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Predicting friendship strength in a music-based social network

Despite the popularity of social network sites based on common interests, the association between these shared interests and relational development is not well understood. This manuscript reports results of an empirical investigation of interpersonal relationships on Last.fm, a music-based social network site with a multinational user base. In addition to baseline descriptors of relational behavior, the chief goals of this study were to examine the degree to which Last.fm relationships are characterized by homophily (and particularly by shared musical taste), the extent to which communication via Last.fm is associated with other forms of communication (both offline and online), how such communication behavior is associated with demographic and relational characteristics, and whether these variables predict strength of relational development. Results indicate that although Last.fm relational partners exhibit shared musical taste, this shared taste is not associated with relational development. Rather, following media multiplexity theory, relational development is strongly and uniquely associated with communication behavior across almost all forms of communication (including Last.fm). These results suggest that shared interests may foster the creation of weak ties, but conversion of these connections to strong ties is relatively rare.

Keywords Communication studies; computer-mediated-communication; media studies; Web 2.0; social networking; popular culture

Social network sites are among the internet's most popular destinations. MySpace consistently ranks among the most-hit sites, while Facebook grows rapidly. Dozens of regional social network sites thrive (e.g., Cyworld/Korea, LunarStorm/Sweden, Arto/Denmark). Many such social network sites are specialized, targeting groups such as Christians, the elderly, knitters, or sports fans. This paper uses Last.fm, a music-focused and unusually international social network site (SNS), to examine friendship in social network sites and explore how SNSs fit into the increasingly mediated landscape of interpersonal relationships.

On Last.fm's blog, a staff member (Levy 2008) recounted the staff's joy at hearing from a newlywed couple who met on site. 'It all started through common musical interests on Last.fm', he wrote, 'which led to them becoming friends online, and, over time, to discover that they were true soulmates'. This 'idea of a musical soulmate' (Levy 2008) suggests music is a tie that binds, shared taste can be a route to shared lives. We draw on an international survey of Last.fm users to examine whether shared taste on a SNS does lead to new meaningful relationships and to situate this in the broader context of interpersonal relational development across media.

We begin by discussing the ambiguity of friendship in SNSs. After a brief introduction to Last.fm, we draw on scholarship on personal and computer-mediated relationships to identify four sets of variables known to influence friendship online and off. We consider homophily (McPherson *et al.* 2001), the tendency to befriend similar others. We then consider how group differences in characteristics such as age, gender, and geographic location affect relational internet use. We discuss how online socializing meshes with other forms of interaction. Finally, before presenting the survey and our findings, we turn to research regarding relationship development in online media.

Mediated friendship

The ambiguity of friendship

In a loose sense, all online interaction is social networking, but the term 'social network site' refers specifically to 'web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system' (boyd & Ellison 2007). Friendship provides SNS's central metaphor, as most sites call within-site connections 'friends'.

Though SNS friendships have been shown to increase social capital by increasing people's sense of community and expanding their range of resources (Ellison *et al.* 2007), they have not received unequivocal enthusiasm. Consider a news story lamenting that 'when MySpace members boast of thousands of "friends", most with whom they've never so much as exchanged e-mail, it's clear that the concept no longer means the same thing to everyone' (Henry 2007). Research suggests that *friendship* is a vague term offline (Kendall 2002; Parks 2006), an ambiguity enhanced in SNSs that use the word *friend* for all interpersonal connections enacted on site (boyd 2006; Fono & Reynes-Goldie 2006; Gross & Acquisti 2005). Although the average Facebook user has approximately 150 friends (Golder *et al.* 2007), Ellison *et al.* (2007) found that Facebook users at one university considered only a third of their friend list to be 'actual' friends,

a finding replicated by Baron (2008). What then of the remaining two-thirds? Qualitative studies indicate that the meanings of SNS friendship range from pre-existing social ties to strategic impression management via links to attractive people or lengthy friend lists (boyd 2006; Fono & Raynes-Goldie 2006). Research on SNS friending to date focuses on general interest sites (Facebook, LiveJournal, MySpace, Friendster, etc.). There has been no comparable research published about Last.fm or any other social SNS based on consumption of a specific shared interest though they are increasingly common. Such research is needed, as different SNSs 'may attract different populations and may encourage different activities' (Hargittai 2007).

Last.fm

Founded in London in 2005, Last.fm is both a SNS and a music recommendation, streaming and legal downloading service. In May 2007, when it was bought by CBS Corporation for US\$280 million, Last.fm boasted more than 15 million active users in hundreds of countries. Anyone can listen to music on Last.fm. Registered users can also download software that tracks music they listen to while online. These data are used to personalize services with sophisticated individualized charts, music recommendations, radio streams and pointers to other users with shared taste (these people are called 'neighbours'). Registered users have profiles which display their most recent listens and individualized top artist and song charts. Users can select their user picture, write brief self descriptions, create play-lists, and create radio streams by tagging music. They cannot modify page design.

Many users ask others to be 'friends', in part for reasons addressed in our study. Once this connection is approved by both partners, each appears in the other's publicly visible friends list. Last.fm provides several communication platforms, including writing publicly-visible messages on one another's profiles in the 'shoutbox', sending private personal messages, and participating in site-wide forums. Users vary in their use of friending; some have many friends, many have none. For some, Last.fm is about music listening, tracking and discovery, not socializing.

Last.fm offers the chance to see how friendships in taste-based SNS sites may differ from those in other sites, and provides an opportunity to explore the relative impact of shared taste in relationship formation and maintenance. Last.fm's multinational user base makes this line of investigation particularly compelling (Fragoso 2006; Kim & Yun 2007). Because we have no data on friendships in this sort of SNS, we begin with basic research questions:

RQ 1: What are the baseline descriptors of the friendships on Last.fm?

RQ 1a. How many friends does the average respondent have?

RQ 1b. What proportion of friendships first began on Last.fm?

RQ 1c. On average, how long have friendship pairs been Last.fm friends?

Homophily in online friendships

Friendship scholars have long recognized that most people tend to prefer friends that they perceive as similar to them on demographic and social characteristics (McPherson *et al.* 2001; McCroskey *et al.* 2005). Research about online friendship formation has emphasized the importance of shared interest online social forums, noting that this creates a platform of similarity on which users build new relationships (McKenna & Bargh 2000; McKenna *et al.* 2002; Parks & Floyd 1996). Most SNSs foreground taste by including pre-determined categories which users can fill in on their profiles (e.g. Heer & boyd 2005; Liu *et al.* 2006; Liu 2007). Last.fm uses commonality in listening habits across users to algorithmically link ‘neighbours’, who are listed on each user’s profile. A presumption of the importance of taste homophily between individuals is thus written into Last.fm’s design.

Evidence for homophily in predicting relationships in SNSs is mixed. Liu (2007) examined 127,477 MySpace profiles and found that people were more likely to differ from their friends than to share tastes. Some studies report homophily in SNS friendships on other factors including shared relationships and ethnicity (Adamic *et al.* 2003; boyd & Heer 2006; Hargittai 2007).

However, SNSs may offer means to create relationships across differences that constrain face-to-face relationships (e.g., age, sex, or nationality). We know from previous research that cross-sex friendships are less common offline than same-sex friendships, forming as little as 20 per cent of adult friendships (Kalmijn 2002). Cross-sex friendships may be more likely to occur online (Parks & Roberts 1998) and be closer and more developed than same-sex online friendships when they do (Chan & Cheng 2004). Age homophily is powerful offline, ‘stronger than any other dimension’ (McPherson *et al.* 2001, p. 424) in close friendship. These have not been explored in SNSs.

The role of geographical homophily is also unclear. Email seems to be particularly useful in sustaining long distance relationships, though widely used in local relationships (Baym *et al.* 2004; Chen *et al.* 2002; Dimmick *et al.* 2000; Ledbetter, 2008; Quan-Haase *et al.* 2002). Golder *et al.* (2007) reported that slightly more Facebook messages were exchanged between students at the same university than different universities. Last.fm encourages connections between geographically distant others who might not otherwise meet, and is hence a context in which to further explore the role of shared place. The second set of research questions examine homophily.

RQ 2: To what extent are Last.fm friendships characterized by homophily?

RQ 2a. To what extent are friendship pairs similar or different in musical taste?

RQ 2b. To what extent are friendship pairs similar or different in sex?

RQ 2c. To what extent are friendship pairs similar or different in age?

RQ 2d. To what extent are friendship pairs similar or different in geographic location?

Group differences in online friendships

The use of the internet for relational purposes varies across populations. Three salient factors are age, gender, and geography. Much of the research and popular discourse about SNSs has focused on youth. We do not know how their experience generalizes to older people. We do know that offline as people age, friendship formation and maintenance become increasingly constrained by factors such as physical limitations, conflict with friends' spouses, and moves (Blieszner & Adams 1998). Despite the potential importance of age differences in shaping how people use SNSs, they have not been investigated.

In contrast, we know much about the role of gender. Women are more likely to use internet technologies for relational purposes (Boneva & Kraut 2002; Gilbert *et al.* 2008; Lampe *et al.* 2007; Pew 2000) and enjoy online communication more than men (McKenna *et al.* 2002). Both sexes have more female MySpace friends (Gilbert *et al.* 2008).

There are also international and ethnic differences in the use of interpersonal online communication. In contrast to the US, Catalonians rarely use the internet to communicate with friends and neighbors (Wellman *et al.* 2003). Research in several Los Angeles ethnic communities found that Korean and Chinese residents were most likely to form a new friendship online (Matei & Ball-Rokeach 2002). Last.fm's internationalism offers the opportunity to compare geographical regions. Our third and fourth research questions examine how demographic variables are associated with Last.fm friendship behavior:

RQ 3: Does the total number of friends that people have on Last.fm vary based on their demographic characteristics (age, sex, geographic region)?

RQ 4: Does the number of friendships that began on Last.fm vary based on demographic characteristics (age, sex, geographic region) of themselves or their partners?

The use of multiple media

Recent research and theory has emphasized how internet use fits into communication patterns across media (Baym *et al.* 2004; Baym *et al.* 2007; Haythornthwaite 2005; Haythornthwaite & Wellman 2002; Ledbetter 2008). These studies have found that online communication does not substitute for face-to-face conversation or other forms of communication, but supplements (and perhaps even increases) offline interaction. We know little about this in the context of communication via SNSs, nor do we know about the interplay amongst different kinds of internet use. Our fifth set of research questions thus ask:

RQ 5: To what extent and how do Last.fm friends use multiple media?

RQ 5a. How many, and which, media (including different modes of online interaction) do Last.fm friends use to communicate?

RQ 5b. How do the uses of those media correlate with one another?

Given that we have already identified a number of factors we expect to affect Last.fm friendships, we also ask:

RQ 5c. How do demographic characteristics (participant age, participant sex, friend sex, and participant's geographic region) and relational characteristics (geographic proximity, age similarity, sex-similarity, shared musical taste) correlate with media use?

Relational development

Tie strength has been an important concept in the analysis of online relationships. The internet may be particularly good for the formation or maintenance of weak or specialized ties (e.g. Wellman & Gulia 1999). Drawing on Haythornthwaite (2005), Ellison *et al.* (2007) demonstrated that many Facebook friendships are weak ties. Donath (2007) questioned whether SNSs might thus 'shift people's social world from one focused on a few important relationships to one consisting of an immense number of weak relationships'.

People with stronger ties seem to use more media to communicate, a phenomenon Haythornthwaite (2005) called *media multiplexity*. She posited that weak ties rely on passive interaction opportunities; conversely, strong ties use multiple means of communication, proactively seeking private communication. The language of tie strength is grounded in sociology. Communication scholars speak more often of 'relational development', conceptualizing relationships as ongoing processes that change along several dimensions as they grow closer. This is consistent with the strong/weak tie approach, although the communication perspective emphasizes how weaker ties may develop into stronger ones and pays less attention to the value of weak ties. Furthermore, media multiplexity theory says little about the relative contribution of media use to tie strength in comparison to other factors known to affect relational quality. Our final set of research questions addresses relational development.

RQ 6: What differentiates the more developed/stronger friendships on Last.fm from those that are less developed/weaker?

RQ 6a. How strong/developed are these relationships?

RQ 6b. Do demographic characteristics (participant age, participant sex, friend sex, and participant's geographic region) predict the extent of relational development?

RQ 6c. Does whether a friendship began on Last.fm predict relational development?

RQ 6d. Does the length of time that people have maintained their 'friend' connection on Last.fm predict relational development?

RQ 6e. Do similarities in age, sex, regional location, musical taste, and geographic proximity predict the likelihood of relational development?

RQ 6f. Does media use predict relational development? If so, does communication *via Last.fm* predict relational development?

Method

Participants. With the approval of Last.fm's management, the first author posted a survey announcement to the two site-wide general discussion forums. One of the site's most visible staff-members endorsed and 'stickied' the thread so that it remained at the top of the forum. The last page of the survey urged participants to recruit others. Several respondents posted notices of the survey in their own profiles, groups, and notes left on others' profiles. We would have preferred a random sample. However, there was no way to solicit participation off-site and direct on-site solicitation would have been considered spam.

The survey was posted in English and was active for six weeks. In that time there were 612 respondents. After deleting those who reported having no friends ($n = 65$), and those who did not answer many questions, there were 559 respondents (355 male, 204 female). Participant age ranged from 18 (the cutoff age for the research) to 57 years ($m = 25.98$, $sd = 8.16$). Length of Last.fm usage ranged from zero to 60 months ($m = 18.35$, $sd = 10.91$). 192 (34.3 per cent) were paid subscribers to the site. Participants reported 48 countries of residence, with the most common being the United States ($n = 165$, 29.5 per cent), the United Kingdom ($n = 101$, 18.1 per cent), Germany ($n = 33$, 5.9 per cent), Australia ($n = 27$, 4.8 per cent), Canada ($n = 26$, 4.7 per cent), the Netherlands ($n = 24$, 4.3 per cent), Poland ($n = 19$, 3.4 per cent), and Finland ($n = 18$, 3.2 per cent). Others reported countries of residence in Europe (e.g., Italy, Spain), South America (e.g., Argentina, Brazil), and Asia (e.g., Japan, Saudi Arabia).

The sample is diverse, but skewed. In comparison to internal statistics provided by Last.fm, respondents are heavily involved in the site. On average, they are older, have used the site longer, are more likely to be paid subscribers, and have more Last.fm friends than the average user. The following analyses should be interpreted with this in mind.

Procedures. The survey instructed participants to open their Last.fm profile in a separate window and note the friend appearing first on their friends list. As Last.fm randomly generates the friend list's order when the profile is loaded, this permitted random selection of a specific Last.fm friend. Respondents were told to answer several questions with this friend in mind.

Demographic characteristics. In addition to their sex and age, participants indicated their country of residence via a list of 25 countries, with an additional

response option for 'other' nations not on the list. As several nations contained few participants, responses were recoded to reflect four broader geographic regions. This recoded variable reflected whether the participant lived in the United States or Canada ($n = 191$, 34.5 per cent), the United Kingdom ($n = 101$, 18.1 per cent), another European nation ($n = 188$, 33.6 per cent), or other nation ($n = 77$, 13.8 per cent). Participants also reported how many friends they had on Last.fm.

Friendship characteristics. A dichotomous measure assessed whether the friendship originated on Last.fm. Participants also reported friendship length, with response options including (a) in the last month, (b) 1–3 months ago, (c) 3–6 months ago, (d) 6–12 months ago, (e) 1–2 years ago, and (f) more than two years ago. These response options reflect that Last.fm only began in 2005.

Shared musical taste. Using two questions measured on a five-point Likert-type scale (1 = Not at all important, 5 = Very important), participants reported the extent to which 'shared taste in music' and 'shared musical history' motivated formation of their Last.fm friendship. These two items demonstrated acceptable internal reliability (Cronbach's $\alpha = .87$) and were averaged into a single indicator of shared musical taste.

Media use. Participants were presented with a list of communication media including instant messaging, chat, email, messages on another website, telephone calls, telephone text messages, face-to-face conversation, and postcards or letters. Participants checked all media they used with this friend.

Last.fm communication. Frequency of Last.fm communication with this friend was assessed via six items measured on a five-point Likert-type scale (1 = Never, 5 = Very often). Sample items included whether the participant '[visits] this person's Last.fm profile', '[writes] in this person's shoutbox', and '[comments] on this person's journal'. These six items were submitted to exploratory factor analysis (EFA) using principal component factor analysis with varimax (i.e., orthogonal) rotation, using the .60/.40 criterion recommended by McCroskey and Young (1979) for item inclusion. The EFA procedure produced a unidimensional solution, with only one item ('Listen to this person's Last.fm radio') failing to load above .60 on the factor; perhaps this item confounds attraction based on shared musical taste with communication frequency. After removing this item, both a principal components factor analysis and a maximum likelihood factor analysis produced comparable solutions for the five retained items, and thus the items were averaged to produce one variable indicating frequency of Last.fm communication.

Relational development. Chan and Cheng's (2004) version of Parks and Roberts' (1998) 18-item instrument assessed relational development. Previous research demonstrates that the scale assesses several manifestations of relational development such as 'the feeling of mutual dependence', 'the variety of conversational topics shared', and 'the degree of self-disclosure' (Chan & Cheng 2004, p. 310). Responses were solicited using a five-point Likert scale. Although the

scale was originally designed to assess multiple dimensions, all 18 items demonstrated such high reliability in this study ($\alpha = .96$) that they were combined into a single measure of relational development.

Results

The first set of research questions addressed baseline descriptors of Last.fm friendships, including average number of friends (RQ1a), whether these friendships began on Last.fm (RQ1b), and how long dyads had been Last.fm friends (RQ1c). Participants had a mean of 26.03 ($SD = 33.88$) Last.fm friends, ranging from a maximum of 404 friends to a minimum of only one friend. The distribution of this variable deviated from the normal distribution (skewness = 4.58, kurtosis = 34.77). Inspection of the histogram and descriptive statistics revealed that 96.3 per cent of participants had fewer than 100 friends, and thus, the few outliers with more friends than this were not included in subsequent analyses involving this variable; this greatly reduced positive skew (skewness = 1.65, kurtosis = 2.95). Among the specific friendships reported, approximately half began on Last.fm ($N = 263$, 47.1 per cent) and half did not ($N = 295$, 52.9 per cent). Most dyads had linked to each other on Last.fm relatively recently, within the last month ($N = 51$, 9.1 per cent), the past one to three months ($N = 124$, 22.2 per cent), the past three to six months (44.1 per cent), or the past six to twelve months ($N = 111$, 19.9 per cent); only a small number of participants reported linking to their partners one to two years ago ($N = 26$, 4.7 per cent).

The second set of research questions investigated homophily in four domains: shared musical interests (RQ2a), sex (RQ2b), age (RQ2c), and geographic location (RQ2d). Friends tended to share musical taste, with a mean of 2.35 ($SD = 1.51$) on a scale of 0 to 4. A one-sample *t*-test revealed that this value was significantly above the scale midpoint, $t(557) = 5.40$, $p < .01$. The chi-square statistic revealed no significant association between participant sex and friend sex, $\chi^2 = 0.24$, $p > .05$. Though several participants did not report their friend's age ($n = 89$, 15.9 per cent), among those who did, participant age and friend age were strongly correlated, $r = .55$, $p < .01$. On geographic distance, a plurality of participants reported living in another country ($N = 226$, 40.5 per cent), though several reported living in the same country ($N = 142$, 25.4 per cent), the same region of a country ($N = 57$, 10.2 per cent), or the same town ($N = 90$, 16.1 per cent), with a handful of participants reporting that they lived in the same neighborhood ($N = 27$, 4.8 per cent).

Research question 3 asked whether demographic characteristics (i.e., participant age, friend age, participant sex, friend sex, and geographic region) are significantly associated with number of Last.fm friends (RQ3); likewise, research question 4 asked whether these demographic characteristics are associated with the friendship originating on Last.fm. Correlational analysis revealed

that participant age ($r = .02, p > .05$) and sex ($r = .08, p > .05$) were not significantly associated with number of Last.fm friends. Similarly, a one-way analysis of variance (ANOVA) with geographic region as the independent variable and number of friends as the dependent variable revealed no significant effect, $F(3, 515) = 1.48, p > .05$. In contrast, several variables were significantly associated with whether friends met on Last.fm; specifically, being an older participant ($r = .14, p < .01$), having an older friend ($r = .10, p < .05$), sharing musical taste ($r = .35, p < .01$), and having a male friend ($r = .10, p < .05$) were associated with meeting on Last.fm. Probing the sex finding revealed that cross-sex friends were more likely to meet on Last.fm ($r = .26, p < .01$). A univariate ANOVA with geographic region as the independent variable and whether friends met on Last.fm as the dependent variable produced a significant effect, $F(3, 554) = 3.28, p < .05$, partial $\eta^2 = .02$, with Tukey post hoc tests indicating that North Americans were more likely to have met friends on Last.fm than Europeans (mean difference = 0.15, $p < .05$).

The next set of research questions addressed how Last.fm friendships employ multiple media. We asked about frequency of media use (RQ5a) and the extent to which use of one medium is associated with use of other media (RQ5b). Friends reported using a mean of 2.13 media beyond Last.fm ($SD = 2.23$), though several participants indicated that Last.fm was their only form of communication in this relationship ($n = 177$; 31.5 per cent). As Table 1 indicates, pairs were most likely to communicate outside Last.fm via IM ($n = 235$; 42.0 per cent), other websites ($n = 194$; 34.7 per cent), face-to-face ($n = 187$; 33.55 per cent), and e-mail ($n = 175$; 31.3 per cent). Almost all correlations among media use variables were statistically significant and positive, with especially strong associations between texting and telephone calls ($r = .67, p < .01$), face-to-face and telephone calls ($r = .62, p < .01$), telephone calls and IM ($r = .51, p < .01$), and texting and IM ($r = .51, p < .01$).

Research question 5c addressed whether demographic and relational characteristics are associated with media use (see Table 2). Though participant and friend sex generally were not associated with media use, cross-sex friends were more likely to communicate via Last.fm ($r = .13, p < .01$) and less likely to communicate face-to-face ($r = -.21, p < .01$), on the telephone ($r = -.12, p < .01$), or on other websites ($r = -.13, p < .01$). Overall, communicating outside Last.fm was inversely associated with friends' ages, geographic distance, and shared musical interest. However, Last.fm communication was positively associated with geographic distance ($r = .11, p < .01$) and shared musical interest ($r = .24, p < .01$).

Relational development

Research question 6a addressed relational development. Participants reported a mean of 1.74 ($SD = 0.96$) on the scale (0 = minimum, 4 = maximum), with a

TABLE 1 Frequency Counts and Pearson product-moment correlations for media use variables ($N = 559$).

<i>variables</i>	<i>frequency</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>
1. Face-to-face	187 (33.5%)	1.00							
2. Telephone	132 (23.6%)	.62**	1.00						
3. Postal mail	31 (5.5%)	.13**	.20**	1.00					
4. E-mail	175 (31.3%)	.36**	.48**	.19**	1.00				
5. IM	235 (42.0%)	.46**	.51**	.14**	.45**	1.00			
6. Web-other	194 (34.7%)	.22**	.21**	.09*	.22**	.30**	1.00		
7. Texting	119 (21.3%)	.56**	.67**	.14**	.41**	.51**	.28**	1.00	
8. Chat	113 (20.2%)	.29**	.36**	.11**	.30**	.38**	.27**	.37**	1.00
9. Last.fm	n/a	-.05	.11*	.15**	.19**	.17**	.03	.11**	.08

Note: As all media use variables except Last.fm communication are dichotomous, the correlations above are point-biserial correlations.

* $p < .05$ ** $p < .01$.

TABLE 2 Correlation matrix of demographic and relational characteristics with media use ($N = 559$).

<i>factors</i>	<i>participant sex</i> ¹	<i>friend sex</i> ¹	<i>cross-sex</i> ²	<i>participant age</i>	<i>friend age</i>	<i>geographic proximity</i>	<i>shared music</i>
1. Face-to-face	-.03	-.09*	-.21**	-.22**	-.19**	-.67**	-.28**
2. Telephone	-.05	-.07	-.12**	-.13**	-.08	-.40**	-.12**
3. Postal mail	.09*	.07	-.03	.03	-.02	-.01	-.03
4. E-mail	-.03	-.05	-.004	.05	.11*	-.19**	-.11**
5. IM	-.04	-.05	-.03	-.28**	-.20**	-.31**	-.16**
6. Web-Other	.07	-.002	-.13**	-.11*	-.13**	-.18**	-.04
7. Texting	.05	-.03	-.06	-.19**	-.16**	-.39**	-.12**
8. Chat	-.08	-.02	-.05	-.16**	-.15**	-.19**	-.06
9. Last.fm	.03	.01	.13**	.09*	.05	.11*	.24**

* $p < .05$ ** $p < .01$.

¹ Female = 1, male = 0.

² Cross-sex = 1, same-sex = 0.

one-sample *t*-test revealing that this mean is significantly below the scale midpoint, $t(558) = -6.30, p < .01$.

The final set of research questions addressed whether demographic characteristics (RQ6b), relational characteristics (RQ6c, 6d, & 6e), and communication behavior (RQ6f) predict relational development. These research questions were examined via hierarchical multiple regression, with relational development as the criterion variable. The first step of the hierarchical regression analysis entered demographic predictors: (a) dummy codes representing participant geographic location, (b) participant sex, (c) friend sex, and (d) participant age. As Table 3 reports, this first step explained a significant amount of variance in relational development, $\Delta F(6, 540) = 3.95, p < .01$, although the effect size was modest (4.2 per cent). Within this step, only the variable contrasting North America and Europe significantly predicted relational development, $t = 3.48, p < .01$, with Europeans demonstrating slightly higher relational development ($M = 1.98, SD = 0.95$) than those in North America ($M = 1.63, SD = 0.95$). Participant age approached significance as an inverse predictor, $t = -1.83, p < .07$.

The second step entered variables assessing relational characteristics of the dyad, including (a) time since becoming Last.fm friends, (b) whether they first met on Last.fm, (c) friend geographic distance, (d) whether the dyad was same-sex or cross-sex, and (e) shared musical taste. This step produced a significant change in total variance explained (21.4 per cent), $\Delta F(4, 536) = 29.26, p < .01$. Univariate results indicated that four relational variables significantly predicted relational development, with heightened relational development associated with longer Last.fm friendships, not meeting on Last.fm, closer geographic proximity, and cross-sex friendships (see Table 3).

The third step entered eight dichotomous variables indicating communication media employed by the dyad, including (a) face-to-face, (b) telephone calls, (c) telephone text messages, (d) e-mail, (e) chat, (f) instant messaging, (g) messages on another website, and (h) postcards or letters. This step was significant, $\Delta F(8, 528) = 64.06, p < .01$, increasing explained variance to 60.1 per cent. Univariate analyses revealed that all media significantly predicted relational closeness with the exception of chat, which approached but did not achieve statistical significance (see Table 3). Furthermore, with the exception of cross-sex pairings, no relationship-level predictors were significant in this step, despite being so in the second step. It appears that these relationship-level variables do not significantly predict relational closeness when controlling for media use.

The fourth step tested whether Last.fm communication explained variance beyond that explained by previous steps. Only Last.fm communication frequency was entered in this step, significantly increasing explained variance to 64.2 per cent, $\Delta F(1, 527) = 60.98, p < .01$. All other media use variables also significantly predicted relational closeness in this final step except for chat and postcards/letters. Other significant predictors in the final step included friend's sex, meeting through Last.fm, and whether friends were same-sex or cross-sex (see Table 3).

TABLE 3 Summary of hierarchical regression analysis for variables predicting relational closeness.

<i>Variables entered</i>	<i>b</i>	<i>SE</i>	β	<i>t</i>	<i>F</i>	ΔR^2	<i>Total R²</i>
Step 1					3.66	.04	.04
1. Contrast code – USA vs. UK	–.01	.12	–.01	–0.09			
2. Contrast code – USA vs. Europe	.33	.10	.16	3.19**			
3. Contrast code – USA vs. Other	.03	.13	.01	0.21			
4. Participant sex ^a	–.00	.09	–.00	–0.03			
5. Friend sex ^a	.11	.08	.06	1.36			
6. Participant age	–.01	.01	–.08	–1.79			
Step 2					28.12	.21	.25
1. Contrast code – USA vs. UK	–.16	.11	–.07	–1.50			
2. Contrast code – USA vs. Europe	.23	.09	.11	2.48*			
3. Contrast code – USA vs. Other	.04	.12	.01	0.30			
4. Participant sex ^a	.04	.08	.02	0.50			
5. Friend sex ^a	.14	.08	.08	1.87			
6. Participant age	.00	.01	.00	0.002			
7. Length of Last.fm friendship	.16	.04	.16	4.08**			
8. Met through Last.fm? ^b	–.52	.09	–.27	–5.72**			
9. Geographic proximity to friend	–.17	.04	–.23	–4.99**			
10. Cross-sex friends? ^c	.28	.08	.15	3.52**			
11. Shared musical taste	–.01	.03	–.01	–0.20			
Step 3					55.84	.35	.60
1. Contrast code – USA vs. UK	–.09	.08	–.04	–1.11			
2. Contrast code – USA vs. Europe	.03	.07	.01	0.35			
3. Contrast code – USA vs. Other	–.06	.09	–.02	–0.65			
4. Participant sex ^a	.04	.06	.02	0.72			
5. Friend sex ^a	.15	.06	.08	2.52*			
6. Participant age	.01	.004	.04	1.21			
7. Length of Last.fm friendship	.04	.03	.04	1.30			
8. Met through Last.fm? ^b	–.05	.07	–.03	–0.71			
9. Geographic proximity to friend	–.01	.03	–.02	–0.39			
10. Cross-sex friends? ^c	.19	.06	.10	3.23**			
11. Shared musical taste	.01	.02	.01	0.43			
12. Face-to-face	.32	.09	.16	3.37**			
13. Telephone calls	.50	.10	.22	5.08**			
14. Telephone text-messaging	.24	.10	.11	2.48*			
15. E-mail	.37	.07	.18	5.15**			
16. Instant messenger	.38	.07	.20	5.24**			

Continued

TABLE 3 Continued

<i>Variables entered</i>	<i>b</i>	<i>SE</i>	β	<i>t</i>	<i>F</i>	ΔR^2	<i>Total R</i> ²
17. Chat	.13	.08	.06	1.74			
18. Messages on another website	.19	.07	.09	2.87**			
19. Postcards or letters	.30	.12	.08	2.52*			
Step 4					60.83	.04	.64
1. Contrast code – USA vs. UK	-.11	.08	-.04	-1.38			
2. Contrast code – USA vs. Europe	-.04	.07	-.02	-0.53			
3. Contrast code – USA vs. Other	-.08	.08	-.03	-1.02			
4. Participant sex ^a	.03	.06	.02	0.53			
5. Friend sex ^a	.14	.05	.07	2.53*			
6. Participant age	.002	.004	.02	0.50			
7. Length of Last.fm friendship	.03	.03	.03	0.94			
8. Met through Last.fm? ^b	-.22	.07	-.11	-2.96**			
9. Geographic proximity to friend	-.00	.03	-.00	-0.04			
10. Cross-sex friends? ^c	.17	.06	.09	3.08**			
11. Shared musical taste	-.02	.02	-.03	-0.95			
12. Face-to-face	.37	.09	.18	4.13**			
13. Telephone calls	.45	.09	.20	4.84**			
14. Telephone text-messaging	.24	.09	.10	2.61**			
15. E-mail	.29	.07	.14	4.19**			
16. Instant messenger	.30	.07	.16	4.38**			
17. Chat	.11	.07	.05	1.52			
18. Messages on another website	.16	.06	.08	2.51*			
19. Postcards or letters	.22	.12	.05	1.90			
20. Last.fm communication	.27	.04	.24	7.80**			

Note: At each step, additional variance accounted for was significant at $p < .01$.

^a Female = 1, male = 0

^b Met through Last.fm = 1, didn't = 0

^c Cross-sex = 1, same-sex = 0

* $p < .05$. ** $p < .01$.

Interestingly, meeting through Last.fm was not a significant predictor in the third step. Thus, it seems that meeting through Last.fm predicts relational development when pairs use Last.fm to communicate.

Discussion

Finding close relationships, let alone soulmates, via Last.fm is not the norm. Last.fm emerged as a weak but meaningful component of relationships.

Participants reported far fewer friends on Last.fm than studies have found in other SNSs (e.g. Baron 2008; Ellison *et al.* 2007). On average, the development of Last.fm friendships was below the midpoint of the scale, suggesting moderately weak ties. Still, those who used Last.fm to communicate with their partner were more likely to have more developed relationships even if they met on site, suggesting the site's potential to contribute to relational development or to buttress already-strong relationships with an additional means of connection.

One purpose of this study was to determine the relative role of homophily in SNS relationships. Friendship pairs most often shared musical taste and were similar in age. Yet, they were often from different geographical regions; only 21 per cent lived in the same town as their Last.fm friend and 41 per cent lived in another country. They were equally likely to be cross-sex or same-sex pairs, adding further evidence to others' claims (e.g. Parks & Roberts 1998) that the internet may foster more cross-sex friendships than face-to-face interaction given the relative paucity of cross-sex friendships offline (Kalmijn 2002). Cross-sex partners were also the only pairs most likely to meet on Last.fm and communicate exclusively through the site.

One might predict that shared musical taste would predict relational development given the subcultural identities tied up in music. Shared taste motivated friendship formation and communication through the site, but did not correlate with relational development. This suggests that shared interests in SNSs may trigger new connections and interactions, but that such specialized relationships remain weak unless they are extended beyond the site.

We found two main group differences. North Americans were more likely to have met friends on Last.fm than were Europeans, and, on average, Europeans considered their relationships more developed than did North Americans. Our sample included many respondents from a few countries but small numbers from most nations, meaning that we had to collapse many nations into large regions for analytic purposes. This leaves questions about the significance of this finding, but piques curiosity about how culture shapes interpersonal media use. We also found that older participants and those with older friends were more likely to meet via Last.fm, further suggesting that SNSs may foster relationships across differences that have made friendship creation difficult offline. This finding also suggests that SNSs, and the internet more generally, may be used differently by older adults. We should be wary about assuming that research done with young people generalizes to other age groups.

Our findings strongly support media multiplexity. Relational development was not only positively correlated with the number of media used, but the inclusion of this variable erased the predictive value of all relationship level variables other than cross-sex partnership. Furthermore, each form of online interaction except for chat contributed uniquely to relational development. This points to the importance of differentiating amongst modes of online interaction

even as we consider each part of an integrated whole that includes communication face-to-face and through other media. At the same time, the different ways of communicating through Last.fm collapsed into a single variable, suggesting that at some point fine distinctions in media use may cease to be meaningful.

Conclusion

Our goal was to provide insight into friendship in social network sites and the role of such sites in the communication landscape of relationships. Our findings suggest that the connections launched on site are weak. In order for them to develop, people must communicate through other means as well. The more ways they communicate, the stronger the relationship is likely to be. Whether pairs met on site or off, using the SNS to communicate is associated with higher relational development. This should caution anyone against making strong claims about friendships in SNSs without considering how else partners communicate.

Our study has limitations. The sample is weighted toward those who are heavily involved with Last.fm. For those less involved, the relationships might be weaker still. Sample sizes limited our ability to compare geographic regions. Human subjects concerns prevented us from being able to contrast teens directly with adults. Future research should explore these variables. Finally, we looked at only one SNS. Our findings point to the importance of considering multiple sites in conjunction with one another and with communication offline. We hope others will pursue that route.

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