

Online Communication and Adolescent Well-Being: Testing the Stimulation Versus the Displacement Hypothesis

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The aim of this study was to contrast the validity of two opposing explanatory hypotheses about the effect of online communication on adolescents' well-being. The displacement hypothesis predicts that online communication reduces adolescents' well-being because it displaces time spent with existing friends, thereby reducing the quality of these friendships. In contrast, the stimulation hypothesis states that online communication stimulates well-being via its positive effect on time spent with existing friends and the quality of these friendships. We conducted an online survey among 1,210 Dutch teenagers between 10 and 17 years of age. Using mediation analyses, we found support for the stimulation hypothesis but not for the displacement hypothesis. We also found a moderating effect of type of online communication on adolescents' well-being: Instant messaging, which was mostly used to communicate with existing friends, positively predicted well-being via the mediating variables (a) time spent with existing friends and (b) the quality of these friendships. Chat in a public chatroom, which was relatively often used to talk with strangers, had no effect on adolescents' well-being via the mediating variables.

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Introduction

Opportunities for adolescents to form and maintain relationships on the Internet have multiplied in the past few years. Not only has the use of Instant Messaging (IM) increased tremendously, but Internet-based chatrooms and social networking sites are also rapidly gaining prominence as venues for the formation and maintenance of personal relationships. In recent years, the function of the Internet has changed considerably for adolescents. Whereas in the 1990s they used the Internet primarily for entertainment (Valkenburg & Soeters, 2001), at present they predominantly use it for interpersonal communication (Gross, 2004; Lenhart, Madden, & Hitlin, 2005).

The rapid emergence of the Internet as a communication venue for adolescents has been accompanied by diametrically opposed views about its social consequences. Some authors believe that online communication hinders adolescents' well-being because it displaces valuable time that could be spent with existing friends (e.g., Kraut et al., 1998; Nie, 2001; Nie, Hillygus, & Erbring, 2002). For example, Kraut et al. (1998) argue that "by using the Internet, people are substituting poorer quality social relationships for better relationships, that is, substituting weak ties for strong ones" (p. 1028). Adherents of this displacement hypothesis assume that the Internet motivates adolescents to form online contacts with strangers rather than to maintain friendships with their offline peers. Because online contacts are seen as superficial weak-tie relationships that lack feelings of affection and commitment, the Internet is believed to reduce the quality of adolescents' existing friendships and, thereby, their well-being.

Conversely, other authors suggest that online communication may enhance the quality of adolescents' existing friendships and, thus, their well-being. Adherents of this stimulation hypothesis argue that more recent online communication technologies, such as IM, encourage communication with existing friends (Bryant, Sanders-Jackson, & Smallwood, 2006). Much of the time adolescents spend alone with computers is actually used to keep up existing friendships (Gross, 2004; Subrahmanyam, Kraut, Greenfield, & Gross, 2000; Valkenburg & Peter, 2007). If adolescents use the Internet primarily to maintain contacts with their existing friends, the prerequisite for a displacement effect is not fulfilled. After all, if existing friendships are maintained through the Internet, it is implausible that the Internet reduces the quality of these friendships and, thereby, adolescents' well-being (Valkenburg & Peter, 2007).

Several studies have investigated the effect of Internet use on the quality of existing relationships and well-being. Some of these studies used depression or loneliness measures as indicators of well-being; others employed measures of life-satisfaction or positive/negative affect. The studies have provided mixed results: Some have yielded results in agreement with the displacement hypothesis (Kraut et al., 1998; Morgan & Cotten, 2003, for surfing; Nie, 2001; Nie, Hillygus, & Erbring, 2002; Weiser, 2001). Others have produced results in support of the stimulation hypothesis. They demonstrated, for example, that Internet use is positively related to time spent with existing friends (Kraut et al., 2002), to the closeness of existing friendships (Valkenburg & Peter, 2007), and to well-being (Kraut et al., 2002, study 1; Morgan & Cotten, 2003, for email and chat; Shaw & Gant, 2002). Finally, several other studies produced no significant results (Gross, 2004; Kraut et al., 2002, study 2; Jackson, von Eye, Barbatsis, Biocca, Fitzgerald, & Zhao, 2004; LaRose, Ghuay, & Bovin, 2002; Mesch, 2001, 2003; Sanders, Field, Diego, & Kaplan, 2000; Waestlund, Norlander, & Archer, 2001).

At least one omission in earlier research may contribute to the inconsistent findings regarding the Internet-well-being relationship. Most research to date has been descriptive or exploratory in nature. The studies investigate direct linear relationships between Internet use and one or more dependent variables, such as social

involvement, depression, or loneliness (Matei & Ball-Rokeach, 2001). Hardly any research has been based on a-priori explanatory hypotheses regarding *how* Internet use is related to well-being. More importantly, there is no research that contrasts opposing explanatory hypotheses in the same study. With some exceptions (LaRose et al., 2001; Morgan & Cotten, 2003; Weiser, 2001), most research has conceptualized the relationship between Internet use and well-being as a simple stimulus-response process. Little research has hypothesized possible mediating variables that might cause a displacement or stimulating effect of Internet use on well-being.

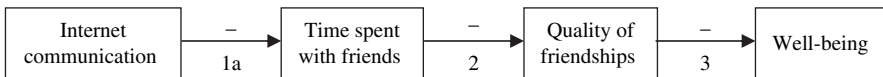
The main aim of this study is to fill the gap in earlier research and pit the predictions of the displacement hypothesis against those of the stimulation hypothesis. By empirically studying the validity of the processes proposed by the two hypotheses, we hope to improve theory formation and contribute to a more profound understanding of the social consequences of the Internet. In fact, the two hypotheses are based on the same two mediators. Both hypotheses state that online communication affects adolescents' well-being through its influence on (1) their time spent with existing friends and (2) the quality of these friendships. However, the displacement hypothesis assumes a negative effect from online communication on time spent with existing friends, whereas the stimulation hypothesis predicts a positive relationship between these two variables. The two opposing hypotheses are stated below and modeled through paths 1a and 1b in Figure 1:

H1a: Online communication will reduce time spent with existing friends.

H1b: Online communication will enhance time spent with existing friends.

As Figure 1 shows, apart from paths 1a and 1b, the remaining assumptions of the displacement and stimulation hypotheses are similar. Neither hypothesis predicts a direct relationship between online communication and well-being. Rather, both suggest that the influence of online communication on well-being will be mediated by the quality of friendships. There is general agreement that the quality of friendships is an important predictor of well-being (Hartup & Stevens, 1997). Quality friendships can form a powerful buffer against potential stressors in adolescence (Bukowski, 2001; Hartup, 2000), and adolescents with high-quality friendships

Displacement Hypothesis



Stimulation Hypothesis

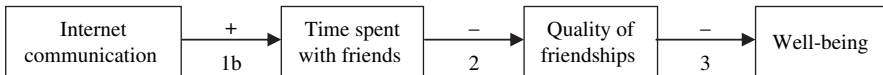


Figure 1 The displacement and the stimulation hypothesis modeled

are often more socially competent and happier than adolescents without such friendships (Hartup & Stevens, 1997). Based on these considerations, we hypothesize that if online communication influences well-being, it will be through its influence on the quality of existing friendships. Our second hypothesis, which is modeled via path 3 in Figure 1, therefore states:

H2: Adolescents' quality of friendships will positively predict their well-being and act as a mediator between online communication and well-being.

However, the relationship between online communication and the quality of friendships may also not be direct. Both the displacement and stimulation hypotheses assume that time spent with existing friends acts as a mediator between online communication and the quality of friendships. Based on these assumptions, we hypothesize an indirect relationship between online communication and the quality of friendships, via the time spent with existing friends (see paths 1a, 1b, and 2 in Figure 1):

H3: Adolescents' time spent with friends will predict the quality of their friendships and act as a mediator between online communication and the quality of friendships.

Type of Online Communication: IM Versus Chat

In earlier Internet effects studies, the independent variable Internet use has often been treated as a one-dimensional concept. This may be another important reason why the findings of these studies are so mixed (Baym, Zhang, & Lin, 2004). Many studies only employed a measure of daily or weekly time spent on the Internet and did not distinguish between different types of Internet use, such as surfing or online communication (e.g., Kraut et al., 1998, 2002). Such a simple conceptualization of the independent variable was already problematic when investigating traditional broadcast media (Baym, Zhang, & Lin, 2004; Jung, Qio, & Kim, 2001), but it becomes even more problematic when researching effects of multi-use platforms such as the Internet (Jung, Qio, & Kim, 2001).

It is quite possible that daily time spent on the Internet does not affect one's well-being, whereas certain types of Internet use do have such an effect. In this study, we focus on the type of Internet use that is theoretically most likely to influence well-being and the quality of existing friendships: online communication. We believe that if the Internet influences well-being, it will be through its potential to alter the nature of social interaction through the use of online communication technologies. In this study, well-being is defined as happiness or a positive evaluation of one's life in general (Diener, 1984; Diener, Suh, Luca, & Smith, 1999).

Online communication in itself is a multidimensional concept. We focus on two types of communication that are often used by adolescents: IM and chat in public chatrooms (Lenhart, Madden, & Hitlin, 2005; Valkenburg & Peter, 2007). Both types of online communication are synchronous and often used for private communication. However, they differ in several respects. First, whereas chat in a public chatroom is often based on anonymous communication between unacquainted partners,

IM mostly involves non-anonymous communication between acquainted partners (Bryant et al., 2006; Valkenburg & Peter, 2007). Second, whereas chat is more often used to *form* relationships, IM is typically used to *maintain* relationships (Grinter & Palen, 2004). Although there is no previous research on the social consequences of IM versus chat, it is entirely possible that these two types of online communication differ in their potential to influence the quality of existing friendships and well-being. For example, IM, as used to maintain friendships, may contribute positively to the quality of existing relationships and well-being, whereas chat in a public chatroom may have the opposite or no effect. The second aim of our study is to investigate the differential effects of IM versus chat on well-being and the two mediating variables. Because previous research does not allow us to formulate a hypothesis regarding these differential effects of different types of online communication, our research question asks:

RQ1: How do the causal predictions of the displacement and stimulation hypothesis differ for IM and chat in a public chatroom?

Method

Sample

In December 2005, an online survey was conducted among 1,210 Dutch adolescents between 10 and 17 years of age (53% girls, 47% boys). Sampling and fieldwork were done by Qrius, a market research company in Amsterdam, the Netherlands. Respondents were recruited from an existing online panel managed by Qrius. The sample was representative of Dutch children and adolescents who use the Internet in terms of age, gender, and education. Prior to the implementation of the survey, institutional approval, parental consent, and adolescents' informed consent were obtained. Adolescents were notified that the study would be about Internet and well-being and that they could stop participation at any time they wished. We took the following measures to improve the confidentiality, anonymity, and privacy of the response process (Mustanski, 2001): On the introduction screen of the online questionnaire, we emphasized that the answers would be analyzed only by us, the principal investigators. Moreover, we ensured the respondents that their answers would remain anonymous. Finally, respondents were asked to make sure that they filled in the questionnaire in privacy. Completing the questionnaire took about 15–20 minutes.

We preferred an online interviewing mode to more traditional modes of interviewing, such as face-to-face or telephone interviews. There is consistent research evidence that both adolescents and adults report sensitive behaviors more easily in computer-mediated interviewing modes than in non-computer-mediated modes, whereas for non-sensitive behaviors no differences in interviewing modes have been reported (e.g., Beebe, Harrison, McRae, Anderson, & Fulkerson, 1998; Brener et al., 2006; Tourangeau & Smith, 1996). Therefore, the response patterns in our study may have benefited from our choice of a computer-mediated interviewing mode as far as more intimate issues, such as the quality of friendships and well-being, are concerned.

Measures

IM Use

We measured adolescents' IM use with four questions: (a) "On *weekdays* (Monday to and including Friday), how many days do you usually use IM?" (b) "On the *weekdays* (Monday to and including Friday) that you use IM, how long do you then usually use it?" (c) "During *weekends* (Saturday and Sunday), how many days do you usually use IM?" The response options were: (1) *Only on Saturday*; (2) *Only on Sunday*; (3) *On both days*; and (4) *I do not use IM on the weekends*. If respondents selected response options 1 to 3 in the question on IM weekend use, they were asked the following question for Saturday and/or Sunday: (d) "On a Saturday (a Sunday), how long do you usually use IM?" Respondents' IM use per week was calculated by multiplying the number of days per week that they used IM (range 0 through 7) by the number of minutes they used it on each day. This operationalization of weekly time spent with a medium has been proven valid for children older than 9 (Van der Voort & Vooijs, 1990). The mean time spent with IM per week was 15 hours and 15 minutes (SD = 21 hours and 10 minutes).

Chat Use

We measured respondents' chat use in the same way as their IM use. Using the same four questions, we asked the respondents to evaluate how much time per week they used chat in public chatrooms. The mean time spent with chat per week was 1 hour and 23 minutes (SD = 7 hours and 30 minutes).

Time Spent with Friends

Time spent with existing friends was measured with three items that were adopted from the companionship subscale of Buhrmester's (1990) Network of Relationship Inventory. We first asked respondents to think of the friends they know from their offline environment, such as from school and the neighborhood. Then we asked them three questions: (a) "How often do you meet with one or more of these friends?," (b) "How often do you and these friends go to places and do things together?," and (c) "How often do you go out and have fun with one or more of these friends?" Response options ranged from 1 (*never*) to 9 (*several times a day*). The three items loaded on one factor, which explained 69% of the variance (Cronbach's alpha = .76; $M = 5.78$; $SD = 1.65$).

Quality of Friendships

The quality of existing friendships was measured with the relationship satisfaction (three items), approval (three items), and support (three items) subscales of Buhrmester's (1990) Network of Relationship Inventory. We asked respondents to think of the friends they know from their offline environment, such as from school and the neighborhood. Example items were: (1) "How often are you happy with your relationship with these friends?" (satisfaction), "How often do these friends praise you for the kind of person you are?" (approval), and (3) "How often do you turn to

these friends for support with personal problems?" Response options ranged from 1 (*never*) to 5 (*always*). The nine items were averaged to form a quality of friendship scale (Cronbach's alpha = .93; $M = 3.44$; $SD = 0.72$).

Well-Being

We used the five-item satisfaction with life scale developed by Diener, Emmons, Larsen, and Griffin (1985). Examples of items of this scale are "I am satisfied with my life" and "In most ways my life is close to my ideal." Response categories ranged from 1 (*agree entirely*) to 5 (*disagree entirely*) and were reversely coded. Cronbach's alpha for the scale was .88, which is comparable to the alpha of .87 reported by Diener et al. (1985).

Results

Time Spent with IM and Chat

Respondents spent significantly more time per day on IM than on chat. Specifically, they spent on average two hours and 11 minutes per day on IM and on average 12 minutes per day on chat. This greater amount of time spent on IM suggests that if any effect of the Internet is to be expected, it will occur through the use of IM. However, to verify this claim, we test the separate effects of IM and chat in the subsequent analyses.

Online Communication with Existing Friends

We also investigated the assumption in this and earlier studies that IM is most often used to communicate with existing friends, whereas chat in a public chatroom is more often used to communicate with strangers. This assumption was supported. Ninety-one percent of the respondents indicated that they "often" to "always" used IM to communicate with existing friends. Thirty-seven percent of the respondents indicated that they "often" to "always" used chat to communicate with existing friends.

Pitting the Displacement Hypothesis against the Stimulation Hypothesis

Following the displacement and stimulation hypothesis, we did not assume a direct relationship between online communication and well-being. Rather, we expected that the direct relationship between online communication would be mediated by the time spent with existing friends and the quality of these friendships (see Figure 1). Table 1 presents the zero-order correlations between the independent variables (IM and chat use), the first mediating variable (time spent with friends), the second mediating variable (quality of friendships), and the dependent variable (well-being). In line with our expectations, neither IM nor chat use was directly related to well-being. However, the results in Table 1 do suggest a mediated positive effect of IM use and, to a lesser extent, a positive mediated effect of chat use on well-being through the time spent with friends and the quality of friendships.

We used a formal mediation analysis to test our hypotheses. In recent years, several approaches to examining indirect or mediated effects have been discussed (for a review, see MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). The most widely used approach is the causal steps approach developed by Judd and Kenny (1981) and Baron and Kenny (1986). This approach assumes that in order to test mediation, the independent, dependent, and mediator (or intervening) variables must all be correlated with each other. The causal steps approach has recently been criticized, first because it does not provide a statistical test of the size of the indirect effects, and second because the requirement that there must be a significant direct association between the independent and dependent variable is considered too restrictive (MacKinnon, Krull, & Lockwood, 2000; MacKinnon, Lockwood, et al., 2002; Shrout & Bolger, 2002).

The problems inherent in the causal steps approach are solved in the intervening variable approach proposed by MacKinnon and his colleagues (MacKinnon, Krull, et al., 2000; MacKinnon, Lockwood, et al., 2002), which was used in the present study. The first step in this approach is to run a regression analysis with the independent variable predicting the mediator. The second step is to estimate the effect of the mediator on the dependent variable, after controlling for the independent variable. However, because we hypothesized that two (rather than one) intervening variables would mediate the effect of online communication on well-being, we used a four-step procedure to test for mediation.

In the first step, the independent variable (online communication) predicted the first intervening variable (time spent with friends). In the second step, the first intervening variable (time spent with friends) predicted the second intervening variable (quality of friendships), while controlling for the independent variable (online communication). In the third step, the first intervening variable (time spent with friends) predicted the second intervening variable (quality of friendships), and in the fourth and final step, the second intervening variable (quality of friendships) predicted well-being, while controlling for the first intervening variable (time spent with friends). The results of these four regression analyses are presented in Table 2.

Table 1 Zero-order correlations among all variables in the study

Variables	Time spent with IM	Time spent with chat	Time spent with friends	Quality of friendships	Well-being
Time spent with chat	.33***				
Time spent with friends	.16***	.07*			
Quality of friendships	-.01	-.07*	.30***		
Well-being	-.03	.01	.18***	.20***	
Age	.20***	.03	-.03	.06*	-.12*
Gender (male)	.05	.02	.00	-.17***	.05

Note: * $p < .05$; ** $p < .01$; $p < .001$

Table 2 Mediation analyses

	B	SE	β
First mediation analysis			
DV: Time spent with friends			
IV: IM frequency	.0014	.0003	.15*
IV: chat frequency	.0005	.0008	.02
DV: Quality of friendships			
IV: IM frequency	-.0002	.0001	-.05
MV: Time spent with friends	.1376	.0121	.32*
Second mediation analysis			
DV: Quality of friendships			
IV: Time spent with friends	.1339	.0119	.30*
DV: Well-being			
IV: Time spent with friends	.0646	.0146	.13*
MV: Quality of friendships	.1858	.0335	.16*

Notes: DV = Dependent variable; IV = Independent variable; MV = Mediating variable
 * $p < .001$; The 4 decimals for the Bs are presented to enable the reader to recalculate the Sobel test.

As the first mediation analysis in Table 2 shows, time spent with IM was positively related ($\beta = .15$, $p < .001$) to the time spent with existing friends, a result which supports the stimulation hypothesis and our H1b (see Figure 1). The opposite displacement hypothesis expressed in H1a, which predicted a negative path between these two variables, was not supported. As Table 1 shows, the regression analysis showed that time spent with chat was not significantly related to time spent with friends ($\beta = .02$, n.s.). This implies that the first condition for mediation was not met in the case of time spent with chat. In other words, the causal predictions of the two hypotheses (H1a and H1b) only applied to IM, but not to chat. Therefore, the subsequent mediation analyses were only conducted for time spent with IM.

Our second hypothesis stated that the quality of friendships would positively predict well-being and act as mediator between time spent with friends and well-being (path 3 in Figure 1). This hypothesis was supported. As the second mediation analysis in Table 2 shows, the quality of friendships significantly predicted well-being ($\beta = .16$, $p < .001$), even when the first mediating variable (time spent with friends) was controlled. The fact that time spent with friends remained a significant predictor ($\beta = .13$, $p < .001$) of well-being when the quality of friendship was controlled indicates that the mediation of quality of friendship was only partial. Finally, in support of our third hypothesis (path 2 in Figure 1), time spent with friends acted as a full mediator between time spent with IM and the quality of friendships (see the significant β of .32 for time spent with friends versus the nonsignificant β of $-.05$ for time spent with IM).

We tested the significance of the indirect effects by means of a formula developed by Sobel (1982). If the Sobel test leads to the critical z-value of 1.96, the mediator carries the influence of the independent variable to the dependent variable. An online version of this test is available at <http://www.unc.edu/~preacher/sobel/sobel.htm> (Preacher & Leonardelli, 2005). The z-value for the first mediation analysis was 5.03, $p = .001$; the z-value for the second mediation analysis was 4.98, $p = .001$. These significant z-values indicate that both the time spent with friends and the quality of friendships are valid underlying mechanisms through which the effect of IM on well-being can be explained.

Discussion

The aim of this study was to test the validity of two opposing explanatory hypotheses on the effect of online communication on well-being: the displacement hypothesis and the stimulation hypothesis. Both hypotheses assume that online communication affects adolescents' well-being through its influence on their time spent with existing friends and the quality of those friendships. However, the displacement hypothesis assumes a negative effect from online communication to time spent with existing friends, whereas the stimulation hypothesis predicts a positive relationship between these variables.

We used formal mediation analyses to test the validity of the two mediating variables. Our results were more in line with the stimulation hypothesis than with the displacement hypothesis. We found that time spent with IM was positively related to the time spent with existing friends. In addition, the quality of friendships positively predicted well-being and acted as a first mediator between time spent with IM and well-being. Finally, we found that time spent with friends mediated the effect of time spent with IM on the quality of friendships.

However, the positive effects of our study held only for the time spent with IM and not for time spent with chat in a public chatroom. IM and chat seem to have very different functions for adolescents. In line with earlier studies, we found that the majority of adolescents use IM to talk with their existing friends. Chat in a public chatroom is less often used by adolescents. However, when utilized, adolescents primarily seem to chat with strangers. It is important for future research to differentiate between the uses of online communication technologies, because there is a risk of finding misleading null-effects when these different uses are unknowingly combined in a survey.

Overall, our study suggests that Internet communication is positively related to the time spent with friends and the quality of existing adolescent friendships, and, via this route, to their well-being. These positive effects may be attributed to two important structural characteristics of online communication: its controllability and its reduced cues. Several studies have shown that these characteristics of online communication may encourage intimate self-disclosure (e.g., Joinson, 2001; Leung, 2002; McKenna, Green, & Gleason, 2002; Tidwell & Walther, 2002; Valkenburg &

Peter, 2007), especially when adolescents perceive these characteristics of Internet communication as important (Schouten, Valkenburg, & Peter, in press; Valkenburg & Peter, 2007). Because intimate self-disclosure is an important predictor of reciprocal liking, caring, and trust (Collins & Miller, 1994), Internet-enhanced intimate self-disclosure may be responsible for a potential increase in the quality of adolescents' friendships.

Our results have several implications for future research. Because the stimulation hypothesis seems to be the best working hypothesis, follow-up research can be specifically designed to explore this hypothesis further and pursue a next step in theory formation: Attempting to answer *why* online communication may stimulate the quality of existing friendships. Although there is growing evidence for the positive effect of online communication on intimate self-disclosure, to date no research has demonstrated whether this potential mediator may account for a stimulation effect on the quality of existing friendships.

Although this study pitted two causal effects hypotheses against one another, we acknowledge that the assumptions of these hypotheses were tested with cross-sectional data. Although our study was theory driven, a reverse explanation for our findings may also be plausible. That is, how people choose to use online communication may be influenced by the quality of their existing relationships and/or by their trait sociability (see also Baym, Zhang, & Lin, 2004). There is a pressing need for causal-correlational research to investigate the longitudinal relationships between online communication and the quality of adolescent existing relationships. Not only are longitudinal designs better able to distinguish causation from covariance, but they are also pre-eminently suitable for exploring the validity of the underlying mechanisms by which Internet communication influences adolescents' social relationships.

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References

- Baron, R., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173–1182.
- Baym, N. K., Zhang, Y. B., & Lin, M. C. (2004). Social interactions across media: Interpersonal communication on the Internet, telephone and face-to-face. *New Media & Society*, 6(3), 299–318.
- Beebe, T. J., Harrison, P. A., McRae, J. A., Anderson, R. E., & Fulkerson, J. A. (1998). An evaluation of computer-assisted self-interviews in a school setting. *Public Opinion Quarterly*, 62(4), 623–632.

- Brener, N. D., Eaton, D. K., Kann, L., Grunbaum, J. A., Gross, L. A., Kyle, T. M., et al. (2006). The association of survey setting and mode with self-reported health risk behaviors among high school students. *Public Opinion Quarterly*, *70*(3), 354–374.
- Bryant, J. A., Sanders-Jackson, A., & Smallwood, A. M. K. (2006). IMing, text messaging, and adolescent social networks. *Journal of Computer-Mediated Communication*, *11*(2), article 10. Retrieved July 2, 2007 from <http://jcmc.indiana.edu/vol11/issue2/bryant.html>
- Buhrmester, D. (1990). Intimacy of friendship, interpersonal competence, and adjustment during preadolescence and adolescence. *Child Development*, *61*(4), 1101–1111.
- Bukowski, W. M. (2001). Friendships and the worlds of childhood. *New Directions for Child and Adolescent Development*, *91*, 93–105.
- Collins, N. L., & Miller, L. C. (1994). Self-disclosure and liking: A meta-analytic review. *Psychological Bulletin*, *116*, 457–475.
- Diener, E. (1984). Subjective well-being. *Psychological Bulletin*, *95*(3), 542–575.
- Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, *49*, 71–75.
- Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, *125*(2), 276–302.
- Grinter, R. E., & Palen, L. (2004). Instant messaging in teen life. *Proceedings of the 2002 ACM Conference on Computer Supported Cooperative Work (CSCW '02)*. Retrieved July 5, 2004 from <http://doi.acm.org/10.1145/587078.587082>
- Gross, E. F. (2004). Adolescent Internet use: What we expect, what teens report. *Journal of Applied Developmental Psychology*, *25*(6), 633–649.
- Hartup, W. W. (2000). The company they keep: Friendships and their developmental significance. In W. Craig (Ed.), *Childhood Social Development: The Essential Readings* (pp. 61–84). Malden, MA: Blackwell.
- Hartup, W. W., & Stevens, N. (1997). Friendships and adaptation in the life course. *Psychological Bulletin*, *121*(3), 355–370.
- Jackson, L. A., von Eye, A., Barbatsis, G., Biocca, F., Fitzgerald, H. E., & Zhao, Y. (2004). The impact of Internet use on the other side of the digital divide. *Communications of the ACM*, *47*(7), 43–47.
- Joinson, A. N. (2001). Self-disclosure in computer-mediated communication: The role of self-awareness and visual anonymity. *European Journal of Social Psychology*, *31*, 177–192.
- Judd, C. M., & Kenny, D. A. (1981). Process analysis: Estimating mediation in treatment evaluations. *Evaluation Review*, *5*(5), 602–619.
- Jung, J. Y., Qiu, L. J., & Kim, Y.-C. (2001). Internet connectedness and inequality. *Communication Research*, *28*(4), 507–535.
- Kraut, R., Kiesler, S., Boneva, B., Cummings, J., Helgeson, V., & Crawford, A. (2002). Internet paradox revisited. *Journal of Social Issues*, *58*(1), 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*(9), 1017–1031.
- LaRose, S., Ghuay, F., & Boivin, M. (2002). Attachment, social support, and loneliness in young adulthood: A test of two models. *Personality and Social Psychology Bulletin*, *28*(5), 684–693.

- Lenhart, A., Madden, M., & Hitlin, P. (2005). *Teens and Technology*. Washington, DC: Pew Internet & American Life Project.
- Leung, L. (2002). Loneliness, self-disclosure and ICQ ("I Seek You") use. *CyberPsychology & Behavior*, 5(3), 241–251.
- MacKinnon, D. P., Krull, J. L., & Lockwood, C. M. (2000). Equivalence of the mediation, confounding, and suppression effect. *Prevention Science*, 1(4), 173–181.
- MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods*, 7(1), 83–104.
- Matei, S., & Ball-Rokeach, S. J. (2001). Real and virtual social ties: Connections in the everyday lives of seven ethnic neighborhoods. *American Behavioral Scientist*, 45(3), 550–564.
- McKenna, K. Y., Green, A. S., & Gleason, M. E. (2002). Relationship formation on the internet: What's the big attraction? *Journal of Social Issues*, 58(1), 9–31.
- Mesch, G. (2001). Social relationships and Internet use among adolescents in Israel. *Social Science Quarterly*, 82(2), 329–340.
- Mesch, G. (2003). The family and the Internet: The Israeli case. *Social Science Quarterly*, 84(4), 1083–1050.
- Morgan, C., & Cotten, S. R. (2003). The relationship between Internet activities and depressive symptoms in a sample of college freshmen. *CyberPsychology & Behavior*, 6(2), 133–141.
- Mustanski, B. S. (2001). Getting wired: Exploiting the Internet for the collection of sexually valid data. *The Journal of Sex Research*, 38(4), 292–301.
- Nie, N. H. (2001). Sociability, interpersonal relations and the Internet: Reconciling conflicting findings. *American Behavioral Scientist*, 45(3), 420–435.
- Nie, N. H., Hillygus, D. S., & Erbring, L. (2002). Internet use, interpersonal relations, and sociability: A time diary study. In B. Wellman & C. Haythornthwaite (Eds.), *The Internet in Everyday Life* (pp. 215–243). Oxford: Blackwell.
- Preacher, K. J., & Leonardelli, G. J. (2005). *Calculation for the Sobel test: An interactive calculation tool for mediation tests*. Retrieved March 1, 2006 from <http://www.unc.edu/~preacher/sobel/sobel.htm>
- Sanders, C. E., Field, T. M., Diego, M., & Kaplan, M. (2000). The relationship of Internet use to depression and social isolation. *Adolescence*, 35(138), 237–242.
- Schouten, A. P., Valkenburg, P. M., & Peter, J. (in press). Precursors and underlying processes of adolescents' online self-disclosure: Developing and testing an "Internet-attribute-perception" model. *Media Psychology*.
- Shaw, L. H., & Gant, L. M. (2002). In defense of the Internet: The relationship between Internet communication and depression, loneliness, self-esteem, and perceived social support. *CyberPsychology & Behavior*, 5(2), 157–170.
- Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, 7(4), 422–445.
- Sobel, M. E. (1982). Asymptotic intervals for indirect effects in structural equations models. In S. Leinhardt (Ed.), *Sociological Methodology* (pp. 290–312). San Francisco: Jossey-Bass.
- Subrahmanyam, K., Kraut, R. E., Greenfield, P. M., & Gross, E. (2000). The impact of home computer use on children's activities and development. *Future of Children*, 10(2), 123–144.

- Tidwell, L. C., & Walther, J. B. (2002). Computer-mediated communication effects on disclosure, impressions, and interpersonal evaluations. *Human Communication Research*, 28(3), 317–348.
- Tourangeau, R., & Smith, T. W. (1996). Asking sensitive questions: The impact of data collection mode, question format, and question context. *Public Opinion Quarterly*, 60(2), 275–304.
- Valkenburg, P. M., & Peter, J. (2007). Preadolescents' and adolescents' online communication and their closeness to friends. *Developmental Psychology*, 43(2).
- Valkenburg, P. M., & Soeters, K. (2001). Children's positive and negative experiences with the Internet. *Communication Research*, 28(5), 653–676.
- Van der Voort, T. H., & Vooijs, M. W. (1990). Validity of children's direct estimates of time spent television viewing. *Journal of Broadcasting and Electronic Media*, 34(1), 93–99.
- Waestlund, E., Norlander, T., & Archer, T. (2001). Internet blues revisited: Replication and extension of an Internet paradox study. *CyberPsychology & Behavior*, 4(3), 385–391.
- Weiser, E. B. (2001). The functions of Internet use and their psychological consequences. *Cyberpsychology & Behavior*, 4(6), 723–744.

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