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Tunes that Bind?: Predicting Friendship Strength in a  
Music-Based Social Network

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Abstract

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.

## Tunes that Bind?: Predicting Friendship Strength in a Music-Based Social Network

Social network sites have become one of the most popular uses of the internet. MySpace consistently ranks among the top web sites in terms of hits, and sites such as Facebook are growing rapidly. Many nations have social network sites that are popular within their borders, yet little known outside of them (for instance, Cyworld in Korea, LunarStorm in Sweden, Arto in Denmark). Many newer social network sites are highly specialized, targeting specific user groups such as Christians, the elderly, knitters, or movie fans. Some of the most provocative questions social network sites raise pertain to the interpersonal relationships developed and maintained via such sites. This paper uses Last.fm, a music-focused and unusually international social network site, to offer a window into the nature of friendship in social network sites and to explore how social network sites fit into the increasingly complex media landscape of interpersonal relationships.

On Last.fm's blog, a staff member (Levy, 2008) recounted the staff's joy at hearing "from two users who had just started a life together." The post explained that "It all started through common musical interests on Last.fm, which led to them becoming friends online, and, over time, to discover that they were true soulmates." Levy used this to introduce that the site is using "the idea of a musical soulmate – someone who shares your most important musical tastes, your loves, likes and dislikes" as a strategy for organizing how it recommends users to one another. Music, this suggests, 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 social network site leads actually does lead to new meaningful relationships and to look more broadly

at how communication and friending via Last.fm map on to other dimensions of personal relationships.

We begin with a discussion of the ambiguous nature of friendship in social network sites. After a brief introduction to Last.fm, we identify four sets of variables known to influence friendship in order to situate the effects of social network sites in the broader context of interpersonal relational development. First we consider homophily (McPherson, Smith-Lovin, & Cook, 2001), the tendency to friend similar others. We then how consider demographic and relational characteristics such as age, gender, and geographic location affect relational internet use. Third, we discuss how online socializing meshes with other forms of interaction. Finally, before presenting the survey and our findings, we turn to research regarding the strength, or extent of development, of online relationships in social network sites and other online media.

### Mediated Friendship

#### **The ambiguity of friendship**

In a loose sense, all interaction on the internet can be considered a form of social networking, but the term “social network site (SNS)” 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 and Ellison, 2007). Friendship provides SNS’s central metaphor, as shared connections labeled “friends” within most sites.

Though they have been shown to increase social capital (Ellison, Steinfield, & Lampe, 2007), SNS friendships have not received unequivocal enthusiasm. Consider, for instance, a recent 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). Much of the concern about friendships in SNSs stems from their ambiguity. Though previous research suggests that *friendship* is a vague term even in offline contexts (Kendall, 2002; Parks, 2007), this ambiguity is enhanced in SNSs that apply the term *friend* to all social relationships enacted on the site (boyd, 2006; boyd & Ellison, 2007; Fono & Reynes-Goldie, 2006; Gross & Acquisti, 2005). For example, though the average Facebook user has approximately 150 friends (Golder, Wilkinson, & Huberman, 2007), Ellison et al (2007) found that Facebook users at one university considered only a third of their friend list to be "actual" friends. This finding, replicated by Baron (2008), raises definitional questions about the remaining two-thirds. Qualitative studies indicate that the meanings of SNS 'friendship' range from social ties that originate offline to efforts to craft public identities by linking to attractive people; some users even add "friends" simply to create a large friend list (boyd, 2006; Fono and Raynes-Goldies, 2006). The research on friending in SNSs 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 SNS based on consumption of a specific entertainment form (e.g. music, movies, television shows,), though they are increasingly common. Hargittai (2007) argues that such research is needed, as different SNSs "may attract different populations and may encourage different activities."

### **Last.fm**

Founded in London in 2005, Last.fm functions as both an SNS and a music recommendation, streaming and, to a lesser extent, downloading service. In May, 2007, when it was bought by CBS Corporation for US\$280 million, Last.fm boasted more than 15,000,000 active users in hundreds of countries. Anyone can stream music through the site. Its millions of

registered users can also download software that tracks all music they listen to on their computer or through personalized radio streams. Each registered user has a profile which displays the most recent songs they have played, and regularly updated charts of their top artists and songs. Users have limited ability to personalize their profiles beyond this – they can select their user picture, write their own content for the “about me” section, create a playlist for others, and create radio stations by tagging music. They cannot modify profile layout, color schemes, fonts or other design elements.

Not all users take advantage of the site’s social network functions. For some, the ability to stream music, keep track of their personal music charts, and receive music recommendations are their sole motivations for using the site. More socially-motivated users mark others as “friends.” Once the friendship is approved by both relational partners, each appears in the others’ publicly visible friends list. Last.fm provides several communication platforms for those interested in using the site socially, including writing publicly-visible messages on one another’s profiles in the “shoutbox”, sending one another private personal messages, and participating in site-wide discussion forums. A quick perusal of the site demonstrates that users vary widely in their use of friending; some have many friends, many have none.

Understanding friendships in Last.fm helps us learn not only about friendship in that site, but also about friendship in SNSs more generally. As it is based on music, Last.fm offers the chance to see how friendships in niche SNS sites may differ from those in other sites, and provides an opportunity to explore the relative impact of shared niche taste in relationship formation and maintenance. Last.fm’s highly multinational user base makes this line of investigation more compelling (Fragoso, 2006; Hargittai, 2007; Kim & Yun, 2007). Because we

have no data on friendships in this sort of SNS, the first set of research questions are aimed at establishing baseline descriptors of Last.fm friendships:

***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 theory and research has long recognized that most people tend to prefer friends that they perceive as similar on a host of demographic and social characteristics (McPherson & Smith-Lovin, 1987; McCroskey, McCroskey, & Richmond, 2005). Likewise, research about online friendship formation has emphasized the importance of shared interest in many of the internet's social forums, noting that this creates a platform of similarity on which users build new relationships (McKenna & Bargh, 2000; McKenna, Green & Gleason, 2002; Parks & Floyd, 1996). Most SNSs foreground interests in profile self presentations by including pre-determined taste categories which users can fill in on their profiles (e.g. Heer and boyd, 2007; Liu, Maes and Davenport 2006; Liu, 2007). Shared musical taste is an important element of Last.fm's design, as the site recommends both music and potential friends (people they call "neighbours") based on overlapping listening habits.

Despite this theoretical argument for the importance of homophily in online friendships, empirical evidence for the role of shared taste in predicting relationships in SNSs is mixed. Some studies report that SNS friendships demonstrate homophily in shared relationships and ethnicity (Adamic, Büyükkökten, & Adar, 2003; boyd & Heer, 2006; Hargittai, 2007). In contrast, Liu (2007) examined 127,477 MySpace profiles and found that rather than matching the interests of

their friends, “on average, MySpace users tended to differentiate themselves from their friends, rather than identifying with their friends' tastes.” Liu argues that this could stem from the need to differentiate one’s self in order to have an identity. Alternatively, SNSs (and, more generally, the internet) may offer the means to create relationships across differences that constrain the development of face-to-face friendships (e.g., crossing difference in age, sex, or nationality). Following previous theory and these conflicting findings, the second set of research questions probe the role of homophily in Last.fm friendships.

***Research Question 2: To what extent are Last.fm friendships characterized by homophily?***

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

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 geographic location?

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

**Demographic Variation in Online Friendships**

The use of the internet for relational purposes varies across populations. Three particularly salient factors are age, gender, and geography. Much of the academic research and popular discourse about SNSs has focused on young people, reflecting concern that SNS use may threaten young people’s well-being (see Marvin, 1988, for a historical comparison). Such work is clearly important, but not sufficient. The lack of research on older populations means that we do not know if young people differ from older people in the ways they use SNSs relationally. Despite the potential importance of age differences, they have not been systematically investigated in previous empirical research.

In contrast, we know a good deal about the role of gender. Several studies report that women are more likely to use a variety of internet technologies for relational purposes (Boneva

& Kraut, 2002; Gilbert et al., 2008; Lampe, Ellison & Steinfield, 2007; Pew, 2000) and enjoy online communication more than do men (McKenna et al., 2002). Relatedly, Gilbert, Karahalios, and Sandvig (2008) also found that both sexes have more female than male MySpace friends. Furthermore, cross-sex friendships may be more likely to occur online (Parks & Roberts, 1998) and be of higher quality than same-sex online friendships when they do (Chan & Cheng, 2004).

A third important demographic factor is the geographical proximity of relational partners. Email seems to be particularly useful in sustaining long distance relationships (Baym, Zhang & Lin, 2004; Chen, Boase, & Wellman, 2002; Dimmick, Kline & Stafford, 2000; Quan-Haase, Wellman, Witte, & Hampton, 2002), though these studies also reported that online communication is widely used in local relationships. Golder et al (2007) reported that slightly more Facebook messages were exchanged between students at the same university than different universities, and Ledbetter (in press) found no difference in the association between online relational maintenance behaviors and friendship closeness when comparing local and long-distance friends. In contrast to the foci of these studies, Last.fm encourages connections between geographically distant others who might not otherwise meet, and hence forms an important context in which to further explore these issues.

There are also international and ethnic differences in the use of online communication for personal relationships. In contrast to the US, Catalonians rarely use the internet to communicate with their friends and neighbors (Wellman et al., 2003). Research in different Los Angeles ethnic communities (Matei & Ball-Rokeach, 2002) found that Korean and Chinese residents were more likely than those from other cultural backgrounds to form new friendships online. Last.fm's internationalism offers the opportunity to compare this across geographical regions. Based on

this previous research, our third and fourth research questions examine how demographic variables are associated with Last.fm friendship behavior:

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

***Research Question 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 empirical research and theoretical development has emphasized how internet use fits into everyday communication across multiple media (Baym, Zhang, & Lin, 2004; Baym, Zhang, Kunkel, Ledbetter, & Lin, 2007; Haythornthwaite, 2005; Haythornthwaite & Wellman, 2002; Katz & Rice, 2002; Ledbetter, in press). 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 how different kinds of internet use (e.g. chat, email, web boards) fit with one another as the internet has generally been treated as a single medium. Our fifth set of research questions thus ask:

***Research Question 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**

As the quote about MySpace suggests, many worry about the quality of SNS friendships. 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 relationships (e.g. Wellman & Gulia, 1999). Ellison et al (2007) demonstrated that many Facebook friendships are weak ties, arguing that Facebook enables “participants to capitalize on weak ties (such as ‘friending’ a friend of a friend) and convert latent ties to weak ties (such as looking up the profile of someone in a shared class . . .).” 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) has called *media multiplexity*. She posited that weak tie relationships rely on passive interaction opportunities; conversely, strong tie relationships use multiple means of communication, proactively seeking private person-to-person communication (Haythornthwaite, 2005). The language of tie strength is grounded in sociology. Communication scholars talk more often in terms of “relational development,” conceptualizing relationships as ongoing processes that change along several dimensions as they grow closer. This approach is consistent with the strong/weak tie approach, although it emphasizes how weaker ties may develop into stronger ones and pays less attention to the meaningful rewards weak ties provide. Furthermore, though media multiplexity suggests that more developed relationships

communicate via more media, the 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 address the issue of relational development.

***Research Question 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 been friends 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.* Ideally, these questions would be addressed by randomly sampling all Last.fm users, but this was not possible as there was no way to directly contact users outside of the site. A random sampling of users online at any given time, or of user profiles, would have been distorted as the former are likely to be particularly heavy users and the latter likely to log on so rarely as to never see the solicitation. Furthermore, on-site direct solicitation would have been considered spam. Therefore, with the approval of Last.fm's management, the first author posted an announcement of the survey to the two site-wide general discussion forums. One of the site's

most visible staff-members then posted an endorsement and “stickied” the thread so that it always appeared at the top of the list of forum threads, regardless of how many new threads were added. To spread the sample more widely, the last page of the survey urged those who had completed it to recruit others. Several respondents posted notices of the survey in their own profiles, in groups of which they were members, and in notes left on others’ profiles.

The survey was active for six weeks. In that time there were 701 respondents. After deleting minors, those who had not answered all questions, and those who reported having no friends, there were 559 respondents (355 male, 204 female). Participant age ranged from 18 to 57 years ( $m = 25.98$ ,  $sd = 8.16$ ). Length of Last.fm usage ranged from zero to 60 months ( $m = 18.35$ ,  $sd = 10.91$ ). Participants reported 48 countries of residence, with the most common being the United States ( $n = 165$ , 29.5%), the United Kingdom ( $n = 101$ , 18.1%), Germany ( $n = 33$ , 5.9%), Australia ( $n = 27$ , 4.8%), Canada ( $n = 26$ , 4.7%), the Netherlands ( $n = 24$ , 4.3%), Poland ( $n = 19$ , 3.4%), and Finland ( $n = 18$ , 3.2%). 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 very diverse, but skewed. In comparison to internal statistics provided by Last.fm, respondents are a particularly heavily involved subset of users. On average, they are older, have been using the site longer, are far more likely to be paid subscribers, and have considerably more Last.fm friends than the average Last.fm user. The data and analyses that follow should be seen as representing the views of those Last.fm users who are most interested in using Last.fm for social and relational purposes, rather than those of the average user of the site.

*Procedures.* While taking the survey, participants were instructed 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 order of the friend list every time the profile is loaded, this permitted

random selection of a specific Last.fm friend and helped to compensate for the nonrandom sampling of participants. Respondents were told to answer all questions about their Last.fm friendship with this friend in mind.

*Demographic characteristics.* Participants reported whether they were female or male, specified their age, and indicated their country of residence. Country of residence was measured via a list of 25 countries, with an additional response option for ‘other’ nations not on the list. Given the small number of participants reporting from several nations, several responses were recoded to reflect four broader geographic regions. This recoded variable reflected whether the participant lived in the United States and/or Canada ( $n = 191$ , 34.5%), the United Kingdom ( $n = 101$ , 18.1%), another European nation ( $n = 188$ , 33.6%), or other nation ( $n = 77$ , 13.8%). Participants also reported how many friends they had on Last.fm.

*Friendship characteristics.* A dichotomous measure assessed whether or not the friendship originated on Last.fm, with a slim majority ( $n = 295$ , 52.8%) reporting that the friendship had originally started elsewhere. Participants also reported how long they had been Last.fm friends 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 2 years ago. These response options reflect that Last.fm began in 2005, and thus friendship links more than two years old would be quite rare.

*Shared musical taste.* Using two questions measured on a 5-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 the formation of their Last.fm friendship. These two items demonstrated acceptable internal reliability (Cronbach’s  $\alpha = .87$ ), and thus were averaged into a single indicator of shared musical taste.

*Media use.* Participants were presented with a list of communication media frequently used in personal relationships, including instant messaging, chat, email, messages on another website, telephone calls, telephone text messages, face-to-face conversation, and postcards or letters. Participants checked which of these 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. 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 these five items were averaged to produce a single variable indicating frequency of Last.fm communication.

*Relational development.* We used Chan and Cheng’s (2004) modified version of Parks and Roberts’ (1998) 18-item instrument to assess relational development. We chose this scale for its proven validity and reliability in both face-to-face and online contexts and in order to make our findings compatible with other studies. 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 internal 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 these dyads had been Last.fm friends (RQ1c). Descriptive statistics reveal that 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% 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 participants reported on, approximately half began on Last.fm ( $N = 263$ , 47.1%) and half did not ( $N = 295$ , 52.9%). Most of these pairs had linked to each other on Last.fm relatively recently, within the last month ( $N = 51$ , 9.1%), the past one to three months ( $N = 124$ , 22.2%), the past three to six months (44.1%), or the past six to twelve months ( $N = 111$ , 19.9%); only a small number of participants reported linking to their partners one to two years ago ( $N = 26$ , 4.7%).

The second set of research questions investigated homophily in four domains: age (RQ2a), sex (RQ2b), geographic location (RQ2c), and shared musical interests (RQ2d). Though several participants did not report their friend's age ( $n = 89$ , 15.9%), among those who did, participant age and friend age were strongly correlated,  $r = .55$ ,  $p < .01$ . The chi-square statistic revealed no significant association between participant sex and friend sex,  $\chi^2 = 0.24$ ,  $p > .05$ . On geographic distance, a plurality of participants reported living in another country ( $N = 226$ , 40.5%), though several reported living in the same country ( $N = 142$ , 25.4%), the same region of

a country ( $N = 57$ , 10.2%), or the same town ( $N = 90$ , 16.1%), with a handful of participants reporting that they lived in the same neighborhood as their friend ( $N = 27$ , 4.8%). Friendship pairs were likely 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,  $t(557) = 5.40$ ,  $p < .01$ .

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 (as well as musical taste) 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) revealed that number of friends did not differ across the four general geographic regions,  $F(3, 515) = 1.48$ ,  $p > .05$ . In contrast, several demographic characteristics 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 positively associated with meeting on Last.fm. Probing the sex finding revealed that cross-sex friends were more likely to meet on Last.fm ( $r = .26$ ,  $p < .01$ ). An univariate ANOVA revealed a significant difference between geographic regions on whether friends met on Last.fm,  $F(3, 554) = 3.28$ ,  $p < .05$ , partial  $\eta^2 = .02$ , with Tukey post hoc tests indicating that Americans were significantly more likely to have met friends on Last.fm than Europeans (mean difference = 0.15,  $p < .05$ ).

The next set of research questions addressed the extent to which Last.fm friendships are characterized by the use of multiple media. The first two research questions in this set asked

about the frequency of use of various media (RQ5a) and the extent to which use of one medium is associated with use of other media (RQ5b). As Table 1 indicates, participants were most likely to communicate with their friend outside of Last.fm via IM ( $n = 235$ ; 42.0%), other websites ( $n = 194$ ; 34.7%), face-to-face ( $n = 187$ ; 33.55%), and e-mail ( $n = 175$ ; 31.3%). Friends reported using a mean of 2.13 media other than Last.fm ( $SD = 2.23$ ), though several participants indicated that Last.fm was their only form of communication with their friend ( $n = 177$ ; 31.5%). Almost all correlation coefficients amongst the 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. Table 2 presents these associations. 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 relational development scale (0 = minimum, 4 = maximum), with a 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 geographic location in the United States, the United Kingdom, Europe, or other country, (b) the participant's sex, (c) the friend's sex, and (d) the participant's 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, explaining only 4.2% of the variance. Within this step, only the variable contrasting the United States 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 the United States ( $M = 1.63, SD = 0.95$ ). Participant age approached significance as an inverse predictor of relational development,  $t = -1.83, p < .07$ .

The second step entered variables assessing relational characteristics of the dyad, including (a) how long ago they became friends on Last.fm, (b) whether they first met on Last.fm, (c) the friend's geographic location, (d) whether the friends were a same-sex or cross-sex dyad, and (e) shared musical taste. Entering these variables produced a significant change in variance explained,  $\Delta F(4, 536) = 29.26, p < .01$ , increasing the total variance explained to 21.4%. Univariate results indicated that four relational variables significantly predicted relational development, with heightened relational development associated with longer Last.fm friendships, friendships that did not meet on Last.fm, friends with closer geographic proximity, and cross-sex friendships (see Table 3).

The third step entered eight dichotomous variables indicating whether the dyad communicated using a specific medium, 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,  $\Delta F(8, 528) = 64.06, p < .01$ , greatly increasing the variance explained to 60.1%. Univariate analyses revealed that all media use variables significantly predicted relational closeness with the exception of chat, which approached but did not achieve statistical significance (see Table 3). It is also worth noting that, with the exception of being cross-sex friends, no relationship-level predictors were significant in this step, despite being so in the second step. Thus, it appears that these relationship-level predictors do not significantly predict relational closeness when communication media use is taken into account.

The fourth and final step tested whether communicating via Last.fm explained variance beyond that already explained by demographic, relational, and communicative variables. Only frequency of Last.fm communication was entered in this step, significantly increasing the variance explained to 64.2%,  $\Delta F(1, 527) = 60.98, p < .01$ . 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, whether the friends met through Last.fm, and whether the friends were same-sex or cross-sex friends (see Table 3). Interestingly, meeting through Last.fm was not a significant predictor in the third step. Thus, it seems that both meeting through Last.fm and frequency of Last.fm contact predict relational closeness when both variables are taken into account.

## Discussion

We began the paper with Last.fm's announcement that they were using the concept of "musical soulmates" to rework their neighbours algorithm. Though they used the language of romantic love to describe the match between two people with shared musical taste, the evidence from our study suggests that finding close relationships, let alone true love, via Last.fm is far from the norm. In general, Last.fm emerged as a weak but meaningful component of relationships. Participants reported having far fewer friends on Last.fm than previous studies have found in other SNSs (e.g. Baron, 2008; Ellison et al, 2007). Furthermore, despite some strong relationships -- including an engaged couple who had met on the site and a parent/child pair -- on average, the development of Last.fm friendships was below the midpoint of the scale, suggesting moderately weak ties. At the same time, though, those who used Last.fm to communicate with their partner were more likely to have more developed relationships, suggesting the potential of the site 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 relationship formation and development. We found that friendship pairs most often shared musical taste and were similar in age. On the other hand, they were often from different geographical regions, with only 21% living in the same town as their Last.fm friend and 41% living in another country. They were also as likely to be cross-sex and 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 affords. This conclusion is furthered by our finding that cross-sex pairs were the only group most likely to meet on Last.fm and communicate exclusively through the site.

Though one might predict that shared musical taste would predict friendship strength given the subcultural identities tied up in music, we found that shared taste motivated friendship formation on the site and communication through the site, but did not correlate with greater relational development. This suggests that shared interests in SNSs may trigger new connections and interactions, but that such specialized relationships may remain weak unless they are extended beyond the site. This would be in keeping with arguments such as Wellman and Gulia (1999) that the internet fosters specialized weak ties.

We found two main demographic differences in friendships. Regarding geographical region, 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 Americans. The small number of people from other regions, and the fact that we were forced to collapse many nations into single variables leave more questions than answers about the significance of this finding, but it piques curiosity about the roles of culture in shaping interpersonal internet use for future research to address. We also found that older participants and those with older friends were more likely to have met via Last.fm, suggesting that the internet may indeed foster relationships across lines 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 who may meet fewer new people and have less access to those with similar tastes in offline life. We should be wary about assuming that research done with teenage or college-aged young people generalizes to other age groups.

Our most important findings may be those related to media multiplexity, a theory which these data strongly support. In our analysis, relational development was not only positively correlated with the number of media used, but the inclusion of this variable also 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 disaggregating the internet and considering each mode of online interaction separately. The fact that all forms of interaction via Last.fm collapsed into a single variable, however, suggests that there may be limits to such disaggregation.

### Conclusion

Our goal in this paper was to provide insight into the nature of friendship in social network sites and the role of such sites in the broader communication landscape of their friendships. Our findings suggest that SNSs may launch new connections, but that in order for these to develop into richly developed relationships, people must communicate through other means as well. Indeed, the more ways they communicate, the stronger the relationship is likely to be. Communicating via SNSs, whether one met on the site or off, is related to relational strength, however, suggesting that fears of SNSs lessening the value of friendship are misplaced. If anything, our findings suggest that ties on SNSs are just one piece of relationships that are connected in many other ways as well. This should caution anyone against making strong claims about friendships in SNSs without considering the other ways in which partners communicate.

Our study is not without limitations. The sample is weighted toward those who are heavily involved with the site. This may mean that for those who are less involved, the relationships would, on average, be weaker. We also were limited in our ability to compare geographic regions, and human subjects concerns prevented us from being able to contrast teens directly with adults. Future research should explore these variables more fully. 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 that this paper will inspire others to do just that.

## References

Adamic, L. A., Büyükkökten, O. & Adar, E. (2003) 'A social network caught in the Web', *First Monday*, vol. 8, no. 6.

[http://www.firstmonday.org/issues/issue8\\_6/adamic/index.html](http://www.firstmonday.org/issues/issue8_6/adamic/index.html) [August 27, 2008].

Baron, N. (2008) *Always On: Language in an Online and Mobile World*, New York, Oxford.

Baym, N., Zhang, Y. B. & Lin, M. (2004) 'Social interactions across media: interpersonal communication on the internet, telephone, and face-to-face', *New Media & Society*, vol. 6, no. 3, pp. 299-318.

Baym, N. K., Zhang, Y. B., Kunkel, A., Ledbetter, A. & Lin, M.-C. (2007) 'Relational quality and media use in interpersonal relationships', *New Media & Society*, vol. 9, no. 5, pp. 735-752.

Boneva, B. & Kraut, R. (2002) 'Email, gender, and personal relationships', in *The Internet in Everyday Life*, ed. B. Wellman & C. Haythornthwaite, Blackwell, Malden, MA, pp. 404-430.

boyd, d. m. & Ellison, N. B. (2007) 'Social network sites: Definition, history, and scholarship', *Journal of Computer-Mediated Communication*, vol. 13, no. 1.

<http://jcmc.indiana.edu/vol13/issue1/boyd.ellison.html> [August 27, 2008].

boyd, d. (2006) 'Friends, Friendsters, and Top 8: Writing community into being on social network sites', *First Monday*, vol. 11, no. 12.

[http://www.firstmonday.org/issues/issue11\\_12/boyd/](http://www.firstmonday.org/issues/issue11_12/boyd/) [August 27, 2008]

Chan, D. K. S. & Cheng, G. H. L. (2004) 'A comparison of offline and online friendship qualities at different stages of relationship development', *Journal of Social and Personal Relationships*, vol. 21, no. 3, pp. 305-320.

Chen, W., Boase, J. & Wellman, B. (2002) 'The global villagers: Comparing internet users and uses around the world', in *The Internet in Everyday Life*, ed. B. Wellman & C. Haythornthwaite, Blackwell, Malden, MA, pp. 74-113.

Dimmick, J., Kline, S. L. & Stafford, L. (2000) 'The gratification niches of personal e-mail and the telephone: Competition, displacement, and complementarity', *Communication Research*, vol. 27, no. 2, pp. 227-248.

Donath, J. (2007) 'Signals in social supernets', *Journal of Computer-Mediated Communication*, vol. 13, no. 1. <http://jcmc.indiana.edu/vol13/issue1/donath.html> [August 27, 2008]

Ellison, N., Steinfield, C. & Lampe, C. (2007) 'The benefits of Facebook "friends": Exploring the relationship between college students' use of online social networks and social capital', *Journal of Computer-Mediated Communication*, vol. 12, no. 3. <http://jcmc.indiana.edu/vol12/issue4/ellison.html> [August 27, 2008].

Fono, D., & Raynes-Goldie, K. (2006) 'Hyperfriendship and beyond: Friends and social norms on LiveJournal', in *Internet Research Annual Volume 4: Selected Papers from the AOIR Conference*, ed. M. Consalvo & C. Haythornthwaite, Peter Lang, New York, pp. 91-103.

Fragoso, S. (2006) 'WTF a crazy Brazilian invasion', in *Proceedings of CATaC 2006*, ed. F. Sudweeks & H. Hrachovec, Murdoch University, Murdoch, Australia, pp. 255-274.

Gilbert, E., Karahalios, K. & Sandvig, C. (2008) 'Red space, blue space: The impact of rural life on social software', CHI, Florence, Italy.

Golder, S. A., Wilkinson, D. & Huberman, B. A. (2007) 'Rhythms of social interaction: Messaging within a massive online network', in *Proceedings of Third International Conference on Communities and Technologies*, ed. C. Steinfield, B. Pentland, M. Ackerman & N. Contractor, Springer, London, pp. 41-66.

Gross, R. & Acquisti, A. (2005) 'Information revelation and privacy in online social networks', in *Proceedings of WPES'05*, ACM, Alexandria, VA, pp. 71-80.

Hargittai, E. (2007) 'Whose space? Differences among users and non-users of social network sites', *Journal of Computer-Mediated Communication*, vol. 13, no. 1. <http://jcmc.indiana.edu/vol13/issue1/hargittai.html> [August 27, 2008].

Haythornthwaite, C. & Wellman, B. (2002) 'The internet in everyday life: An introduction', in *The Internet in Everyday Life*, ed. B. Wellman & C. Haythornthwaite, Blackwell, Malden, MA, pp. 3-41.

Haythornthwaite, C. (2005) 'Social networks and internet connectivity effects', *Information, Communication, & Society*, vol. 8, no. 2, pp. 125-147.

Heer, J. & boyd, d. (2005) 'Vizster: Visualizing online social networks', in *Proceedings of Symposium on Information Visualization*, IEEE, Minneapolis MN, pp. 33-40.

Henry, F. (2007). 'How do you define a friend?', *Newhouse News Service*, 15 January [accessed through Lexis-Nexis, September 28, 3007].

Katz, J. E. & Rice, R. E. (2002) 'Project Syntopia: Social consequences of internet use', *IT & Society*, vol., no.1, pp. 166-179.  
<http://www.stanford.edu/group/siqss/itandsociety/v01i01/v01i01a11.pdf#search=%27The%20Syntopia%20Project%27> [August 27, 2008]

Kendall, L. (2002) *Hanging Out in the Virtual Pub: Masculinities and Relationships Online*, University of California Press, Berkeley, CA.

Kim, K.-H. & Yun, H. (2007) 'Cying for me, Cying for us: Relational dialectics in a Korean social network site', *Journal of Computer-Mediated Communication*, vol. 15, no. 1.  
<http://jcmc.indiana.edu/vol13/issue1/kim.yun.html> [August 27, 2008].

Lampe, C., Ellison, N. & Steinfeld, C. (2007) 'A familiar Face(book): Profile elements as signals in an online social network', in *Proceedings of Conference on Human Factors in Computing Systems*, ACM Press, New York, pp. 435-444.

Ledbetter, A. M. (in press) 'Family communication patterns and relational maintenance behavior: Direct and mediated associations with closeness in friendships', *Human Communication Research*.

Levy, M. (2008, 22 August). Musical Soulmates. Last.fm blog,  
<http://blog.last.fm/2008/08/22/musical-soulmates>.

Liu, H. (2007) 'Social network profiles as taste performances', *Journal of Computer-Mediated Communication*, vol. 13, no. 1. <http://jcmc.indiana.edu/vol13/issue1/liu.html> [August 27, 2008].

Liu, H., Maes, P. & Davenport, G. (2006) 'Unraveling the taste fabric of social networks', *International Journal on Semantic Web and Information Systems*, vol. 2, no. 1, pp. 42-71.

Marvin, C. (1988) *When Old Technologies Were New*, Oxford, New York.

Matei, S. & Ball-Rokeach, S. (2002) 'Belonging in geographic, ethnic, and Internet spaces', in *The Internet in Everyday Life*, ed. B. Wellman & C. Haythornthwaite, Blackwell, Malden, MA, pp. 404-430.

McCroskey, J. C. & Young, T. J. (1979) 'The use and abuse of factor analysis in communication research', *Human Communication Research*, vol. 5, no. 4, pp. 375-382.

McCroskey, L. L., McCroskey, J. C. & Richmond, V. P. (2005) 'Analysis and improvement of the measurement of interpersonal attraction and homophily', *Communication Quarterly*, vol. 54, no. 1, pp. 1-31.

McKenna, K. Y. A. & Barge, J. A. (2000) 'Plan 9 from cyberspace: The implications of the internet for personality and social psychology', *Personality and Social Psychology Review*, vol. 4, no. 1, pp. 57-75.

McKenna, K. Y. A., Green, A. S. & Gleason, M. E. J. (2002) 'Relationship formation on the Internet: What's the big attraction?', *Journal of Social Issues*, vol. 58, no. 1, pp. 9-31.

McPherson, M., Smith-Lovin, L. & Cook, J. (2001) 'Birds of a feather: Homophily in social networks', *Annual Review of Sociology*, vol. 27, pp. 415-444.

Parks, M. R. (2006) *Personal Relationships and Personal Networks*. Lawrence Erlbaum.

Parks, M. R. & Floyd, K. (1996) 'Making friends in cyberspace', *Journal of Communication*, vol. 46, no. 1, pp. 80-97.

Parks, M. R. & Roberts, L. D. (1998) "'Making MOOsic": The development of personal relationships on line and a comparison to their offline counterparts', *Journal of Social and Personal Relationships*, vol. 15, no. 4, pp. 517-537.

Pew (2000) 'Tracking Online Life: How Women Use the Internet to Cultivate Relationships with Family and Friends', Pew Internet and American Life Project, Washington, DC. [http://www.pewinternet.org/report\\_display.asp?r=11](http://www.pewinternet.org/report_display.asp?r=11) [August 27, 2008].

Quan-Haase, A., Wellman, B., Witte, J. & Hampton K. N. (2002) 'Capitalizing on the net: Social contact, civic engagement, and sense of community', in *The Internet in Everyday Life*, ed. B. Wellman & C. Haythornthwaite, Blackwell, Malden, MA, pp. 291-324.

Wellman, B. & Gulia, M. (1999) 'Virtual communities as communities: Net surfers don't ride alone', in *Communities in Cyberspace*, ed. M. Smith & P. Kollock, Routledge, New York, pp. 167-194.

Wellman, B., Quan-Haase, A. Q., Boase, J., Chen, W., Hampton, K., de Diaz, I. I. & Miyata, K. (2003) 'The social affordances of the Internet for networked individualism', *Journal of Computer-Mediated Communication*, vol. 8, no. 3. <http://jcmc.indiana.edu/vol8/issue3/wellman.html> [August 27, 2008].