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Social Connectivity in America: Changes in Adult Friendship Network Size From 2002 to 2007

Hua Wang[1] and Barry Wellman[2]

Abstract

There is some panic in the United States about a possible decline in social connectivity. The authors used two American national surveys to analyze how changes in the number of friends are related to changes in Internet use. The authors found that friendships continue to be abundant among adult Americans between the ages of 25 to 74 and that they grew from 2002 to 2007. This trend is similar among Internet nonusers, light users, moderate users, and heavy users and across communication contexts: offline, virtual only, and migratory from online to offline. Heavy users are particularly active, having the most friends both online and offline. Intracohort change consistently outweighs cohort replacement in explaining overall growth in friendship.

Keywords

Internet use, friendship, network size, social connectivity, social isolation

Americans are in a panic that social connectivity has drastically declined in the United States. Even though most Americans increasingly use the Internet to connect with others, the media, the public, and even some scholars blame it for pulling Americans away from friends, neighbors, and civic involvement. Fueled by limited evidence this tizzy has mostly been a media panic as scholars have repeatedly shown that the Internet and social relationships are intertwined. Yet, the Internet—and Americans' use of it—is changing rapidly in the first decade of the 21st century. We believe that our research

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sheds light on how social connectivity is changing with it, and we use evidence from two American national surveys of adults to consider the following questions:

Has the number of friends changed in recent years?
Is the extent of Internet use associated with the extent of these friendships?

The Recurrent Panic About Social Isolation in America

Has Social Connectivity Declined? A Perennial Question

Panic about the decline of social connectivity is an old story. Commentators have offered different reasons, ranging from industrialization, capitalism, socialism, urbanization to bureaucratization (for reviews, see Chua, Madej, & Wellman, forthcoming; Wellman, 2001a). Some have blamed technology, especially since the invention and diffusion of trains, cars, telephones, radios, and televisions (e.g., Berger, 1979; Cowan, 1999; Fischer, 1982; Marvin, 1988; Marx, 1964; Wellman & Leighton, 1979). For example, Putnam (2000) looked back nostalgically from the 1990s to the 1960s and argued that Americans were "bowling alone" because television watching was keeping people from community involvement. Likewise, in the 1960s, Stein (1960) and Nisbet looked back to the 1930s and mourned the decline of social connectivity. Yet in the 1930s, Wirth (1938) looked to preurban America and worried about the loss of social connectivity in transitory urban life.

More recently, McPherson, Smith-Lovin, and Brashears (2006) used the U.S. General Social Survey data to warn, yet again, about the loss of social connectivity. They showed that the average number of people with whom adult Americans discussed "important matters" decreased 28% in two decades: from 2.9 in 1985 to 2.1 in 2004. In addition, they reported that Americans' close confidants shifted away from friends and neighbors and toward close kin and spouses and that the percentage of the sample who reported having a friend as a confidant had decreased from 73% to 51%. Although the authors were cautious in reporting a significant downward change (cf. Fischer, 2009; McPherson et al., 2009), release of their findings nonetheless led to the return of yet another media panic over the quality of people's personal and communal lives. Within days of the article's appearance, a *Washington Post* columnist asserted that "by some reckoning, social isolation is as big a risk factor for premature death as smoking" and blamed it on the Internet (Mallaby, 2006, p. A21).

Despite these contentions, there has been continuing ethnographic and survey evidence of the abundance of supportive ties with friends and neighbors (e.g., Fischer, 1982; Gans, 1962, 1967; Wellman, 1979; see review in Wellman, 2001a). In this vein, Spencer and Pahl's British study (2006) argued against the pessimistic view of a society made of isolated, self-absorbed individuals. The authors concluded that friendship still functions as a social glue of contemporary Western societies through various forms of personal communities that are often invisible and unconscious to many. More recently, a 2009 U.S. national survey found that only 6% of Americans have no significant other

available to discuss important matters. Those authors concluded that the extent of social isolation has hardly changed since 1985 (Hampton, Sessions, Her, & Rainie, 2009).

What Has the Internet Done to Social Connectivity?

In the past decade, the Internet has become the hot topic in the debate about social isolation and connectivity in America. It started in 1998 when Kraut and colleagues asserted an Internet paradox, claiming a decline in social involvement and an increase in loneliness and depression among a group of Internet newbies. When the *New York Times* made this front-page news (Harmon, 1998), the media panic was on. Nie and associates (e.g., Nie & Hillygus, 2002) used the time diaries of Internet users to support the disconnection claim. Yet, both studies looked only at newbies coming to grips with computers.

The 2006 McPherson et al. article rekindled the media panic. Several pundits accused Internet use of producing a closed generation of social isolates who are comfortable only in front of computer screens (e.g., Cornish, 2006; Fountain, 2006; Vedantam, 2006). In his World Communications Day message, Pope Benedict XVI (2009) recognized the power and value of the Internet for spreading information but warned that people need to get away from their computers and meet in person. British media commentator Sigman (2009) went further, arguing that because individuals were staying indoors while online, they were not encountering a range of people in person; as such, this lack of diverse contact could compromise immune function, increasing morbidity and mortality.

Although these negative assertions were widely publicized, they did not provide systematic evidence. By contrast, there is abundant, consistent, and systematic evidence showing a positive association between Internet use and contact with friends. To their credit, Kraut and associates (2002) retracted their original contention of social isolation as the onetime newbies became more comfortable with computer use and more engaged in the rapidly evolving Internet. Concomitantly, a variety of studies—from U.S. national surveys to in-depth case studies—have shown that the addition of the Internet and mobile phone communication to traditional face-to-face and phone contact means that there is more overall communication between friends and relatives now than before. The reason is that computer-mediated communication has become cheaper, quicker, and much more efficient than visiting, telephoning, or writing letters the old-fashioned pen-to-paper way (Boase, Horrigan, Wellman, & Rainie, 2006; Chen, Boase, & Wellman, 2002; Collins & Wellman, 2010; Hampton et al., 2009; Katz & Rice, 2002; Quan-Haase & Wellman, 2002; Stern, 2008). Studies have shown the following:

- For most Americans, the time they spend with friends since they started using the Internet has, at a minimum, remained the same—some report an increase, only a few report a decrease (Center for the Digital Future, 2008; Katz & Aspden, 1997).

- The more people use the Internet, the more social contact they have with their friends (Cole & Robinson, 2002; Hampton et al., 2009; Howard, Rainie, & Jones, 2002; Kraut et al., 2002; Quan-Haase et al., 2002; Shklovski, Kiesler, & Kraut, 2006; Shklovski, Kraut, & Rainie, 2004).
- Rather than replacing in-person and telephone connectivity, the Internet adds to it by developing and maintaining ties between meetings, both local and long distance (Baym, Zhang, & Lin, 2004; Boase et al., 2006; Carrasco, Hogan, Wellman, & Miller, 2008; Cummings, Lee, & Kraut, 2006; Hampton et al., 2009; Hampton & Wellman, 2003; Mok, Wellman, & Carrasco, 2010; Quan-Haase et al., 2002; Shklovski, Kraut, & Cummings, 2008).
- The Internet provides opportunities for forming and developing new friendships that usually continue in person and by telephone (Bargh & McKenna, 2004; Di Gennaro & Dutton, 2007; Hampton et al., 2009; Parks & Floyd, 1996; Rice, Sheperd, Dutton, & Katz, 2007).
- Compared to nonusers, Internet users may have more—and more diverse—friends than nonusers (Boase, et al., 2006; Hampton, et al., 2009). For example, a 2004 Pew survey about Americans' socially close ties with friends and relatives showed that Internet users had a median of 37 in their networks, as compared with 30 for the nonusers, and the number of Americans relying on the Internet for major life decisions had increased by one-third since 2002 (Boase et al., 2006).

How Have Internet Use and Friendship Changed in This Decade?

The saying "An Internet year is like a dog year" highlights the fast pace of Internet development. For example, in 2000, 67% of Americans had Internet access, but only 16% were broadband users; by 2008, 80% of Americans were Internet users, and fully 69% were broadband users (Center for the Digital Future, 2009). Broadband has brought more than speed. It has allowed people to leave their computers on all day instead of intermittently dialing up, thereby affording the opportunity for spontaneous communication. It has fostered not only the development of Web 2.0, where people can communicate collaboratively via the Internet, but also the explosive growth of social network sites such as MySpace and Facebook (Jones & Fox, 2009). These changes in the Internet may have affected friendship: perhaps for the worse (i.e., they may be giving more reason to stay online and avoid contact with friends), perhaps for the better (i.e., they may be providing more ways to contact existing friends, make new friends, and strengthen ties).

Building on Existing Studies

We build on the aforementioned studies on the Internet, friendship, and social connectivity in five ways. First, assertions about the decline of friendship and social

connectivity have either been free of data (exhibiting a Colbertian "truthiness") or limited to extremely close ties, earlier Internet eras, or atypical newbies. By contrast, we studied a large sample of adult Internet users and a much broader set of social ties.

Second, with rare exceptions, most of these studies are based on data from cross-sectional surveys that interviewed participants at only one time. Therefore, researchers have not been able to detect changes in friendship networks over time and relate those changes to Internet use and other factors. In this study, we compared 2002 and 2007, a time span when Internet use expanded and diversified.

Third, few studies focused on the size of social networks. Even when they did, friends were often bundled with other types of interpersonal relationships, such as kin. We focused on changes in the size of friendship networks, given that friendship is more likely to be sensitive to social changes.

Fourth, most studies simply compared all Internet users with nonusers. Yet, Internet use has expanded to the great majority of American adults. Hence, we made comparisons based on the extent of Internet use, and we did not assume a linear association between Internet use and the number of friends.

Fifth, we assessed the extent to which changes in the number of friends were due to changes within the cohorts or to population turnover.

To address these matters, we posed the following research questions:

Research Question 1: Are there differences in friendship network size among the groups of Internet nonusers, light users, moderate users, and heavy users in 2002 and 2007?

Research Question 2: Are there changes in friendship network size over time overall and within the groups of Internet nonusers, light users, moderate users, and heavy users?

Research Question 3: Are the changes in friendship network size over time different across the groups of Internet nonusers, light users, moderate users, and heavy users?

Research Question 4: How much of the overtime changes in the number of friends can be attributed to intracohort change and how much to cohort replacement?

Method

Data

Since 2000, the Center for the Digital Future (http://www.digitalcenter.org/) at the Annenberg School for Communication and Journalism, University of Southern California, has led the World Internet Project, working with 26 international partners to study social involvement with the Internet. Its flagship project in the United States is an annual survey of more than 2,000 households. For both the original sample drawn in 2000, and the replacement samples in subsequent years until 2006, a national

Table 1. Sample Characteristics (in Percentages)

Study Year	2002	2007
Sample size	501	677
Gender		
Male	41	45
Female	59	55
Age		
25–34	20	13
35–44	22	17
45–54	26	23
55–64	18	28
65–74	15	20
Education		
Less than high school	12	3
High school diploma	25	25
Some college	29	20
Four-year college or beyond	34	52
Internet use		
Nonusers	35	23
Light users	35	27
Moderate users	21	30
Heavy users	10	21

Total percentages may not add up to 100, owing to rounding errors.

random digit dial (RDD) telephone sample was used based on an equal probability selection method. The final sample for each year derives from both the ongoing panel and a new RDD replacement sample. Starting in 2007, the survey respondents were first contacted via telephone with the same protocol as in previous years, but Internet users were given the option to complete the study by telephone or by an identical Web-based survey. Because no record is available regarding which methods were used for specific interviews, we could not compare the two means of acquiring information.

For the purpose of our analysis, we selected data sets from 2002 and 2007 when identical friendship network questions were asked. We restricted our samples to the unweighted RDD subsets from adult respondents between the ages of 25 and 74. We excluded respondents aged 12 to 24 and 75 or older because the structures and practices of teen friendships could be drastically different from those of adults and because these other age groups in the sample were disproportionately too large or too small compared to the population. The respondents in our samples were somewhat more likely to be women, older, and better educated than what the 2000 U.S. census shows for this age range (Table 1). Therefore, these three key sociodemographic variables (gender, age, and education) were used as control variables in data analysis whenever possible. Because we analyzed separate RDD samples in 2002 and 2007, it is unlikely that our samples contain the same individuals. Hence, our goal was not to make causal inferences but rather to look at changes in the number of friends over time.

Key Variables

Independent variables. According to the Center for the Digital Future (2009), Internet users spent an average of 1.6 hours online per day in 2002 and 2.2 hours per day in 2007. To enrich our examination about the association between Internet use and number of friends, we divided our respondents into four groups—nonusers, light users, moderate users, and heavy users—rather than a simple binary categorization. Light users reported spending an average of 1 hour or less per day on the Internet; moderate users, 1 to 3 hours; and heavy users, more than 3 hours. Not surprising, the percentage of Internet nonusers declined by one third between 2002 and 2007, from 35% to 23%, whereas the percentage of heavy users more than doubled, from 10% to 21%.

Dependent variables. To address our research questions, we focused on three questions about the size of three types of friendship and how each is associated with Internet use:

Offline friendship: "How many friends outside of your household do you have that you see or speak to at least once a week?"
Virtual friendship: "How many online friends do you have whom you have never met in person?"
Migratory friendship: "How many friends, whom you originally met online, have you since met in person?"

We applied outlier controls to the size of all three types of friendships. For offline friendship network size, the maximum value is 76, as implemented in the original survey. For both virtual and migratory friendship network size, the maximum value is set as the mean plus three standard deviations.

We are aware that use of the word *friend* expanded between 2002 and 2007 as MySpace grew popular. However, Facebook had not yet proliferated, and MySpace was then mostly for teens and young adults rather than those aged 25 to 74, whom we studied. Despite the reputation of MySpace for housing vast numbers of "friends," Thelwall's analysis (2008) of 20,000 MySpace user profiles found that they contained only limited numbers of close friends (n = 2 to 9).

Analytical Procedures

We used four types of statistical analysis to answer our research questions about changes in adult friendship network size in America.

First, we used multiple classification analysis for group comparisons within each survey year, which allowed us to detect nonlinear relationships and present adjusted means that control for sociodemographic differences between groups (Andrews, Morgan, Sonquist, & Klem, 1973). We also calculated percentage changes in adjusted means from 2002 to 2007 to examine the differences for each group over time.

Second, we used independent sample t tests to examine differences in friendship network size between 2002 and 2007, which enabled us to reveal the magnitude of changes over time at the group level and combined.

Third, to compare changes across groups over time, we followed the changing-effect model (Firebaugh, 1997, 2008) by running a series of multiple regressions and investigating the significance of interaction effects of individual groups and survey year. For example, if the change in offline friendship network size among nonusers from 2002 to 2007 were drastically different from the change among heavy users, we would expect to see a significant interaction effect there. However, if the slopes of individual groups were parallel and the interaction effects not significant, that means the changes would be consistent across groups.

Fourth, we used a linear decomposition method developed by Firebaugh (1997, 2008) to partition total change in friendship network size between 2002 and 2007 owing to intracohort change and cohort replacement. By intracohort change, we mean aggregated individual change within each age cohort. By cohort replacement, we mean the change in composition of the cohort as a result of population turnover—the entry in 2007 of those too young to be in the sample in 2002 and the omission in 2007 of people who were eligible in 2002 but were older than 74 in 2007—with possible consequences for differences in Internet use and the number of friends.

This linear decomposition method required only three continuous variables: two independent variables (survey year and birth cohort) and a dependent variable. In our case, the survey year is either 2002 or 2007; birth cohort—defined as the respondent's birth year and calculated by survey year minus age—ranges from the oldest cohort (born in 1928) to the youngest (born in 1982); and the dependent variable is friendship network size. The dependent variable y is regressed on survey year x_1 and birth cohort x_2. With the first survey year and the oldest cohort recoded as zero, the standardized regression coefficient β_1 represents the average within-cohort change per year, and β_2 represents the average cross-cohort change. To calculate the contribution of intracohort change, β_1 is weighted by the number of years between two surveys. To calculate the contribution of cohort replacement, β_2 is weighted by the difference between the means of birth years between two surveys. The total change in dependent variable as predicted by the linear decomposition method is the sum of the contributions of both intracohort change and cohort replacement.

Results

Descriptive Results

Offline friendships. Whereas McPherson et al. (2006) found that 23% of American adults did not have anyone available to discuss important matters, our less restrictive survey question showed that only 5% of American adults did not have any friends whom they saw or spoke with at least weekly in 2002 and 2007 (Table 2).

Although the mean size of friendships has grown, the median size of friendships stayed about the same between 2002 and 2007 and is about the same for different levels of Internet use (and nonuse) in both years (Table 2). The median number of friends is either 5 or 6 (except for heavy users in 2002, when it is 7). In all comparisons, the

Table 2. Number of Offline Friends in 2002 and 2007 by Internet Use

	2002				2007			
	M	*Mdn*	*SD*	1+ Friends	*M*	*Mdn*	*SD*	1+ Friends
Nonusers	9.5	5	13.29	92.4%	10.2	5	14.89	96.8%
Light users	9.9	6	11.85	94.8%	12.3	6	15.17	96.1%
Moderate users	8.5	6	10.91	98.0%	10.5	5	13.68	96.5%
Heavy users	9.0	7	8.86	98.0%	12.4	6	17.56	95.3%
Overall	9.4	6	11.91	94.9%	11.3	5	15.23	95.3%

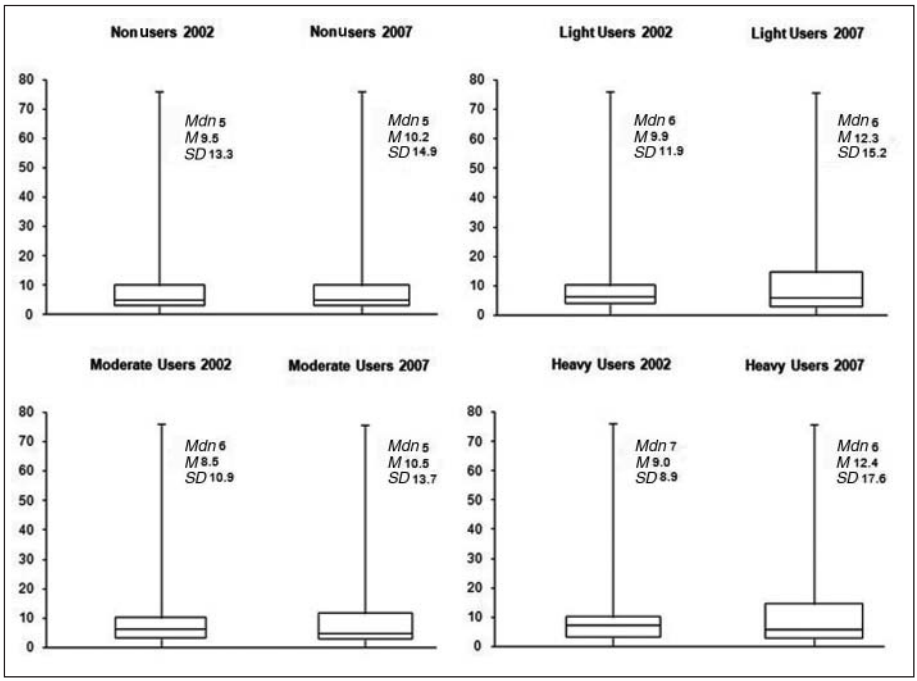

Figure 1. Box Plots of the Number of Offline Friendships by User Groups: 2002 and 2007

mean is substantially higher than the median, which means that the upper tails of the distributions are consistently larger: what statisticians call a positive skew (Figure 1).

What is going on? The average number of friends contacted face-to-face and by phone was substantial early in the decade, and it continued to be substantial. The number of friendships did not decline. Rather, it increased on average between 2002 and 2007 and increased the most for heavy Internet users. But the positive skew indicates a complex pattern. The discrepancy between the mean and the median shows that a substantial minority of Americans have had weekly contact with a sizable number of

friends, that this large number grew in the 5-year period of 2002 to 2007, and that it especially grew for Internet users.

Virtual friendships. Since the dawn of Internet time, scholars have wondered about people having a second life online in cyberspace, independent of the people with whom they deal in person, supplemented by the telephone (Gibson, 1984; Turkle, 1984, 1995). Yet despite the lure of the Internet, our analyses show that just more than one fifth of all Internet users report having one or more friends who are online only. Higher levels of Internet use are associated with a higher number of virtual friends. When people do have virtual friends, they tend to have quite a few: There is a positive skew of the means from the medians that is similar to that observed in the changes over time in offline friendships (Table 3, Figure 2).

Migratory friendships. Insofar as many friendships expand their contact from offline encounters to online contact, some relationships that begin online expand to include face-to-face encounters. For example, Kendall (2002) showed such contacts among the members of a men's chat group, and Bastani (2000) showed how members of an Arab women's support group in America often traveled to meet their online "sisters." However, our analyses suggest that such migratory friendships are less common than virtual friends. But when people do have migratory friends, they often have more than one. Heavy users are the most apt to have more migratory friends (Table 3).

Group Comparisons

We used multiple classification analysis for group comparisons in 2002 and 2007. For both years, there is a nonlinear relationship between Internet use and the size of offline friendship networks. After controlling for sociodemographic variations among groups, the adjusted mean is highest among light users (10.4), followed by heavy users (9.5), moderate users (8.8), and nonusers (8.7) in 2002. In 2007, the adjusted mean is highest among heavy users (13.1), followed by light users (12.3) and moderate users (10.9), with nonusers behind (9.1). The changes in percentage between two survey years indicate that heavy users have the largest increase (38.0%), then moderate users (24.0%), light users (18.0%), and nonusers (4.6%; Figure 2). However, almost none of the user groups are significantly different in size from the nonuser group. The only exception is that for 2007 heavy users have many more offline friends than do nonusers (Table 4). To double-check these findings, we carried out additional multiple classification analyses to rotate the reference group, which did not show any significant differences among the three user groups for 2002 or 2007.

We applied the same analytical procedure to virtual and migratory friendships. Results of multiple classification analyses rotating the reference groups suggest that for both survey years, heavy users consistently have more virtual friends and migratory friends than do light and moderate users (Table 5). Among other group comparisons, for 2002 only moderate users have significantly more virtual friends than do light users.

Table 3. Number of Online Friends in 2002 and 2007 by Internet Use

	Among All Internet Users						Among Internet Users With 1+ Such Friends							
	2002			2007			2002				2007			
	M	*SD*	1+ Friends	*M*	*SD*	1+ Friends	*M*	*Mdn*	*SD*	*n*	*M*	*Mdn*	*SD*	*n*
Virtual														
Light users	0.8	3.02	12%	1.3	8.76	13%	6.8	5	5.88	21	10.2	3	22.78	22
Moderate users	2.1	4.77	28%	2.8	9.65	24%	7.3	5	6.59	29	11.5	5	17.03	45
Heavy users	4.1	6.90	45%	8.7	2.64	35%	9.0	5	7.92	22	24.8	6	40.02	46
Overall	1.7	4.51	22%	3.9	16.04	23%	7.7	5	6.80	72	16.7	5	30.02	113
Migratory														
Light users	0.4	1.60	10%	0.5	1.93	10%	4.5	4	2.88	17	4.6	3	4.39	17
Moderate users	0.8	2.10	21%	1.4	4.00	23%	3.7	2	3.25	22	5.9	3	6.62	43
Heavy users	1.6	3.40	22%	2.2	5.32	31%	7.4	10	3.15	11	7.1	4	7.59	40
Overall	0.7	2.16	15%	1.3	3.92	20%	4.7	4	3.37	50	6.2	4	6.72	100

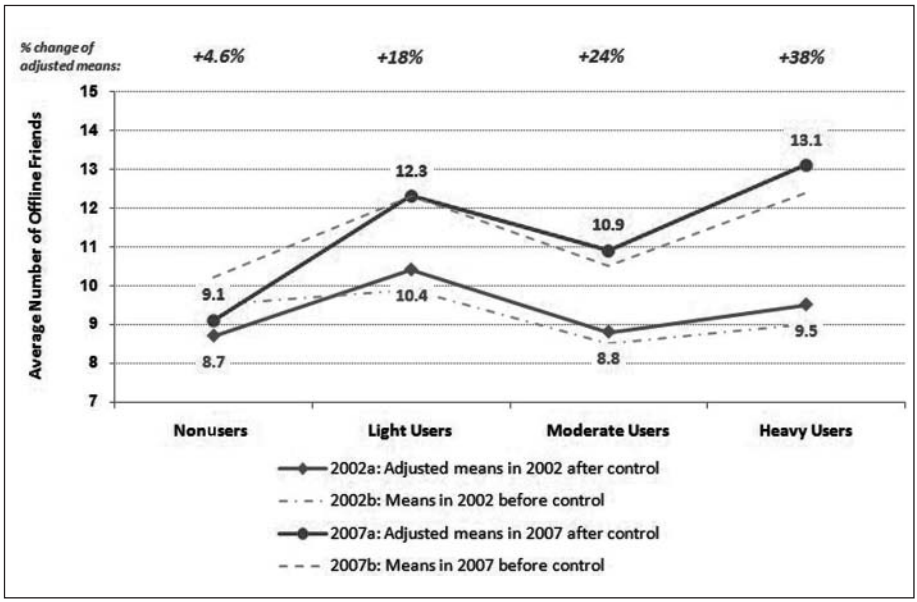

Figure 2. Change in Number of Offline Friends from 2002 to 2007

Table 4. Number of Offline Friends in 2002 and 2007 Adjusted by Multiple Classification Analysis, by Internet Use

Year	*M*	Difference	Adjusted *M*	Difference
Nonusers (reference)				
2002	9.5		8.7	
2007	10.2		9.1	
Light users				
2002	9.9	0.4	10.4	1.7
2007	12.3	2.1	12.3	3.2
Moderate users				
2002	8.5	−1.0	8.8	0.1
2007	10.5	0.3	10.9	1.8
Heavy users				
2002	9.0	−0.5	9.5	0.8
2007	12.4	2.2	13.1	4.0*

Multiple classification analysis controlled for age, gender, and education.
*$p < .05$.

Change Over Time

Independent sample *t* tests show that, overall, the mean number of friends increased significantly from 2002 to 2007. This increase is significant for all three types of

Table 5. Number of Offline Friends in 2002 and 2007 Adjusted by Multiple Classification Analysis, by Internet Use

Year	*M*	Difference	Adjusted *M*	Difference
Heavy users (reference)				
Virtual				
2002	4.0		4.0	
2007	8.7		8.1	
Migratory				
2002	1.6		1.6	
2007	2.2		2.1	
Moderate users				
Virtual				
2002	2.1	1.9*	2.1	1.9*
2007	2.8	5.9***	2.7	5.4**
Migratory				
2002	0.8	0.8*	0.8	0.8*
2007	1.4	0.8*	1.4	0.7*
Light users				
Virtual				
2002	0.8	3.2***	0.9	3.1***
2007	1.3	7.4***	1.9	6.1**
Migratory				
2002	0.4	1.2**	0.5	1.1**
2007	0.5	1.7**	0.6	1.5**

Multiple classification analysis controlled for age, gender, and education.
*$p < .05$. **$p < .01$. ***$p < .001$.

friendships—offline, virtual, and migratory—but increases within each group are not statistically significant (Table 6).

Change Across Groups Over Time

Growth in the number of offline friendships occurs among nonusers and users with all levels of Internet use. Multiple regressions do not show significant interaction effects, suggesting that the change in the number of offline friends between 2002 and 2007 among light users, moderate users, and heavy users do not differ significantly from the trend among nonusers. When sociodemographic factors are included as covariates, the results remain essentially the same (Table 7). Additional regression analyses rotating the reference groups also do not show significant interaction effects for offline, virtual, and migratory friendships

Partitioning Change

Linear decomposition analyses indicate that intracohort change consistently outweighs the contribution of cohort replacement in overall changes in the mean number of friends

Table 6. Independent Sample *T* Tests on Friendship Network Size in 2002 and 2007

	M				
	2002	2007	*t*	*df*	*p*
Offline					
All respondents	9.4	11.3	−2.30	1,088	.022*
Nonusers	9.5	10.2	−0.44	317	.661
Light users	9.9	12.3	−1.57	322	.118
Moderate users	8.5	10.5	−1.35	272	.177
Heavy users	9.0	12.4	−1.66	174	.100
Virtual					
All Internet users	1.7	3.9	−2.82	596	.005**
Light users	0.8	1.3	−0.69	338	.489
Moderate users	2.1	2.8	−0.72	288	.472
Heavy users	4.0	8.7	−1.87	178	.063
Migratory					
All Internet users	0.7	1.3	−2.50	789	.013*
Light users	0.4	0.5	−0.08	341	.934
Moderate users	0.8	1.4	−1.62	291	.107
Heavy users	1.6	2.2	−0.70	178	.483

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

Table 7. Changing Effects of Internet Use on the Number of Offline Friends, 2002–2007

Independent Variables	*B*	*p*	*B*	*p*
Intercept	9.50**	.002	6.70*	.015
Main effects				
Dummy light user group	0.40	.787	1.86	.231
Dummy moderate user group	−1.05	.544	0.51	.780
Dummy heavy user group	−0.48	.830	1.33	.565
Survey year (2007 = 1)	0.69	.656	0.46	.769
Interaction effect				
Dummy Light User Group × Survey Year	1.70	.437	1.19	.583
Dummy Moderate User Group × Survey Year	1.34	.565	0.90	.697
Dummy Heavy User Group × Survey Year	2.63	.347	2.21	.426
Covariates				
Age			0.13***	.000
Gender (female = 1)			−1.75*	.040
Education			−0.54	.260

$N = 1,093$.
*$p < .05$. **$p < .01$. ***$p < .001$.

for all three types of friendships (Table 8). For offline friendships, the survey year coefficient is positive, indicating an increase in the average number of offline friends within cohorts per year. However, the birth cohort coefficient is negative, suggesting

Table 8. Results of Linear Decomposition of Friendship Network Size From 2002 to 2007

Friendship Network Size	β_1	Intracohort Change		β_2	Cohort Replacement		Total Change
Offline	.07*	.36	134%	–.113***	–.091	–34%	.27
Virtual	.09*	.43	81	.125***	.101	19	.53
Migratory	.08*	.41	82	.107**	.086	18	.49

*$p < .05$. **$p < .01$. ***$p < .001$.

a decrease in the average number of offline friends across cohorts and that younger cohorts have fewer friends.

The situation is slightly different for the more Internet-oriented virtual and migratory friendships, where the entry and exit of the younger and older users account for some of the overall increase in the number of online friends. For virtual friendships, both the survey year coefficient and the birth cohort coefficient are positive, indicating an increase in the average number of virtual friends within cohorts per year, as well as across cohorts. The total contribution of aggregated individual change accounts for 81% of the total change, while cohort replacement accounts for 19% of the total change. A similar pattern appears for migratory friendships. The total contribution of aggregated individual change accounts for 82% of the total change, while cohort replacement accounts for 18% of the total change.

Discussion

Summary of Main Findings

Friendship is alive and well—and living offline, online, and sometimes in between.

Friendship is still abundant. In 2002 and 2007, American adults had on average about 10 friends whom they met or spoke with at least weekly, with a few additional virtual friends and migratory friends. Despite the scholarly cautions and media panics, our data suggest that almost everyone has social ties whom they contact on a regular basis. People's friendship network sizes vary depending on their Internet use or nonuse. In general, Internet users do not have fewer offline friends than do nonusers, as the panic-stricken media have feared. In fact, after controlling for sociodemographic differences, the adjusted means of user groups tend to be higher than those of the nonuser group. Heavy users had significantly more offline friends than did nonusers in 2007—a percentage change of 38.0% versus 4.6%.

Meeting new friends online is not yet prevalent. Only 22% of Internet users reported having virtual friends, and only 15% reported having friends who migrated from online to offline contact. But when people do have friendships online, they usually have quite a few. Heavy Internet users are particularly active, having substantially more virtual and migratory friends in both survey years.

Friendships grew from 2002 to 2007. We believe that we are the first to use comparable data sets at different periods to study changes in the number of adult friendships in association with Internet use. Our analyses show that the average number of friends consistently and substantially increased between 2002 and 2007 in all three communication contexts (offline, virtual, and migratory). This general trend of growth in friendship is statistically significant. Although the number of friends within each group shows a consistent increase for all three types of friendship, none are statistically significant. Moreover, our data reveal a positive skew of means from medians over time, indicating a strong growth for those with more than the median number of friends, thus creating the mean–median discrepancy in the distributions even after outlier control.

The trend is similar in all groups. Contradictory to what many have assumed, not only does the number of friends increase for all groups (nonusers, light, moderate, and heavy users) within the 5 years, but the upward trends across groups are not significantly different from one another. The growth in offline friendship for nonusers is not faster or slower than any of the user groups. Likewise, the growth in online friendship for heavy, moderate, or light users is not substantially different.

Intracohort change outweighs cohort replacement in overall growth in friendship. We believe that we are the first to use linear decomposition method to tease out aggregated individual change from the overall social change in the context of friendship communication. The consistent findings of intracohort change outweighing cohort replacement rule out a cohort effect as a dominant source of change in adult American friendship network size. It is not so much that heavier Internet users are becoming adults and having more friendships; it is more that there is an overall increase in both Internet use and friendship.

Changing Friendships: Changing Technologies, Social Structures, and Norms

Our analysis of changes in the number of adult American friendships suggests an overall expansion of social connectivity. The rising tide of the Internet raises many boats, for the Internet is preeminently a social medium. We discuss three possible and interrelated explanations.

Changing technologies. One of the greatest challenges of Internet research has to do with the moving target of rapid change (Lievrouw & Livingstone, 2002). In untangling the Internet paradox, Kraut and colleagues (1998) attributed the diminishing of initial negative social impact partly to newbies dealing with changing technologies. The Internet has dramatically proliferated in the number of users and applications, transforming from the early organization- and military-centered functions to the widespread use of social media services (e.g., boyd & Ellison, 2007; DiMaggio, Hargittai, Newman, & Robinson, 2001; Donath, 2007; Jones & Fox, 2009). We believe that the growing number of friends in America is linked in part to the proliferation, popularity, and penetration of social media; increasingly diversified Internet users; and ubiquitous mobile connections. These technological tools and features afford ample opportunities for fostering preexisting ties and developing new ones (e.g., Bargh & McKenna, 2004;

Boase & Wellman, 2006; Herring, 2004; Rainie & Wellman, forthcoming; Walther, 2006; Wellman et al., 2003).

Changing social structures. Social structure is shifting: People once functioned in encompassing, densely knit, bounded local groups in the traditional mass society. Now they are maneuvering in fragmented, sparsely knit, permeable, and specialized networks in postmodern society, or network society (Castells, 1996; van Dijk, 2006; Wellman, 2001b). A particularly relevant concept here is networked individualism: the transformation of interpersonal social structures from "door-to-door" or "place to place" to "person to person," and (even more specialized) "role to role" relations (Wellman, 2001a, 2002; see also network individualization, van Dijk, 2006, 2008). This shifting emphasis on individual freedom and responsibility means that people can no longer rely on others to exchange messages on their behalf: Personal computers, personal Internet accounts, and mobile phones hold greater importance for social connectivity than ever before, with many people interacting almost continuously. Although the individualized networking trend started before the Internet (Wellman, 2001b), "the developing personalization, portability, and ubiquitous connectivity of the Internet are facilitating more individual connectivity" (Wellman, 2004, p. 29).

Changing norms. Does heavy Internet use cause more friendship, or does more friendship cause more Internet use? We suspect that it is a reciprocal feedback process: Those with more friends use the Internet more to keep in contact; those with heavy Internet use develop more friendships. When early users found friends through the Internet more than a decade ago, it seemed novel, unusual, and perhaps a bit risky (Katz & Apsden, 1997). But having hundreds of "friends" on one's Facebook profile has become so commonplace that the word *friend* may have expanded in meaning (Ellison, Steinfield, & Lampe, 2007; Tong, Van Der Heide, Langwell, & Walther, 2008). Moreover, Internet use has become normalized, with more people spending more time engaging in various activities via the Internet everyday and with the boundaries between online and offline becoming ever blurring.

We believe that the nature of friendship networks will continue to evolve alongside the Internet, the transformation of social structure, and the cultural norms around these increasingly mediated communication practices. As the Internet is being incorporated into people's everyday life and becoming an indispensable aspect of their social spheres for many, we suggest that what appears as socially isolating from the view of traditional group-based analysis can be fully social in the context of a network society (van Dijk, 2008). It is not that people are all becoming intimate strangers in the Internet era; it is that people's social connectivity is quantitatively—and probably qualitatively—different than before. Changing social connectivity is, after all, neither a dystopian loss nor a utopian gain but an intricate, multifaceted, fundamental social transformation (Wellman, 2001a, 2001b).

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References

Andrews, F., Morgan, J., Sonquist, J., & Klem, L. (1973). *Multiple classification analysis* (2nd ed.). Ann Arbor: University of Michigan, Institute for Social Research.

Bargh, J., & McKenna, K. (2004). The Internet and social life. *Annual Review of Psychology, 55,* 573-590.

Bastani, S. (2000). Muslim women on-line. *Arab World Geographer, 3,* 40-59.

Baym, N., Zhang, Y., & Lin, M. (2004). Social interactions across media. *New Media & Society, 6*(3), 299-318.

Berger, M. (1979). *The devil wagon in God's country*. Hamden, CT: Archon.

Boase, J., Horrigan, J., Wellman, B., & Rainie, L. (2006, January). *The strength of Internet ties.* Washington, DC: Pew Internet & American Life Project. Retrieved December 3, 2007, from http://www.pewinternet.org/PPF/r/172/report_display.asp

Boase, J., & Wellman, B. (2006). Personal relationships: On and off the Internet. In A. Vangelisti & D. Perlman (Eds.), *The Cambridge handbook of personal relationships* (pp. 709-726). New York: Cambridge University Press.

boyd, d., & Ellison, N. (2007). Social network sites. *Journal of Computer-Mediated Communication, 13*(1), article 11. Retrieved April 12, 2008, from http://jcmc.indiana.edu/vol13/issue1/boyd.ellison.html

Carrasco, J.-A., Hogan, B., Wellman, B., & Miller, E. (2008). Agency in social activities interactions. *Tijdschrift voor economische en sociale geografie, 99*(5), 562-583.

Castells, M. (1996). *The rise of the network society.* Oxford, UK: Blackwell.

Center for the Digital Future. (2008, January). *The 2008 digital future report: Surveying the digital future—Year seven*. Los Angeles: Center for the Digital Future.

Center for the Digital Future. (2009, April). *The 2009 digital future report: Surveying the digital future—Year eight*. Los Angeles: Center for the Digital Future.

Chen, W., Boase, J., & Wellman, B. (2002). The global villagers. In B. Wellman & C. Haythornthwaite (Eds.), *The Internet in everyday life* (pp. 74-113). Oxford, UK: Blackwell.

Chua, V., Madej, J., & Wellman, B. (forthcoming). Personal communities. In P. Carrington & J. Scott (Eds.), *Handbook of social network analysis*. Thousand Oaks, CA: Sage.

Cole, J., & Robinson, J. (2002). Internet use and sociability in the UCLA data. *IT & Society, 1*(1), 202-218.

Collins, J., & Wellman, B. (2010). Small town in the Internet society. *American Behavioral Scientist, 53*.

Cornish, D. (2006, October 13). Is computer glow the new hearth-light? *Toronto Globe & Mail,* p. A13.

Cowan, R. (1999). The consumption junction. In W. Bijker, P. Hughes, & T. Pinch (Eds.), *The social construction of technological systems* (pp. 261-280). Cambridge, MA: MIT Press.

Cummings, J., Lee, J., & Kraut, R. (2006). Communication technology and friends during the transition from high school to college. In R. E. Kraut, M. Brynin, S. Kiesler (Eds.), *Computers, phones, and the Internet* (pp. 265-278). New York: Oxford University Press.

Di Gennaro, C., & Dutton, W. (2007). Reconfiguring friendships. *Information Communication & Society, 10,* 591-618.

DiMaggio, P., Hargittai, E., Newman, W., & Robinson, J. (2001). Social implications of the Internet. *Annual Review of Sociology, 27,* 307-336.

Donath, J. (2007). Signals in social supernets. *Journal of Computer-Mediated Communication, 13*(1), article 12. Retrieved from http://jcmc.indiana.edu/vol13/issue1/donath.html

Ellison, N., Steinfield, C., & Lampe, C. (2007). The benefits of Facebook "friends." *Journal of Computer-Mediated Communication, 12*(3), article 1.

Firebaugh, G. (1997). *Analyzing repeated surveys*. Thousand Oaks, CA: Sage.

Firebaugh, G. (2008). *Seven rules for social research*. Princeton, NJ: Princeton University Press.

Fischer, C. (1982). *To dwell among friends*. Berkeley: University of California Press.

Fischer, C. (2009). The 2004 GSS finding of shrunken social networks: An artifact? *American Sociological Review*, *74*, 657-669.

Fountain, H. (July 2, 2006). The lonely American just got a bit lonelier. *New York Times*. Retrieved June 7, 2007, from http://www.nytimes.com/2006/07/02/weekinreview/02fountain.html

Gans, H. (1962). *The urban villagers*. New York: Free Press.

Gans, H. (1967). *The Levittowners*. New York: Pantheon.

Gibson, W. (1984). *Neuromancer*. New York: Ace Science Fiction.

Hampton, K., Sessions, L., Her, E. J., & Rainie, L. (2009, November). *Social isolation and new technology: How the Internet and mobile phones impact Americans' social networks*. Washington, DC: Pew Internet & American Life Project. Retrieved November 5, 2009, from http://pewinternet.org/Reports/2009/18--Social-Isolation-and-New-Technology/Executive-Summary.aspx?r=1

Hampton, K., & Wellman, B. (2003). Neighboring in Netville. *City and Community, 2*(4), 277-311.

Harmon, A. (1998, August 30). Sad, lonely world discovered in cyberspace. *New York Times,* p. 1.

Herring, S. (2004). Slouching toward the ordinary. *New Media & Society, 6*(1), 26-36.

Howard, P., Rainie, L., & Jones, S. (2002). Days and nights on the Internet. In B. Wellman & C. Haythornthwaite (Eds.), *The Internet in everyday life* (pp. 45-73). Malden, MA: Blackwell.

Jones, S., & Fox, S. (2009). *Generations online in 2009*. Washington, DC: Pew Internet & American Life Project. Retrieved May 5, 2009, from http://www.pewinternet.org/Reports/2009/Generations-Online-in-2009.aspx

Katz, J., & Aspden, P. (1997). A nation of strangers? *Communications of the ACM, 40*(12), 81-86.

Katz, J., & Rice, R. (2002). Project syntopia: Social consequences of Internet use. *IT & Society, 1*(1), 166-179.

Kendall, L. (2002). *Hanging out in the virtual pub*. Berkeley: University of California Press.

Kraut, R., Kiesler, S., Boneva, B., Cummings, J., Helgeson, V., & Crawford, A. (2002). Internet paradox revisited. *Journal of Social Issues, 58,* 49-74.

Kraut, R., Patterson, M., Lundmark, V., Kiesler, S., Mukopadhyay, T., & Scherlis, W. (1998). Internet paradox: A social technology that reduces social involvement and psychological well-being? *American Psychologist, 53,* 1017-1031.

Lievrouw, L., & Livingstone, S. (2002). Introduction: The social shaping and consequences of ICTs. In L. A. Lievrouw & S. Livingstone (Eds.), *Handbook of new media* (pp. 1-16). Thousand Oaks, CA: Sage.

Mallaby, S. (2006, June 26). Why so lonesome? *Washington Post*, p. A21. Retrieved June 7, 2007, from http://www.washingtonpost.com/wp-dyn/content/article/2006/06/25/AR2006062500566.html

Marvin, C. (1988). *When old technologies were new.* New York: Oxford University Press.

Marx, L. (1964). *The machine in the garden*. New York: Oxford University Press.

McPherson, M., Smith-Lovin, L., & Brashears, M. (2006). Social isolation in America. *American Sociological Review, 71,* 353-375.

McPherson, M., Smith-Lovin, L., & Brashears, M. (2009). Models and marginals. *American Sociological Review, 74*(4).

Mok, D., Wellman, B., & Carrasco, J.-A. (2010). Does distance still matter in the age of the Internet? *Urban Studies, 46*.

Nie, N., & Hillygus, D. (2002). The impact of Internet use on sociability. *IT & Society, 1*(1), 1-20.

Nisbet, R. (1962). *Community and power*. New York: Oxford University Press.

Parks, M., & Floyd, K. (1996). Making friends in cyberspace. *Journal of Computer-Mediated Communication, 1*(4). Available at http://jcmc.indiana.edu/vol1/issue4/parks.html (accessed January 19, 2010)

Pope Benedict XVI. (2009). *Message for the World Day of Communication*. Available at http://www.vatican.va/holy_father/benedict_xvi/messages/communications/documents/hf_ben-xvi_mes_20090124_43rd-world-communications-day_en.html (accessed January 23, 2009)

Putnam, R. (2000). *Bowling alone*. New York: Simon & Schuster.

Quan-Haase, A., & Wellman, B. (with Witte, J., & Hampton, K.). (2002). Capitalizing on the net. In B. Wellman & C. Haythornthwaite (Eds.), *The Internet in everyday life* (pp. 291-324). Malden, MA: Blackwell.

Rainie, L., & Wellman, B. (forthcoming). *Networked.* Cambridge, MA: MIT Press.

Rice, R., Sheperd, A., Dutton, W., & Katz, J. (2007). Social interaction and the Internet. In A. Joinson, K. McKenna, T. Postmes, & U. Reips (Eds.), *Oxford handbook of Internet psychology* (pp. 7-30). New York: Oxford University Press.

Shklovski, I., Kiesler, S., & Kraut, R. (2006). The Internet and social interaction. In M. B. Kraut & S. Kiesler (Eds.), *Computers, phones, and the Internet* (pp. 251-264). New York: Oxford University Press.

Shklovski, I., Kraut, R., & Cummings, J. (2008). *Keeping in touch by technology*. Available at http://www.cs.cmu.edu/%7Ekraut/RKraut.site.files/articles/shklovski08-KeepingInTouch WithTechnology.pdf (accessed January 19, 2010)

Shklovski, I., Kraut, R., & Rainie, L. (2004). The Internet and social participation: Contrasting cross-sectional and longitudinal analyses. *Journal of Computer-Mediated Communication, 10*(*1*). Available at http://jcmc.indiana.edu/vol10/issue1/shklovski_kraut.html (accessed January 19, 2010)

Sigman, A. (2009) Well connected? The biological implications of "social networking." *Biologist*, *56*(1), 14-20.

Spencer, L., & Pahl, R. (2006). *Rethinking friendship*. Princeton, NJ: Princeton University Press.

Stein, M. (1960). *The eclipse of community*. Princeton, NJ: Princeton University Press.

Stern, M. (2008). How locality, frequency of communication, and Internet usage affect modes of communication within core social networks. *Information, Communication and Society, 11*(5), 519-616.

Thelwall, M. (2008). Social networks, gender, and friending. *Journal of the American Society for Information Science and Technology, 59*(8), 1321-1330.

Tong, S., Van Der Heide, B., Langwell, L., & Walther, J. (2008). Too much of a good thing? *Journal of Computer-Mediated Communication, 13*(3), 531-549.

Turkle, S. (1984). *The second self.* New York: Simon & Schuster.

Turkle, S. (1995). *Life on the screen*. New York: Simon & Schuster.

van Dijk, J. (2006). *The network society* (2nd ed.). Thousand Oaks, CA: Sage.

van Dijk, J. (2008, May). *Do ICTs foster social connectivity or social isolation*? Paper presented at the annual meeting of the International Communication Association, Montreal, Quebec, Canada.

Vedantam, S. (2006, June 23). Social isolation growing in U.S., study says. *Washington Post*, p. A03. Retrieved June 7, 2007, from http://www.washingtonpost.com/wp-dyn/content/article/2006/06/22/AR2006062201763_pf.html

Walther, J. (2006). Nonverbal dynamics in computer-mediated communication, or :(and the net : ('s with you, :) and you :) alone. In V. Manusov & M. Patterson (Eds.), *The Sage handbook of nonverbal communication* (pp. 461-480). Thousand Oaks, CA: Sage.

Wellman, B. (1979). The community question. *American Journal of Sociology, 84,* 1201-1231.

Wellman, B. (2001a). *The persistence and transformation of community*. Ottawa, Toronto: Law Commission of Canada.

Wellman, B. (2001b). Physical place and cyberplace. *International Journal of Urban and Regional Research, 25*(2), 227-252.

Wellman, B. (2002). Little boxes, glocalization, and networked individualism. In M. Tanabe, P. van den Besselaar, & T. Ishida (Eds.), *Digital cities II* (pp. 10-25). Berlin: Springer-Verlag.
Wellman, B. (2004). The glocal village: Internet and community. *Idea&s, 1*, 26-30.
Wellman, B., & Leighton, B. (1979). Networks, neighborhoods and communities. *Urban Affairs Quarterly, 14,* 363-390.
Wellman, B., Quan-Haase, A., Boase, J., Chen, W., Hampton, K., & Diaz de Isla, I. (2003). The social affordances of the Internet for networked individualism [Online]. *Journal of Computer Mediated Communication, 8*(3).
Wirth, L. (1938). Urbanism as a way of life. *American Journal of Sociology, 44,* 3-24.

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