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The effects of text, audio, video, and in-person communication on bonding between friends

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Abstract

Considerable research on computer-mediated communication has examined online communication between strangers, but little is known about the emotional experience of connectedness between friends in digital environments. However, adolescents and emerging adults use digital communication primarily to communicate with existing friends rather than to make new connections. We compared feelings of emotional connectedness as they occurred in person and through digital communication among pairs of close friends in emerging adulthood. Fifty-eight young women, recruited in pairs of close friends, engaged in four conversations each: in-person, video chat, audio chat, and instant messaging (IM). Bonding in each condition was measured through both self-report and affiliation cues (i.e., nonverbal behaviors associated with the emotional experience of bonding). Participants reported feeling connected in all conditions. However, bonding, as measured by both self-report and affiliation cues, differed significantly across conditions, with the greatest bonding during in-person interaction, followed by video chat, audio chat, and IM in that order. Compared with other participants, those who used video chat more frequently reported greater bonding with friends through video chat in our study. Compared with other participants, those who spoke on the phone more frequently with their participating friend reported greater bonding during audio chat. Use of textual affiliation cues like emoticons, typed laughter, and excessive letter capitalization during IM related to increased bonding experience during IM. Nonetheless, a significantly lower level of bonding was experienced in IM compared with in-person communication. Because adolescent and emerging adults' digital communication is primarily text-based, this finding has significant real-world implications.

Keywords: Emerging adulthood; digital communication; friendship; bonding

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Introduction

Emerging adults are among the most avid users of digital communication technologies, including texting, instant messaging (IM), and video chat (Duggan & Brenner, 2013; Lenhart et al., 2011). Furthermore, today's 18-29 year olds are often described as "digital natives" because they have grown up using these technologies, utilizing text-based tools to develop existing friendships during adolescence, a sensitive period for socioemotional development (Baird, 2010; Prensky, 2001; Steinberg, 2005). While research has established that digital communication can enhance existing friendships over the long-term (e.g., Valkenburg & Peter, 2007, 2009), a continuing concern among some is that youth are less "connected" than they were in the past or that increasing digital communication contributes to stunted socioemotional or empathic growth (Small & Vorgan, 2008; Turkle, 2012). This question is provocative, but difficult to test empirically. One way to address potential differences in digital and in-person communication is to compare them directly. In developmental psychology, the existing literature on social media use, while increasingly sophisticated, has nonetheless relied primarily on survey-based approaches. In the field of communication and media studies, on the other hand, a rich literature spanning from the middle of the 20th century to the present has experimentally compared in-person and computer-mediated communication (CMC). However, it has been primarily concerned with the establishment of new relationships, rather than communication between existing friends. Our study fills this gap. Drawing on the experimental traditions of CMC research, the present study aimed to directly compare digital and in-person communication between pairs of close, emerging-adult friends to ascertain potential differences in ability to foster bonding. Bonding was defined as the momentary emotional experience of feeling connected to and affection for a friend.

Research comparing face-to-face and more distal forms of communication predates the rise of the Internet by several decades. By the late 1970's, experimental work examining information exchange through teleconferencing and closed-circuit television was advanced enough to warrant a review in *Psychological Bulletin* (Williams, 1977). In the years since, CMC researchers have compared audiovisual, auditory, and text-based communication to in-person communication on a wide variety of variables, including efficiency of communication, cognitive task performance, intimacy of disclosure, and trust (Antheunis, Schouten, Valkenburg, & Peter, 2012; Bargh, McKenna, & Fitzsimons, 2002; Burgoon et al., 2002; Ray & Floyd, 2006; Tidwell & Walther, 2002; Walther, Loh, & Granka, 2005).

For strangers meeting for the first time, digital communication has been shown to enhance the intimacy and frequency of self-disclosure (Antheunis, Valkenburg, & Peter, 2007; Tidwell & Walther, 2002), and strangers meeting in text-based environments show higher affinity for one another than strangers meeting one another face-to-face (Antheunis et al., 2012, Bargh et al., 2002). These results seem at first to fly in the face of media richness theory (Daft & Lengel, 1986), which proposes that the number of cues and channels available for communication relates directly to the exchange of richer information, as well as social presence theory (Short, Williams, & Christie, 1986), which suggests that these "richer" media allow for greater warmth and affection. Social information processing theory (Walther, 1992), suggests a more complex story: when using a medium with limited availability of visual cues or other channels of communication, interlocutors adapt their behaviors in order to connect more effectively using that particular medium. While bonding may take longer, Walther argues, it can ultimately reach levels present in face-to-face communication. Interlocutors furthermore may experience the online disinhibition effect (Suler, 2004), whereby the nature of text-based communication itself contributes to feelings of intimacy and connectedness.

The above evidence from the media studies literature might suggest that when young adults engage in digital communication, they can, with time, achieve the same level of connectedness as in-person communication. However, this literature has focused on the process of meeting and getting to know others digitally. In contrast, adolescents and young adults use digital tools mainly to communicate with existing connections, whether friends, family, or acquaintances (Gross, 2004; Reich, Subrahmanyam, & Espinoza, 2012; Subrahmanyam, Reich, Waechter, & Espinoza, 2008; Valkenburg & Peter, 2007). Stated differently, youth use digital media to maintain connections established in face-to-face contexts. CMC research, therefore, has explored different processes in online environments. Little is yet known about the emotional experience of bonding with an existing friend as it occurs online. Given the frequency with which adolescents and young adults use digital tools to communicate with friends, we hope to shed light on their ability to feel emotionally bonded when using various tools.

To examine bonding in close friendships, we turn to the work of Gonzaga and colleagues. In a series of studies, these researchers discovered that a cluster of four nonverbal cues—the Duchenne smile, affirmative head nods, leaning towards the conversation partner, and positive hand gesturing—relate reliably to feelings of affection towards a friend and commitment to close relationships (Gonzaga et al., 2001, 2006). We summarize these feelings and commitment to the relationship with the term "bonding," a central concept in our study. Following Gonzaga et al. (2001), we term the nonverbal cues associated with bonding *affiliation cues*. Given the evidence suggesting that this particular cluster of cues is a distinct indicator of feelings of affection in face-to-face interaction, we examined how affiliation cues change in mediated contexts.

The concept of emotional connectedness is particularly relevant in emerging adulthood, a period which includes the final years of adolescence and during which social development continues to occur (Arnett, 2001; Arnett & Schwab, 2013). Emerging adults, sometimes defined as college-age students (Arnett, 2001), are frequently establishing new social networks in their schools, jobs, or cities. Emerging adults also increasingly use digital tools to connect with friends and maintain friendships over long distances (Manago, Taylor, & Greenfield, 2012).

Among teens and emerging adults, text-based technologies are by far the most popular communication technologies, but youth—and particularly young women—are increasingly using video chat tools like Skype and FaceTime to communicate (Lenhart, 2012). This widespread use is even more meaningful, considering that one of the essential tasks of adolescence is the honing of the social skills important for one's society or cultural context (e.g., Baird, 2010; Steinberg, 2005). Might young people who have grown up relying on digital communication and who continue to use it voraciously, be uniquely adapted to affiliate within this context? Alternatively, have youth become accustomed to relying on digital communication in circumstances where the reduced richness of the medium makes conversation easier in the short run, but ultimately prevents them from practicing certain social skills or fostering close bonds? The present study thus aimed to directly compare in-person and various forms of mediated communication while holding other factors as constant as possible.

We utilized a well-established experimental approach from CMC research to shed light on the role of communication technologies in established friendships, an important topic in the peer-relations literature. Specifically, we invited self-identified pairs of close female friends into the laboratory to engage in four brief conversations: in person, through video chat, audio-only chat, and IM. We measured emotional connectedness through both conscious self-report and through the nonconscious display of affiliation cues. Our decision to examine female dyads reflected the tendency for female youth to be particularly sensitive to social signals, both online and offline, and to develop closer peer attachments than males (e.g., Ma & Huebner, 2008; McClure, 2004; Stern, 2004). Previous research has documented the use of textual cues such as emoticons (Lo, 2008; Walther & D'Addario, 2001), typed laughter, excessive punctuation or capitalization, and letter repetition (Parkins, 2012), to convey emotion and emphasis in text-based environments. We therefore investigated whether these potential "digital affiliation cues" might relate to bonding. Our hypotheses were as follows:

> *Hypothesis 1. Emotional connection should decline as interpersonal cues decline in the communication situation. That is, both number of affiliation cues and self-reported bonding with the friend will decrease as the level of information afforded by the medium does: it will be highest in person, followed by video chat, audio chat, and, finally, IM.*

While some studies have shown that affinity or affection is stronger online than in-person among strangers (Antheunis et al., 2007, 2012; Bargh et al., 2002), evidence has not emerged to suggest that affection will also be higher in online environments for existing close relationships. Rather, one recent study (Seltzer, Prososki, Ziegler, & Pollak, 2012) examining oxytocin levels in daughters while they communicated with their mothers in person and through digital mediation found that IM, unlike face-to-face communication and audio-only communication, did not induce an increase in the bonding-related hormone oxytocin, a hormone that has also been found to correlate with affiliation cues when romantic couples communicate (Gonzaga et al., 2006). Another recent study found that emerging adults ranked friends with whom they communicated offline higher on measures of relationship quality and social attraction than friends with whom they communicated online only (Antheunis, Valkenburg, & Peter, 2012). Ultimately, humans evolved in the context of in-person communication and are highly attuned to human faces and gestures from infancy (Goren, Sarty, & Wu, 1975; Tomasello, Carpenter, & Liszkowski, 2007).

Thus, we hypothesized that media richness theory, which proposes that some media allow for the exchange of richer information due to the number of cues and channels available for communication, will hold for the experience and expression of emotional connectedness among preexisting friends.

Hypothesis 2. All conditions will elicit feelings of bonding and some affiliation cues.

Given the literature summarized above demonstrating the ease with which individuals affiliate and self-disclose online, we expected that both in-person and online communication would elicit some self-reported bonding and affiliation cues.

Hypothesis 3. Individuals who have used tools longer and with greater frequency will report higher bonding and show more affiliation cues than participants having less experience with a given tool.

This hypothesis is in line with social information processing theory, which suggests that experience with a tool will allow participants to more effectively adapt to the tool.

Hypothesis 4. Participants will use potential "digital affiliation cues"—emoticons, typed laughter, excessive punctuation, and capitalization —and those individuals who use them more frequently will also report greater bonding with friends than those individuals who use them less.

In line with social information processing theory, we hypothesized that these potential digital affiliation cues would be a means by which participants would adapt to the text-based environment and convey bonding even without access to one another's physical behaviors.

Method

Participants

A total of 58 female university students aged 18-21 years (M = 19.33, SD = 1.09) participated in the study. Participants were recruited from the Psychology participant pool or from flyers posted at a large university in Los Angeles and were asked to bring a close female friend to participate with them in the study. Thus, our complete sample consisted of 29 pairs of close female friends, though all analyses were conducted with the individual as the unit of analysis (controlling for the nonindependence of the dyads through a nested model, as explained in more detail in the Data Analysis section). Eligibility requirements included being female, between the ages of 18-24, and identifying as heterosexual. Participants were compensated with either course credit or entrance into a raffle for $60. Participants who completed the experimental protocol reported having known one another for an average of 32.70 months (SD = 40.15). The sample was diverse and the racial/ethnic breakdown was as follows: 37.9% European American, 29.3% Asian American, 12.1% Hispanic/Latina, 5.2% African American, 5.2% Multi-racial, and 3.4% other racial/ethnic groups; 6.9% declined to provide information about their race/ethnicity.

All participants were videotaped during the experiment for subsequent coding of affiliation cues. However, malfunctions with the cameras occurred on several occasions, resulting in missing video data. Participants for whom any video data was missing were excluded entirely from affiliation cues analysis. Of the 58 participants included in our study, complete video data were available for 50 (including 24 matched pairs and 2 additional individuals from separate pairs). Camera malfunctions occurred in a separate control room and could not be perceived by participants. Thus, analyses involving video data (i.e., analysis of affiliation cues) use an n of 50 and all other analyses use the complete n of 58 participants.

Instruments

Two laptop computers with built-in webcams were used. Participants interacted using the program Skype (version 5.1.0), which allows for video chat, audio-only chat, and instant messaging (IM). The audio was considered a simulation of telephone communication; IM was considered a simulation of textual communication more generally. Participants were videotaped with either wall mounted cameras (Room A) or a camera placed on a tripod behind the computer (Room B). Cameras were positioned so as to capture the upper bodies and faces of participants as they engaged in conversation. Room A was equipped with cameras on opposite walls, allowing for video capture of participants as they conversed in person across a table.

Design

In a within-subjects design, participant pairs engaged in four 5-minute conversations, each in a different condition: in-person, video chat, audio chat, and instant messaging (IM). The basic design was a comparison of the subjective sense of bonding and frequency of affiliation cues across the four conditions for each pair of friends. We let closeness of the pairs of friends vary naturally, in order to increase the generality of our results. Because each pair of friends was compared with itself across the four conditions, this variation in closeness did not introduce a bias into the analysis or results.

Both order of conversation conditions and order of conversation prompts were initially counterbalanced. Because some participants were excluded from analysis due to equipment malfunction or failure to complete all four conditions, condition order and condition/prompt pairing were not completely counterbalanced. We therefore conducted a series of one-way univariate analyses relating condition order and condition/ prompt pairing to the levels of bonding and affiliation cues in that condition, and confirmed that neither order nor prompt influenced results in a consistent or meaningful way.

Procedure

In the in-person condition, participants sat facing one another in a private room (Room A). In the other three conditions, participants engaged in conversation from separate rooms (Room A and Room B). In the video chat condition, participants communicated using the video chat feature on Skype. In the audio chat condition, participants communicated on Skype using only the audio function without video. In the IM condition, participants communicated using the IM feature on Skype. All conversations were videotaped, thus providing data for the analysis of affiliation cues.

At the beginning of each conversation, participants received a conversation prompt and were instructed to discuss the prompt, or to move on to other topics if they so desired. Four unique prompts were used. These prompts were designed to stimulate conversation and to encourage participants to engage in discussion about their friendship and other close relationships, e.g., "You are planning the

ideal party. What kind of party would it be? Where would it be held? Who would you invite? etc. Topics of the other prompts involved the participants being neighbors in twenty years, switching places for a day, and planning a trip to a location of their choice. Participants were asked to read the conversation prompts aloud from a paper to their friends after the experimenters left the room. Participants alternated reading the prompts, with each participant reading two of the four conversation prompts.

After five minutes of conversation, the experimenters returned to the room(s) and halted the conversation. If participants had just completed the in-person condition, the experimenters directed one participant to Room B; otherwise, participants remained in separate rooms. Once participants were separate, the experimenters administered emotion reports and cognitive distractor tasks, described below. Following the completion of each cognitive distractor task, the experimenters either reunited the participants in Room A (for the in-person condition) or initiated the next conversation through Skype.

Emotion reports. Following each conversation, participants independently reported on the level of several emotions they felt during the conversation on a scale ranging from (0=*No emotion*) to (8=*Extreme emotion*) for the following emotions: anxious/nervous, amused, embarrassed, frustrated/angry, hurt/sad, liking/bonding, and love (Gonzaga et al., 2001). During debriefing, participants reported interpreting "liking/bonding" as meaning emotional bonding with a friend, so this emotion was used in analyses.

Cognitive distractor task. Following the emotion reports, participants independently completed a worksheet containing a math problem or brainteaser and a maze. These distractor tasks were designed to give participants a momentary break from social tasks.

Online habits survey. Following the four conversations, participants independently completed a survey about their use of digital communication. To assess frequency of use, participants were asked how frequently they communicated generally and with their participating friend using the phone, video chat, texting, and IM on response items ranging from (1=*I never use this tool*) to (8=*Every day*). To assess length of use, participants reported how long they had been using each of these tools, both generally and with their participating friend, on response items ranging from (1=*I never use this tool*) to (6=*More than ten years*). Participants reported the number of texts they sent the previous day, either by estimating or by counting on their cell phone if available.

Coding Procedures and Criteria

Coding procedure and criteria for affiliation cues data. As noted above, video data were available for 50 of the 58 participants; thus, the authors coded affiliation cues for a total of 50 participants. Given the laborious nature of coding, 90-second clips were selected from each of the four videos of each participant for coding. Previous work has demonstrated the predictive power of short, intensely coded samples of nonverbal behavior (Gonzaga et al., 2001; Keltner & Bonnano, 1997). Clips were chosen based on a number of criteria. First, overlap in conversation between participants was avoided. Given that all analyses were conducted at the level of the individual, the avoidance of overlap was intended to ensure maximal independence between the data of each pair. If a 90-second clip was selected from the first half of a participant's IM conversation, a 90-second clip from the latter half of her partner's IM video would be chosen (e.g., if participant 8A's clip was chosen from the first half of the IM conversation, Participant 8B's clip was chosen from the second half). For each participant, the authors selected a clip from the first half of two out of four conditions and a clip from the second half of the remaining two conditions. Thus, for all matched pairs, data from the first and second half of each conversation were represented in the total data sample. Within the designated first or second half of the conversation, clips were chosen that minimized both interruptions (e.g., if the experimenters entered at the end of the conversation or if the video chat froze briefly) and limited visibility (e.g., if the participant turned away from the camera).

The first and second authors then coded the occurrence or duration of four affiliation cues (smile, laughter, head nods, and gestures) for all four conversation conditions based. Coding was adapted from the training criteria established by Gonzaga and colleagues (2001, 2006).

A *Duchenne smile* is the co-occurrence of muscle movement in the orbicularis oculi and zygomatic muscles (Messinger, Fogel, & Dickson, 2001). Duchenne smiles were coded using frequency coding; that is, the total *number of smiles* in each 90-second clip was recorded. Participants occasionally demonstrated Duchenne smiles immediately before or after laughter; if this smile was visible for a full second or longer before the beginning or after the ending of laughter, this was marked as a distinct cue.

Unlike Gonzaga and colleagues (2001, 2006), we coded laughter as a separate cue to account for the fact that, in the audio chat condition, laughter but not smiling could be picked up by the partner. Laughter was coded using length coding; the total *number of seconds* in which the participant engaged in laughter during the 90-second clip was recorded by adding together the length (in seconds) of each laugh. The beginning of a laughter cue was marked by either the first audible sound of laughter, or the first physical sign of laughter if laughter was silent (i.e., shaking shoulders or body). The end of the cue was marked when the last audible or physical sign of laughter ended. Smiles that led into or out of laughter and lasted less than a second in duration were not coded as separate cues, but rather a feature of the laughter.

A *head nod* was coded as an unsolicited distinct upward and downward motion of the head. Head nods were coded using frequency coding. When nods occurred in direct response to a question, they were not recorded as affiliation cues (Gonzaga et al., 2001).

Gestures were defined as any movement of the hand/s not in moving contact with another object (e.g., tapping on the table) or body part (e.g., scratching face or playing with hair). Hand gestures were coded using length coding, with the cue beginning at the moment the hand/s moved away from the table, body, or from a still position. Gestures ended when the hand/s once again made contact with the table or a body part or ceased to move.

Gonzaga and colleagues (2001) identified *leaning towards the partner* as an affiliation cue. It was ultimately determined that the leaning behaviors in the online conditions resulted from other motivations (e.g., attempting to hear the partner better, or scrutinizing text in the IM conditions). Thus, this cue was excluded from further analysis. Ultimately, four cues were analyzed in all four conversation conditions: smiles, laughter, head nods, and gestures.

The first author and second author independently coded the same 26% of the sample, consisting of all four video clips for 13 out of the 50 participants with video data. To assess reliability, coding scores were compared between the authors using Cronbach's alpha, a reliability statistic used for continuous data. Cronbach's alpha for each cue was within the "good" or "excellent" range (George & Mallery, 2003) (for Duchenne smiles, α = .84; for laughter, α = .97; for head nods, α = .94; for gestures, α = .95). The remaining

videos in the sample were subsequently coded by either the first or second author.

Coding procedure and criteria for textual cues. Following each data collection session, a copy of the IM transcript was saved for further analysis. Each conversation was coded for the frequency of the following potential digital affiliation cues: emoticons, letter repetition, capitalization, excessive punctuation, and typed laughter. An *emoticon* was defined as each sideways or upright representation of a facial expression, such as a smiley face. *Letter repetition* was defined as each individual occurrence of a word involving one or more repeated letters (when letter repetition does not occur in the correct spelling of the word). *Capitalization* was defined as each word or phrase in which all letters were capitalized. *Excessive punctuation* was defined as each occurrence (maximum, once per sentence) in which more than one punctuation mark was used in a row. Finally, typed laughter was defined as each occurrence of either onomatopoeic laughter (in which the sound of laughter was typed out, e.g., "hahaha") or acronymic laughter (in which an acronym describing laughter was used, e.g., "LOL" for "laughing out loud"). All cues were identified in transcripts and quantified as total number of occurrences per participant.

Data Analysis

Data analysis consisted of both within-subjects and between-subjects comparisons. Within subjects, we compared across all four conditions (in-person, video chat, audio chat, IM) levels of self-reported bonding and a composite score of all affiliation cues (smiles, laughter, nods, gestures). Between subjects, we examined the relationship between affiliation cues, self-reported bonding, potential "digital affiliation cues," and survey measures of frequency and length of use of each tool.

All analyses reported below were conducted with the *individual*, rather than the pair, as the unit of analysis. Given the nonindependence of the dyads in our sample, tests of linear mixed models (also known as linear multilevel models or nested models) were used instead of ANOVA or Pearson correlations. ANOVA and correlational analyses, like other traditional parametric tests, assume that data is independent; by using mixed models we were able to model and control for the variability accounted for by relationships between pairs. Each between-subjects analysis involved a two-level mixed model (first level: participant, second level: pair) and each within-subjects analysis involved a three-level mixed model (first level: condition, second level: participant, third level: pair). Thus, all significance tests reported below describe the relationship between the independent and dependent variable of interest while taking into account the relatedness of data from friend dyads. For all analyses, we report the test statistic (*F)* and significance level resulting from these tests. As the interpretation of R^2 in mixed models is ambiguous (Kreft & De Leeuw, 1998), we refrain from reporting R^2. Mixed models yield an *F* test which indicates the significance of the model, in this case the relationship between the independent and dependent variable when taking into account participant pairs. Mixed models and analyses were conducted using SPSS Statistics (IBM Corp, 2012).

Results

Measures of Bonding: Emotion Reports and Affiliation Cues

Hypothesis 1. Emotional connection should decline as interpersonal cues decline in the communication situation. That is, both number of affiliation cues and self-reported bonding with the friend will decrease as the level of information afforded by the medium does: it will be highest in-person, followed by video chat, audio chat, and, finally, IM.

To examine differences between conditions in all four affiliation cues simultaneously, we calculated z-scores for smiles, laughter, nods, and gestures, in all conditions. We then summed the z-scores of each cue for each condition to create a composite variable. Figure 1 demonstrates the decrease in z-scores for smiles, laughter, nods, and gestures across the four conversation conditions. Composite score was highest for the in person condition (2.24) followed by video chat (1.21), audio chat (-0.73), and IM (-2.72). In a model testing the effect of condition on composite score, the four conditions differed significantly in composite scores ($F = 72.89$, $p = .000$). Furthermore, cues were significantly higher in person than on video chat ($t = 2.81$, $p = .005$), significantly higher on video chat than on audio chat ($t = 5.34$, $p = .000$), and significantly higher on audio chat than on IM ($t = 5.50$, $p = .000$). Table 1 presents the level of affiliation cues and level of self-reported bonding demonstrated in each conversation condition.

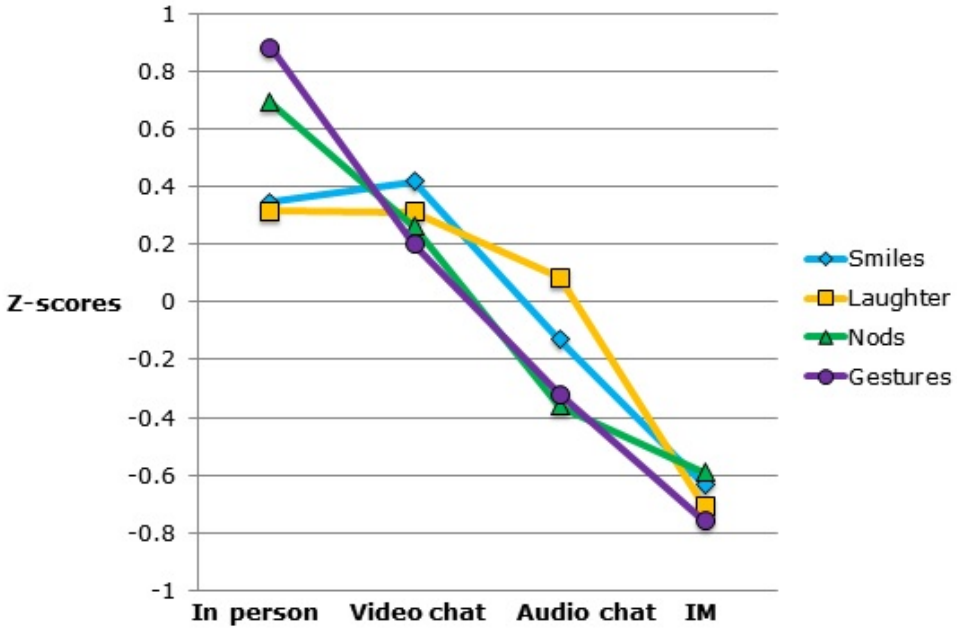

Figure 1. Affiliation cues in four conversation conditions (N = 50).

In-person affiliation cues and in-person bonding were marginally related (F = 3.13, p = .084). However, there was no significant relationship between reported bonding and affiliation cues in the mediated conditions (For video chat, F = 0.00, p = .988; for audio chat, F = 1.16, p = .287; for IM, F = 0.49, p = .487).

Table 1. Affiliation Cues and Self-Reported Bonding in Each Conversation Condition.

	In-Person	Video Chat	Audio Chat	IM
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Smiles	4.62 (2.34)	4.82 (3.22)	3.32 (2.34)	1.94 (1.92)
Laughter	8.21 (6.14)	8.19 (5.77)	6.81 (6.39)	1.99 (3.38)
Head nods	8.18 (8.01)	5.56 (6.37)	1.74 (2.38)	0.34 (1.52)
Gestures	12.14 (8.17)	7.17 (6.58)	3.29 (5.35)	0.04 (0.28)
Self-Reported Bonding	6.59 (1.44)	6.31 (1.42)	6.02 (1.79)	5.88 (1.72)

Note. N = 50 for Affiliation Cues: Laughter and gestures reported in seconds; smiles and head nods reported in frequency. N = 58 for Self-Reported Bonding.

Participants differed significantly in their level of reported liking/bonding across conditions (F = 5.71, p = .001). In accord with Hypothesis 1, every reduction in the cues normally part of in-person interaction led to reduced experience of liking/bonding (Table 1). As predicted, liking/bonding self-report was significantly greater in person than using audio chat (t = 3.05, p = .003), significantly greater in person than using IM (t = 3.79, p = .000), and significantly greater using video chat than using IM (t = 2.31, p = .022). However, while all medium differences went in the predicted direction, some differences were not statistically significant. Self-reported bonding differed significantly between in person and video chat, in person and audio chat, in person and IM, and video chat and IM ($p < .05$).

Hypothesis 2. All conditions will elicit feelings of bonding and some affiliation cues. As predicted, all four conditions elicited a sense of bonding; on a 0 to 8 scale, the lowest mean was on the upper half of this scale (Self-Reported Bonding, Table 1). Like the emotion self-reports, affiliation cues were also present in all conditions (Smiles, Laughter, Head nods, Gestures, Table 1). Participants produced smiles, gestures, and nods even during audio chat and IM, when they could not be seen by their partner. Note, however, that in the IM condition, where hands must be used to communicate textually, there are virtually no gestures.

The Role of Experience: Long-Term Habits, Self-Reported Bonding/Liking, and Affiliation Cues

Hypothesis 3. Individuals who have used tools longer and with greater frequency will report higher bonding and show more affiliation cues than participants with less experience. In order to test this hypothesis, we used mixed models (first level = participant, second level = pair) to examine whether self-reported bonding during the video chat condition was predicted by frequency or length of video chat use, whether self-reported bonding during the audio chat condition was predicted by frequency of phone use, and whether self-reported bonding in the IM condition was predicted by frequency or length of IM use or texting. For all analyses, we examined survey results as reported both generally and specifically with the participating friend. Finally, we examined whether the number of texts the participant reported sending on the previous day predicted bonding in the IM condition.

Length of time using a tool did not significantly predict bonding in any condition. Frequency of use significantly predicted self-reported level of bonding in two conditions. The frequency with which participants used video chat generally (M = 4.66, SD = 1.92) significantly

predicted level of self-reported bonding in the video chat condition ($F = 4.89$, $p = .031$). The frequency with which participants spoke on the phone with their participating friend ($M = 5.76$, $SD = 1.99$) significantly predicted level of self-reported bonding in the audio chat condition ($F = 6.69$, $p = .013$). All other results were nonsignificant. We also investigated the relationship between long-term experience and composite scores of affiliation cues in each condition, but all results proved to be nonsignificant.

Hypothesis 4. Participants will use potential "digital affiliation cues"—emoticons, typed laughter, excessive punctuation, and capitalization—and those individuals who use them more frequently will also report greater bonding with friends. This hypothesis related specifically to the IM condition. Table 2 presents the frequency of the digital affiliation cues, including emoticons, typed laughter, letter repetition, repeated punctuation, and capitalization. Many of these cues were used by a majority of participants, thus confirming the first proposition in Hypothesis 4.

Table 2. Use of Digital Affiliation Cues in the IM Condition (N = 58).

Cue	Example	Percentage of sample that used this cue	Average number of occurrences per participant (SD)
Emoticons	*;D , (:*	27.6%	0.84 (1.67)
Typed Laughter	*LOL, hahahah*	93.1%	5.21 (4.68)
Letter repetition	*righttttt!*	79.3%	2.81 (2.85)
Excessive Punctuation	..., !!, !?	75.9%	3.10 (3.49)
Capitalization	YES YOU CAN	60.3%	1.78 (2.77)

We next examined whether each participant's digital affiliation cues, as well as a composite score of these cues, related to her self-reported bonding and affiliation cues during IM. We also examined specifically whether individual participants' emoticon use related to the frequency of smiles in the IM condition and whether digital laughter (e.g., "hahah" and "LOL") related to total actual laughter during IM. Table 3 presents the results of these analyses. The results shown in Table 3 indicate that the second proposition in Hypothesis 4 was confirmed: The composite score of digital affiliation cues was significantly related to self-reported bonding during IM. In addition, typed laughter and vocal laughter were significantly related to each other.

Table 3. Digital Affiliation Cues, Physical Affiliation Cues, and Self-Reported Bonding.

Digital affiliation cue	Self-reported bonding during IM ($N = 58$)	Composite score of physical affiliation cues in IM ($N = 50$)	Frequency of smiles during IM ($N = 50$)	Laughter (in seconds) during IM *($N = 50$)*
Composite score (emoticons, laughter, letter repetition, excessive punctuation, capitalization)	$F = 4.13$*	$F = 3.04$†	--	--
Emoticons	$F = 3.29$†	$F = 0.73$	$F = 1.14$	--
Typed Laughter	$F = 1.13$	$F = 4.10$*	--	$F = 7.36$**
Letter repetition	$F = 3.13$†	$F = 0.40$	--	--
Excessive punctuation	$F = 0.02$	$F = 0.57$	--	--
Capitalization	$F = 3.26$†	$F = 3.19$ †	--	--

Note. †$p < .10$ *$p < .05$. **$p < .01$. *F* scores indicate the result of each mixed model relating level of digital affiliation cues to level of self-reported bonding or the composite score of physical affiliation cues. For all significant and marginally significant results, a positive relationship was discovered: as digital affiliation cues increased, self-reported bonding/ physical affiliation cues also increased.

Discussion

The present study tested levels of emotional connectedness, as consciously experienced by each participant (self-report) and through automatic, nonconscious behavior (affiliation cues), during in-person and mediated conversations between pairs of close female friends. Our results demonstrate that multiple indicators of affiliation differ in mediated and in-person communication among emerging adults. Furthermore, the specific type of mediated communication—video chat, audio chat, or IM—influenced the degree to which our participants acted and felt connected. As the cues present in face-to-face communication declined, so did the subjective bonding experience and nonverbal affiliation cues; thus, both kinds of bonding measures declined from video to audio to textual communication.

While it may seem obvious that the weakest bonding would occur in text-based communication, this is nonetheless a socially significant finding, given that most of young people's digital communication in the United States today is taking place through texting (Lenhart, 2012). Even though our findings indicate that digital cues increase the bonding experience, the ability of digital cues to compensate for lack of other cues was not complete: Compared with in-person communication and video chat, text-based

communication provided a significantly weaker experience of liking and bonding between friends. Hence, the online disinhibition effect posited by Suler (2004) did not occur; contrary to this effect, text-based communication led to the weakest sense of connection. Our results suggest that the advantage of text-based communication for bonding may be limited to the situation of communication between strangers and may not apply to pre-existing friends (but see discussion in Limitations section for an alternative possibility).

Compared to self-report results, behavioral results suggest a starker contrast between in-person and various mediated conversation contexts. Participants showed a statistically significant decline in affiliation cues from in person to video chat to audio chat to IM. Other factors may also have contributed to the significant decline in affiliation cues from one condition to the next. It is unsurprising, for example, that gestures were very rarely used in the IM condition, since participants had to use their hands to type (although it is notable that a participant used a gesture on one occasion). Nonetheless, participants demonstrated differences in the other conditions as well.

Despite these differences between condition, participants *did* report feelings of bonding in all conditions—indeed, even during IM the mean reported liking/bonding was closer to (8=*Extreme emotion*) than (0=*No emotion*)—and they displayed affiliation cues even in situations where their partners could not perceive them. These findings suggest that participants were able to connect effectively with friends even without audiovisual connection. The ability of text-based online environments to maintain or strengthen existing friendships in adolescence and emerging adulthood has been well-characterized in the literature (Ellison et al., 2007; Valkenburg & Peter, 2007, 2009). The emotional connectedness reported by our participants suggests that the feeling of affection during digital communication is one mechanism by which this ongoing building of relationships may occur.

Our results also suggest that some forms of mediated communication are more effective at fostering the experience of bonding than others: video chat, which is becoming more popular among teens and young adults, did not differ significantly from in-person communication in the subjective sense of bonding, although the production of more nonconscious, automatic affiliation cues was significantly lower.

Relationship to Theory and Research in Communication Studies.

Our findings are in accord with media richness theory (Daft & Lengel, 1986), which proposes that some media allow for the exchange of richer information due to the number of cues and channels available for communication. Richer cues (e.g., face-to-face) allow for less equivocal and therefore more effective communication. Similarly, findings are in line with social presence theory (Short et al., 1976), which suggests that richer communication allows for greater experience of and expression of affection.

The fact that our participants reported significantly higher levels of bonding in the in-person condition as compared to audio-only chat or IM conditions, and significantly higher levels of bonding in the video chat condition as compared to IM, seems at first to differ markedly from work in the CMC literature, which has found greater affiliation and self-disclosure in online environments (Antheunis et al., 2007; Bargh et al., 2002; Tidwell & Walter, 2002). Several important distinctions help to explain this discrepancy: we measured feelings of affection, rather than sense of intimacy or disclosure, and, most important, we looked at the experience of *existing* friends, rather than strangers.

The Role of Digital Cues and Previous Experience: Support for Social Information Processing Theory?

Our hypotheses on the relationship between long-term experience and bonding during the study and on the use of digital affiliation cues to increase bonding were both consonant with social information processing theory. To some extent both of these hypotheses were supported. Participants who engaged in video chat use more frequently reported greater bonding with friends during the video chat condition. Similarly, participants who spoke more frequently on the phone *with their participating friend* reported greater bonding with their partner during the audio chat condition. These results suggest that under some circumstances, long-term communication habits and emotional experience during communication may be related. The specific pattern of results makes intuitive sense. Many of our participants rarely or never used video chat with their participating friend; thus, it would have been unlikely for us to find a relationship between this variable and bonding during video chat. Rather, participants who used video chat more frequently, perhaps with long-distance family members or long-distance friends, felt closer to their participating friends when they did take the opportunity to video chat with them. Unlike video chat, which is often used to connect with existing family and friends, general phone use can have many purposes, such as making appointments or conversing in a professional capacity. Thus, frequency of phone use may be neither a reflection of the enjoyment one derives from phone conversations nor a means by which one hones the ability to establish close connections. Frequency of phone use *with the participating friend* was related to bonding in the audio chat condition; this result suggests a potential relationship between the time our participants spend bonding with their friend on the phone in everyday life and the level of bonding they experienced during the audio chat condition.

Given that IM and other text-based tools are the *most* different from in-person communication, we expected to find a relationship between bonding in the IM condition and general use of IM or text messaging. Despite measuring text-based communication in a number of ways, we failed to find a relationship. How to account for this result? Perhaps young women who text and IM frequently do not actually connect more effectively through text-based tools than young women who use them less. Another explanation is that our failure to detect an effect was the result of limited variability in the sample, as texting is widely popular among this age group. Digital communication is dictated by peers' usage as well as personal preferences; it may be that, regardless of one's interest in or ability to effectively use textual communication, texting is unavoidable.

Our digital affiliation cues results provide additional nuance to the issue of text-based communication. During IM, our participants used a number of expressive techniques unique to text-based environments, including emoticons, capitalization, letter repetition, excessive punctuation, and typed laughter. We tested the possibility that these cues might help our participants connect in the IM condition. Notably, a composite score of these digital cues were significantly related to self-reported bonding, and the frequency of typed laughter was significantly related to level of actual laughter during IM. A number of other tests nearly reached significance, suggesting the potential for future focused investigation. Walther (1992) proposed that interlocutors adapt to the available medium in order to connect with others; our results suggest that the use of emoticons and other "digital affiliation cues" may be one way In which such adaptation occurs.

Ultimately, therefore, our findings lend partial support to social information processing theory. Our participants did adapt to the

medium, by using digital affiliation cues, and these were related to an increase in connectedness. However, the amount of time participants had been using a tool did not relate to their ability to bond on that tool, and frequency of use was related only under certain circumstances. The adaptation, moreover, did not bring the sense of bonding up to the level of that occurring during in-person communication.

Limitations

Experimental work comparing text-based and audio-based communication in the CMC literature has traditionally allowed for more time to communicate in the text condition, given that messages take longer to transmit (Antheunis et al., 2007; Tidwell & Walther, 2002; Walther, 1996). In our study, we elected to hold conversation time constant across conditions. We were primarily interested in the experiences of adolescents and emerging adults, who frequently engage in short message exchanges with existing friends using tools like text messaging. While our results suggested that a conversation of equal length leads to less emotional connectedness when conducted through text than when conducted in-person or through other media, it is still an open question as to whether longer text-based exchanges would increase bonding between existing friends.

We conducted our study on a live wireless network which was subject to occasional interruptions. Upon viewing the videos of participant conversations, it was clear that the video chat "froze," on a few occasions. To minimize this confound, we excluded the data of one set of participants that experienced excessive interruptions and chose 90-second video clips for coding that included little to no freezing. Nonetheless, these interruptions may have affected participants' ability to feel connected to one another during video chat. It could be argued that this confound is actually relevant for our conclusions, since freezing is a typical issue with video chatting generally. Future studies should differentiate between disconnection caused by video malfunction and that caused by the video chat medium itself. And as the technology of video chat improves, its ability to foster bonding may also reach the level of in-person communication.

Gonzaga (2001, 2006) found an overall correlation in face-to-face communication between affiliative cues and self-report of bonding; we too found a positive relationship in our face-to-face condition, although it was only a trend. In our IM condition, we found a significant correlation between digital affiliation cues and self-reports of bonding. However, we did not find a correlation between Gonzanga's affiliative cues and the bonding experience in any of our three modes of mediated communication. This pattern of findings suggests that the relationship between affiliation cues and the bonding experience may be modality-specific.

Implications, Conclusions and Future Directions

The desire for close interpersonal attachments is a basic and pervasive human motivation, and social attachments form even when connection is brief, tenuous, or less than ideal (Baumeister & Leary, 1995). It is therefore unsurprising that our participants reported feeling connected when they were unable to see and hear one another. Ultimately, however, participants felt most bonded during the in-person and video-chat conditions. To fully understand the implications of our findings, it is important to consider the developmental context of our population. Today's emerging adults spent their adolescent years surrounded by digital communication tools. They are the first generation to incorporate text-based communication into their daily lives. Indeed, our participants utilized a variety of textual cues to convey nuance in their text-based conversations; and, under some circumstances, these cues related to feelings of bonding or their physical counterpart (i.e., typed laughter and actual laughter). Nonetheless, our participants reported feeling closer to friends in person than when communicating through text, and their behavior reflected this. Furthermore, participants who had used tools for longer did not show greater ability to connect with their partners. Despite our remarkable ability to utilize tools and technologies to improve our lives in many ways, humans are constrained by the evolutionary context in which human social interaction developed.

However, as digital communication more closely resembles in-person interaction, youth more effectively achieve emotional closeness. Video chat, which affords the ability to exchange both verbal and visual cues, more closely resembled in-person communication in terms of bonding than it did IM. The subjective experience of bonding was not significantly less, when communication was in person compared with video chat. Video chat is growing in popularity (Lenhart, 2012) and is now available on mobile tools like smartphones and tablets. It is only one of several new digital technologies that rely on visual or audiovisual communication—the popular photo-texting application, Snapchat, is another example. As the technology continues to improve and becomes faster and clearer, we may see a tendency to prefer visual and audiovisual communication to textual communication in digital environments, allowing both adolescents and adults to more effectively connect. A decade down the line, experimental studies inspired by adolescents' typical digital media use may be asking very different questions.

While our methodological approach was more typical of CMC research, our study was directly motivated by the habits of young adults. This work highlights the importance of collecting experimental and/or behavioral data in the study of youth online habits. Survey approaches are certainly important—indeed, knowledge from many such studies motivated this experiment—but they tell us very little about the actual experience of online interaction, and are unable to provide a direct comparison between online and offline interaction. Developmental psychologists studying digital media can draw on the well-established methodological approaches of CMC researchers to better understand moment-to-moment experiences of digital connectedness as they occur in existing relationships. We have elected to measure bonding using self-report and affiliation cues, but these are only two of many possible approaches. We propose that additional emotion-related measures, such as the collection of physiological, hormonal, or neural data, will shed further light on the relationship between emotion and behavior in computer-mediated contexts. Studies using these approaches have potential to contribute meaningfully not only to developmental psychology, but across multiple disciplines concerned with the psychological, social, and neural implications of digital communication.

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