. Because participants answered these questions once, we altered our model to analyze the results at the participant level and substituted in participants' levels of gender or major identification as a third possible moderator. Our results noted that gender identification was not a significant moderator across all the measures (ts<1), so it was removed from the model. Therefore, subsequent results are reported on the predictive power of a three-factor Participant Type X Target Stereotypicality X Major Identification model.

Class project. Our analyses uncovered a significant three-way interaction whereby STEM women significantly differed from the rest of the sample in their response to whether they'd invite either of the female targets into their group for the course project, B = -0.18, SE = 0.10, t(225) = -1.92, p = .06. This pattern was evidenced when all three participant groups were compared at the average level of major identification. Upon further probing, we found two significant 2-way interactions at high but not low levels of major identification. More specifically, STEM men, B = 0.18, SE = 0.10, t(225) = 1.77, p = .08, and STEM women, B = -0.27, SE = 0.13, t(225) = -2.13, p = .03, differed from everyone else in their responses to both female targets. Finally, we conducted a simple slopes analysis to observe for the presence of collective threat in STEM women's responses to this academic scenario. Our results revealed a non-significant finding where STEM women did not show a preference for the STEM-stereotypic target over the STEM-nonstereotypic target when asked to report their eagerness to integrate them into their group (t<1). Quite interesting, STEM men reported a preference for welcoming the STEM-nonstereotypic target into their group for the class project, B = 0.28, SE = 0.10, t(225) = 2.93, p = .004.

Percentage work allocated. We extended our analyses to test the predictive power of the three-factor model in estimating scores on the behavioural measure. In addition to the raw scores of the percentage work allocated to the self, the female target, and one's friends, we created difference scores comparing the percentages between the self or one's friends and Jamie. Across these behavioural measures, we did not find main effects or interactions that significantly predicted patterns of responding to either female target (ts<1).

Soliciting course notes from Jamie. We tested our model's ability to predict participants' level of eagerness to solicit course notes from the female target. The analyses revealed a significant three-way interaction whereby STEM women significantly differed from the rest of the sample in their responding (see Table 12). This pattern was evidenced when all three participant groups were compared at the average level of major identification. Upon further probing, we found two significant 2-way interactions at high but not low levels of major identification. Both STEM men, $B = 0.16$, $SE = 0.08$, $t(225) = 1.91$, $p = .06$ and STEM women, $B = -0.31$, $SE = 0.11$, $t(225) = -2.92$, $p = .004$, differed from everyone else in their responses to both female targets. Finally, we conducted a simple slopes analysis to observe for the presence of collective threat in STEM women's responses to this academic scenario. Our results revealed a non-significant trend whereby STEM women showed a preference for the STEM-stereotypic target over the STEM-nonstereotypic target when asked to report their willingness to solicit notes, $B = -0.16$, $SE = 0.11$, $t(225) = -1.43$, $p = .15$. Similar to the results on the class-project question, STEM men reported a preference for soliciting notes from the STEM-nonstereotypic target, $B = 0.16$, $SE = 0.08$, $t(225) = 1.94$, $p = .053$.

Study group. Finally, we tested our model's ability to predict participants' level of willingness to invite the female target. Similar to the previous results, STEM women

significantly differed from the rest of the sample in their responding, $B = -0.19$, $SE = 0.08$, $t(225) = 2.39$, $p = .02$, at the average level of major identification. Upon further probing, we found a marginally significant two-way interaction at high but not low levels of major identification. STEM women marginally differed from everyone else in their responses to both female targets, $B = 0.20$, $SE = 0.11$, $t(225) = 1.77$, $p = .08$. Finally, we conducted a simple slopes analysis to observe differences in preference for both female targets. Non-significant findings were evidenced across each participant group (ts<1). Therefore, our academic-related scenarios revealed limited evidence for collective threat's influence on STEM women's choices.

Chapter 4: General Discussion

Across both studies, we have found consistent support for the presence of collective threat within a population of female students who represent a numerical, stigmatized group in the field of science, technology, engineering, and math. These findings support the argument that stigmatized group members face an additional burden as a consequence of being aware that other ingroup members may confirm negative stereotypes. In further support of past research, our results validate the notion that collective threat motivates individuals to preserve the group's integrity in the face of possible derision from outgroup members. This motivation can be observed through strategies of avoidance directed at the ingroup member who appears to confirm these stereotypes (Cohen & Garcia, 2005). However, despite consistency with past research, the results provide new insights that are applicable to understanding the domain of friendship dynamics and intergroup relations.

Friendship Formation

Across both studies, STEM women's exposure to another female target has been associated with the discharge of concerns and goals that extend not only to the maintenance of a positive self-image but also the image portrayed of one's social identity. Consistent with research pertaining to goal structures, the activation of a goal renders goal-relevant stimuli meaningful to the individual within whom the goal is salient (Foerster, Liberman, Friedman, 2007). Within the two studies, we have replicated past research insofar as we have propose an instigator for the goal of preserving group integrity; however, we have also extended research by delving further into analyzing how features of the situation are more relevant for the expression of collective threat.

While there are a number of reasons for associating with positive ingroup members across a variety of situations, a focal reason has been to derive the same valuation from those persons and to uphold a standard for the group based on them. Within the present set of studies, STEM women displayed differential preferences for forming friendships with the STEM-stereotypic the STEM-nonstereotypic target despite these differential preferences having waned in magnitude across the various types of friends (i.e., STEM male, STEM female, and non-STEM female friends). Friendships are forged, in part, based on a concern for self-image and, in some cases, group image. The application of collective threat within this immediate and relevant context of university experiences underscores how one's stigmatized social identity can dictate the patterns of friendship formation, which afford opportunities for intergroup harmony and trust.

As an extension of previous research, the current set of studies connote how the content and structure of one's personal network of friends shapes the outcomes that collective threat afford to STEM women. Placing the threat in context, the current set of studies divulge how the steps between the onset of collective threat and the dissociation from suspected stereotype-confirming ingroup members does not follow a linear progression. Considering the type of friends that STEM women currently associate with (e.g. STEM male friends) can amplify their concern for maintaining a positive social identity and predict inclusion of STEM-stereotypic female target and the rejection of STEM-nonstereotypic target. The results across Studies 1 and 2 found a marginal to significant effect that having STEM-male friends, with whom to introduce the target to, had on STEM women's decisions to choose one female target over the other. Our hypotheses were further supported through the lack of replication within the other two participant groups. The absence of a similar pattern of responding ruled out the attributions of

being part of a certain major or gender, which could have explained our data. Therefore, the present study provided support for our hypothesizing.

Furthermore, the present set of studies are the first to employ the analysis and influence of participants' network structures in the predicting the effects posed by collective threat. Fascinating about this component has been that certain network positions (i.e. brokerage) connote status within the friendship setting. Within Study 1, we witnessed that STEM women who served a high-power/high-brokerage position within their friendship network were less likely to show the effects of collective threat because of their ability to integrate both targets into separate cliques within the network. Additionally, it was found that STEM women were more likely to serve a brokerage role within their friendship circle than their STEM male colleagues. Therefore, these findings imply that collective threat may not only predict the avoidance of stereotype-confirming individuals but may reinforce cliques within a friendship network that are segregated by demographic characteristics.

Academic Integration

In addition to the concerns STEM women express within friendship-integration contexts, an argument can be made that these concerns are transferrable to academic realms where the negative-stereotypes of women are relatively more salient and to which professional networks are created. The results of Study 2 provide support for the emergence of collective threat as accountable for STEM women's preference for the STEM-stereotypic vs. STEM-nonstereotypic female target when making introductions to the STEM-male friends in their LinkedIn network. Because STEM men are a salient out-group to which the negative stereotypes of women in STEM are perpetuated, frequent exposure to STEM men may prime the motivation to dispel these stereotypes by introducing female exemplars who appear to not confirm negative

stereotypes of women. Evident in our results, STEM women's unique preference for the STEM-stereotypic target over the STEM-nonstereotypic target was not replicated within STEM men and non-STEM women. In a setting where the number of professional contacts one has provides great utility for career opportunities, the selectivity displayed by STEM women signifies the precedence given to the quality of the potential professional contact as it pertains to the value or threat posed by that female target.

Quite unexpectedly, we found limited evidence of collective threat within other academic scenarios. Only a non-significant trend emerged whereby STEM women, who identified strongly with their major, showed differential willingness to solicit notes from the STEM-stereotypic vs. STEM-nonstereotypic target. However, our results may be accounted for by the content of the academic scenario instead of collective threat being less evident. Because STEM women were instructed to imagine taking an elective course with the female target, the reputational concern associated with taking the course may not be as high when compared to taking a program requirement with the female target. Analogous to the importance that the test's difficulty has in the evoking of stereotype threat, the difficulty or diagnosticity of the course would amplify STEM women's concerns that other women may confirm negative stereotypes. Therefore, we would anticipate stronger support for our hypothesis if, in future research, the stakes were raised in these academic scenarios.

Similarity: Very Little Means A Lot

Forming social and professional connections with stigmatized ingroup members is a decision-making process that is preceded by the judgment of how similar or dissimilar that ingroup member is to the self and one's existing connections. Reliably, similarity precedes liking and affords a greater opportunity for positive social contact with ingroup members. However, the

present study extends our knowledge of how connections are formed by including a pivotal ingredient that stigmatized group members weigh heavily in forging ties with their ingroup members. In particular, the results across Study 1 and 2 question the argument that shared social identity and similarity are the two sole ingredients that bridge connections between stigmatized group members.

Across both studies, we tested a four-factor model that included our three primary categorical predictors and ratings of the target's perceived similarity to each friend. We found patterns consistent with the hypothesis that STEM women would be more willing to suggest the STEM-stereotypic target to their Facebook and LinkedIn STEM male. This pattern was unique to STEM women when they believed that both targets were highly dissimilar to these friends, a finding that is intriguing and in need of interpretation.

Despite not having both types of ingroup members within one's social network, stigmatized groups may prefer exemplary over stereotype-confirming ingroup members because of the role the former play in the construction of a positive group identity. For example, the presentation of a female student who doesn't remind STEM women of their STEM male or female friends would create an ambiguous and potentially threatening situation when asked whether they would introduce her to these friends. The threat in this situation is amplified when the female target is perceived to confirm negative stereotypes via the interests, traits, and/or behaviours they display. Awareness of these indicators, and the decision to introduce this female could result in STEM women being stigmatized through their association with her. In contrast, a female who is unique compared to one's friends but displays a STEM-prototypic character would salvage any concerns that STEM women would indulge in when deciding whether to make her part of their social network.

Similarly, we found an intriguing pattern of results that provided evidence in support collective threat even when both targets were perceived to be highly similar to participants' friends. Both STEM women and non-STEM women, but not STEM men, preferred to introduce the STEM-stereotypic vs. STEM-nonstereotypic target to their STEM male friends on Facebook, a result that could be attributable to gender preferences. However, STEM women continued to prefer the STEM-stereotypic vs. STEM-nonstereotypic target when they were asked about their eagerness to integrate the female target into their circle of STEM male friends on LinkedIn. In contrast, non-STEM women preferred to integrate the STEM-nonstereotypic target into their circle of STEM male friends on LinkedIn. STEM men did not report any significant preferences for one target over the other, which ruled out major-related preferences being an alternative account for these patterns. Therefore, the interactive effects that shared group membership, perceived similarity, and perceived STEM-prototypicality pose on decisions to integrate ingroup members purport the notion that stigmatized groups drawn on additional criterion in the realm of ingroup affiliation.

Limitations and Future Directions

Although the findings of our two studies provide robust evidence of collective threat, the experimental design used was not impervious to the extraneous variables that could have influenced the pattern of responses. In both studies, we excluded non-STEM males from either participating in the study (Study 1) or from the final sample (Study 2). This restriction lends room to the alternative explanation for the pattern of responses shown by STEM women: that their responses are exemplary of groups who are a numerical minority in an academic field, regardless of whether there is a negative stereotype associated with them or not. Whether our results are attributable to these circumstances requires future studies to include this participant group.

Second, within our experimental design, all participants were exposed to only female student profiles and asked to respond to questions pertaining to integrating her within one's social and professional circle of friends. This introduces the possibility that participants' responses to the target may be accounted for by the fact that she is a woman. Although the inclusion of a male profile may introduce new influential factors to the study, especially if the profile contains feminine-stereotypic content, it would provide a more conservative test for the presence of collective threat.

Third, we did not assess participants' perception of how competent they believed the female student to be and whether this evaluation would be related to the stereotype content in her Facebook profile. Although we altered the LinkedIn profiles to contain the same content across all conditions, it would be interesting to gauge whether viewing the stereotypic content of the Facebook profile prior to the LinkedIn profile would colour participants' perception of the female student's competence. Furthermore, all participants were shown the Facebook profile

prior to viewing the LinkedIn profile, which gives way to possible order effects that influenced their judgment. Therefore, implementing a counterbalance procedure in future studies would feasibly allow for us to control for possible memory or attentional biases as a result of the order of presentation.

Finally, within our study design, participants' responses were mainly assessed through self-report measures. Therefore, the validity of their responses were limited by the biases evident in self-report assessments. Despite this caveat, we were able to witness varying levels of willingness to integrate the female target that did not lend themselves to social desirability. Thus, the implementation of more subtle behaviour and implicit measures of threat would greatly facilitate the argument for the presence of collective threat in STEM women.

Conclusions

Therefore, the presence set of studies provide us with cogent evidence of collective threat being manifested within STEM women and influencing their decision to associate with other women across two relevant contexts: social and professional contexts. Furthermore, our results have revealed the moderating conditions whereby collective threat operates within, conditions that include the target's perceived similarity to the STEM friends (male and female) whom STEM women currently affiliate and their structural position within their network of friends. Therefore, our current findings elucidate on how patterns of segregated friendships can be accentuated by the psychological consequences that indicators of identity threat pose to intergroup harmony.

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Tables and Figures

Table 1.

Number of STEM Men, STEM Women, and Non-STEM Women across Target Major (Study 1).

	Target Major		
Participant Group	STEM	non-STEM	Total
STEM men	49	62	111
STEM women	24	17	41
Non-STEM women	54	47	101
Total	127	126	253

Table 2.

Number of STEM male, STEM female, and Non-STEM female friends across Participant Groups (Study 1).

	Friend Group			
	STEM male	STEM female	NON-STEM female	Total
STEM men	n = 616	n = 165	n = 58	839
STEM women	n = 100	n = 100	n = 27	227
NON-STEM women	n = 31	n = 18	n = 311	360
Total	748	283	396	1426

Table 3.

Mean Friend Acceptance, Friend Suggestion, Perceived Similarity, Perceived Fit, Gender Identification, Major Identification Scores, Normalized Brokerage, and Ego-Betweeness across Participants (Study 1).

	Descriptive Statistics		
Measure	*M*(*SD*)	Skewness	Kurtosis
Friend acceptance	2.83(0.76)	-0.59	0.35
Friend suggestion	2.12(0.71)	0.11	-0.28
Perceived similarity	2.70(0.72)	-0.63	0.4
Perceived fit	2.41(0.88)	0.03	-0.54
Major identity	3.78(0.94)	-0.83	0.46
Gender identity	3.69(0.85)	-0.5	0.28
Normalized brokerage	0.49(0.24)	-0.57	-0.51
Ego-Betweeness	23.49(20.35)	0.67	-0.66

Table 4.

Generalized Estimation Equations Predicting Scores on Friendship Integration Measures from Friend Type, Target Major, Participant Type, and their Interactions (Study 1).

	Perceived Similarity		Friend Suggest	
	B	SE	B	SE
Intercept	2.71***	0.06	2.14***	0.05
StemMalP	-0.03	0.08	-0.06	0.07
StemFemP	-0.03	0.09	-0.12	0.08
Tmajor	-0.25***	0.06	-0.14**	0.05
StemMalF	-0.06	0.06	-0.17***	0.04
StemFemF	-0.08	0.06	0.08*	0.04
StemMalP * Tmajor	-0.01	0.08	0.08	0.07
StemFemP * Tmajor	-0.22**	0.09	-0.12	0.08
StemMalP * StemMalF	0.05	0.07	0.04	0.05
StemMalP * StemFemF	-0.05	0.07	0.04	0.05
StemFemP * StemMalF	-0.08	0.08	-0.02	0.06
StemFemP * StemFemF	0.17	0.09	-0.04	0.05
Tmajor * StemMalF	0.07	0.06	-0.008	0.04
Tmajor * StemFemF	-0.01	0.07	-0.001	0.04
StemMalP * Tmajor * StemMalF	-0.02	0.07	-0.02	0.05

Note. Participant Type and Friend Type are represented by four effects code labels, StemMalP, StemFemP, StemMalF, and StemFemF, respectively. Target Stereotypicality is represent by the effects code label Tmajor.
*$p < .05$, **$p < .01$, *** $p < .001$

Table 5.

Multiple Regression Analyses Predicting Scores on Friendship Integration Measures from Major Identification, Target Major, Participant Type, and their Interactions (Study 1).

Source	Friend Accept		Perceived Fit	
	B	SE	B	SE
Intercept	2.85***	0.05	2.40***	0.06
major_id_c	0.15*	0.06	0.13*	0.06
StemMalP	-0.11	0.07	-0.05	0.08
StemFemP	0.07	0.09	-0.07	0.1
Tmajor	0.09	0.05	-0.17*	0.06
StemMalP x Tmajor	-0.006	0.07	-0.04	0.08
StemFemP x Tmajor	0.0003	0.09	-0.17	0.1
StemMalP x major_id_c	-0.04	0.07	0.03	0.08
StemFemP x major_id_c	0.06	0.09	-0.21*	0.1
Tmajor x major_id_c	0.03	0.06	-0.02	0.07
StemMalP x Tmajor x major_id_c	-0.02	0.07	-0.04	0.08
StemFemP x Tmajor x major_id_c	0.03	0.09	-0.03	0.1

Note. Participant Type and Target Stereotypicality are represented by three effects code labels, StemMalP, StemFemP, and Tmajor, respectively. Centred scores on levels of major identification are represented by the label major_id_c.
*$p < .05$ **$p < .01$ ***$p < .001$

Table 6.

Multiple Regression Analyses Predicting Scores on Friendship Integration Measures from Gender Identification, Target Major, Participant Type, and their Interactions (Study 1).

Source	Friend Accept		Perceived Fit	
	B	SE	B	SE
Intercept	2.86***	0.05	2.41***	0.06
gender_id_c	0.14*	0.06	0.04	0.07
StemMalP	-0.12	0.07	-0.07	0.08
StemFemP	0.12	0.09	-0.05	0.1
Tmajor	0.12	0.09	-0.17*	0.06
StemMalP x Tmajor	-0.02	0.07	-0.02	0.08
StemFemP x Tmajor	0.008	0.09	-0.21*	0.1
StemMalP x gender_id_c	-0.12	0.08	-0.05	0.09
StemFemP x gender_id_c	0.08	0.09	0.07	0.11
Tmajor x gender_id_c	-0.03	0.06	-0.02	0.07
StemMalP x Tmajor x gender_id_c	-0.13	0.08	0.06	0.09
StemFemP x Tmajor x gender_id_c	0.09	0.09	-0.15	0.11

Note. Participant Type and Target Stereotypicality are represented by three effects code labels, StemMalP, StemFemP, and Tmajor, respectively. Centred scores on levels of gender identification are represented by the label gender_id_c.
*$p < .05$ **$p < .01$ ***$p < .001$

Table 7.

Multiple Regression Analyses Predicting Scores on Facebook Friend Acceptance from Normalized Brokerage, Target Major, Participant Type, and their Interactions (Study 1).

	Friend Accept	
Source	B	*SE*
Intercept	2.97***	0.14
n_brokerage	-0.17	0.25
StemMalP	-0.25	0.17
StemFemP	0.11	0.23
Tmajor	-0.28*	0.14
StemMalP * Tmajor	-0.008	0.17
StemFemP * Tmajor	-0.55*	0.23
StemMalP * n_brokerage	0.23	0.31
StemFemP * n_brokerage	-0.07	0.41
Tmajor * n_brokerage	0.80**	0.25
StemMalP * Tmajor * n_brokerage	0.05	0.31
StemFemP * Tmajor * n_brokerage	1.01*	0.41

Note. Participant Type and Target Stereotypicality are represented by three effects code labels, StemMalP, StemFemP, and Tmajor, respectively. Normalized brokerage predictor is represented by the label n_brokerage.
*$p < .05$ **$p < .01$ ***$p < .001$

Table 8.

Multiple Regression Analyses Predicting Scores on Friend Suggestion from Normalized Brokerage, Target Major, Participant Type, and their Interactions (Study 1).

	Friend Suggest	
Source	B	*SE*
Intercept	2.77	0.13
n_brokerage	0.26	0.23
StemMalP	0.24	0.16
StemFemP	0.19	0.21
Tmajor	0.09	0.13
StemMalP * Tmajor	0.22	0.16
StemFemP * Tmajor	0.10	0.21
StemMalP * n_brokerage	-0.31	0.29
StemFemP * n_brokerage	-0.05	0.38
Tmajor * n_brokerage	-0.05	0.23
StemMalP * Tmajor * n_brokerage	-0.64*	0.29
StemFemP * Tmajor * n_brokerage	0.07	0.38

Note. Participant Type and Target Stereotypicality are represented by three effects code labels, StemMalP, StemFemP, and Tmajor, respectively. Normalized brokerage predictor is represented by the label n_brokerage.
*p < .05 **p< .01 ***p< .001

Table 9.

Mean Facebook Friend Acceptance, LinkedIn Contact Acceptance, Facebook Friend Suggest, LinkedIn Contact Suggest, Perceived Similarity, Class Project, Percentage Work Allocated, Borrow Notes, Study Group, Perceived Fit, and Gender and Major Identification Scores (Study 2).

	Mean (*SD*)	Skewness	Kurtosis
Similarity	2.82 (0.965)	-0.185	-0.6
Friend Suggest – LinkedIn	2.01 (0.84)	0.446	-0.491
Friend Suggest – Facebook	2.13 (0.852)	0.319	-0.58
Join study group?	3.02 (0.65)	-0.19	-0.052
Borrow notes from Jamie?	3.10 (0.68)	-0.42	0.187
Join friends on class project?	2.89 (0.83)	-1.178	1.107
Accept Jamie as a Facebook Friend	2.74 (0.82)	-0.201	-0.499
Accept Jamie as a LinkedIn Contact	2.68 (0.93)	-0.405	-0.65
Perceived Fit	2.61 (0.84)	-0.051	-0.411
Percentage of Work – You	31.44 (10.18)	1.21	7.176
Percentage of Work – Friends	40.48 (12.71)	0.962	2.555
Percentage of Work – Jamie	27.43 (8.36)	-0.905	2.494
Gender Identification	3.55 (0.96)	-0.681	0.186
Major Identification	3.69 (1.01)	-0.899	0.471

Table 10.

Number of STEM male, STEM female, and non-STEM female friends across the three participant groups (Study 2).

Participant Group	Friend Group			Total
	STEM Men	STEM Women	nonSTEM Women	
STEM Men	624	101	38	763
STEM Women	220	105	19	344
Non-STEM Women	21	12	131	164
Total	865	218	188	1271

Table 11.

Generalized Estimation Equations Predicting Perceived Similarity to Friends from Participant Type, Target Stereotypicality, Friend Type, and their Interactions (Study 2).

Source	B	SE
(Intercept)	3.167***	0.1427
StemMalP	-0.04	0.1896
StemFemP	0.573*	0.2402
Tmajor	-0.041	0.1427
StemMalF	-0.177*	0.0896
StemFemF	0.306*	0.1225
StemMalP * Tmajor	0.329	0.1896
StemFemP * Tmajor	-0.42*	0.2402
StemMalP * StemMalF	-0.149	0.1104
StemFemP * StemMalF	0.335*	0.1333
StemMalP * StemFemF	-0.079	0.1523
StemFemP * StemFemF	0.385	0.2096
Tmajor * StemMalF	-0.291**	0.0896
Tmajor * StemFemF	-0.265*	0.1225
StemMalP * Tmajor * StemMalF	-0.136	0.1104
StemFemP * Tmajor * StemMalF	-0.137	0.1333
StemMalP * Tmajor * StemFemF	0.218	0.1523
StemFemP * Tmajor * StemFemF	-0.434*	0.2096

Note. Participant Type and Friend Type are represented by four effects code labels, StemMalP, StemFemP, StemMalF, and StemFemF, respectively. Target Stereotypicality is represent by the effects code label Tmajor.
*$p < .05$ **$p < .01$ ***$p < .001$

Table 12.

Multiple Regression Analysis Predicting Eagerness to Borrow Course Notes Off Of Jamie From Participant Type, Target Stereotypicality, and Levels of Major Identification (Study 2)

Source	B	SE
Intercept	3.122	0.049
StemMalP	-0.03	0.061
StemFemP	-0.056	0.076
Tmajor	-0.014	0.049
major_id_c	0.061	0.052
StemMalP * Tmajor	0.081	0.061
StemFemP * Tmajor	-0.067	0.076
StemMalP * major_id_c	-0.097	0.062
StemFemP * major_id_c	-0.009	0.081
Tmajor * major_id_c	-0.005	0.052
StemMalP * Tmajor * major_id_c	0.084	0.062
StemFemP * Tmajor * major_id_c	-0.25**	0.081

Note. Participant Type and Target Stereotypicality are represented by three effects code labels, StemMalP, StemFemP, and Tmajor, respectively. Centred scores on levels of major identification are represented by the label major_id_c.
*$p < .05$ **$p < .01$ ***$p < .001$

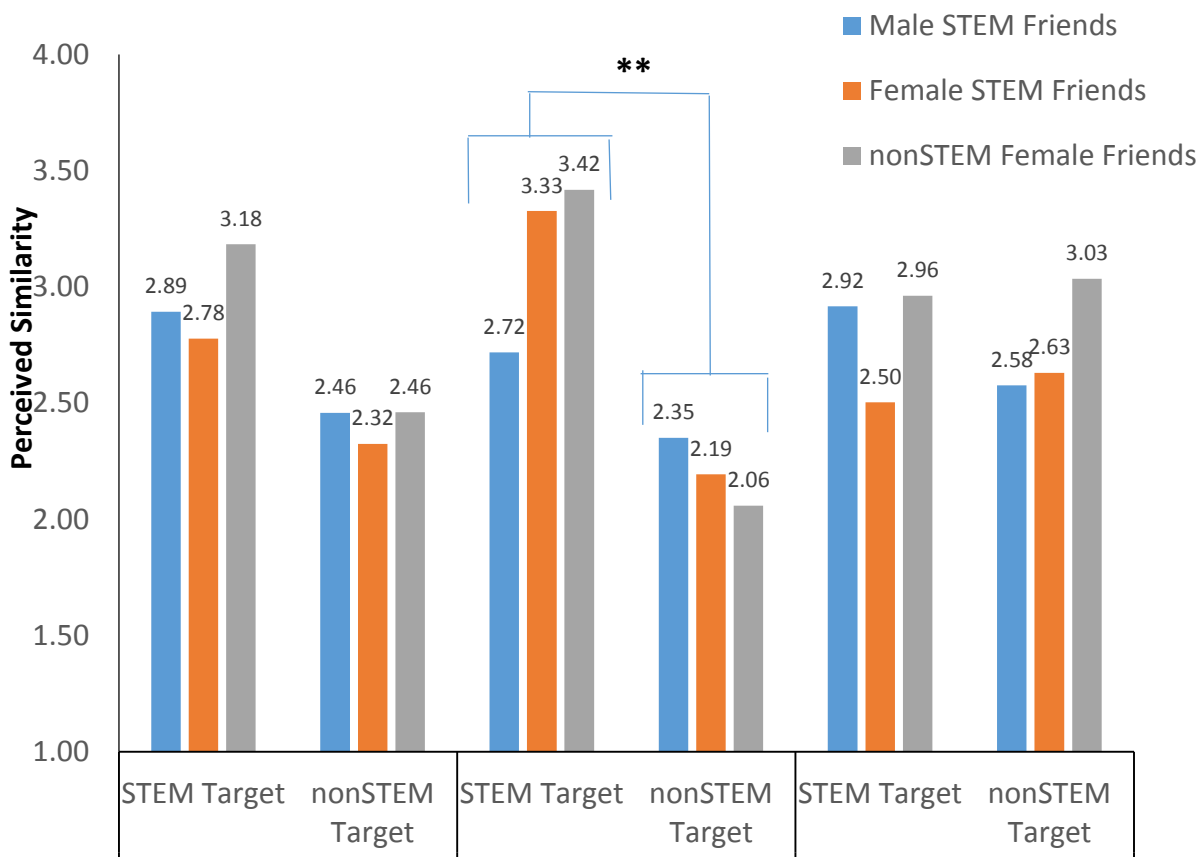


Figure 1. Mean estimates of the female target's similarity to participants' friends *(Study 1)*.

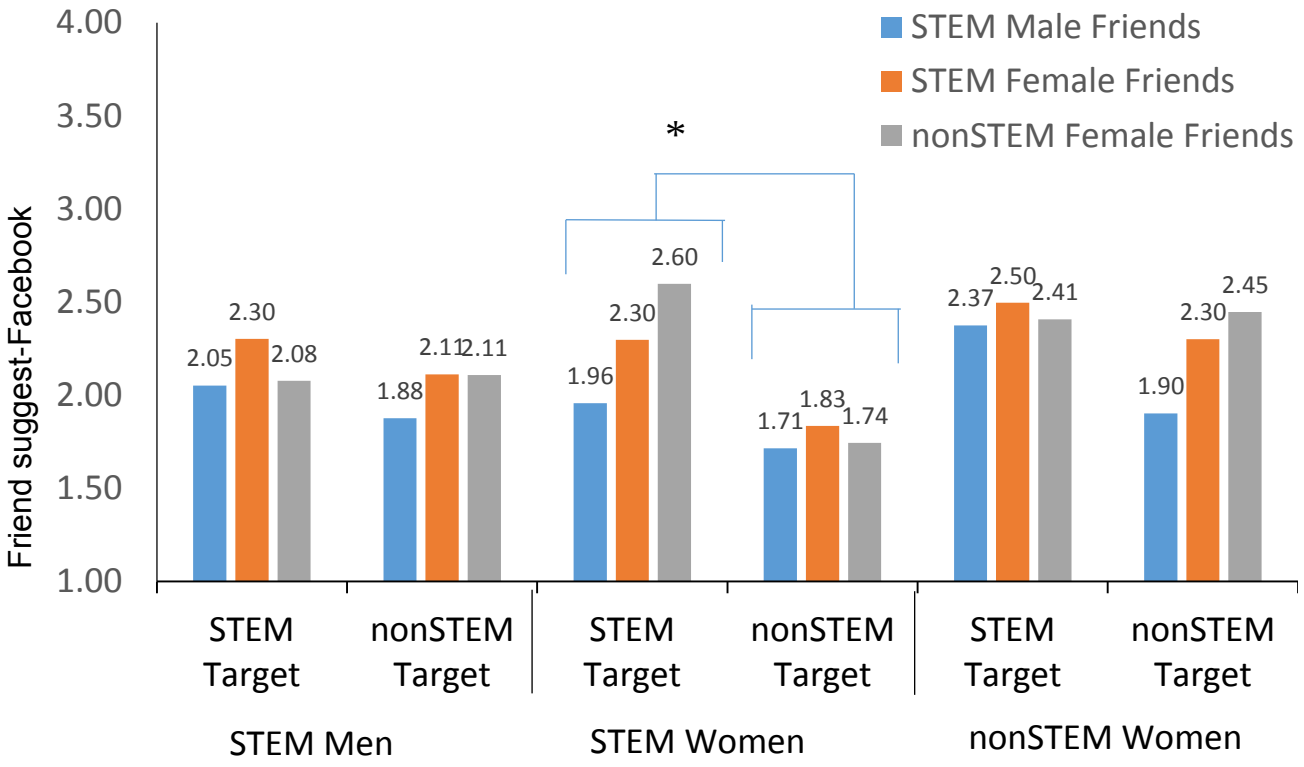


Figure 2. Mean estimates of participants' levels of willingness to suggest the female target to different types of friend *(Study 1)*.

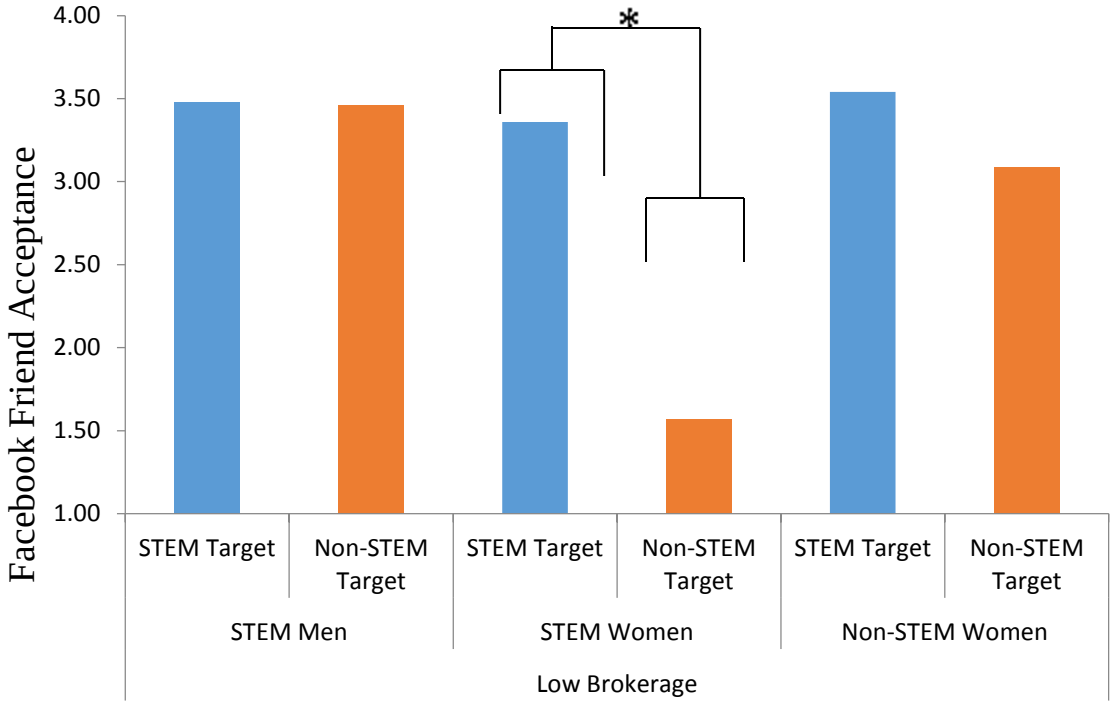


Figure 3. Mean estimates of participants' levels of willingness to accept a Facebook-friend request from the female target. Estimates are made at one standard deviation below the mean normalized brokerage score *(Study 1)*.

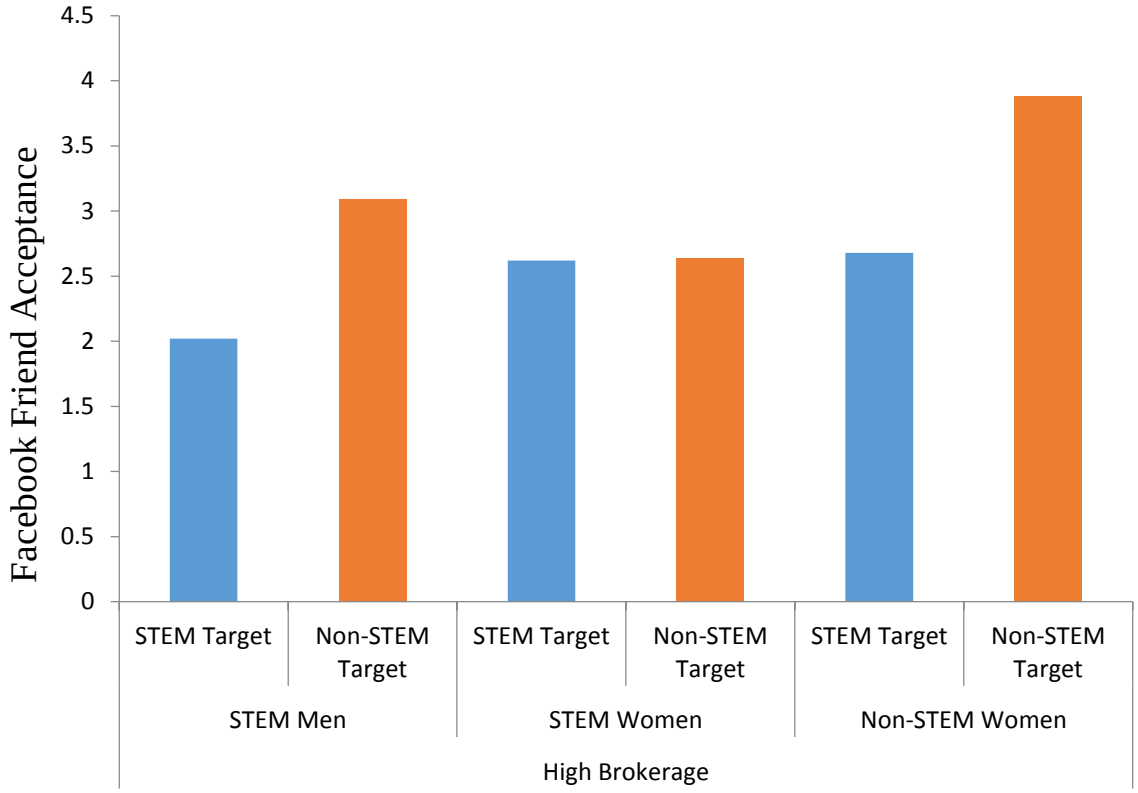


Figure 4. Mean estimates of participants' levels of willingness to accept a Facebook-friend request from the female target. Estimates are made at one standard deviation above the mean normalized brokerage score *(Study 1)*.

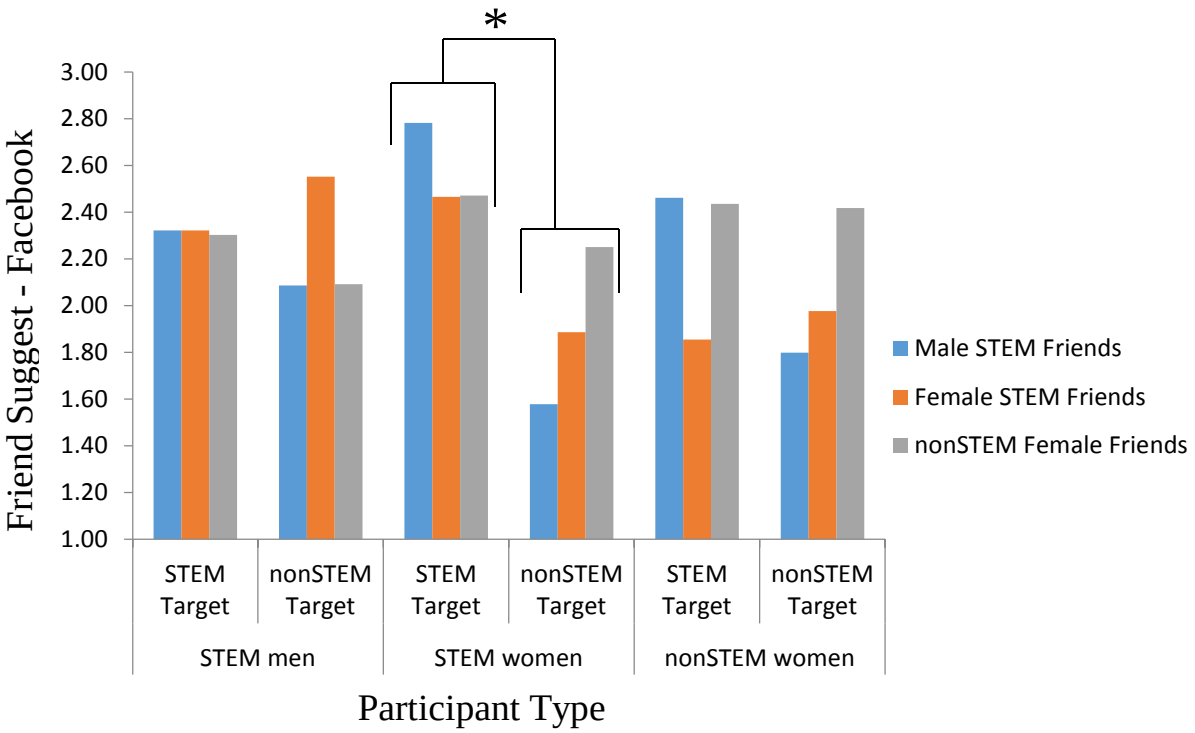


Figure 5. Mean estimates of participants' willingness to suggest the female target to each friend type on Facebook *(Study 2).*

Appendices

Appendix 1: Study Eligibility Form

STUDY ELIGIBILITY FORM

What is your faculty?

- ◯ Applied Health Sciences
- ◯ Engineering
- ◯ Mathematics
- ◯ Other
- ◯ Arts
- ◯ Environment
- ◯ Science

What is your age?

What is your sex?

- ◯ Male
- ◯ Female

What is your specific ethnic background (e.g., Irish, Korean, Mexican)?

What is your primary racial group?
(If you identify with more than one group, please select one group that represents an important identity for you.)

- ◯ White
- ◯ East Asian
- ◯ South Asian
- ◯ Black
- ◯ Hispanic/Latino
- ◯ Other

Appendix 2: Questions Regarding Participant's Demographic Information

What is your current or intended academic major?

- ◯ ENG: Architecture
- ◯ ENG: Chemical Engineering
- ◯ ENG: Civil Engineering
- ◯ ENG: Computer Engineering
- ◯ ENG: Electrical Engineering
- ◯ ENG: Electrical/Computer
- ◯ ENG: Environmental Engineering
- ◯ ENG: General Engineering
- ◯ ENG: Geological Engineering
- ◯ ENG: Management Sciences
- ◯ ENG: Mechanical Engineering
- ◯ ENG: Mechatronics Engineering
- ◯ ENG: Nanotechnology Engineering
- ◯ ENG: Systems Design Engineering
- ◯ SE: Software Engineering
- ◯ Other not listed (please specify): [ ]

What is your current academic term?

◯ 1a ◯ 1b ◯ 2a ◯ 2b ◯ 3a ◯ 3b ◯ 4a ◯ 4b ◯ Other: [ ]

Have you had any experience using Facebook.com?

◯ Yes ◯ No

Appendix 3: Questions Assessing Participants' Level of Internet Use

INTERNET USE PROFILE

Which of the following Internet-based services do you use for social purposes at least once per month? Please select all that apply.

- ☐ Facebook.com ☐ Twitter ☐ MySpace ☐ LinkedIn ☐ Google groups ☐ Personal blog
- ☐ Photo-sharing site (e.g., Flickr, Smugmug) ☐ Instant messaging (e.g., AIM, gChat) ☐ Email
- ☐ RSS feed reader ☐ None of the above

What type of content/information do you seek out on the Internet regularly (i.e., at least once per week)? Please select all that apply.

- ☐ News ☐ Weather ☐ Music ☐ Videos ☐ Maps ☐ Social ☐ Games ☐ Academic
- ☐ Retail ☐ Athletic ☐ Financial ☐ Political ☐ None of the above

In what year did you first use Facebook.com? (If you don't know the exact year, please estimate.)

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
○	○	○	○	○	○	○	○	○	○

Approximately how often do you perform the following actions on Facebook?

	Never	Rarely	A few times a month	A few times a week	Daily
Post status update	○	○	○	○	○
Post on someone's wall	○	○	○	○	○
Upload photos or videos	○	○	○	○	○
Play games	○	○	○	○	○
Share links	○	○	○	○	○
"Like" others' content	○	○	○	○	○

Appendix 4: Name Generator

FRIEND LIST

Please list the first names of your 10 closest friends who attend the University of Waterloo, with whom you spend the most time.

(If you are in a romantic relationship, do not list your boyfriend / girlfriend or spouse.)

If multiple friends share the same first name, include the first initial of their last names (e.g., Jim S, Jenn M).

If you cannot list 10 friends, please list as many as you can and leave the rest blank.

Friend 1:	Charnel
Friend 2:	Hilary
Friend 3:	Crystal
Friend 4:	Anne
Friend 5:	Brenda
Friend 6:	Chris
Friend 7:	Daniel
Friend 8:	Eric
Friend 9:	Franklin
Friend 10:	Gregory

Appendix 5: Questions Assessing Demographic Information of Friends

FRIENDS' BACKGROUND

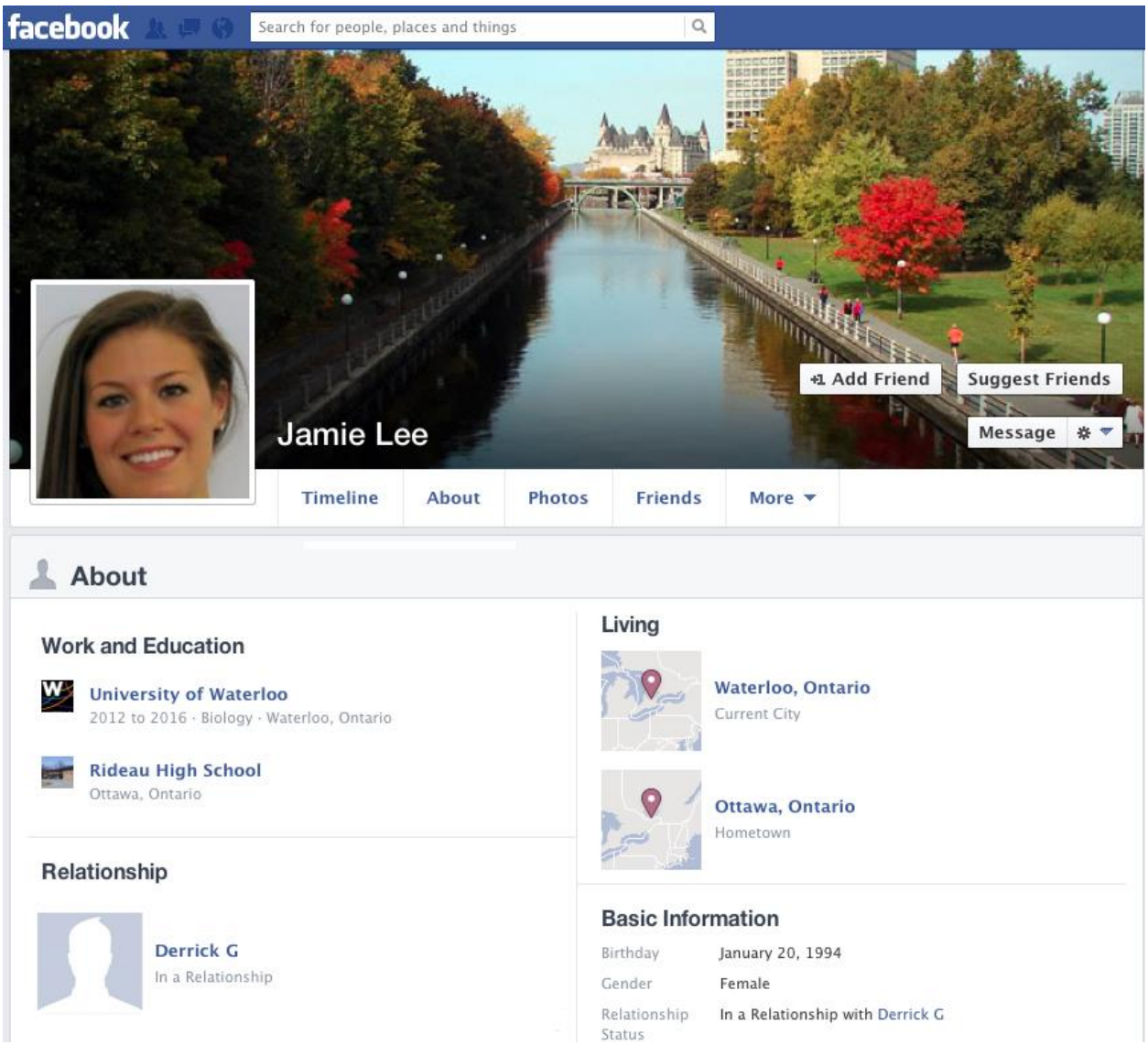
Please identify the gender, race, faculty, and major of each friend.

	Gender		Race	Faculty	Major
	Male	Female			
Charnel	○	◉	Black	ARTS	ARTS: Psychology
Hilary	○	◉	White	ARTS	ARTS: Psychology
Crystal	○	◉	East Asian	ARTS	ARTS: Psychology
Anne	○	◉	White	ARTS	ARTS: Drama
Brenda	○	◉	White	AHS	AHS: Kinesiology
Chris	◉	○	Black	ENV	ENV: Integrated Studies
Daniel	◉	○	Black	ENG	ENG: Mechatronics Engineering
Eric	◉	○	East Asian	ENG	ENG: Mechanical Engineering
Franklin	◉	○	Black	MATH	MATH: Pure Mathematics
Gregory	◉	○	White	SCI	SCI: Chemistry

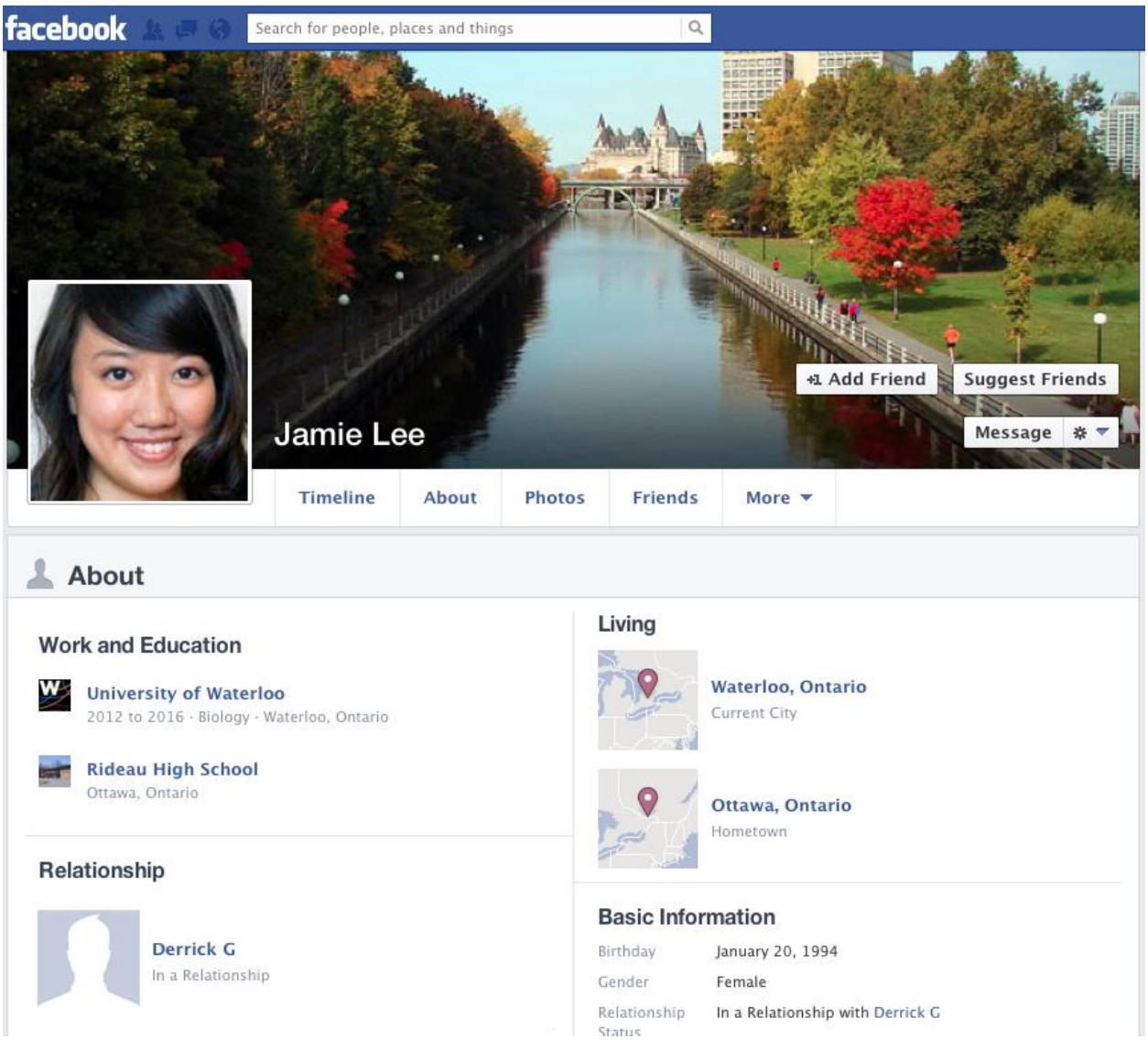
Which people are friends with you on Facebook? Please check the box next to each person who is your Facebook friend.

☑ Charnel	☐ Crystal	☐ Brenda	☐ Daniel	☑ Franklin
☐ Hilary	☐ Anne	☑ Chris	☐ Eric	☐ Gregory

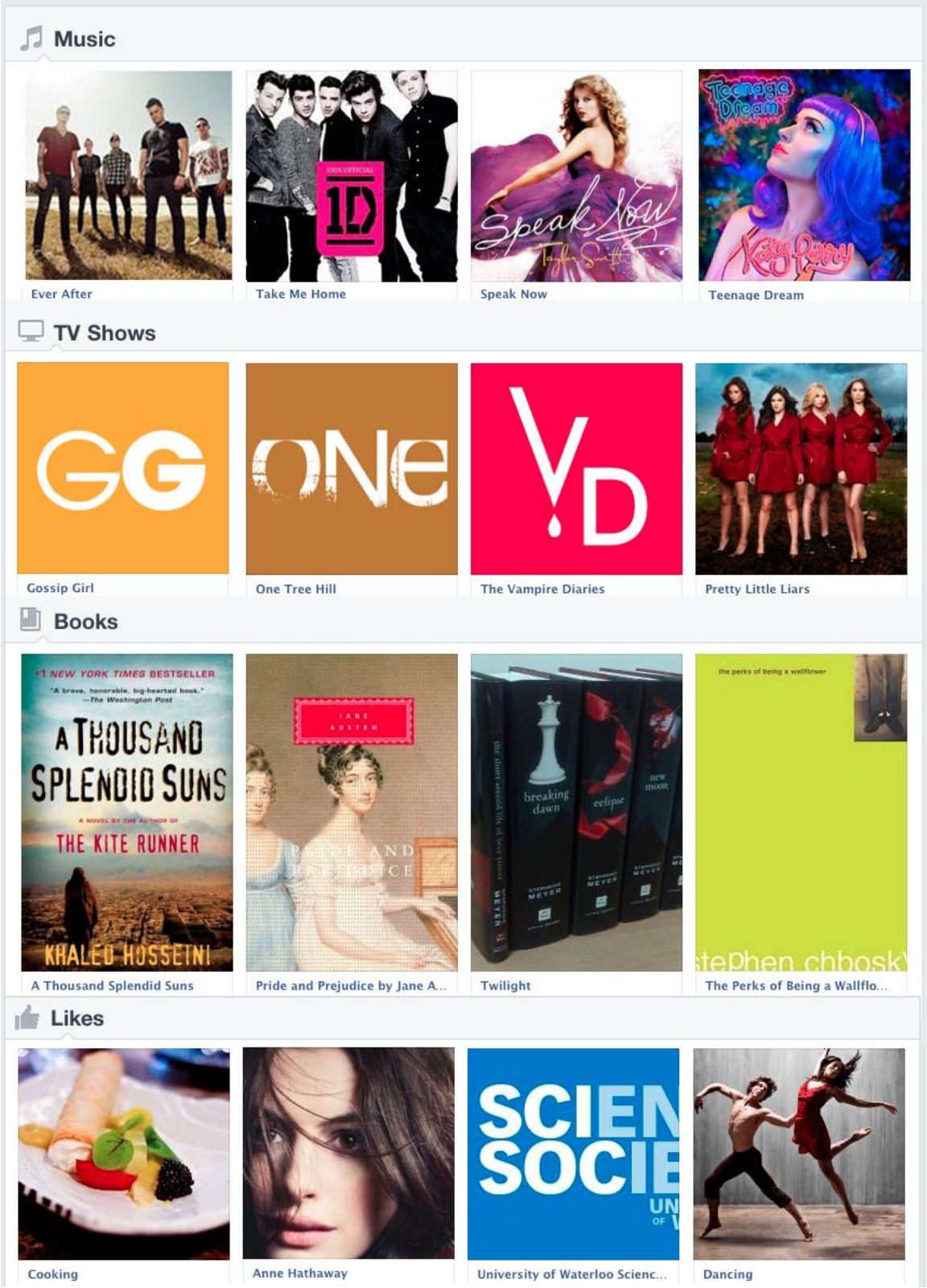
Appendix 6a: Caucasian Facebook Profile Header (Study 1)



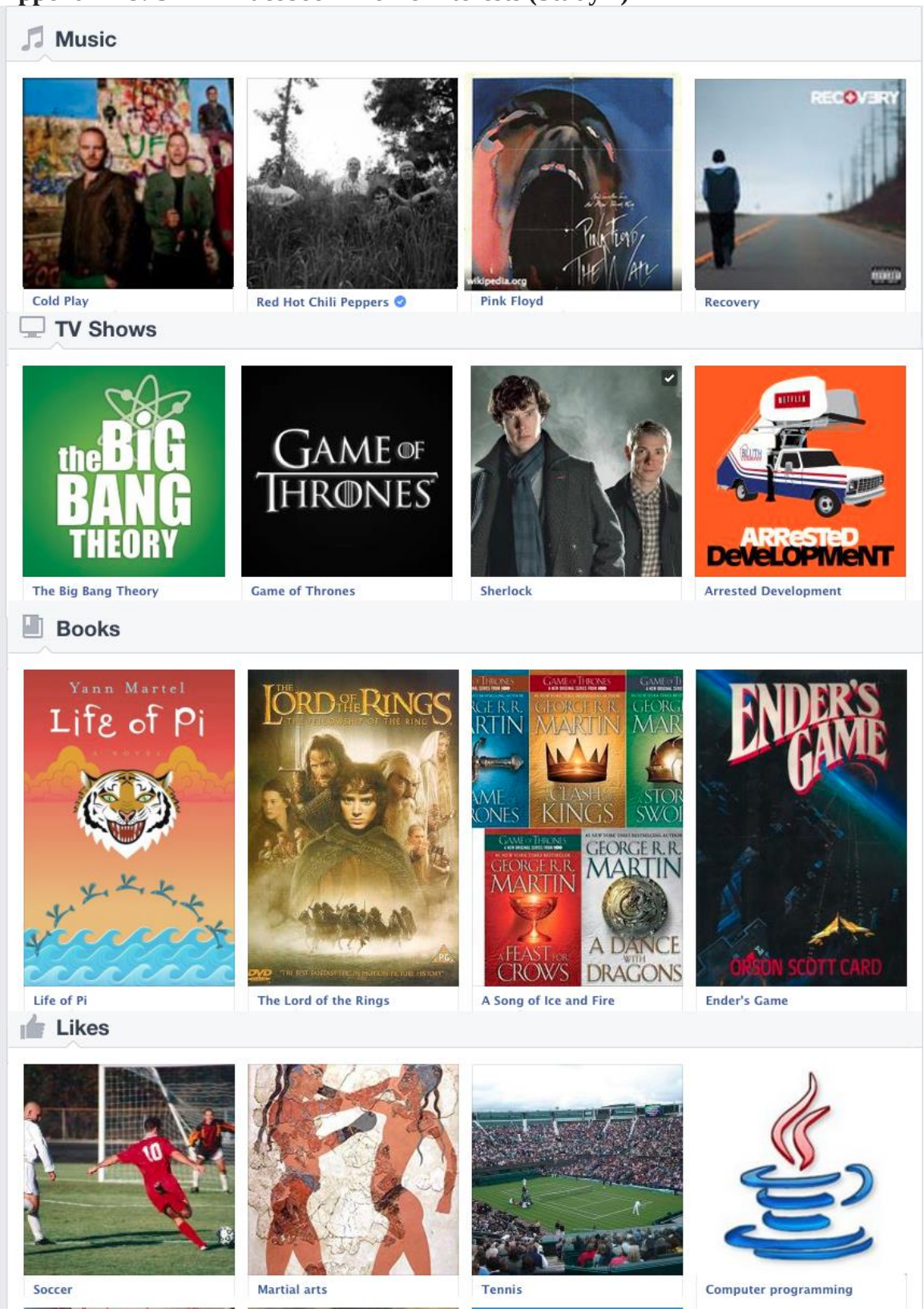
Appendix 6b: East Asian Facebook Profile Header (Study 1)



Appendix 7a: Non-STEM Facebook Profile Interests (Study 1)



Appendix 7b: STEM Facebook Profile Interests (Study 1)



Appendix 8: Measures of Target's Perceived Similarity and Fit with Friends

How similar or dissimilar is Jamie to you and to each of your friends?

	Very Dissimilar	Dissimilar	Neutral	Similar	Very Similar
You	○	○	◉	○	○
Charnel	○	○	○	◉	○
Hilary	○	○	◉	○	○
Crystal	○	○	◉	○	○
Anne	○	○	○	◉	○
Brenda	○	○	○	◉	○
Chris	◉	○	○	○	○
Daniel	◉	○	○	○	○
Eric	◉	○	○	○	○
Franklin	○	◉	○	○	○
Gregory	○	○	○	○	○

How well would Jamie fit in with your circle of friends?

○ Not at all well ◉ Somewhat well ○ Moderately well ○ Very well ○ Extremely well

Appendix 9: Manipulation Check Questions

STUDY RECALL AND EXPERIENCE

Please answer the following questions candidly and recall that your responses will NOT affect your study compensation.

What was Jamie's last name?	Lee
What was Jamie's major?	Biology
What was an interest on Jamie's Facebook profile? (e.g., movie, book, music, TV, activity)	Pink Floyd

Did you recognize Jamie's photograph?

○ Yes ○ Maybe ◉ No

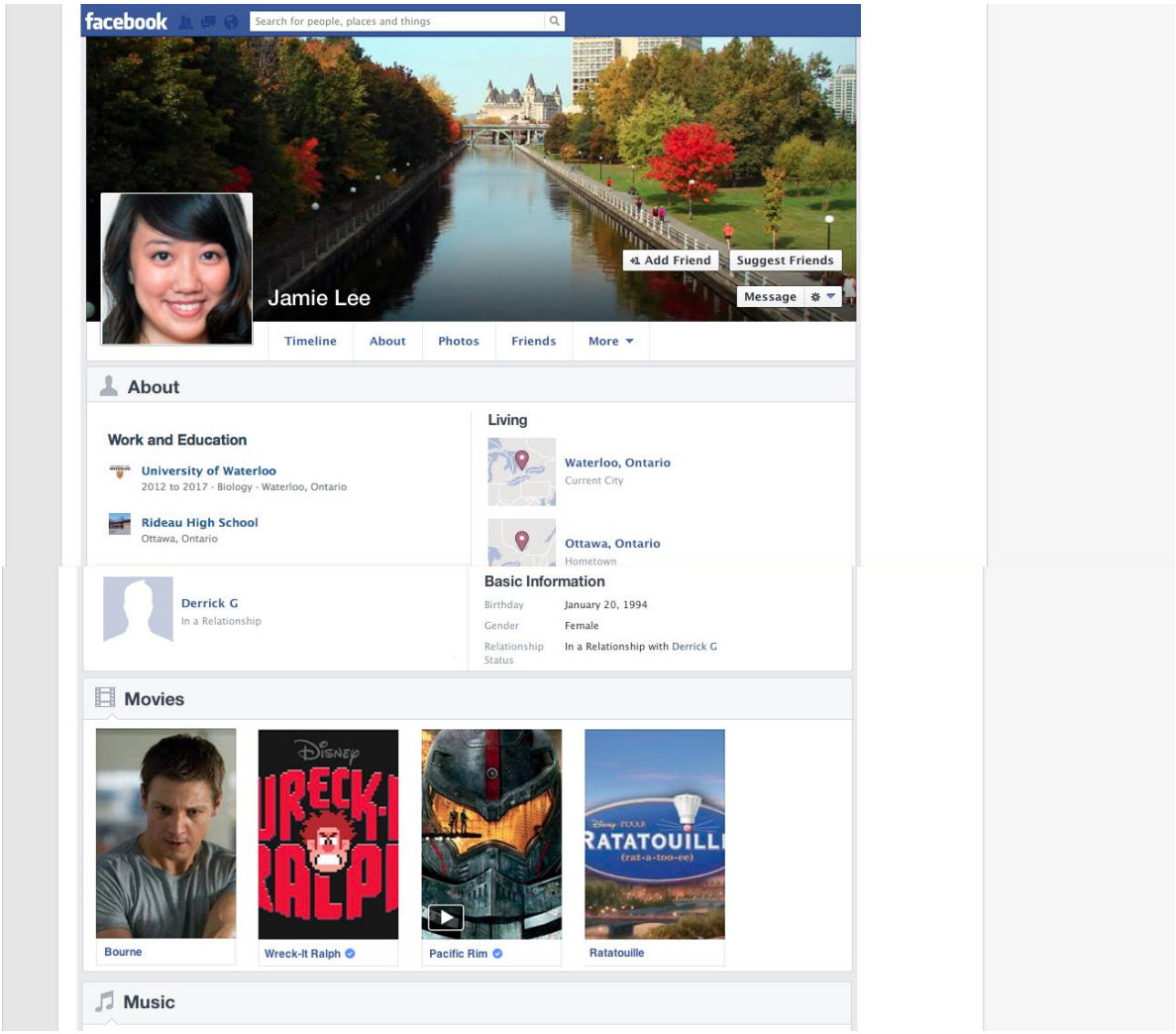
How DISTRACTED did you feel as you completed the study?

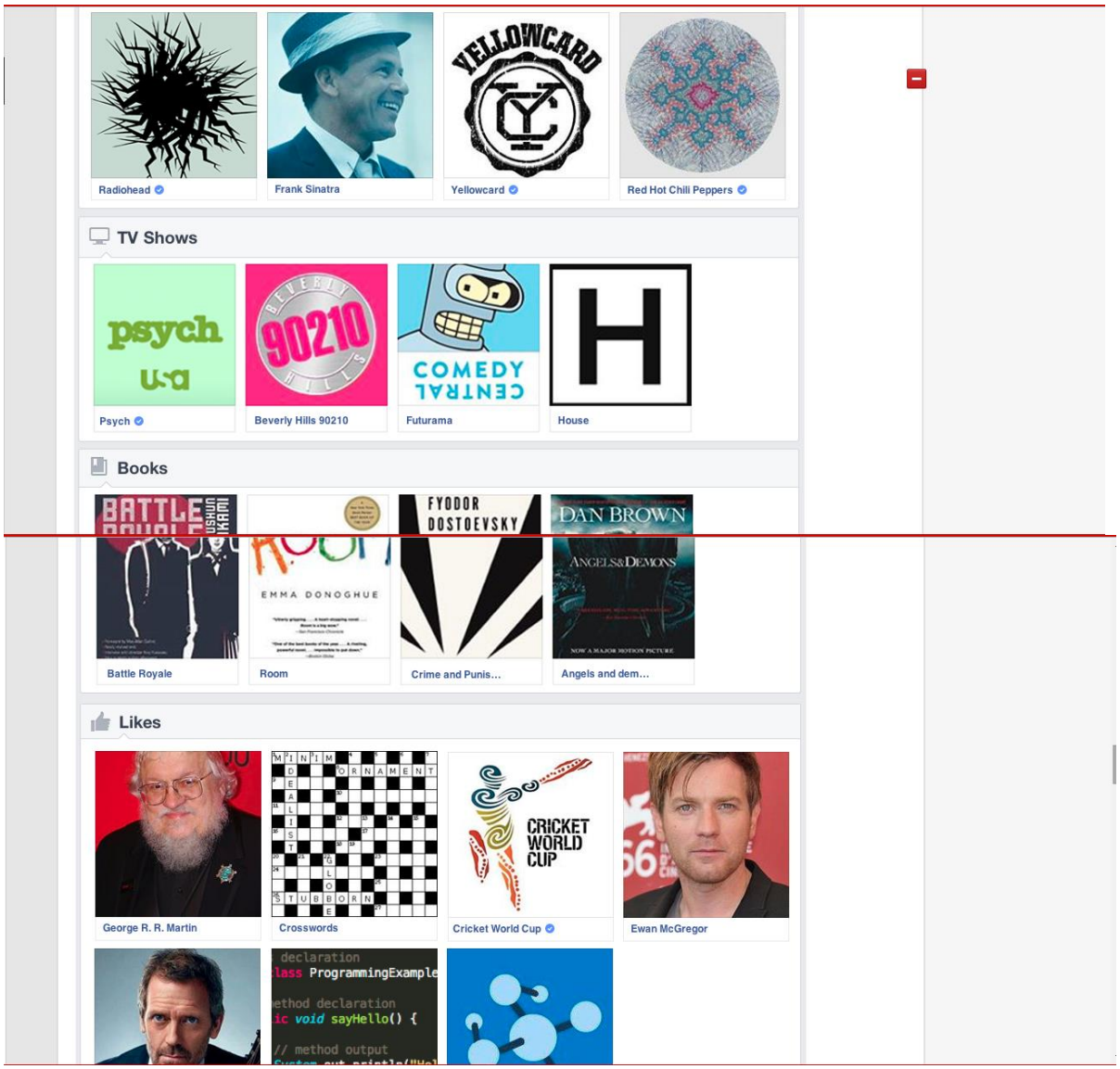
◉ Not At All ○ A little ○ Moderately ○ Very

How SERIOUSLY did you take this study?

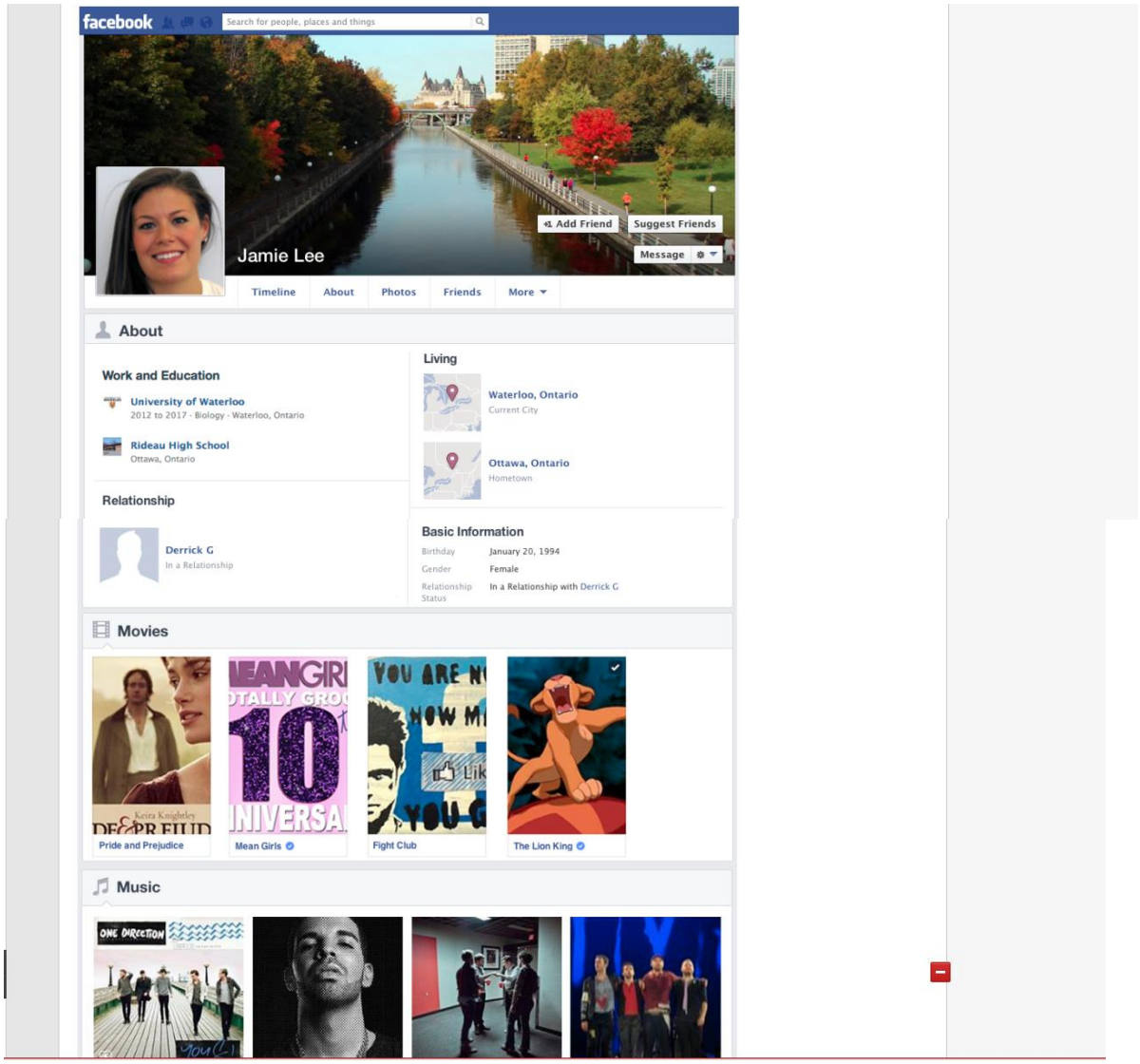
○ Not At All ○ A little ○ Moderately ◉ Very

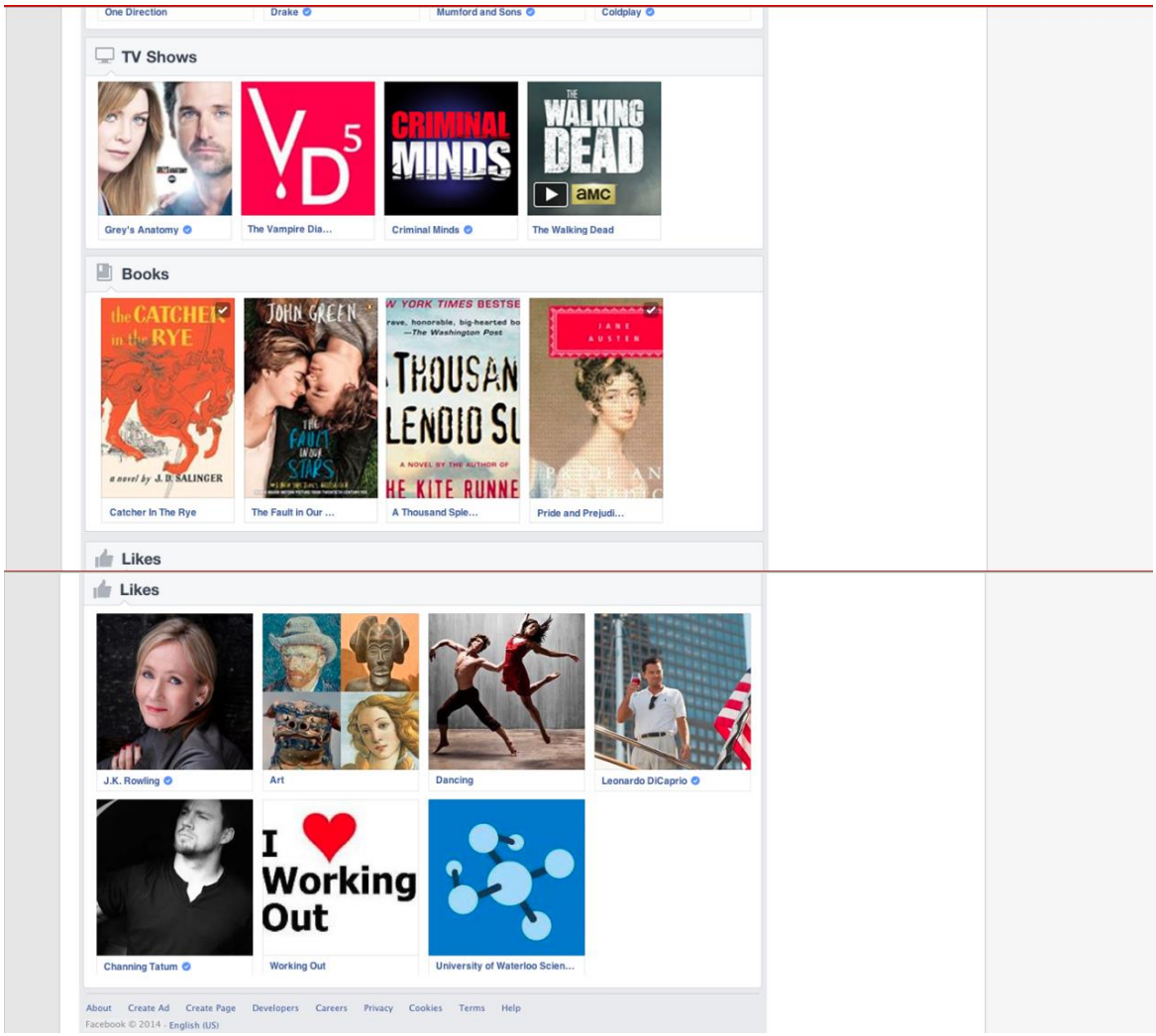
Appendix 10a: East Asian Facebook Profile (Study 2)



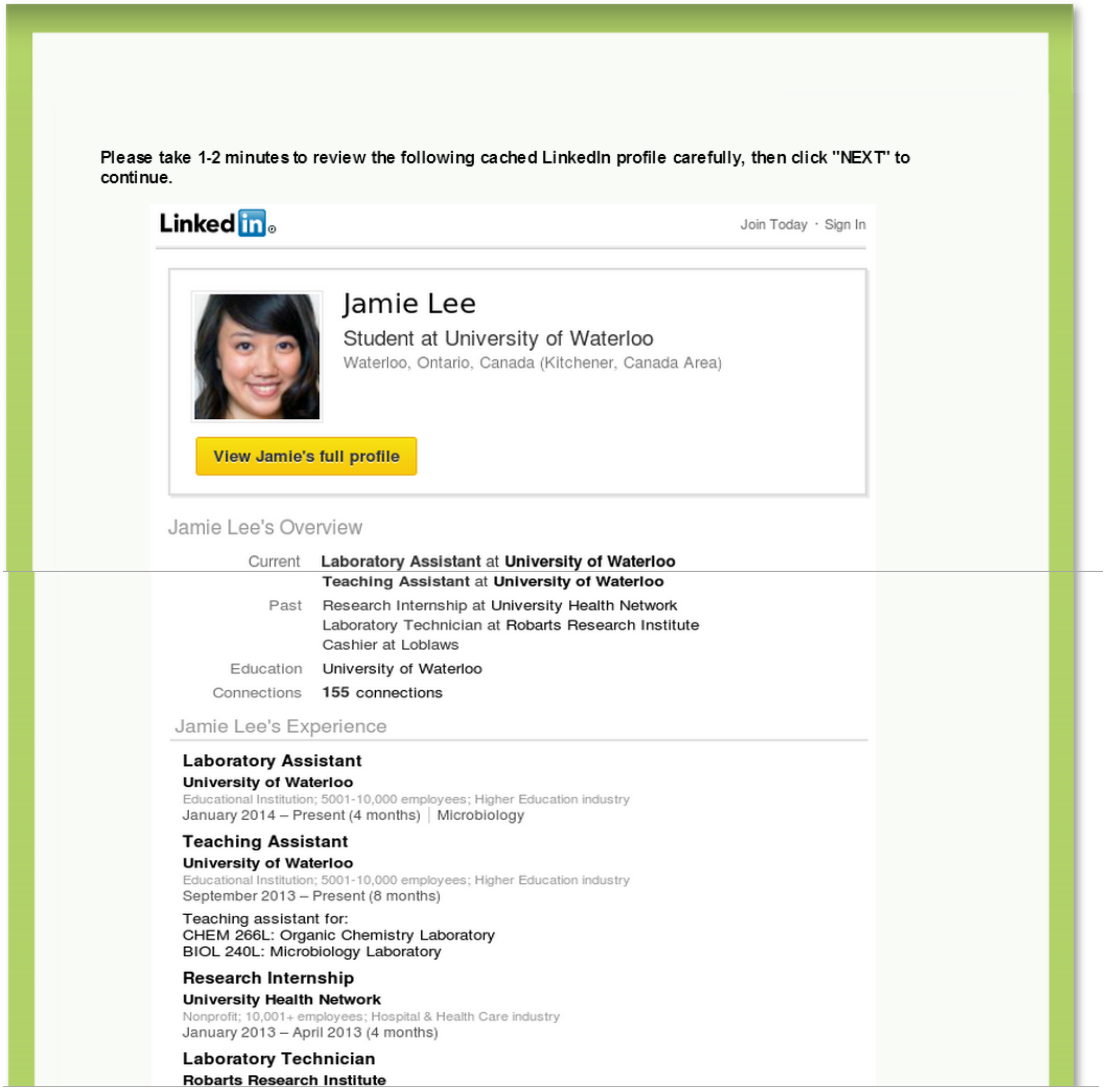

Radiohead
Frank Sinatra
Yellowcard
Red Hot Chili Peppers
TV Shows
Psych
Beverly Hills 90210
Futurama
House
Books
Battle Royale
Room
Crime and Punis...
Angels and dem...
Likes
George R. R. Martin
Crosswords
Cricket World Cup
Ewan McGregor

Appendix 10b: Caucasian Facebook Profile Header




One Direction
Drake
Mumford and Sons
Coldplay
TV Shows
Grey's Anatomy
The Vampire Dia...
Criminal Minds
The Walking Dead
Books
Catcher In The Rye
The Fault in Our ...
A Thousand Sple...
Pride and Prejudi...
Likes
Likes
J.K. Rowling
Art
Dancing
Leonardo DiCaprio
Channing Tatum
Working Out
University of Waterloo Scien...
About
Create Ad
Create Page
Developers
Careers
Privacy
Cookies
Terms
Help
Facebook © 2014 · English (US)

Appendix 11: East Asian LinkedIn Profile Header



Please take 1-2 minutes to review the following cached LinkedIn profile carefully, then click "NEXT" to continue.

LinkedIn

Join Today · Sign In

Jamie Lee

Student at University of Waterloo

Waterloo, Ontario, Canada (Kitchener, Canada Area)

View Jamie's full profile

Jamie Lee's Overview

Current	**Laboratory Assistant** at **University of Waterloo** **Teaching Assistant** at **University of Waterloo**
Past	Research Internship at University Health Network Laboratory Technician at Robarts Research Institute Cashier at Loblaws
Education	University of Waterloo
Connections	**155** connections

Jamie Lee's Experience

Laboratory Assistant
University of Waterloo
Educational Institution; 5001-10,000 employees; Higher Education industry
January 2014 – Present (4 months) | Microbiology

Teaching Assistant
University of Waterloo
Educational Institution; 5001-10,000 employees; Higher Education industry
September 2013 – Present (8 months)
Teaching assistant for:
CHEM 266L: Organic Chemistry Laboratory
BIOL 240L: Microbiology Laboratory

Research Internship
University Health Network
Nonprofit; 10,001+ employees; Hospital & Health Care industry
January 2013 – April 2013 (4 months)

Laboratory Technician
Robarts Research Institute

Nonprofit; 501-1000 employees; Research industry
January 2012 – April 2012 (4 months)

Cashier
Loblaws
Food Production industry
May 2010 – August 2010 (4 months)

Jamie Lee's Volunteer Experience & Causes

Complex Continuing Care Volunteer
Grand River Hospital
May 2012 – present (2 years)

Jamie Lee's Honors and Awards

Merit Scholarship
University of Waterloo
September 2012

Dr. Margaret Lowe Benston Memorial Scholarship
Scholarships for Canadian Women In Science And Technology
2012

Jamie Lee's Education

University of Waterloo
2010 – 2015 (expected)

Appendix 12a: Questions Assessing Level of Inclusiveness in Academic Circle

NETWORKING INTEREST

If you had met Jamie, based on the information in Jamie's profiles, would you accept a request from her to be her Facebook friend or LinkedIn contact?

	Definitely yes	Probably yes	Probably no	Definitely no
Facebook friend	○	○	○	○
LinkedIn contact	○	○	○	○

Please indicate your primary reason(s) for choosing to accept versus reject Jamie's request to be her Facebook friend:

Please indicate your primary reason(s) for choosing to accept versus reject Jamie's request to be her LinkedIn contact:

Which of your friends would you be most likely to introduce to Jamie?

Please indicate whether you encourage each of the following friends to connect with Jamie:

	Accept as Facebook friend?				Add as LinkedIn contact?			
	Definitely yes	Probably yes	Probably no	Definitely no	Definitely yes	Probably yes	Probably no	Definitely no
Sean	○	○	○	○	○	○	○	○
Tim	○	○	○	○	○	○	○	○
Danielle	○	○	○	○	○	○	○	○
Leo	○	○	○	○	○	○	○	○
Christine	○	○	○	○	○	○	○	○

Please RANK (not rate) your friends in order of how likely they would be to accept a friend request from Jamie, from most likely to least likely. (1 = most likely)

- [ ] Sean
- [ ] Tim
- [ ] Danielle
- [ ] Leo
- [ ] Christine

Appendix 12b: Academic Scenarios

INTEREST IN COLLABORATION

Imagine that you and two friends from your major are taking an elective course, and Jamie is in the same section. The course involves an important in-class lab project that requires students to work in groups of 3-4 people who will all receive the same final mark on the project.

Based on your impression of Jamie, would you ask her to join you and your friends in working on the project?

Definitely yes	Probably yes	Probably not	Definitely not
○	○	○	○

Assume that Jamie, your friends, and you have decided to work together on the lab project. You are responsible for dividing the amount of work to be completed by each person, including yourself.

Please indicate the percentage of work you would give to each person.

You	0
Friends	0
Jamie	0
Total	0

Imagine that you are ill and can not attend one of the lectures for the course. None of your friends in the course are able to attend the lecture either; however, Jamie happens to be attending the lecture.

Based on your impression of Jamie, would you ask her to take notes for you?

Definitely yes	Probably yes	Probably not	Definitely not
○	○	○	○

Imagine you and your friends have formed a study group to prepare for the final exam of this elective course. You are studying for this exam at the UW Dana Porter Library. Jamie is also preparing for the final exam in the library.

Based on your impression of Jamie, would you invite her to be a part of your study group?

Definitely yes	Probably yes	Probably not	Definitely not
○	○	○	○

Survey Powered By Qualtrics

NEXT