# Revisiting Media Richness Theory:

## Social Cues Impact on Understanding in a Textual World

by

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A Doctoral Project Submitted in Partial Fulfillment of
the Requirements of the Degree of Doctor of Psychology
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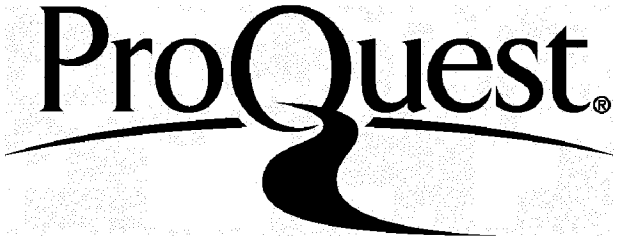


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## ABSTRACT

Today people are more connected by technology than ever, but the impact of changing preferences for interacting on communication is still largely unknown. Differing levels of richness in modes of communication as determined by media richness theory were examined as a function of participants' accuracy and certainty in interpreting ambiguous messages. A sample of 111 undergraduate student participants were randomly assigned to text, audio, or video condition groups where they read, heard, or viewed ambiguous stimuli in four emotional tone categories (affection, aggression, sarcasm, and wit/humor) in an online survey. Findings included significant positive correlations between accuracy and certainty overall; when separated by condition, the association between accuracy and certainty was significant in the richest communication condition (video) across all four emotional tone categories and in the leanest condition (text) for affectionate messages only. Overall, there was a significant main effect for condition on accuracy scores, with the richest (video) condition having highest accuracy scores across the majority of emotional tone categories. Affectionately toned message accuracy was the exception, with higher accuracy scores in the moderately rich audio condition. Generally, the moderately rich condition produced accuracy rates that were lower than the richest condition but higher than the leanest (text) condition. Across all emotional categories, the leanest condition had significantly lower accuracy scores. There were no significant differences in certainty scores between conditions. In summary, while accuracy decreased in leaner forms of communication, individuals' confidence in their ability to accurately perceive messages remained stable across all communication mediums and emotional categories. This suggests people tend to be overconfident in their ability to accurately

perceive messages; they may be unaware interpretational accuracy can vary significantly both across emotional tone and by medium, with accuracy decreasing most in text-based interactions. These findings could be used to help individuals better predict when to use richer forms of communication mediums to avoid misunderstandings, or to at least be more aware when their messages may be less clear. Additionally, the certainty findings support that richness alone does not predict media choices as participants did not appear to consider richness as a factor in effectively conveying meaning in their perceived understanding of information.

# CHAPTER I

## INTRODUCTION

Modern technologies have played a vital role in social evolution (Nye, 2006). The ever expanding market of technological innovation can encourage societal advances, yet it may also create unforeseen social consequences. Changing communication preferences (such as favoring text messaging, or texting, instead of phone calls for conveying information) has fundamentally altered Americans interactional patterns in ways that are just beginning to be understood (Archer, 2013; Cisco, 2012; IDC, 2013; National Chamber Foundation, 2012; National Institutes of Health) and have inspired the current study.

Widespread global adoption and increasing dependence on computers and "smart" mobile devices has fundamentally shifted the manner in which people interact. With the nearly universal usage of the Internet, online social networking sites, mobile text messaging, and electronic mail, shorter text-based communications comprise a growing percentage of daily interpersonal exchanges (Adobe, 2013; Cisco, 2012; Lenhart, 2012b; Lenhart, Madden, Smith, & Macgill, 2007; Maynard, 2014; Roose, 2014; Shim, 2007; Wu et al., 2014). While convenient, these text interactions are largely devoid of the social cues inherent in face-to-face and verbal communications (Daft & Lengel, 1984, 1986; Lengel & Daft, 1988; Olaniran, 2003; Valacich, Paranka, George, & Nunamaker, Jr., 1993).

At this time, the impact of individuals increasingly interacting via mediums which effectively preclude aspects of nonverbal communication from being conveyed is only beginning to be understood. However, historical research on the richness of various modes of communication may provide a valuable lens to examine and predict the difficulties which may arise from shifting patterns of interacting which favor text-based mediums.

# CHAPTER II

# LITERATURE REVIEW

For the majority of the historical record there have been two basic types of interpersonal communication. Spoken speech was the most common, natural, instantaneous, unmediated form of communication delivered in the presence of both the recipient and the sender, leaving no tangible record (Kalman & Rafaeli, 2007). The other communication option was writing, described as being "at a distance, using the written word, a messenger, or a combination of both: it was slow, mediated, costly, time consuming, it left a record and it was used primarily for formal communication or when talking was impossible and the message was of importance" (Kalman & Rafaeli, 2007, pp. 1-2). Letters were often subject to interference, interception, and limited by the technology of the era; especially the available writing instruments and product mediums to compose on, as well as modes of transportation (Baron, 1998; Kalman & Rafaeli, 2007; Winston, 1998). As technology evolved and provided novel means of interacting and conveying information, communication science began to study and explore the differences between various mediums.

## Media Richness Theory

First conceptualized by Daft and Lengel (1986), media richness theory (MRT) refers to the notion that different forms of communication vary by information richness based upon inherent media qualities. The degree of richness, or "the ability of information to change understanding within a time interval" (Daft & Lengel, 1986,

p.560) is based upon the capacity to transmit multiple social cues, provide immediacy of feedback, use natural conversational language, and have a personal focus (Daft & Lengel, 1984; Daft, Lengel, & Trevino, 1987; Gilman & Turner, 2001; Park, Chung, & Lee, 2012; Trevino, Lengel, & Daft, 1987). Generally, richer communicative mediums will encompass more of these factors, especially with regard to interactivity and social cues (Gilman & Turner, 2001).

**Ranking media richness.** Media richness theory provides for a continuum of ordinal rankings to gauge the effectiveness of various types of interpersonal communications from the richest forms with the most important information and favorable communication features to the most impoverished lean communication mediums. In traditional MRT, mediums are ranked by four main criteria, including immediacy of feedback, multiplicity of cues, variety of language, and personal focus (Daft & Lengel, 1984, 1986; Daft et al., 1987; Trevino et al., 1987). According to MRT, immediacy of feedback refers to how quickly a medium allows for a response to a message (responsive interactivity); multiplicity of cues is the number of ways information can be communicated (such as visual and auditory signals like gestures, vocal tone, and inflection); variety of language includes the verbal and nonverbal aspects of communication; and personal focus is the ability to direct and personalize a message to the desired individual (Daft & Lengel, 1984, 1986; Daft et al., 1987; Gilman & Turner, 2001; Park et al., 2012; Trevino et al., 1987).

When Daft and Lengel (1984) first proposed their richness theory, it contained just five mediums including face-to-face communication, telephone conversation, written personal documents, written impersonal documents, and formal numeric documents (Daft

& Lengel, 1984). In ranking communications richness, Daft and Lengel (1984, 1986) considered physically present interactions to be the richest, followed by interactive technology media (such as telephone conversations). They believed formal written communication to be least rich, which is subdivided into slightly richer personal static media (such as memoranda and letters) and leaner impersonal static media (flyers, bulletins, and general reports) (Daft & Lengel, 1984, 1986; Lengel & Daft, 1988; Gilman & Turner, 2001).

In 1987, Daft, Lengel, and Trevino updated MRT to include these new technologies, ranking their richness loosely based upon their original (1984) criteria, ranking email between telephone and written communication and video conferencing between telephone and face-to-face conversations. In 1988, Lengel and Daft further expanded MRT ranking by grouping interactive media closest to telephone communication richness. Daft and Lengel's (1984) rationale for ranking face-to-face interactions as the richest communication medium is due to the presence of verbal and nonverbal cues, instant feedback, high personalization, and use of more natural conversational language via serial communication. They considered video and phone conferencing to be moderately rich due to conveying verbal cues, providing instant feedback, and the familiar back-and-forth manner of conversation (Daft et al., 1987; Lengel & Daft, 1988). Text-based media are considered the least rich (leanest) form of interactive media due to the absence of traditional verbal and nonverbal cues, delays in feedback, and how it can support an unlimited number of parallel and distinct communication episodes (Daft & Lengel, 1984, 1986; Lengel & Daft, 1988; Olaniran, 2003; Valacich et al., 1993).

While Lengel and Daft (1988) attempted to incorporate newer communication mediums into their model of media richness rankings, they did not specify exactly where each type of new interactional medium should fall within their ranking construct. Based upon their original four ranking criteria, a more inclusive richness ranking continuum is proposed which estimates where new media richness ranks in relation to traditional media (see Figure 1).

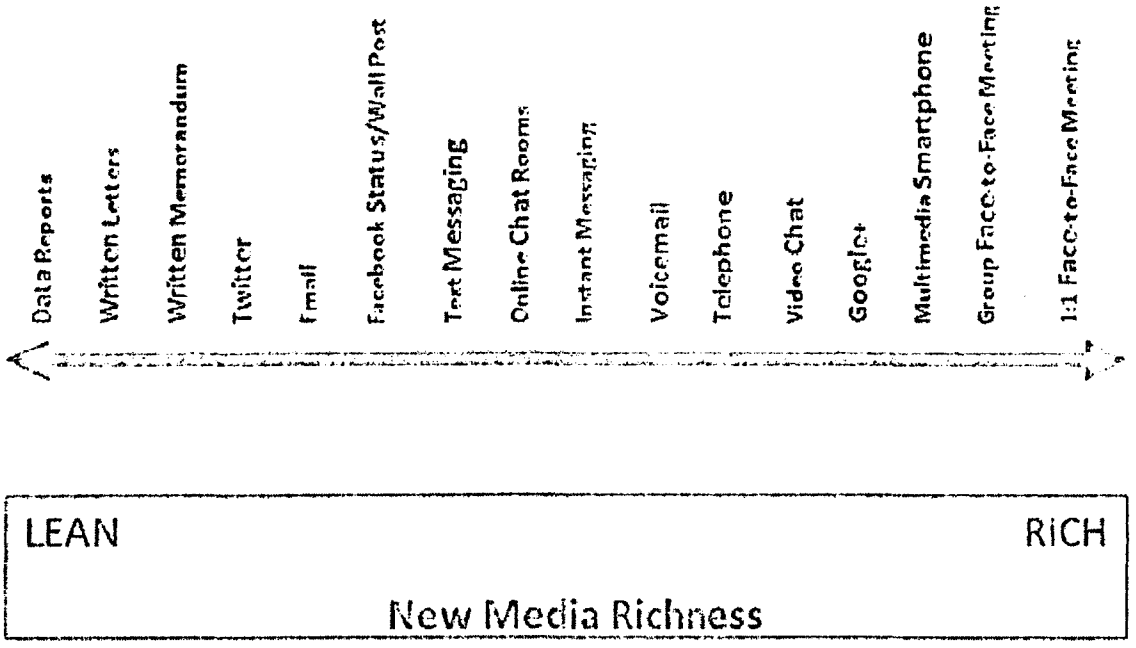


*Figure 1.* Approximated media richness continuum rankings for new and old media.

**Applications of media richness theory.** Media richness is critically important when individuals are faced with communicative ambiguity, also known as message equivocality, which exists when there is potential for multiple and conflicting interpretations about an interaction (Dennis & Valacich, 1999). If a message is equivocal, it is unclear and thus more difficult for the receiver to decode; it can lead to confusion, disagreements, and misunderstandings (Daft et al., 1987). Generally, the more equivocal

or ambiguous a message, the more social or contextual clues are needed to decipher it accurately.

Another profound application of MRT relates to its extension to predicting how message senders will choose communication mediums, or the task-media fit hypothesis. Media richness theory implies that senders should select a communication medium of appropriate richness to convey the desired message, or more simply that individuals will alter their media usage in an attempt to better match the richness of the communication medium with the complexity of the task at hand (Flanagin & Metzger, 2001; Lengel & Daft, 1988; Park et al., 2012). For instance, early empirical research supported the notion that face-to-face interactions were preferred for more ambiguous situations and textual interactions were reserved for more clear and simple communications (Trevino et al., 1987). In 1988, Lengel and Daft proposed that richer media are better suited for equivocal, non-routine messages, while leaner media are better suited for unequivocal or routine messages.

**Critiques of the media richness theory.** It was not long before the predictive nature of the media richness theory and task-media fit hypothesis was challenged by the advent of new electronic media. Early research found computer mediated communication to be more effective in task completion than face-to-face interactions and proposed that new media differs from old media in terms of having greater concurrency (the number of distinct communication episodes that can be supported) (Valacich et al., 1993). Other studies refuted the assumptions of MRT as they found increasing preferences for using leaner media (such as electronic mail or text messaging) for ambiguous tasks (El-Shinnawy & Markus, 1997; Markus, 1994; Rice & Shook, 1990).

Research on communication media preferences is central to media richness theory. Studies on preference rates of face-to-face communication gives has yielded varying results, with a 2014 study of American teens age 16 to 19 finding that 15% preferred to interact with friends over social media than in person (Northeastern University, 2014). However, a 2012 international survey by TIME found 32% of people to prefer communicating via text, while a survey of American daily social media users found 49% would rather text than call a person, and 40% felt more comfortable interacting with people online rather than in person (Performics, 2012). More recently, it is believed that up to 50% of Americans prefer electronic communication to face-to-face interactions (Imperato, 2014).

In terms of email, Palvia, Pinjani, Cannoy, and Jacks (2011) found email communication to be highly preferred in the business world with a 78% preference for using email over other forms of richer communication in organizations. However, for personal (non-business related) communication, Park et al. (2012) and Radicati (2014) determined individuals prefer using other text-based communication mediums such as texting or Facebook messages over email. Notwithstanding, with 45% of email (translating to roughly 98 emails sent and received daily) being used for personal non-work purposes (Radicati, 2014), email is definitely a prevalent daily form of modern interpersonal communication despite its inherent lack of media richness. These findings allude to media richness not being a primary consideration for modern communication medium preferences, but that the personal or professional nature of the communication is a confounding variable.

Overall, changing patterns of communication media preferences has countered the predictive assumptions of MRT and is a major area of contemporary critique surrounding the theory. Thus, the task-media fit hypothesis has received mixed performance results in how richness alone may not reliably predict effectiveness or preferences (Dennis & Kinney, 1998; Markus, 1994; Mennecke, Valacich, & Wheeler, 2000).

Despite an increasing trend in preferences for less rich interactional mediums, for certain specific types of communication it appears MRT holds valid. Simpson's (2013) study examining various communication situations (such as resolving disputes, conveying unpleasant information, and clarifying stance on a social issue with friends or family) supported MRT's prediction for general preferences of richer face-to-face or telephone mediums, but also found leaner media to be a preferred choice in some situations (such as setting up social engagements or reminders about forgotten items). Importantly, while communication medium preferences are important, people's stated preferences do not always correspond with real-life behaviors; research has demonstrated that actual media usage patterns support a drastic increase in text-based leaner mediums (Adobe, 2013; Cisco, 2012; Lenhart, Madden, Smith, & Macgill, 2007; Lenhart, 2012b; Maynard, 2014; Roose, 2014; Shim, 2007; Wu et al., 2014) which challenge the predictive validity of MRT.

To address the shortcomings of MRT in predicting new communication media usage, other explanation have been posited to better predict media choices. Some theorist believed that social pressures influence media use more than richness (Markus, 1994), while others surmised the most appropriate communication medium to be dependent upon familiarity and skills, or the individual's willingness, opportunity and resources to

learn and use newer mediums (Lee, 1994). It has also been argued that social convention and habit predict media choice as opposed to media richness (Rice, 1999), and that richness may become irrelevant as experience with communication partner and messaging increases (Timmerman & Madhavapeddi, 2008). However, Simpson's 2013 study supported MRT by noting that richness was generally more important to participants than experience, but also found that media selection was dependent upon more than one variable.

Additionally, there may be alternative aspects of communication which influence and predict media choices. Dennis and Valacich (1999) proposed the media synchronicity theory whereby conveyance of information and convergence on shared meaning are paramount and that media use is predicted by the needs of the communication process to convey and clarify information, not just the task at hand as per the task-fit hypothesis. Kock (2005) offered an evolution-based media naturalness hypothesis whereby any decrease in naturalness (the degree of similarity to face-to-face interactions) of a communication medium increases cognitive effort needed for comprehension due to a corresponding decrease in arousal and increase in ambiguity; thus, compensatory adaptations are believed account for media preferences and usage. Similarly, the social presence model, which defines social presence as the degree of awareness of the other person in a communicative interaction, supposes that media choices are based upon the level of interpersonal involvement required for a task, with a preference for mediums with more social presence (Fulk, Steinfield, Schmitz, & Power, 1987; Sallnas, Rassmus-Grohn, & Sjostrom, 2000).

Taken together, research has largely refuted the task-fit hypothesis and media richness as being central to influencing communication media preferences (Dennis & Kinney, 1998; El-Shinnawy & Markus, 1997; Markus, 1994; Mennecke, et al., 2000; Rice & Shook, 1990). While there is emerging support for richness being an important choice factor for certain types of interactions (Simpson, 2013), contemporary theorists point to multiple factors which may influence communication media preferences (Dennis & Valacich, 1999; Fulk et al., 1987; Kock, 2005; Lee, 1994; Markus, 1994; Rice, 1999; Sallnas et al., 2000; Timmerman & Madhavapeddi, 2008). Overall, it appears there is considerable support that perceptions of media appropriateness as related to richness are dynamic, fluid, and not evaluated solely based upon task or message complexity (Carlson & Zmud, 1999; King & Xia, 1997) as MRT suggests. In summary, while many theories and explanations have been proposed to predict media use and communication outcomes, there is no general consensus on why individuals tend to choose leaner forms of communication mediums over richer options. It is likely a variety of variables influence media choices (Simpson, 2013).

In addition to critiques surrounding MRT's difficulty in predicting media usage, Daft & Lengel (1984) (as well as their contemporaries) did not quantify or operationally specify how criteria were specifically used to assign richness rankings. Doing so may have provided a more precise and replicable manner of ranking media richness that would be easier to extend to novel communication mediums and better facilitate research validity and reliability. Thus, a lack of discrete rules for ranking new media's richness within the traditional MRT model has introduced an unacceptable level of vagueness for some researchers.

Indeed, Dennis and Kinney (1998) argued the MRT richness hierarchy was not based upon empirical research, but more on the sender's perception of richness. A lack of clarity in the MRT ranking process has encouraged calls for further clarification of the dimensions and perceptions of novel communication technology richness (Fulk & Boyd, 1991; Markus, 1994; Park et al., 2012). While D'Urso and Rains (2008) supported MRT in how objective characteristics of communication mediums (language variety, social cues, feedback, and personal focus) are critical for ranking richness, they contended that a subjective experience variable should be used as well. In 1993, Valachic et al. suggested that concurrency, or the communication capacity of the environment to support multiple distinct communication episodes which don't detract from one another, be added as an additional criterion to rank media richness. Meanwhile, Carlson and Zmud (1994) countered MRT's assumption of merged information and media richness and proposed the channel expansion theory illustrating how experience shapes individuals' perceptions of media richness based upon the channel, messaging topic, context, and messaging partner. Similarly, Otondo, Van Scotter, Allen, and Palvia (2008) also opted to specify and separate media richness (a medium's capacity to process information) and information richness (the ability of a message to change understanding within a timeframe due to clarity and understandability) in ranking overall richness.

Ultimately, MRT has been criticized for its assertion that media richness via the task-fit hypothesis is the sole predictor of communication medium choices, in addition to vagueness in how to rank new media within the MRT richness continuum. Despite these criticisms, the utility and necessity of MRT is not entirely negated. As a concept, media richness provides a useful framework to explore and potentially explain issues related to

accurately perceiving messages in leaner communication mediums (as explored in this study). With the global proliferation of new computer and text-based media (most of which fall on the lean to moderately rich side of the richness continuum), MRT may help elucidate the potential negative impact of increasingly lean media use comprising a growing percentage of interpersonal communications and even replacing richer interactions.

## Computer Mediated Communication

Modern text-based communication technologies came into common use in the 1990s, with rapid and varying social applications evolving through the present day. Initially, non-handwritten text-based communication was confined to interactions via computers (desktop and laptop), but has since extended to mobile and portable messaging devices. Computer mediated communication (CMC) incorporates many different types of variously rich forms of interpersonal interactions. Modern computer technology allows for interpersonal interactions to occur in text-based messages, audio messages, pictures, and video. While there are many communication technologies that incorporate richer audio and video mediums (such as Skype, Google Hangouts, SnapChat, Instagram, podcasts, and Apple Facetime), most studies have found that leaner text-based CMC and mobile phone applications are the most commonly and frequently used mediums for interpersonal communication (Cisco, 2012; Goble, 2012; IDC, 2013; Olaniran, 2003; Pew Research Center, 2010; Radicati, 2013; Zickuhr, 2010).

**Richer computer mediated communication.** By MRT standards, video chatting should be the richest form of electronic communication since it most closely mimics the characteristics of face-to-face communication. While recent technological innovations are

increasing the availability of richer computer communication mediums such as video or audio messaging, historically Americans have not utilized these mediums for routine daily communication. In 2009, just 2% of Internet users reported participating in video messaging, growing slightly over the next year to 4%; with 19% of Americans reporting attempts at video-based communication (Rainie & Zuckuhr, 2010). In 2012, overall video chat usage increased to 21%, with 37% of youth age 12 to 17 trying video-based CMC (Duggan, 2013; Lenhart, 2012a). In January 2014, Skype, a web-based video and voice calling application, reported 4.9 million daily active users, up 2.2 million from the year prior; however, this number includes both video messaging and voice calling users, and some attribute this jump to a rapid increase in international Skype traffic rather than domestic usage in America that would suggest it is used for routine daily correspondence (Andras, 2014; Gara 2014).

Similar to video chatting, video and photo sharing via social media as a means of communication is also increasing. In 2013, 26% of American Internet users posted original videos online and 52% posted photos (Pew Research Center, 2013a). While many of these interactions could be deemed leaner by MRT due to being unidirectional, social media platforms often allows for text-based commenting and replies to posted videos and pictures, which has made them more bidirectional. However, posting videos and photos to social media platforms does not appear to be used for everyday communication; this is further supported by its absence in contemporary communication research. In summary, while richer forms of electronic interpersonal communication (such as interactional video chatting) are becoming more popular, they are not consistently used for routine interpersonal exchanges (Duggan, 2013).

According to MRT, computer-based audio communication should have similar richness as speaking on the telephone, due to practically identical characteristics. The technology which allows for web-based calling is the often free Voice over Internet Protocol (VoIP), with over 34.21 million American subscribers to the various providers of the service (Statista, 2013). In 2012, nearly 30% of online Americans used VoIP services (such as Skype or Vonage), with 40% of individuals age 18 to 29 using VoIP (Rainie, 2013). Another popular web-based calling platform is Google Voice, with 1.419 million American users, 570,000 of whom used the service daily after its 2009 launch (Hesseldahl, 2009). More recently, its use has grown and is estimated at 3.5 million users (Kravits, 2013). A final example of information being communicated via auditory channels are (unidirectional) podcasts, which would be considered by MRT to be less rich than back and forth forms of audio interactions, and are growing in popularity with 27% of Internet users age 18 and older downloading podcast audio files, up from 21% in 2010 (Pew Research Center, 2013c).

In conclusion, while richer forms of CMC incorporating video and audio are increasing in popularity, they do not appear to be used for routine daily interactions by most individuals. However, the advent of recent technology by mobile phone giant Apple in their iOS 8 encourages seamless voice and video messaging within their ubiquitous iMessage application, which may spur more people to use these richer mediums. For instance, sending short audio messages is very popular in China since typing a quick note takes longer due to their highly complex written language (Arthur, 2014). Additionally, in Apple's 2014 iPhone 6 television advertising campaign the company touts audio messaging as a panacea for sarcasm-linked texting misunderstandings. Thus, in the future

many more people will likely have easier access to richer forms of media right at their fingertips; the real question is if they will use them.

**Leaner computer mediated communication.** While use of richer CMC mediums are increasing, text-based computer mediated communication (CMC) remains the most popular way to socialize online, and includes email, social media (like status updates or wall postings on Facebook, tweets on Twitter, et cetera), and various instant messaging services (such as Instant Messenger, and WhatsApp). Based upon Daft & Lengel's (1984) richness criteria (immediacy of feedback, multiplicity of cues, variety of language, and personal focus), each type of text-based CMC possesses unique characteristics and therefore varying degrees of media richness that can either bolster or limit their utility for effective interpersonal exchanges.

Email was the earliest form of electronic text-based communication, with the first message being sent in 1971 (Shontell, 2013). It remains highly utilized despite possessing low to moderate richness due to its inherent lack of nonverbal cues and synchronicity (Park et al., 2012). Email was initially a web-based application, but has since spread to mobile platforms. Globally, 196.3 billion emails are sent and received daily (12% of which is spam junk mail), with upwards of 4.1 billion active email accounts worldwide (Radicati, 2013; 2014). While the majority of the 76% currently active email accounts are personal, the bulk of email traffic comes from business email accounts (Radicati, 2013; 2014). Thus, it appears there are differences in preference for using email as a communication medium depending on whether the nature of the interaction is professional or personal, and other typed of text-based CMC appear to be used more frequently for interpersonal communication.

Following the advent of email, in the mid 1980s online chat rooms became popular, and in 1993 the first AOL Instant Message (IM) was sent (Shontell, 2013). By 2000, 55% of online teenagers and 28% of online adults used online chat rooms, but by 2005 chat rooms had fallen out of favor (Roos, 2008). Perhaps the moderate richness of chat rooms (due to synchronous nature and immediacy of available feedback paired with a lack of personal focus) was supplanted by the slightly richer IM medium which did have a high personal focus in addition to being synchronous and offering immediate feedback. Zickuhr (2010) highlighted the demise of the chat room which was further reinforced by its absence in a 2010 Pew Research Center study which found 67% of online teenagers and 47% of adults sent IMs. Despite its dominance over chat rooms and over 2.9 billion worldwide accounts, IM growth is now slowing due to increased usage of social networking, texting, mobile IM, and other forms of communication by business and consumer users (Radicati, 2013).

The modern communication era is heralded by the advent of social media, in particular, social networking websites and applications. In 2002, the social networking website Friendster launched, followed by LinkedIn and MySpace in 2003; Facebook started as a campus-oriented website in 2004 prior to opening to the public in 2006, and has become the most widely used social networking site (Goble, 2012). Facebook encourages users to become "friends" so that they can follow each other's posts, share content, and communicate directly. In general, aside from the instant messaging Facebook chat application, Facebook has moderately low richness due to the way that this medium potentially limits the immediacy of feedback and the privacy (personal focus) of posts (Park et al., 2012).

The second most popular text-based social networking site, Twitter, sent its first "tweet" in 2006 (Goble, 2012). Twitter is a social microblogging service where users "follow" one another to subscribe to their 140 character-limited messages, and users can reply to or "retweet" (forward) those messages, in addition to sending short direct messages to users (Nielsen, 2012b; Shontell, 2013). By MRT standards, Twitter is slightly leaner than Facebook due to the character limitation which restricts language variety significantly. Additionally, since Twitter does not have as many users as Facebook, it may restrict personal focus since many users may be following public figures, celebrities, or other people they do not personally know.

In 2014 there were nearly 3.6 billion worldwide social networking accounts (the majority being consumer personal user accounts), which is expected to experience steady future growth (Radicati, 2014). Combined, Facebook and Twitter users represent nearly half of the market, with over 1 billion Facebook and half a billion Twitter accounts (Facebook Statistics, 2013; Twitter Statistics, 2013). Twitter is experiencing exceptional growth with young adults whose membership quadrupled from 14% in 2010 to 56% by 2012 (Cisco, 2012; Pew Research Center, 2010).

Overall, Facebook use represents 17% of all personal computer time (Nielsen, 2012b). Forty-one percent of American teens and young adults update Facebook daily, and 21% of Twitter users tweet at least once daily (Cisco, 2012). Every day there are 58 million tweets sent, with 40% of Twitter users logging in even if they aren't tweeting (Facebook Statistics, 2013; Twitter Statistics, 2013). On any given day, half of all Facebook users log into their account, with 1 in 5 users posting several times daily, and 1 in 10 keeping Facebook up and active on their electronic devices (Cisco, 2012). The

average time spent on Facebook per visit is approximately 20 minutes (Facebook Statistics, 2013). However, 29% of users age 18 to 29 and between 19% to 11% of older adult cohorts report logging into Facebook multiple times per day (Pew Research Center, 2010) and 40% percent of college students belonging to "Class of 2015" Facebook groups reported checking it at least ten times a day (MrYouth, 2011). As many as 76% of university students spend more than one hour daily on Facebook (MrYouth, 2011).

After realizing the newfound cultural importance and power of social networking, Google launched their answer to Facebook, Google+ in 2011 (Goble, 2012). The fledgling social network topped its more popular predecessors in media richness thanks to the integration of video chat via Google Hangouts (incorporating more social cues and natural language) and their highly popular GChat instant messaging feature allowing for more personal focus and instant feedback. Despite gaining 250 million users by June 2012, Google+ was largely considered a flop since it wasn't a full-featured social networking site and merely added a "social layer" to the Google experience; ultimately it nor any other social networking site has been able to overthrow the monopoly-like popularity of Facebook (Goble, 2012).

Social networking sites aren't just attracting users but keeping them engaged. Connected individuals ages 18 to 35 average between 3.8 and 4.2 hours a day social networking; startlingly, 20% of the group spends 6 hours or more per day using social media (Ipsos 2013a, 2013b). The majority of 35 to 49 year olds spend between 3 and 3.1 hours daily social networking, while individuals over 50 dedicate between 2.4 and 2.8 hours daily to social media (Ipsos, 2013a, 2013b). This engagement in social media doesn't end when users leave their abodes. Despite common workplace policies barring

use of company-owned device for personal activities (like social media) for 40% of all employees, 71% of workers don't obey such policies (Cisco, 2012). Fifty-one percent of users age 25 to 34 use social networking in the office; out of an eight hour work day, employees spend approximately one hour social networking, with the younger workforce spending up to 1.8 hours social networking (National Chamber Foundation, 2012; Nielsen, 2012b).

**Mobile device communication.** Mobile phones came into popular use in the 1990s, with the sole purpose of making phone calls without the need for a landline. Current rates of American mobile phone ownership have held steady the past couple years with 90% to 91% of the adult population owning a mobile phone (Duggan, 2013; Pew Research Center, 2014a). The first short message service (SMS), or "text message" was sent in 1992; initially each 160 character limited SMS message had a set carrier cost to be sent and received (Kelly, 2012). As text messaging, or "texting" increased in popularity, it facilitated a shift away from mobile devices being used to speak on the phone. Subsequently, phone calls were increasingly viewed by many as intrusive since they are inherently "greedy for your social preference" in how they require an immediate response (answering a ringing phone) unlike texting which allows for conveniently timed responding without the immediacy factor (Greenblatt, 2014). This is supported by current figures indicating U.S. mobile phone customers (not including pre-paid options) average 164.5 incoming or outgoing phone calls per month, spending an average of 644.1 voice minutes monthly, while averaging 764.2 text messages sent and received monthly (Nielsen, 2013b).

**Smartphones.** Fifty-eight percent of American adult's mobile phones are smartphone devices capable of accessing the Internet, email, and mobile applications; many people are using mobile devices for more than the phone calls that were the hallmark of the early devices (Duggan, 2013; Pew Research Center, 2013a, 2014a). Smartphones enabled access to desirable features such as the Internet, email, social networking and instant messaging applications without a desktop or laptop computer; the 2007 introduction of the Apple iPhone ushered in the modern era of limitless mobile applications (Statista, 2012). Nearly two decades after the advent of mobile phones, tablet devices (like iPads, and E-readers) emerged, and more recently, "phablets" (smartphones with screensize of five to seven inches) have driven mobile device use to progress from phone calls and texting to encompass nearly full computer capabilities (Apple, 2010; Kopp, 2013).

Smartphone ownership increased to an all-time high of 83% among 18 to 29 year olds (Nielsen, 2013a; Pew Research Center, 2014a). Younger Americans uptake of smartphones is widespread with 19% of elementary school students, 42% of middle school students, 56% of high school students and 72% of college students reporting current smartphone use (Pearson, 2013). Seventy-seven percent of households with school-age children own smartphones, with 43% of children age 3 to 18 reporting use (Grunwald Associates LLC, 2012). Similarly, nearly 65% of children used smartphones daily, with comparable daily use of iPod Touch at 53%, personal computers at 51%, while 47% reported daily tablet use, and 32% daily E-reader use (Grunwald Associates LLC, 2012).

**Decline in SMS Messaging.** According to most analysts, the use of basic SMS text messaging has peaked due to character limitations and carrier fees; by using a Wi-Fi connection or cellular data smartphone users can access popular instant messaging applications and services (such as Apple's iMessage, WhatsApp, Blackberry Messenger (BBM), Facebook chat, SnapChat) to send infinite text messages without character limitations or charges (Kelly, 2012). Thus, late 2012 marked the start of a decline in both SMS messaging revenue and the total number of SMS messages sent in America as rates of mobile instant messaging applications increased, with 81% of mobile users sending or receiving texts (Pew Research Center, 2013a; Sharma, 2012). It should be noted that most texting research does not separate SMS texting from mobile instant messaging applications; both are commonly referred to as texting.

**Decline of Phone Calls.** Ever since the introduction of the iPhone, the use of voice calls has been declining; currently, 26% of mobile phone activity is making calls, with 34% of high school seniors making daily phone calls (Roose, 2014). Similarly, by 2013, the number of people using their smartphone to make phone calls was surpassed by those who used it to check email (Adobe, 2013). Overall, research on average daily time spent communicating on a smartphone generally ranges from 58 to 132 minutes; with between 16% to 26% of that time used for phone calls and up to 84% of that time dedicated to texting, instant messaging, or social networking (Fetto, 2013; IDC, 2013). Thus, the use of smartphones has contributed to a shift in communication from a moderately rich audio medium (e.g. calling) to leaner text-based media.

**Rise of Texting.** Despite its leaner richness due to a lack of social cue, texting is one of the most popular applications on mobiles. Since mobile texting lacks social cues, it

should be considered as slightly leaner than computer based instant messaging by MRT ranking due to the overall slower responsiveness and feedback. Data supports that vast amount of text messages are sent and received, especially for teen and young adult females. The Nielsen Company (2010) found that teens ages 13 to 17 average 3,339 text messages sent and received per month, with females accounting for 4,050 texts (about 135 texts per day) while their male peers averaged 2,539 monthly texts (85 per day). American smartphone owners age 18 to 24 send an average of 2,022 texts monthly (67 daily), nearly double compared to users age 25 to 34 (Cocotas, 2013). Texting is the most popular used smartphone feature, with 81% of Americans (and about 88% of youth) using a cell phone for texting, and 80% reporting texting in the past 24 hours with a median of 20 text messages sent (Pew Research Center, 2010; 2013).

**CMC Shift from Computers to Smartphones.** Smartphones have generated a shift in CMC away from laptop and desktop computers since they support numerous mobile application platforms, in addition to increased availability and portability. Globally, web-accessed instant messaging (IM) is decreasing as mobile IM has increased to 460 million worldwide accounts and is expected to continue growth over the next four years due to increasing smartphone adoption (Radicati, 2013; 2014). Current research increasingly blurs the distinction between mobile texting and instant messaging, with 87% of smartphone users partaking in various forms of mobile messaging (Shannon-Missal, 2013). Currently, 33% of mobile Facebook users take advantage of their instant messaging platform to send friends private messages daily (IDC, 2013). With regard to media richness, using Daft & Lengel's (1984; 1986) ranking criteria, instant messaging and text messaging should have similar levels of richness, with instant messaging

possibly exceeding texting in how many require being signed into an application which may facilitate responsiveness.

Furthermore, mobile phones are now extensively used to send and receive emails, with 1.1 billion mobile email users worldwide (Radicati, 2014). Mobile email has overtaken those sent via desktop computers with at least 51% of all email now opened on mobiles devices (Jordan, 2014; Smith, 2014). In 2012 and 2013, between 75% and 79% of American smartphone users checked or read their email via mobile which was just above the amount of users making calls on the device, and also above rates of mobile Facebook and Twitter use (Adobe, 2013; IDC, 2013; Nielsen 2013b; Pew Research Center, 2013b). However, when survey parameters were widened to include the sending or receiving of mobile emails, the rate dropped to somewhere between 52% and 56% (Duggan, 2013; Pew Research Center, 2013; Shannon-Missal, 2013). It seems that mobile email enjoys high usage rates when it comes to checking and reading incoming emails, but that sending emails on mobile devices is less favorable, or that people simply receive more emails than they send in general. Web-based consumer email traffic is expected to continue decreasing in the future due to individuals choosing to check their email via mobile devices as well as interpersonal communication preferences shifting towards social networking sites, instant messaging, and texting (comScore, 2011; Radicati, 2013). Overall, the data reveals that mobile devices have taken over as the preferred method of text-based interpersonal computer mediated communication.

While smartphones and mobile devices are dominating the texting and emailing sphere, mobile applications have increased to account for 34% of social networking time, while web-based access of social media has decreased to 61% (Nielsen, 2012b). Of all

the time spent using smartphones, social networking mobile applications accounts for 30%; this has likely contributed to the drop in social media access via web-based personal computers despite a 24% increase in overall social networking time, suggesting deeper engagement of users (Nielsen, 2012b).

Further cementing mobile domination of the communication realm, approximately 63% of American smartphone owners reported using their mobile device for social networking (Nielsen, 2013b), with between 58% and 70% of smartphone users taking advantage of mobile Facebook access and 20% to 43% using smartphones to access Twitter (Adobe, 2013; IDC, 2013, Twitter Statistics, 2013). Facebook mobile users now account for more than half of all logons (Facebook Statistics, 2013). Nielsen (2012a) found the year over year (YOY) change in new mobile applications audience increased 88% for Facebook, and 134% for Twitter. These mobile YOY gains corresponded to personal computer YOY decreases in unique website visits by 4% for Facebook and 3% for Twitter. As users increasingly access Facebook via mobile platforms, overall Facebook usage has declined to about 33 minutes daily; however, Facebook mobile users appear to be logging in more frequently, averaging 13.8 daily sessions for just under two and a half minutes per login (IDC, 2013). It appears trends in communication media usage support that consumers are choosing mobile communication that is faster, shorter, and text-based as opposed to longer or perceived "intrusive" means of interacting.

In summary, new research supports the notion that CMC's interactional technology is trending away from web-based access to more mobile platforms. The popularity of smartphones and mobile devices has surged across America, especially

among younger consumers, half of whom say they access the Internet more often through than phone than via computer (Burger, 2014). With evermore communicative technology applications at people's fingertips favoring shorter text-based exchanges as opposed to the longer emails which are a hallmark of early web-based CMC, questions are raised about the impact of shifting communication patterns on the American public.

**Population Most Impacted By New Technology**

With the advent of various forms of CMC taking off during and after the 1990s, it is the generation born after 1980 which is temporally and most fundamentally impacted by these new technologies. There is some controversy over the exact start and end dates between the most recent generations. In 1991, Howe and Strauss (2010) labeled the generation born between 1982 and 2004 as "Millennials"; popular references also refer to this cohort as "Generation Y" (Wikipedia, 2013). Others split the Millennials into Generation Y (born between 1977 and 1995) and Generation Z (born 1995 to present) (Nielsen, 2014a; Wikipedia, 2013). More broadly, Pew Research Center (2014b) identified individuals born after 1980 to be termed the "Millennial Generation" and noted there to be no set chronological end point for this group. Thus, any subsequent references to Millennials will be based upon this broader guideline of individuals born after 1980.

Prensky (2001) labeled Millennials to be "digital natives" in how they are native speakers of the novel digital language compared to previous generations. Millennials appear to acknowledge this, with 24% attributing their generational uniqueness to technology use; they far outpace older Americans in virtually all Internet and mobile phone usage (Pew Research Center, 2010). Currently enrolled college students have grown up with computer technologies, mobile phones, and the Internet; many have faint,

if any, memories of dial-up modems. Millennials are the first generation to spend more time (35 hours weekly) using digital media than traditional forms of media (such as television or newspapers) with 32 hours of weekly usage (Burger, 2014). This shift favoring digital media is likely due to the popularity of mobile devices like smartphones and tablets among Millennials.

Current estimates posit that 85% to 86% of Millennials own smartphones (Nielsen, 2014b). Furthermore, Millennials are considered to be very heavy mobile users, spending 14.5 hours weekly talking, texting, or using mobile social media applications (Perez, 2014). Millennials are thus history's first always connected generation, and thus bear the brunt of unforeseen changes growing up increasingly connected to others by technology.

### Consequences of Constant Connection

Humans evolved into social animals to better their chances of survival; people are programmed with a universal need and desire to connect with others, especially those they care about most (IDC, 2013). Human's innate socialization needs paired with the widespread use of ever faster, more capable, and increasingly portable mobile devices has fundamentally altered how people interact and go about their daily communication routines (Cisco, 2012; Lenhart, 2012b; Maynard, 2014; Shim, 2007).

Prenksy (2001) predicted that mobile phones would become tantamount to bodily appendages. For 29% of mobile phone users, this rings true as they describe their mobile as "something they can't imagine live without" (Smith, 2012). Similarly, 40% of Millennials believe losing their phones would be a bigger hardship than losing their automobile (Maynard, 2014). Some may even argue that mobile social communication

technologies have spawned a generation of smartphone addicts; Palfrey and Gasser (2008) noted Millennials have created a 24/7 social network with between 63% and 79% of individuals have their mobile device on or near their person for all but one to two hours of their waking day (IDC, 2013).

For 60% of Millennials, checking a smartphone for updates is a compulsive behavior they wish they could do without, bordering between extremely connected and hopelessly addicted (Cisco, 2012). Respectively, 19% of smartphone users acknowledged people tell them they spend too much time on their phone, with 14% of users self-admitting to spending too much time on their smartphones (Smith, 2012). Nomophobia, or the fear of being without a mobile phone, now affects 40% of the population and 42% of individuals experience anxiety if they can't check their phones constantly or lose their phone even for a few minutes (Archer, 2013; Cisco, 2012). It should be noted there are gender communication differences; women are more driven to connect electronically, on average spending an hour more using social media than men, and 85% of women admit to being compulsive mobile checkers compared to 63% of men (Cisco, 2012; Ipsos, 2013b).

There are numerous examples which illustrate how mobile devices have altered interactional patterns. Instead of the traditional bedtime routine of winding down, relaxing, and spending quality time alone or with significant others, 75% of Millennials use their smartphones while in bed, with the highest rates of social networking engagement occurring between the hours of 10pm and 11pm (Cisco, 2012; Nielsen, 2012a). Approximately 80% of Millennials sleep with their mobiles powered on next to the bed, often checking it intermittently (National Chamber Foundation, 2012; National

Institutes of Health, 2011; Pew Research 2010). Smartphone use is also encroaching upon romantic time in the bedroom, with 10% of individuals admitting to use of their mobile mid-coitus, with as many as 20% of Millennials age 18 to 34 engaging in the behavior (Archer, 2013). Additionally, 90% of Millennials report checking smartphones to be an important part of their daily morning routine, with 80% reaching for them within the first 15 minutes of waking up, often prior to doing anything else (Cisco, 2012; IDC, 2013). This research illustrates how a preference for using leaner and short text-based mobile interactions has impacted interactional patterns, especially for Millennials.

While the notion that MRT predicts greater preferences for richer communication mediums has been debunked, it is unclear if being interpersonally connected by technology is responsible for a decrease in face-to-face connectedness. Early research demonstrated high school students' Internet use significantly correlated to a drop in face time communication with their family, and additionally decreased their desire to spend time with family members (Shim, 2007). However, the decrease of in-person communication did not mean it was less frequent than other forms of communication; Lenhart et al. (2007) found that 12 to 17 year old adolescents partake in daily face-to-face socializing more than via texting, emailing, or using social media, although daily phone calls were most frequent. By 2012, Cisco found that 40% of individuals reported spending more time with their friends online than in person, while two-thirds spent equal or more time online with friends than in person. Similarly, Lenhart (2012b) noted 63% of teens to engage in texting daily, compared to 39% who talk on the phone, 35% who socialize with others in person outside of school and 29% who engaged in social network site messaging. A more recent study found 40% of Millennials to substitute texting,

email, or video chat for meeting up with friends in person (Maynard 2014). Additionally, Wu et al. (2014) found that texting between coworkers in the workplace led to a depersonalization of communication due to decreasing the frequency of face-to-face interactions, resulting in a negative impact upon the quality of work relationships.

While half of Americans feel new technology makes people closer to friends and family, nearly 40% believe these new technologies are actually making more people isolated (Pew Research Center, 2010). Some believe they are even causing emotional harm as an equal percentage of adults endorsed experiencing some kind of online harassment (Drake, 2014). Nearly 81% of Millennials believe other people have different online and offline identities, with over one-third believing the majority of people to have vastly different online and offline identities (Cisco, 2012). Additionally, nearly a quarter of Americans dislike that mobile devices make them reachable at any time (Smith, 2012). In particular, mobile devices are highlighted for negatively impacting interpersonal interactions in how Smith (2012) found that 21% of Americans believe mobile devices make it harder to give people their undivided attention, and using a mobile phone decreases the quality of attention in face-to-face interactions (Turkle, 2011).

For Millennials who have grown up with mobile devices, the increase in virtual social connection has been noted to decrease their ability to communicate effectively outside of cyberspace. A 2012 National Chamber Foundation survey of managers who oversee Millennial age employees found many need major improvements in communication and interpersonal skills, with Millennial workers also indicating a need for growth in areas of communication, especially in the ability to give and receive criticism. Similarly, a 2012 Pew Research Center Study found 42% of participants agreed

that by 2020, teenagers and young adults will lack face-to-face social skills, while other experts posit that Millennials do not know how to speak in a polished manner, listen attentively, or read other people's expressions and body language (Alsop, 2013; Anderson & Rainie, 2012). While these are largely opinions about Millennials face-to-face interactional skills, there are no studies to date which empirically determine if older generations have better in-person social skills compared to Millennials.

### Limitations of Textual Communication

With the Millennials preference for communication shifting away from face-to-face interactions, it becomes of ever greater importance to investigate the potential limitations of living in a textual world. The study of computer mediated communication (CMC) allows researchers to examine how people adapt to the restrictions of electronic text-based interactions (Van Der Heide, 2008). This emerging field of study is crucial because of the widespread use and adoption of various technology-driven textual interpersonal interactions, especially by the Millennial generation. The major limitations of the inherently lean text-based communication mediums are largely due to a lack of social cues and referencing in addition to providing slower feedback which may hamper clarity and confirmation of understanding (Byron, 2008; Kiesler, Siegel, & McGuire, 1984; Kruger et al., 2005; Lengel & Daft, 1988; Olaniran, 2003; Riva, 2002; Sproull & Kiesler, 1986; Tardanico, 2012).

Richer face-to-face communication is characterized by the presence of both verbal and nonverbal social cues, instant feedback, social referencing, and a greater variety of language used (Lengel & Daft, 1988; Olaniran, 2003). Interestingly, research has demonstrated the majority (93%) of interpersonal communication is based upon

nonverbal social cues (Tardanico, 2012). Accordingly, studies on text-based CMC found it to be largely devoid of contextual emotional and behavioral social cues (Byron, 2008; Kiesler, Siegel, & McGuire, 1984; Kruger et al., 2005; Riva, 2002; Sproull & Kiesler, 1986) and lacked the ability to transmit nonverbal cues (Olaniran, 2003) as outlined by MRT. Some examples of the contextual and nonverbal information normally gleaned from face-to-face interactions includes social cues such as body language, facial expression, as well as the tone, volume, and rate of speech.

Additionally, in face-to-face interactions there is immediate feedback from an individual's facial expression about any confusion, which provides a timely opportunity to clarify and accurately interpret messages (Byron, 2008; Olaniran, 2003). The presence of bilateral simultaneous feedback as the conversation is occurring is quite important as this allows for any misinterpretations or misunderstandings to be more easily clarified via behavioral confirmation (Olaniran, 2003). Since time often passes between electronic messages being sent and responded to, it can be difficult to confirm if the intended meaning of the message was perceived correctly by the recipient. Even with the immediacy and intimacy modern man shares with smartphones, enabling more fluid, and near-constant social interactions (IDC, 2013), electronic text-based communication provides slower feedback and no opportunity for social referencing than face-to-face interactions. Social referencing is when an individual looks to another person in an ambiguous situation to obtain clarifying information about how they should react and respond, which is noticeably absent in text-based interactions.

Overall, the lack of nonverbal social cues and inconsistent ability to provide immediate or timely feedback often produces textual misunderstandings or

misinterpretations. Accordingly, Schulman (2000) found that when social cues are reduced, messages can be distorted or less clear. Thus, one of the chief losses with increasingly text-based communication patterns is the resulting lack of clarity within conversations (Hollingshead, 1996, 2000, 2001).

**Textual misunderstandings.** The inherently ambiguous nature of text-based communication can lead to misinterpreting and misunderstanding the sender's intended meaning (Byron, 2008; Hertlein & Ancheta, 2014; Hollingshead, 1996, 2000, 2001; Schulman, 2000; Wu et al., 2014). Valenziano (2007) found university professors reported frequent and high incidences of email misinterpretations and miscommunication. Similarly, Byron (2008) found that email communication increases the likelihood of conflict and misunderstanding. Specifically, individuals tend to misinterpret positive emails as neutral, and neutral-toned emails as more negative than the sender intended (Byron, 2008). This suggests that individuals may be pessimistically conservative in their email interpretations. More recently, Hertlein & Ancheta's (2014) open-ended survey of undergraduate students in relationships found texting to negatively impact relational communication in how texting often lacked clarity and produced misinterpretations of messages due to a lack of contextual and social cues. Additionally, texting complex information often results in message decontextualization which increases the likelihood of misinterpretation and often necessitates additional back and forth messaging to gain clarity about the message (Wu et al., 2014).

Given all the misinterpretations and misunderstandings text-based interaction creates, one may expect individuals to choose richer communication mediums. While people openly acknowledge the lack of nonverbal interpersonal cues in CMC as the

source of many misunderstandings, they are often still willing to use CMC to communicate, even for the sole purpose of resolving misunderstandings (Olaniran, 2003). Difficulties in issue resolution via text-based communication may have influenced Simpson's (2013) findings that people prefer richer communication mediums over textual means to resolve disputes and misunderstandings. However, it should be noted that individual's preferences are not always reflected in their behavior, and some may be largely unaware of the shortcomings of text-based communication. Overall, the lack of nonverbal social and emotional cues individuals are accustomed to with face-to-face interactions are negatively impacting textual comprehension. Emerging empirical evidence supports the absence of these critical cues in decreased accuracy in understanding text-based communications.

Kruger, Epley, Parker, and Ng (2005) found that most people overestimate their abilities to communicate effectively over email. They studied the ability to communicate and interpret sarcastic and seriously toned messages in textual or audio forms, with audio recipients having 75% accuracy while email recipients were 56% successful at interpreting tone (Kruger et al., 2005). Interestingly, 78% of the message senders in both conditions were highly confident their message's tone would be interpreted correctly (Kruger et al., 2005). This study suggests that individuals tend to overestimate the ability of leaner text-based communication to accurately convey emotional tone due to assuming the receiver has the same inside information about the intentions and motivation of the sender, or egocentrism (Kruger et al., 2005). However, many individuals appear cognizant of the difficulties in conveying emotional tone via email; in Byron and Baldridge's (2005) focus group all participants indicated difficulty in expressing and

perceiving emotions in work emails. More recently a study found 81% of workers struggle to convey emotion in digital communications (Symons, 2014). Taken together, these difficulties with communicating via leaner textual media may explain the results of Schiffrin, Edelman, Falkenstern and Stewart's (2010) study of college undergraduates who perceived text-based CMC to be less useful compared to traditional face-to-face interactions.

The inherent difficulties with interpersonal perception in CMC have often been described as the cues-filtered-out (CFO) perspective since the interactive social part of communication has effectively been filtered out of the conversation (Culnan & Markus, 1987). With the inherent limitations of text-based communications due to the absence of such important contextual information, how can people understand each other in an increasingly text-based interactive world?

**Increasing the Clarity of Computer Mediated Communication**

Berlo's (1960) generally accepted source-message-channel-receiver (SMCR) model is a basic theory of communication in which four factors determine the effectiveness of communication: the sender or source (S) of the message (M), the channel (C) used, and the receiver (R). The sender can verbally and nonverbally encode the message which is sent to the recipient by the mode of communication (the channel), which the recipient must subsequently decode. Both senders and receivers impact this interactional process in how they may have different levels of communication skills, differing attitudes towards one another, and sociocultural contexts (Byron, 2008). While some may point to language or cultural barriers as the chief source of CMC misunderstandings, theorists believe these are not likely to be the primary cause of textual

misperceptions (Olaniran, 2003). Indeed, conclusions drawn from MRT suggests that varying levels of richness in a communication medium may impact misunderstandings; while richness is relevant to message comprehension, theorists have posited additional means of promoting CMC clarity (Olaniran, 2003).

Walther's (1992) social information processing theory (SIPT) theorizes that interpersonal impressions can form via CMC over a period of time. Since there is less social information present in text-based communication, it can take longer to process the social information embedded in linguistic and textual manipulations that can be more easily and automatically discerned in face-to-face interactions. This SIPT perspective explains how people can maintain longitudinal text-based interactive relationships since their comprehension of communication with individuals increases over time (Byron, 2008). In summary, the more individuals get acquainted with each other's textual communication style and the more experience they have messaging each other, the better they get at accurately interpreting those messages. Alternatively, SIPT would also predict an increase in textual misunderstanding between people who are newly acquainted or who do not frequently interact via textual means.

Hollingshead (2001) believed that other hints are included in text-based interactions to give clues to how a person should interpret the conversation. Since emotions are usually expressed and perceived nonverbally (Ekman, Friesen, & Ancoli, 1980) emoticons (linear character pictorial representations of facial expressions) were created to lend socio-emotional tone to textual interactions (Byron, 2008; Valenziano, 2007). Braumann, Preveden, Saleem, Xu, and Koeszegi (2010) suggested that emoticons serve similar functions to nonverbal social cues in face-to-face communication. Research

has supported emoticons to have a positive impact on message interpretation and increase accuracy in how they are believed to strengthen the intensity of a verbal message or express sarcasm by varying the valence of the emoticon in relation to the message (Derks, Bos, & von Grumbkow, 2008; To, 2008). However, emoticons can also create ambiguity in how these techno-emotional "workarounds", like some nonverbal social cues, are not uniformly perceived by all individuals (Thompsen & Foulger, 1996; Walther & D'Addario, 2001) and thus may contribute to issues in understanding instead of clarifying meaning.

More recently, a more nuanced iteration of visual representations to supply richer visual cues in textual interactions has become popular. Emojis, or more complex digital pictorial representations of facial expressions and everyday objects, are now commonly used, with 88% of participants using emojis for personal communication and 76% using them in textual interactions at work (Symons, 2014). There is evidence to support that both emoticons and emojis produce nearly identically levels of message perception accuracy, but that individuals are more confident in their interpretations with traditional emoticons as opposed to the newer more complex emoticons such as emojis (To, 2008). In addition to emojis, it should be noted that various forms of punctuation (SCREAMING CAPITOLS, question marks, exclamation points, etc.) also help to provide context and social cues to aid digital media users in understanding and interpreting conversations; exclamation points are routinely used in texting to convey emotion, enthusiasm, or excitement (Ball, 2011). In summary, while there are many strategies utilized to address the limitations of communicating in an increasingly textual world to help clarify meaning

and provide context, misunderstandings and misinterpretations remain a commonly experienced issue which warrants further research.

**Current Study**

This study revisited one of the basic tenets of the media richness theory (MRT) in focusing on the lack of social cues in text-based conversations compared with face-to-face visual or auditory communication. Nonverbal social cues are important in conveying information necessary to readily derive meaning (Olaniran, 2003; Tardanico, 2012); this is especially relevant in short or ambiguous messages which may often lack other contextual cues. Four emotional tone categories were examined including sarcasm, aggression, wit/humor, and affection to determine if the presence (or absence) of social cues in short, decontextualized and potentially ambiguous messages impacted participants' accuracy and certainty of correctly perceiving communications. Undergraduate students were chosen to reflect the cohort of society who has grown up accustomed to communicating via textual means, as modern text-based communication technologies came into common use in the 1990s.

Ultimately, this study examined the nature of potential communication misinterpretations and misunderstanding when across various emotional tones and communication mediums. Specifically, it will determine if the varying richness of social cues across three different electronic communication mediums (text, audio, and video conditions) impacts levels of accuracy and confidence in discerning the intended emotional tone of short ambiguous messages derived from four overlapping communication domains (affection, aggression, sarcasm, or wit/humor).

**Significance of the Study.** As new portable technologies like smartphones and tablets with mobile texting and email become an increasingly dominant form of interpersonal interactions, it is crucial we understand the limitations of text-based mediums. Contemporary research has demonstrated that many individuals have experienced misunderstandings due to difficulties understanding the intended emotional tone and therefore meaning of text and email messages (Byron, 2008; Hertlein & Ancheta, 2014; Hollingshead, 1996, 2000, 2001; Schulman, 2000; Wu et al., 2014). Additionally, findings are mixed when it comes to how confident people are in the interpretations, with some evidence suggesting individuals can be overconfident in their textual message interpretations (Kruger et al., 2005), and other evidence showing that people admit to having difficulties in perceiving and conveying emotional tone in text-based communications. Thus, this study sought to specifically examine if certain types of emotional tone may prove more difficult to interpret accurately across computer mediated communication mediums (condition) with varying degrees of media richness. In addition, results pertaining to perceived certainty should either support or refute the notion that individuals may be overconfident in the ability to accurately understand the intended meaning of variously rich messages.

**Hypotheses.** In this study there were three main research questions examined:

1. It is hypothesized that accuracy will be correlated with certainty across all communication mediums. An analysis was conducted to determine if a correlational relationship existed between participant's accuracy and certainty scores in general, as well as if accuracy and certainty were correlated within the three experimental conditions (text, audio, or video mediums).

2. It is hypothesized there will be a significant difference in accuracy scores by condition, with the richest medium (video) having the highest rates of accuracy. A mixed between-within subjects 3x4 ANOVA was run to test for main effects and any interactions between condition and accuracy scores.
3. Lastly, it is hypothesized there will be a significant difference between certainty ratings by condition, with the richest medium (video) having highest certainty. One-way ANOVAs were conducted to test for main effects and any interactions between condition and certainty scores.

# CHAPTER III

# METHOD

## Participants

American undergraduate college students age 18 to 22 were selected for inclusion in the current study. Based upon Pew Research Center's (2014b) broad classification of individuals born after 1980 belonging to the Millennial generation, these undergraduates reflect a population significantly impacted by text-based communication and have grown up interacting via technology. This cohort is also expected to be more familiar and comfortable with the materials used in this study (a Qualtrics-platform survey with embedded text, audio, and/or video) since many Millennials have used online survey technology previously or were at least been exposed to it before.

**Sample size.** To determine how many participants would need to be recruited, an a priori power analysis was conducted for a 3 X 4 repeated measures ANOVA between factors to test the second hypothesis, with power set to .80 with an alpha level of .05. A medium to large effect size was anticipated and medium correlations (p = .50) between the communication domains were assumed. Erdfelder, Faul, and Buchner's (1996) GPower3 software tool was utilized for a general power analysis, yielding a sample size of 42 for a large effect ($f$= .40) and a sample of 102 for a medium effect size ($f$ = .25). In the present study, the effect was expected to be between a medium and large effect size. Hence, a sample size of 102 (n = 34 per experimental group) would have adequate power to detect a medium to large effect size. Since a one-way ANOVA was used to test the

third hypothesis, an additional power analysis was run without repeated measures, yielding a sample size of 158 participants to detect a medium to large effect size. Due to resource constraints and a resulting decrease in power for the mixed design if the sample size was amply increased, the final sample size was closer to the recommendations for the mixed design.

**Participant Demographics.** Participants were 111 American undergraduate students who ranged in age from 18 to 22, ($m$ = 19.68, $sd$ = 2.83) and lived in 31 different states. The majority of participants (93.7%) spoke English as a native language ($n$ = 104). Regional differences were assessed using the United States Census Bureau (2013) designations, with the majority of participants (44.9%) living in the South ($n$ = 48). Most of the survey participants (73.9%) were female ($n$ = 82), with men comprising 25.2% of the sample ($n$ = 28), and one individual who identified as neither solely female nor male. Racial minorities (African American, Asian, Hispanic, Other) were well represented, accounting for 41.4% of the sample ($n$ = 46) while Caucasians comprised 58.6% ($n$ = 65). The majority of the sample (32.4%) identified as majoring in arts and sciences ($n$ = 36). Participant's age when they first owned a mobile phone ranged from eight to 18 years old, with 81% of ownership occurring between age 10 to 15 ($n$ = 90). Similarly, the majority of the sample (56.8%) first owned a computer between age 10 to 15 ($n$ = 63), although the range was from age four to 20. Table 1 includes detailed information on the demographic characteristics of the study participants.

Table 1

*Participant Characteristics as a Percentage of the Sample*

| Characteristic | *n* | % Sample |
|---|---|---|
| Native Language | | |
| English | 104 | 93.7 |
| Non-English | 7 | 6.3 |
| Gender | | |
| Female | 82 | 73.9 |
| Male | 28 | 25.2 |
| Other | 1 | 0.9 |
| Race | | |
| Caucasian/White | 65 | 58.6 |
| Minority/Non-White | 45 | 41.4 |
| African American/Black | (14) | (12.6) |
| Asian | (15) | (13.5) |
| Hispanic (Non-White) | (7) | (6.3) |
| Hispanic (White) | (8) | (7.2) |
| Other | (2) | (1.8) |
| Age | | |
| 18 | 21 | 18.9 |
| 19 | 37 | 33.3 |
| 20 | 26 | 23.4 |
| 21 | 10 | 9.0 |
| 22 | 17 | 15.3 |
| Major | | |
| Arts & Sciences | 36 | 32.4 |
| Business | 16 | 14.4 |
| Education | 8 | 7.2 |
| Health | 22 | 19.8 |
| Technology | 9 | 8.1 |
| Undeclared | 12 | 10.8 |
| Multiple Majors | 8 | 7.2 |
| U.S. Region | | |
| Northeast | 18 | 16.8 |
| Midwest | 23 | 21.5 |
| South | 48 | 44.9 |
| West | 18 | 16.8 |
| Age Owned 1st Mobile Phone | | |
| < 10 Years | 4 | 3.6 |
| 10 to 15 Years | 90 | 81.0 |
| 16+ Years | 17 | 15.3 |
| Age Owned 1st Computer | | |
| < 10 Years | 7 | 6.3 |
| 10 to 15 Years | 63 | 56.8 |
| 16+ Years | 41 | 36.9 |

*Note.* Sample size was $N = 111$ for all demographic variables except Region with $N = 107$.

## Materials

The online Qualtrics survey included an electronic informed consent (see Appendix A), standardized instructions (see Appendix B), message stimuli in text, audio, or video form (see Appendix C), demographic questions (see Appendix D), and a debriefing presented after completion of the main items (see Appendix E). A separate paper version of informed consent was provided to the actor who created the audio and video stimuli (see Appendix F).

Following the survey's informed consent and instructions, 36 separate slides displayed the embedded message stimuli examples as well as two identical questions for each message. The first question to measure accuracy was "Which of the following best represents the emotional tone of this message?" with four response options (affection, aggression, sarcasm, wit/humor). The second question, used to gauge perceived certainty, was "How certain are you of the intended meaning of the message?" with a five-point Likert scale ranging from *not certain at all* to *absolutely certain*. A forced response setting was applied for all survey questions so that participants had to choose one response to each question in order to continue and finish the survey. Across each randomly assigned experimental condition (text, audio, or video groups), the message stimuli were presented in the same randomized sequence.

Following the experimental stimuli questions, demographic questions including participant's age, gender, race, native language, degree major, and age at which they first owned a mobile phone and computer (see Appendix D) were asked prior to completing the survey. These questions were presented at the end to mitigate any potential priming effects. Embedded survey data to obtain state and zip code information were also

collected, although four participant's location data was not obtained, possibly due to privacy settings.

**Message stimuli.** To represent lean media with its inherent lack of nonverbal social cues, a set of text message stimuli for each emotional domain was created. Accordingly, these text messages were also made into equivalent audio messages to capture more moderate richness, as well as video stimuli to represent the richest form of electronic communication in how it mimics face-to-face interactions. For each stimuli message, accuracy was determined by matching perceived emotional tone of the participant (affection, aggression, sarcasm, or wit/humor) with the intended emotional tone by the sender.

A total of 36 short text-based message stimuli with nine examples from each intended emotional tone category (sarcasm, wit/humor, aggression, and affection) were created by the researcher who drew inspiration from personal experience and public online communications (see Examples of Text Stimuli in Appendix C). Due to research noting inconsistent interpretation of emoticons (Thompsen & Foulger, 1996; To, 2008; Walther & D'Addario, 2001), they were not included in this study's text-based stimuli, although some popular texting shorthand (such as 'u' for you) was utilized for authenticity.

Subsequently, audio and video stimuli were then created verbatim from the 36 text message stimuli as portrayed by a professional actor who was instructed to represent the intended message meaning of the sender (researcher). The actor was recruited from the examiner's social network and was a 30 year old racially ambiguous female with an educational degree in performing arts (related to acting) and a primary occupation as an

actor. She was considered highly qualified, with castings in over sixty films, television shows, and commercials; most notably as a principal in the Academy Award nominated film *American Hustle*.

The researcher selected the versions of audio and video messages in which the actor best represented the intended emotional tone of the message. For consistency, the audio stimuli were recorded at the same time as the video stimuli so the audio is uniform in both the audio and video recordings.

**Survey Procedure**

Survey participants were recruited via a compensated Qualtrics panel, whereby individuals were previously recruited to participate in surveys by the company but their personal identifying information and compensation were unknown to the researcher. Recruits were screened for eligibility by answering two questions related to their age and student status. Participants were screened in if they were between ages 18 to 22 and identified as either an undergraduate freshman, sophomore, junior, or senior. Following screening, the informed consent and standardized set of instructions were presented for all participants. Ultimately, 111 undergraduate students age 18 to 22 qualified to complete the survey and consented to participate. After reviewing the instructions and entering the survey, participants were randomly assigned into either text, audio, or video conditions, where the 36 message stimuli were individually displayed along with the pair of questions used to assess their accuracy and perceived certainty. Demographic variables were then inquired about to minimize the potential for any priming effects. Following the survey completion participants were debriefed.

# CHAPTER IV

# RESULTS

## Analysis of Variance Assumptions

The information from the Qualtrics survey was downloaded into SPSS statistical software and coded into variables prior to running tests and ensuring analytical assumptions were met in order to perform statistical analyses to evaluate this study's hypotheses. Since the analyses required both a one-way and mixed between-within subjects ANOVA design, the assumptions necessary to use these ANOVAs for analysis were validated. The first assumption required the dependent variable (accuracy within emotion tone categories) be a continuous variable. Emotional tone accuracy was measured according to whether or not the participant's perceived emotional tone "matched" the intended emotional tone of the sender (researcher) for that message. For each participant, a summed accuracy score was calculated for each tone whereby each matching tone message added one point to the accuracy score (which could potentially range from zero to nine). Since accuracy scores by tone were numerical ratio variables (and therefore continuous), the first mixed ANOVA assumption was met.

Assumptions also required the within-subjects independent variable consist of at least two categorical "related groups" or "matched pairs" (Laerd Statistics, 2013). Since the within-subjects independent variable was emotional tone category (affection, aggression, sarcasm and wit/humor), and the dependent variable (accuracy) paired intended and perceived emotional tone ratings, this assumption was met. Additionally,

the between-subjects independent variable (condition) should consist of at least two categorical "independent groups" (Laerd Statistics, 2013). In the current study text, audio, and video groups comprised the condition variable, therefore meeting this assumption.

Also, there should not be significant outliers in any group of the within-subjects factor or between-subjects factor (Laerd Statistics, 2013) as this may lead to a violation of the assumption of normality. Using the widely accepted reference values proposed by West, Finch, and Curran (1995) with the absolute value of skew > 2 and kurtosis > 7 as indicating a major departure from normality, none of the accuracy or certainty scores across emotional tone categories or by condition violated this assumption. A single participant (case 42) was an outlier responsible for producing skewness in audio condition certainty scores for affectionate and aggressive messages. However, this did not have a large impact on affectionate ($M = 4.11$, $Mdn = 4.22$) or aggressive ($M = 4.08$, $Mdn = 4.11$) certainty overall. Aggressive video messages ($M = 4.28$, $Mdn = 4.39$) had one participant outlier (case 5) for certainty ratings. Affectionate video messages ($M = 4.31$, $Mdn = 4.56$) had five outliers with three (case 5, 25, and 77) being far out.

For accuracy, it should be noted that of the 36 total messages, all but four stimuli had median accuracy scores above 50% ($M \geq 4.5$), suggesting the stimuli to be valid for measuring accuracy across emotional tone categories as they did not produced excessively low accuracy score which may have indicated the stimuli were not a good fit for the task at hand. Overall accuracy scores by emotional tone were not skewed, but when broken down by condition there were a few outliers that elevated skewness above -1. Only one outlier (case 43) was considered to be a significantly far outlier, along with 8

other outliers (cases 28, 29, 35, 41, 85, 91, 97, and 105), which contributed to skewness in the text condition for aggressive messages ($M$ = 4.45, $Mdn$ = 5). Aggressive audio messages ($M$ = 6.62, $Mdn$ = 7) had two outliers (cases 42 and 83) while comparable video messages ($M$ = 7.24, $Mdn$ = 8) had one outlier (case 77). Affectionate audio messages ($M$ = 7.05, $Mdn$ = 8) had one outlier (case 111) while their video counterpart had three (cases 69, 77, and 103). Skewness for sarcastic audio ($M$ = 6.7, $Mdn$ = 7) and video ($M$ = 7.12, $Mdn$ = 8) messages were due to three outliers (cases 42, 83, and 111) and one outlier (case 61), respectively. Some skew for witty video messages was due to a single outlier (case 61). Overall, while there are some outliers across condition and emotional tone categories for accuracy and certainty, none produced excessive skewness or kurtosis to violate ANOVA assumptions and were generally within the expected range of individual differences.

The assumption of normality was further assessed using the Kolmogorov-Smirnov test of normality, which found largely normal distributions for certainty scores across aggressive ($p$ = .085), sarcastic, ($p$ = .135) and witty messages ($p$ = .07). Affectionate messages were not normally distributed ($p$ < .001), due to outliers in the video condition ($p$ < .001). Across affectionate, aggressive, and sarcastic messages, certainty scores had a slight negative skew for richer mediums which supported the main hypotheses that richer mediums would have higher certainty. For witty or humorous messages, the distribution was also approximately normal but tended toward a more positively skewed distribution for audio and text conditions, indicating less certainty for leaner mediums. For accuracy, findings produced a significant negative skew in how richer communication mediums had significantly higher accuracy scores than in the lean

condition across all emotional tones. This skewness in accuracy across conditions paired with the presence of outlier scores were the likely factors that contributed to significant Kolmogorov-Smirnov tests across all conditions and emotional tone categories for accuracy. However, these normality violations for accuracy reflect the significant findings of the study as it was predicted there would be significant differences between conditions and thus does not preclude the use of ANOVA for their analysis. Additionally, despite outliers significantly impacting affectionate message certainty. the overall assumption of normality for the majority of certainty scores was not violated, although special consideration must be given to affectionate message certainty as outlier and individual differences may have a greater impact than for other emotionally toned messages.

There is also the need for homogeneity of variances for each combination of the groups for both within-subjects and between subjects factors (Laerd Statistics, 2013). Box's test of equality of covariance matrices was not significant, indicating adequate homogeneity of inter-correlations of the accuracy by tone across condition, $F(20, 40396.35) = 1.287$, $p = .175$. A Levene's test of equality of error variances verified that accuracy scores for all emotional tone categories between conditions had equal error variances, with $F(2, 108) = .468$, $p = .627$ for affection; $F(2, 108) = .161$, $p = .851$ for aggression; $F(2, 108) = .585$, $p = .559$ for sarcasm; and $F(2, 108) = .484$, $p = .618$ for witty/humorous stimuli. Findings for certainty were similar, with Levene's test verifying all the emotional tone certainty groups to have equal variances: $F(2, 108) = .356$, $p = .701$ for affection; $F(2, 108) = .375$, $p = .688$ for aggression; $F(2, 108) = 1.124$, $p = .329$ for

sarcasm; and $F(2, 108) = .450, p = .639$ for witty or humorous stimuli. Overall, the assumption of homogeneity of variance was not violated for either accuracy or certainty.

The last assumption, sphericity, is specific to mixed ANOVAs, and is the need for equal variances between emotional tone category and accuracy for all communication conditions (Laerd Statistics, 2013). Mauchly's test of sphericity was used to test the assumption of sphericity, and found it was not violated, $\chi^2 (5) = 9.168, p = .103$. Overall, all assumptions to conduct both the mixed and one-way ANOVAs were not violated, indicating them to be appropriate means of analyzing this study's data.

**Preliminary Analyses**

Demographic and potential confounding variables were analyzed to determine if outside factors (other than condition) may have an influence on participant's accuracy and certainty scores. For certainty, a one-way analysis of variance (ANOVA) tested for significant differences between these variables on certainty scores, which ranged from one to five.

For accuracy, a mixed between-within subjects ANOVA was conducted to test for significant differences between these variables on accuracy scores. The within measure was accuracy while the between factor were the variables. Mauchly's test of sphericity indicated the assumption of sphericity had not been violated, except for the case of region, $\chi^2 (5) = 12.068, p = .034$. For certainty, one-way ANOVAs were conducted to test for significant differences between various factors on certainty scores. Levene's test of homogeneity of variances was not significant for the majority of the variables when evaluating certainty. Native language for affectionate $F(1, 109) = 4.033, p = .047$, and sarcastic $F(1, 109) = 3.674, p = .058$ messages were not homogenous, which may be due

to the fact there were only seven participants whose native language was not English. Additionally, this assumption was violated with regard to region for affectionate $F(3, 103) = 2.838, p = .042$ and aggressive $F(3, 103) = 2.591, p = .057$ messages.

**Gender.** A between groups test indicated a main effect for gender, with female participants having higher overall accuracy scores in general when compared to non-female participants $F(1, 108) = 6.761, p = .011, \eta_p^2 = .059$. Gender also had a significant effect upon accuracy scores by emotional tone category, $F(3, 324) = 6.15, p < .001, \eta_p^2 = .054$, but there were no significant interaction effects, $F(3, 324) = 2.532, p = .057$. While gender appears to have a significant effect on accuracy scores, the effect size is relatively small so that gender only accounts for 5.4% to 5.9% of the variance in accuracy depending if emotional tone categories are separated or if overall accuracy scores are used. There were no significant main effects for gender on certainty scores across all emotional tone categories.

**Race.** There was no overall main effect for race on accuracy scores, $F(1, 109) = 2.634, p = .107, \eta_p^2 = .024$. However, when accuracy scores were sorted by emotional tone, race was found to have a significant effect upon accuracy scores with Caucasian participants averaging higher accuracy scores in all emotion tone categories than minorities, $F(3, 327) = 7.167, p < .001, \eta_p^2 = .062$, with no significant interaction effects $F(3, 327) = 1.127, p = .338$. Overall, race accounts for 2.4% of the variance in accuracy scores, but when examined more closely in the context of accuracy for various emotional tones, race accounts for 6.2% which is a much larger proportion of the variance and slightly more than gender variance. There were no significant main effects for race on certainty scores across all emotional tone categories.

**Native language.** Overall, there were no significant main effects for native language $F(1, 109) = .786, p = .377$, on accuracy scores even in light of emotional tone categories, $F(3, 327) = .918, p = .432$. There were no significant interaction effects of native language on accuracy scores $F(3, 327) = .739, p = .529$. There were significant differences in certainty scores for aggressive $F(1, 110) = 3.953, p = .049, \eta_p^2 = .035$ and sarcastic $F(1, 110) = 5.094, p = .026, \eta_p^2 = .045$ messages, with non-native English speakers having higher certainty means across all emotional tone categories. Thus, 4.9% of the variance in certainty scores for aggressive messages and 4.5% of variance in sarcastic message certainty was accounted for by differences in native language. It should be noted there were only seven participants whose native language was not English out of the sample of 111 participants, so these findings are not particularly robust.

**Degree major.** Overall, there was no main effect for major upon accuracy scores $F(6, 104) = 9.1, p = .491$. When accuracy scores were examined by emotional tone, there was a significant effect for degree major, with those pursuing education degrees to have the lowest accuracy scores across all emotional tones aside from those in the witty/humorous categorization, $F(3, 312) = 4.426, p = .005, \eta_p^2 = .041$, so that degree major accounted for 4.1% of the variance in accuracy scores. There were no significant interaction effects for accuracy and major, $F(18, 312) = 1.167, p = .288$. There were no significant main effects of degree major on certainty scores across all emotional tone categories.

**Age.** A main effect for age on overall accuracy scores was significant, $F(4, 106) = 4.152, p = .004, \eta_p^2 = .135$ with the oldest age 22 cohort having the lowest accuracy scores across all conditions and participants age 18 scoring highest. This main effect for

age was also significant when analyzed in terms of emotional tone categories $F(3, 318) = 7.516, p < .001, \eta_p^2 = .066$. There was no significant interaction between age and accuracy, $F(12, 318) = .938, p = .509$. Age appears to account for 13.5% of the overall accuracy variance and 6.6% of the accuracy variance across emotional tone categories. There were no significant main effects of age on certainty scores across all emotional tone categories.

**Age at first mobile phone ownership.** There were no main effects for the age at which participants first owned a mobile phone on accuracy scores, $F(2, 108) = .469, p = .627$, even when separated by emotional tone $F(3, 324) = 1.487, p = .22$. There was a significant interaction effect for age at first mobile phone ownership on accuracy scores, $F(6, 324) = 3.179, p = .005, \eta_p^2 = .056$. This should be interpreted with caution as the number of participants in the three levels for this variable were not evenly distributed (under age 10 $n = 4$, age 10 to 15 $n = 90$, and over age 16 $n = 17$). Additionally, there were significantly lower accuracy scores for individuals who got their first phone under age 10 in the affectionate emotional tone group ($M = 3.5, SD = 3.12$), so the effect of outliers is more pronounced and may contribute to the interaction significance. There was a significant main effect for sarcasm certainty $F(2, 110) = 3.652, p = .029, \eta_p^2 = .063$ and witty or humorous message certainty $F(2, 110) = 4.813, p = .01, \eta_p^2 = .082$ in how the youngest ownership group (under 10 years at first mobile phone ownership) had significantly higher certainty scores than participants who owned their first mobiles once they were older. Overall, 6.3% of the variance in sarcastic message interpretation certainty and 8.2% was due to the age at which participants first owned their mobile phone.

**Age at first computer ownership.** When comparably divided by age levels, the sample for age at first computer ownership was more evenly distributed than for mobile phone ownership (under age 10 $n = 7$, age 10 to 15 $n = 63$, and over age 16 $n = 41$). There were no significant main effects for age at first computer ownership on accuracy scores $F(2, 108) = .865, p = .424$, even when analyzed by emotional tone category, $F(3, 324) = 2.304, p = .077$. Additionally, there was no significant interaction between accuracy and age at first computer ownership $F(6, 324) = .606, p = .725$. There was a significant main effect for age at first computer ownership on sarcastically toned messages $F(2, 110) = 3.185, p = .045, \eta_p^2 = .056$ in how the 10 to 15 range had highest certainty scores. Thus, 5.6% of the variance in sarcastic message interpretation certainty is due to differences in the age at first computer ownership.

**Region.** When it comes to region of the country, there were no significant main effects on participant's overall accuracy scores, $F(3, 103) = 1.255, p = .294$. Mauchly's Test of Sphericity indicated the assumption of sphericity was violated, $\chi^2 (5) = 12.068, p = .034$, so the Huynh-Feldt correction was used to assess for main effects within the levels of emotional accuracy by tone. Findings were significant, with region of the country significantly affecting accuracy scores by tone, with the West averaging highest accuracy levels across all tones $F(2.937, 302.514) = 5.961, p = .001, \eta_p^2 = .055$. There were no significant interaction effects between region and accuracy, $F(8.811, 302.514) = 1.683, p = .094$. Thus, regional differences accounted for 5.5% of the variance in accuracy scores across emotional tones. There were no significant main effects of region on certainty scores across all emotional tone categories.

**Survey completion time.** There was no significant main effect for overall survey completion time on accuracy, $F(2, 108) = .178, p = .837$. However, there was a significant main effect when completion times across conditions were examined by emotional tone, $F(3, 324) = 6.83, p < .001, \eta_p^2 = .059$ due to the significant differences in accuracy between witty messages compared to the other emotional tones. Thus, 5.9% of the variance in accuracy was due to differences in completion time for witty or humorous messages. There were no significant main effects for survey completion time on certainty scores across all emotional tone categories.

## Descriptive Characteristics of the Sample

A total sample of 111 college undergraduates yielded 40 participants randomly assigned into the text condition, 37 in the audio condition, and 34 in the video condition. Completion times for the survey ranged from just over 5 minutes (309 seconds) to approximately 108 minutes (6502 seconds). The majority of participants (44.1%) completed the survey within 10 to 15 minutes, while 39.6% finished it within five to 10 minutes, and 16.2% took over 15 minutes to complete the survey. There was no time limit to the survey, so participants did not have to complete it all in one sitting.

Accuracy scores had the potential to range from zero to nine, while certainty ratings ranged from one to five. With regard to emotional tone without accounting for condition, participants most accurately perceived sarcastic messages ($M = 6.44$, $SD = 2.18$) followed by affectionate ($M = 6.4$, $SD = 2.46$) and aggressive messages ($M = 6.03$, $SD = 2.23$). Participants were least accurate in determining witty or humorous messages ($M = 5.49$, $SD = 1.96$). Largely, participant's certainty ratings were highest for affectionate messages ($M = 4.14$, $SD = .63$), followed by aggressive ($M = 4.1$, $SD = .62$),

and sarcastic messages ($M = 4.09$, $SD = .64$). Similar to accuracy, witty or humorous messages had the lowest certainty ratings ($M = 3.77$, $SD = .61$; refer to Table 2 for descriptive statistics).

Table 2

*Descriptive Statistics for Accuracy and Certainty by Condition*

| | Text $n = 40$ | | Audio $n = 37$ | | Video $n = 34$ | | Condition Total $N = 111$ | |
|---|---|---|---|---|---|---|---|---|
| Measure | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Accuracy | | | | | | | | |
| Affectionate | 5.43 | 2.38 | 7.05 | 2.17 | 6.82 | 2.55 | 6.4 | 2.46 |
| Aggression | 4.45 | 1.75 | 6.62 | 1.92 | 7.24 | 2.02 | 6.03 | 2.23 |
| Sarcasm | 5.63 | 2.14 | 6.7 | 2 | 7.12 | 2.16 | 6.44 | 2.18 |
| Witty/Humor | 4.98 | 1.99 | 5.59 | 1.76 | 5.97 | 2.04 | 5.49 | 1.96 |
| Certainty | | | | | | | | |
| Affectionate | 4.01 | .63 | 4.11 | .61 | 4.31 | .63 | 4.14 | .63 |
| Aggression | 3.95 | .63 | 4.08 | .58 | 4.28 | .62 | 4.1 | .62 |
| Sarcasm | 3.98 | .66 | 4.03 | .59 | 4.26 | .65 | 4.09 | .64 |
| Witty/Humor | 3.77 | .67 | 3.66 | .56 | 3.9 | .59 | 3.77 | .61 |

*Note.* Means for accuracy score could range between zero to nine while certainty means could range between one to five.

When accuracy was examined with regard to condition, the least rich condition (text medium) had lowest accuracy rates across all emotional tone categories ($M = 5.63$, $SD = 2.14$ for sarcasm; $M = 5.43$, $SD = 2.38$ for affection; $M = 4.98$, $SD = 1.99$ for humor; and $M = 4.45$, $SD = 1.75$ for aggression). The richest condition (video) had the highest accuracy scores across all emotional tones ($M = 7.24$, $SD = 2.02$ for aggression;

*M* = 7.12, *SD* = 2.16 for sarcasm; and *M* = 5.97, *SD* = 2.04 for humor) with the exception of affectionate messages (*M* = 6.82, *SD* = 2.55; refer to Table 2 for descriptive statistics).

When certainty was examined across conditions, the lean textual medium had lower certainty ratings across all emotional tones (*M* = 4.01, *SD* = .63 for affection; *M* = 3.95, *SD* = .63 for aggression; and *M* = 3.98, *SD* = .66 for sarcasm) except for witty or humorous messages (*M* = 3.77, *SD* = .67). The richest condition had the highest certainty ratings across all emotional tone categories (*M* = 4.31, *SD* = .63 for affection; *M* = 4.28, *SD* = .62 for aggression; *M* = 4.26, *SD* = .65 for sarcasm; and *M* = 3.90, *SD* = .59 for humor; refer to Table 2 for descriptive statistics).

**Testing the Main Hypotheses**

Correlations were run for accuracy and certainty both individually and across conditions to test the first hypothesis to determine if a significant relationship exists between accuracy and certainty in general, and across conditions. To test for the second hypothesis, a 3x4 mixed between-within subjects ANOVA was performed to test for mean differences on accuracy scores across emotional tone categories by condition. Lastly, one-way ANOVAs were utilized to test the final hypothesis for mean differences in certainty rating by emotional tone by condition.

**Accuracy and certainty correlations.** A Pearson product-movement correlation (Pearson's *r*) was conducted to determine whether there were significant correlations between accuracy and certainty in general, as well as across communication mediums. Across all emotional tone categories, accuracy and certainty were highly positively correlated when assessed with both two-tail and one-tail tests. This finding suggested directionality in how higher accuracy scores correlated with higher certainty scores; thus,

the more powerful one-tailed test results were used in this interpretation. When accuracy and certainty were correlated across conditions, a two-tailed test was used.

In general, accuracy and certainty scores were highly significantly correlated ($p < .001$) for affectionate, aggressive, and sarcastically toned messages. For witty or humorous messages, accuracy and certainty were also significantly correlated but less so than the other emotional tones, $r(111) = .22, p = .022$ (refer to Table 3 for correlation details). Further correlational analysis was conducted to determine if this significantly positive relationship between accuracy and certainty would hold true when accounting for condition.

Table 3

*Accuracy and Certainty Correlations by Condition (and Overall Certainty)*

| | Certainty $N = 111$ | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Text $n = 40$ | | | | Audio $n = 37$ | | | | Video $n = 34$ | | | |
| Accuracy | Aff | Agg | Sar | Wit | Aff | Agg | Sar | Wit | Aff | Agg | Sar | Wit |
| Affection (Aff) | .41** **.48‡** | | | | .46** | | | | .53* | | | |
| Aggression (Agg) | | .2 **.4‡** | | | | .53** | | | | .38* | | |
| Sarcasm (Sar) | | | .22 **.42‡** | | | | .45** | | | | .56** | |
| Wit/Humor (Wit) | | | | .04 **.22†** | | | | .24 | | | | .42* |

*Note.* Bolded correlations are measures of *r* between accuracy and certainty by overall emotional tone category, without accounting for condition. All non-bolded correlations were measured within levels of condition.
* $p < .05$, one-tailed. ** $p < .001$, one-tailed. † $p < .05$, two-tailed. ‡ $p < .001$, two-tailed

Findings supported that the richest condition (video) had significant positive correlations ($p < .05$ and $p < .001$) between accuracy and certainty across all emotional tone categories, while the leanest condition (text) had just one significant positive correlation for affectionately toned messages $r(40) = .41, p = .008$. For the moderately rich condition (audio), accuracy and certainty were significantly positively correlated for affectionate, aggressive and sarcastic messages ($p < .001$), but not witty or humorous ones $r(37) = .24, p = .149$ (see Table 3 for correlation details). Overall, findings supported the first hypothesis that accuracy and certainty are significantly correlated in general, as well as across rich (video) and moderately rich (audio) conditions. However, for lean communication mediums (text), accuracy and certainty are only significantly correlated for affectionately toned messages.

**Accuracy between conditions.** A mixed between-within subjects 3x4 ANOVA was conducted to test the second hypothesis that accuracy would vary significantly by condition, with richer conditions having the highest accuracy scores. The analysis yielded a significant main effect for stimuli condition $F(2, 108) = 12.463, p < .001, \eta_p^2 = .188$, so that 18.8% of the variance in accuracy can be accounted for by condition. More specifically, when accuracy was examined by emotional tone there was a significant main effect for condition, $F(3, 324) = 8.603, p < .001, \eta_p^2 = .074$ so that 7.4% of the variance in accuracy across emotional tone categories are due to condition (refer to Table 4 for detailed ANOVA results).

Table 4

*Accuracy: Mixed Between-Within Subjects ANOVA*

| Main Effect | *MS* | *df* | *F* | *p* | $\eta_p^2$ |
|---|---|---|---|---|---|
| Accuracy | 22 | 3 | 8.603 | <.001 | .074 |
| Condition | 120.511 | 2 | 12.463 | <.001 | .188 |
| Accuracy x Condition | 7.455 | 6 | 2.915 | <.001 | .051 |
| Error (Accuracy) | 2.557 | 324 | | | |
| Error (Condition) | 9.669 | 108 | | | |

*Note*. Accuracy is the within-subjects factor while condition is the between-subjects factor.

These findings reflect the significant mean differences in accuracy between participants in the richest stimuli condition (video) with the highest accuracy rates for aggressive ($M$ = 7.24, $SD$ = .33), sarcastic ($M$ = 7.12, $SD$ = .36), and witty or humorous messages ($M$ = 5.97, $SD$ = .33) when compared to moderately rich (audio) or lean (text) stimuli conditions. The only exception was for affectionate messages where accuracy was highest in the moderately rich audio condition ($M$ = 7.054, $SD$ = .390; see Table 2 for more descriptive statistics). There was also a significant interaction effect between accuracy across emotional tone categories and condition, $F(6, 324) = 2.915$, $p = .009$, $\eta_p^2 = .051$, so that 5.1% of the variability in accuracy scores is due to their interactional effect.

***Post hoc analyses.*** Due to a significant main effect of condition on accuracy scores, as well as a significant interaction effect between condition and accuracy, post hoc analyses were conducted on all possible pairwise contrasts. The leanest (text)

condition was found to be significantly less accurate than both the audio and video conditions ($p < .001$) across all emotional tone categories. More specifically, in terms of emotional tone, witty messages were significantly less accurate than affectionate ($p < .001$), aggressive ($p = .01$), and sarcastic ($p < .001$) messages. Additionally, aggressive messages were significantly less accurate than sarcastic messages ($p < .054$).

**Certainty between conditions.** Separate one-way ANOVAs were conducted determine if there were differences between condition and participant's certainty in understanding the intended meaning of messages (hypothesis three). There were no significant differences in participants' levels of perceived tone certainty between condition groups for affectionate messages, $F(2, 108) = 2.194$, $p = .116$; aggressive messages, $F(2, 108) = 2.682$, $p = .073$; sarcastic messages $F(2, 108) = 1.958$, $p = .146$; and witty or humorous messages, $F(2, 108) = 1.340$, $p = .266$; refer to Table 5 for detailed ANOVA results).

Table 5

*Certainty: One-way ANOVAs*

| Main Effect | | *MS* | *df* | *F* | *p* | $\eta_p^2$ |
|---|---|---|---|---|---|---|
| Affection | Between Groups | .855 | 2 | 2.194 | .116 | .039 |
| | Within Groups | .390 | 108 | | | |
| Aggression | Between Groups | .998 | 2 | 2.682 | .073 | .047 |
| | Within Groups | .372 | 108 | | | |
| Sarcasm | Between Groups | .786 | 2 | 1.958 | .146 | .035 |
| | Within Groups | .401 | 108 | | | |
| Wit/Humor | Between Groups | .501 | 2 | 1.340 | .266 | .024 |
| | Within Groups | .374 | 108 | | | |

# CHAPTER V

# DISCUSSION

## Interpretation of Preliminary Analyses

While preliminary findings found significant variance in overall accuracy scores to be due to age (13.5%), gender (5.9%), and degree major (5%), the majority of overall variance in accuracy scores was due to stimuli condition (18.8%). Specifically, the trend for highest accuracy in youngest participants and lowest accuracy in the oldest participant cohort supports Prensky's (2001) assertion regarding digital natives and the notion that familiarity with new technological communication mediums is the best mastered by the young. While it is believed that gender findings concluding significantly higher accuracy scores in female participants may reflect the study's overwhelmingly female sample, further research is needed to determine if true gender differences in accurate message interpretation exists. Similarly, when accuracy was considered in light of emotional tone, condition accounted for the greatest amount of variance (7.4%), followed by age (6.6%), race (6.2%), completion time (5.9%), region (5.5%), gender (5.4%), and major (4.1%). Thus, while these variables may have a significant impact upon accuracy scores, condition is the greatest source of accuracy variance, supporting the main hypotheses. With no significant main effect for condition on certainty scores by emotion tone, it is possible that variables such as native language and age at first ownership of mobile phone and computer have a more significant impact on certainty ratings for some emotionally

toned messages. However, these variables account for well under 10% of the variance observed in certainty scores by emotional tone.

**Interpretation of Main Hypotheses**

**Hypothesis one: Correlation between accuracy and certainty.** The first hypothesis that accuracy and certainty are significantly correlated in general, and across conditions was supported by the findings of this study. When closely examined, the richer conditions (video and audio) had significant positive correlations between accuracy and certainty across a greater variety of emotional tone categories than in the leaner text condition. This study thus supported previous research in demonstrating a significant positive relationship between accuracy and certainty, especially for richer communication mediums (Byron, 2008; Byron & Baldridge, 2005; Hertlein & Ancheta, 2014; Hollingshead, 1996, 2000, 2001; Kruger et al., 2005; Schulman, 2000; Simpson, 2013; Symons, 2014; Wu et al., 2014). The moderately rich (audio) condition had the highest accuracy rates for affectionate messages, suggesting that more social cues do not always help individuals correctly interpret positively toned messages. This further suggests there may be fewer differences in accuracy between rich and moderately rich media than previously assumed by MRT.

**Hypothesis two: Differences in accuracy scores across condition.** Since accuracy and certainly were found to have a significant positive relationship, especially for richer conditions, the second hypotheses probed if a functional relationship existed between condition and participant's emotional tone accuracy scores. The results from a mixed between-within subjects 3x4 ANOVA found significant mean differences in accuracy scores by condition, with the richest medium generally having the highest

accuracy scores; the video condition and audio condition were both significantly more accurate overall than the text condition, but video was not significantly more accurate than the audio condition. Overall, condition accounted for 18.8% of the variance in accuracy scores, the highest of all variables examined. Furthermore, a significant interaction between accuracy and condition was noted. In addition to condition, the emotional tone of witty or humorous messages had a significant negative impact on accuracy when compared to the other emotional tone categories. This suggests a general difficulty in accurately perceiving witty or humorous messages across all conditions; further research is needed to confirm if individuals experience greater difficulties in interpreting witty messages or if confounding variables in the delivery of these messages across conditions are responsible for this difference.

This study's findings on the differences in participants accurately perceiving the intended meaning of various messages supports media richness theory in how moderate to rich mediums provide more social cues than lean forms of communication. Thus, media richness may be used to predict some of the challenges individuals are experiencing in correctly interpreting messages when leaner mediums are utilized as described in current and past communication research (Byron, 2008; Hertlein & Ancheta, 2014; Hollingshead, 1996, 2000, 2001; Schulman, 2000; Simpson, 2013; Valenziano, 2007; Wu et al., 2014). However, this study also found no significant differences in accuracy when the rich and moderately rich conditions were compared, suggesting that both audio and video communication mediums are equally good channels for increasing message accuracy. These findings also counter Daft & Lengel's (1984; 1986) MRT continuum rankings related to differences in richness via audio and video channels in

how both had similar effectiveness in conveying meaning accurately despite audio being ranked as lower in richness.

**Hypothesis three: Differences in certainty scores across condition.** The final hypothesis was disproven by the results of this study in how there were no significant differences in certainty ratings by condition. This supports the research on media richness not playing a large role in subjective accounts of utility and determining actual medium usage for communication (Adobe, 2013; Dennis & Kinney, 1998; El-Shinnawy & Markus, 1997; Imperato, 2014; Markus, 1994; Mennecke et al., 2000; Northeastern University, 2014; Palvia et al., 2011; Park et al., 2012; Performics, 2012; Radicati 2014; Rice & Shook, 1990; Roose, 2014). Notably, significant outliers in affectionate message certainty may support evidence suggesting that individuals tend to be pessimistically conservative in their textual message interpretations (Byron, 2008).

While an examination of the demographic variables in this study found no significant differences in certainty scores by gender, race, age, degree major, region, or survey completion time, findings on participants' generally stable certainty scores across media richness conditions supported how other personal variables (specifically in this study including native language, and age of ownership for first mobile phones and computers) are likely to influence perceptions and usage patterns of communication mediums as suggested by previous research (Carlson & Zmud, 1999; King & Xia, 1997; Kruger et al., 2005; Schiffrin et al., 2010). Most interesting was the finding that non-native English speakers had higher certainty means across all emotional tone categories, most significantly for aggressive and sarcastic messages, suggesting these individuals

may overestimate their interpretation abilities more than non-native English speakers, or that they may be less aware of the limitations of communicating via less rich mediums.

Additionally intriguing was the finding that favored the youngest mobile phone ownership group (under 10 years of age) in how they had significantly higher certainty scores than participants who owned their first mobiles once they were older for interpreting both sarcastic and witty or humorous messages. Similarly, participants who owned their first computer between the ages of 10 to 15 had highest certainty scores for understanding sarcastically toned messages. Taken together, these findings support prior research suggesting that familiarity and skills may predict media choice more so than richness (Lee, 1994) in how individuals who begin using these technologies at a younger age become more confident in their abilities to communicate using these technologies.

### Communication Implications

Overall, this study confirms the importance of richness in the ability to accurately perceive the intended meaning of short, decontextualized messages. While the richest communication medium (video) that mimics face-to-face communication is most accurate, it appears the moderately rich audio medium is also a good option for being able to accurately interpret messages, supporting Simpson's 2013 finding that many people will switch to richer mediums to communicate potentially misinterpretable information. In this study there were no significant differences between rich and moderately rich communication mediums on accuracy. This suggests the auditory social cues gained from hearing someone speaking are of prime importance (as they were present in both audio and video conditions), as opposed to the visual cues of observing facial expressions and upper body language (present only in the video condition). When it

comes to new communication technologies it appears there is little difference between seeing or hearing someone, and making phone calls instead of video calls is not likely to contribute to message misinterpretation. However, caution is required when communicating via purely textual means as interpretational accuracy may be significantly decreased for texting and emailing.

The findings from this study are highly relevant in modern society where an ever-increasing amount of interpersonal communication is occurring over text-based media. While people may say they are aware of the misunderstandings and misperceptions which can occur communicating by technology instead of face-to-face interactions (Byron & Baldridge, 2005; Symons, 2014) this study's findings are two-fold in how message interpretation accuracy is lowest when using text-based mediums, but that people are likely to overestimate their certainty in understanding messages regardless of communication medium used.

Interestingly, this study suggests individuals may not be aware of the limitations of perceptual accuracy in variously rich forms of communicative media as there were no significant differences in participants' certainty ratings across lean (text), moderate (audio), and rich (video) communication conditions. Thus, even though findings demonstrated that accuracy is impacted by factors like communication medium and emotional tone (primarily witty or humorous messages) it appears individuals' perception of their understanding the intended meaning of a message remains largely constant and unchanged despite variance in accuracy across such variables. This suggests that individuals may think they perceive textual messages more accurately than they actually do. This overconfidence may be what is contributing to findings of increased

misinterpretations for texting and email (Byron, 2008; Hertlein & Ancheta, 2014; Hollingshead, 1996, 2000, 2001; Schulman, 2000; Simpson, 2013; Valenziano, 2007; Wu et al., 2014).

These findings demonstrate important implications for media richness theory (MRT). The theory asserts that individuals will change their choice of communication mediums depending upon the complexity of the task at hand (Flanagin & Metzger, 2001; Park et al., 2012). However, the results of this study indicate messages recipients overestimate their ability to accurately interpret the emotional tone of messages, complimenting previous findings by Kruger et al. (2005) that message senders tend to overestimate the ability of leaner text-based communication to accurately convey emotional tone. Thus, it appears that when it comes to text-based communication, both message senders and receivers are overconfident when it comes to the messages emotional tone being accurately perceived. In terms of implications for MRT, the tendency for individuals to overestimate their ability to accurately perceive messages may preclude them from changing their choice of communication to a richer medium to gain clarity.

In addition to communication medium impacting message perception, findings of differences in accuracy related to the messages' emotional tone, suggests both conditional and emotional variables to play a significant role in message accuracy. Specifically, witty or humorous messages were found to have a significant negative impact on accuracy when compared to the other emotional tone categories across all conditions. Thus, it appears there may be generalized difficulty in accurately perceiving witty or humorous messages across when communicating via new technology, regardless of the medium's

richness. Similarly, while differences in certainty were not statistically significant across overall emotional tone categories, affectionate messages had the largest amount of certainty score outliers, supporting past research that individuals experience difficulty accurately perceiving positively toned messages (Byron, 2008). Upon closer examination of affectionate message outliers, it was found that the richest (video) condition had the most outliers, suggesting the presence of additional nonverbal social cues may confuse more than clarify in some situations; this may further explain modern communication medium preferences largely favoring lean text-based mediums which are contrary to MRT predictions (El-Shinnawy & Markus, 1997; Imperato, 2014; Markus, 1994; Performics, 2012; Rice & Shook, 1990; TIME, 2012).

In summation, the differences in message accuracy and certainty patterns when examining emotional tone variables supports the notion that many individuals report difficulties in conveying emotion via new communication mediums (Byron, 2008; Byron & Baldridge, 2005; Symons, 2014) and suggest difficulties related to conveying emotion through technology have entered the public psyche. This is further reflected in how the emotional communicative shortfalls of technology have made its way into popular culture. For example, organizations are developing solutions and encouraging use of richer mediums to address issues in conveying and perceiving sarcasm (Apple, 2014). This study's findings supports that individuals are apprehensive when it comes to communicating sarcasm in how participants were generally less certain of their interpretational accuracy for sarcastically toned messages than in the other emotional domains (aside from witty or humorous messages). However, it appears the public's difficulties related to communicating sarcasm may be unwarranted as findings rather

surprisingly noted sarcastically toned messages to be generally perceived more accurately than all the other emotional tone domains. Thus, individuals may be underestimating their ability to understand sarcasm using new media.

### Study Strengths and Limitations

Prior research on media richness, message interpretation and communicative confidence has largely consisted of subjective self-report surveys and ranking data to gain insight into the issues faced using newer communication technologies. This study is rather unique in that the design allows for both the subjective and objective collection of communication certainty and accuracy data. By examining both objective and subjective measures, the researcher was able to gauge if communication performance matched expectations in addition to highlighting concerns related to interpretational difficulties. Thus, a major study strength was in how its design provided more contextual certainty information in addition to accuracy scores. Additionally, this study examined multiple experimental variables, including media richness and emotional tone, in addition to more individual variables (like demographic data) that have been posited to impact communication choices and accuracy (Byron, 2008; Dennis & Valacich, 1999; Fulk et al., 1987; Kock, 2005; Lee, 1994; Markus, 1994; Rice, 1999; Sallnas et al., 2000; Timmerman & Madhavapeddi, 2008; Walther, 1992).

The current study is further strengthened from both a statistical and methodological perspective. Assumptions needed to use both a one way and mixed ANOVA were largely met, and how all assumption variability was explained by the significant differences between experimental groups which were highlighted in the findings of this study. Possible influences from outside variables were limited by the fact

that audio and video recordings were conducted concurrently so that the only stimuli differences were due to the condition variable. Additionally, the use of a highly trained actor skilled in conveying the designated emotional tones requested is a strength due to expertise in accurately and realistically conveying emotions. However, it should be noted that the use of a skilled professional may not match or truly represent the average individuals' ability to convey such emotions in everyday settings. Also, using a racially ambiguous actor to portray the audio and video stimuli may have helped decrease the impact of racial differences on accuracy and certainty. Lastly, the actor was filmed from the shoulders up so that facial expressions (which Ekman et al., 1980 demonstrated are largely universal) would be the primary nonverbal cue for the video condition as opposed to more potentially confusing body language cues.

Notable study limitations include interpreting the differences in accuracy by gender with caution, as the sample was overwhelmingly female. Since the majority of the participants were female it is unknown if the variance in accuracy scores by gender is due to the match in gender between the the actor and participants, or if females are truly better at accurately interpreting messages than males. Similarly, the majority of the sample were native English speakers, so that applications for nonnative English speakers are not particularly robust.

In addition to concerns related to the study sample, it is possible the design of the study in itself has its own limitations. As accuracy was operationally defined as a match between the sender's intended emotional tone with the receivers perceived emotional tone, the accuracy measure is not entirely objective. Since the intended emotional tone was dictated by the researcher, some emotional subjectivity was thus introduced.

Perceptually, the emotional tone categories of wit/humor and sarcasm, as well as sarcasm and aggression do overlap sometimes, depending upon a person's sense of humor and personality. This perceptual overlap in emotional tone may impact the ability for participants to accurately categorize the intended meaning and may cause them to be less certain of their responses than in the affection domain, which is not thought to overlap with the other tone categories much. However, the perceptual ambiguity in interpreting differently toned stimuli is crucial to the study to tease out if participants can better interpret certain types of emotionally toned messages in the context of leaner (text) or richer (audio and video) communication mediums. Notwithstanding, only four stimuli examples were found negatively impacted by such ambiguity and subjective assignment of emotional tone, as the majority of stimuli messages had accuracy scores at or above 4.5 out of 9, suggesting these limitations may have not had a great impact on findings.

**Implications for School Psychology and Clinical Child Psychology**

This study's findings demonstrated significant differences in accuracy by age, with the youngest group (participants age 18) having the highest accuracy scores while the oldest cohort (participants age 22) having the lowest accuracy scores across nearly all conditions and emotional tone categories. While all Millenials have grown up with new communication technology, it may be that younger individuals are learning to adapt to the constraints of communicating via leaner mediums.

As the younger Millennials include those just entering school, particular attention should be paid by school psychologists and teachers to focus on the limitations of using new text-based communication technologies in education and the social impact of communicating via technology. As most of these technologies will represent leaner

communication mediums and are therefore more likely to be misinterpreted by students, richer classroom interactions should be used whenever possible to clarify and support the use of these leaner new educational technologies. Additionally, while school curriculums should incorporate new technology, recent accounts of Millennials reported subpar in-person communication skills (Alsop, 2013; Anderson & Rainie, 2012; National Chamber Foundation, 2012; Pew Research Center, 2012) warrants the increased importance on teaching face-to-face communication and presentation skills. This will hopefully promote more opportunities for interpersonal interactions, debates, and public speaking as those skills are highly valued by many employers.

From a more clinical perspective, schools are in the position to act as gatekeepers in promoting more healthy patterns of engagement with technology and to crack down on cyberbullying, sexting, and other problematic behaviors driven by technology. By drafting social media policies, schools can set repercussions for maladaptive student communications whether they occur inside or outside of the school setting and address bullying and social problems from all angles. Additionally, with schools limiting access to mobile phones during the school day (both during instructional time and free periods), younger Millennials may be encouraged to engage in less phone checking, which could decrease rates of smartphone addiction and anxiety related to not having immediate access to mobile devices. Setting limits on technology use in schools may also have the added benefit of encouraging students to interact more face-to-face to combat research demonstrating a decrease in the frequency of in-person social interactions (Cisco, 2012; Lenhart, 2012b; Maynard 2014; Shim 2007; Wu et al., 2014).

**Directions for Future Research**

Future research should seek to quantify MRT rankings for new and old media to give weight to the various informational variables which impact the ability to accurately interpret messages. By examining discrete aspects of verbal and nonverbal social cues, greater weight can be lent to MRT and people can gain insight into what information is most important to communicate effectively. This study's findings of insignificant differences in accuracy between the social cues provided by audio and video communication suggests further research is needed to determine what auditory and visual communication cues are chiefly important to accuracy. Additionally, since this study's video was filmed from the shoulders up, future research directions include examining the nonverbal cues impact of body language on perceptual accuracy since that was not addressed by this study.

Furthermore, a more in-depth examination of individual differences in several areas is warranted. For instance, future studies may benefit from including subjective and objective measures on general communication style and effectiveness, as these variables may impact accuracy and certainty. Additionally, the presence of certain personality traits or psychopathologies should be explored in the context of text-based communication use and misunderstandings. These factors may impact the cognitive appraisal patterns (how individuals assign positive, negative, or neutral meaning to a message) of more ambiguous text-based interactions in various populations. For example, depressed patients may interpret every vague, ambiguous textual interaction (or indeed any message that is not obviously inert) in a negative, self-defeating, or otherwise unhealthy manner. Similarly, based upon clinical symptoms (such as emotional lability, misinterpretation of social intent, social difficulties) outlined in the DSM-V, individuals with borderline

personality disorder may tend to be overly reactive and hostile in the face of ambiguous text-based exchanges, and may being inclined to perceive the interaction as aggressive or rejecting. Thus, examining the impact of individual differences that may contribute to errors in accurately perceiving text-based messages could provide insight into how to better address the limitations of textual interactions. It may help to inform new mental health treatment approaches or even lead to the creation of interventions using social media or other communication technologies since text-based interactions are so commonplace.

With children increasingly using textual mediums to communicate, future research should investigate both the individual impact of growing up in a society increasingly communicating via technology instead of in person. As young brains are highly plastic with neuronal connections that are constantly being strengthened through experience, or going unused and subsequently eliminated via synaptic pruning (Kolb & Gibb, 2011), shifting communication patterns favoring greater experience communicating in a text-based world are likely impacting Millennial's brains in some manner. Also, this may further support and even explain the evidence noting significant social skills deficits between Millennials and older generation (Alsop, 2013; Anderson & Rainie, 2012; National Chamber Foundation, 2012; Pew Research Center, 2012). Thus, more research is needed to determine what neuronal changes may be occurring as the result of growing up with communication technology, and to examine the impact of technology on interpersonal interactions.

While future research should seek to identify the brain differences being driven by experiences related to technological advances in communication, it may help to

specifically look at the neuronal differences in individuals with social communication disorders like autism. With an autism spectrum disorder, difficulties related to the use and interpretation of nonverbal social cues are a central symptom; since the prevalence of autism has been steadily increasing in modern times with no definitive cause (although there is thought to be both a genetic and environmental component) (Centers for Disease Control and Prevention, 2015) it may be useful for communication research to examine the possible effects of interpersonal experiences and technology use in individuals with autism. Additionally, due to the social deficits inherent to autism spectrum disorder, it is possible that communication strategies using text-based means may be useful as a compensatory strategy to supplement or even replace difficult or anxiety-producing face-to-face interactions. Thus, more research is needed to determine the effects of communication technology on autism spectrum symptomology, mood features, and social skills acquisition.

Overall, the changing patterns of interaction and new communicative technologies provide novel opportunities to study how individuals cope with the unforeseen consequences of being perennially connected and reliant upon technological devices. It is also important for future research to investigate the limitations and difficulties created by evolving social communication trends since society and future generations will be greatly impacted by their impact. Hopefully, raising awareness of the limitations of text-based interactions and the propensity for overconfidence in the ability to accurately interpret messages will encourage people to use richer forms of media more frequently.

In conclusion, the changing patterns of interaction and new communicative technologies provide novel opportunities to study how individuals cope with the

unforeseen consequences of being perennially connected and reliant upon technological devices. It is also important for future research to investigate the limitations and difficulties creating by evolving social trends toward more textual interactions since society and future generations will be greatly impacted by these new communication practices.

# CHAPTER VI

# CONCLUSION

It appears as if Nye's (2006) assertion that modern technologies have played a vital role in social evolution has come to fruition. With the majority of the population walking around with a computer in their pocket via smartphones, the manner in which individuals interact with one another has fundamentally been altered and even replaced by more textual communication. However, this social evolution favoring text-based interactional patterns and shifting away from richer communication mediums comes with unforeseen consequences, such as smartphone addiction and technology related anxiety.

One of the most important unforeseen consequences of communicating in an increasingly text-based world are the limitations associated with using lean text-based media. This study supported previous research indicating textual misinterpretations and difficulties related to conveying and perceiving emotional tone, and confirmed that interpretational accuracy is decreased when using lean textual media. However, this study refuted media richness theory in how there was no significant differences in accurately perceiving messages between moderately rich (audio) and rich (video) mediums. Thus, while texting and emailing are increasingly popular, newer technologies offering audio and video messaging may help to counter some of the limitations of textual communications.

Unfortunately, this study's findings also supports research indicating variable levels of awareness concerning the limitations of communicating via lean textual means.

Findings indicate that individuals tend to overestimate their abilities to accurately perceive text messages. Thus, awareness must be raised about the limitations of lean textual communication in addition to directing more research to study the changing nature of how we interact and its impact both on individuals and society as a whole. While it is truly the Millennials that have grown up in an era of communicative changes, it is up to all the generations to become more knowledgeable in how technology may be impacting human growth and development, and the potential pitfalls of communicating in an increasingly textual world.

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# Appendix A

## Informed Consent

Dear Participant,

As a current doctoral student at Pace University, I am conducting a communication research study on social cues in various communication mediums for my dissertation. I am asking for your assistance and participation in this research study. Participants must be 18 years or older in order to partake in the study.

If you choose to participate, you will be asked to dedicate about 15 minutes of time taking an online survey assessing the meaning of certain communications based on a set of presented stimuli. At the end of the study you will be asked to fill out a short demographic information questionnaire and debriefed. There will be no identifying or personal information collected in the survey, it is entirely anonymous.

Your voluntary participation in this communication study is greatly appreciated. Deception will not be used; involvement in the study poses no foreseen risk or discomfort to participants. There are no specific benefits to you aside from contributing to research which may be relevant and of interest to you.

Participation is completely voluntary and you may choose to withdraw your participation at any time with no resulting negative consequences. By clicking "Save & Continue" below and completing this study questionnaire you acknowledge you are at least 18 years of age and are indicating your explicit informed consent. Feel free to consult with family members or other advisors before deciding to participate in this study. A copy of this consent can be accessed at by clicking the forwarded survey email link.

If you have any additional questions about the study, subject's rights, or any research-related concerns please do not hesitate to contact the researcher, Jenicka Hornung, at jh71712n@pace.edu at any time. You can also contact my research advisor, Dr. Leora Trub, at ltrub@pace.edu.

Thank you for your time and participation.

*The Institutional Review Board (IRB) at Pace University has approved the solicitation of subjects for this study. If you have any questions or concerns, please contact the Office of Sponsored Research at 212.346.1273.*

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Save & Continue

## Appendix B

Instructions to all Participants

Thank you for your voluntary participation in this communication study!

Please ensure your device's mute button is off and you are in a quiet environment with volume set at an appropriate level for you to hear audio clearly. Not all survey participants will hear audio, but in the case that you are presented with audio-based stimuli, it is requested that you find a private area where you can focus on the survey for 15 minutes.

This online Qualtrics survey will present you with 36 different short messages, either displayed as text, or embedded audio or video that you will need to hit play to start. For each stimuli message there will be two questions to answer:

**Question 1: Which of the following best represents the emotional tone of this message?**

___ affectionate
___ aggressive
___ sarcastic
___ witty/humorous

**Question 2: How certain are you of the intended meaning of the message?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Not Certain At All | | | | Absolutely Certain |

Please select one answer per question that is the best response in your opinion. There are no right or wrong answers.

Navigate to the next message by hitting the Next button on each page. At the end of the survey you will be asked a few demographic questions. Lastly, you will be debriefed on the study.

Once you are ready, please hit "Save & Continue" below to begin the study.

Save & Continue

## Appendix C

*Examples of Text Stimuli and Questionnaire*

I guess of all my uncles, I liked Uncle Caveman the best. We called him Uncle Caveman because he lived in cave, and because sometimes he'd eat one of us. Later on we found out he was a bear.

**Question 1: Which of the following best represents the emotional tone of this message?**

___ affectionate
___ aggressive
___ sarcastic
___ witty/humorous

**Question 2: How certain are you of the intended meaning of the message?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Not Certain At All | | | | Absolutely Certain |

Hey... u. Who are you again? Did I meet you last night or are you from earlier this morning?

**Question 1: Which of the following best represents the emotional tone of this message?**

___ affectionate
___ aggressive
___ sarcastic
___ witty/humorous

**Question 2: How certain are you of the intended meaning of the message?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Not Certain At All | | | | Absolutely Certain |

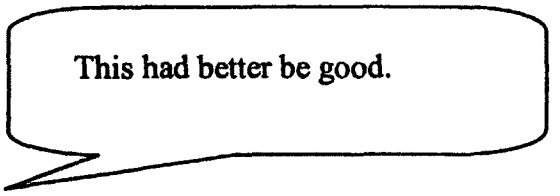
Im really looking 4ward to seeing u

**Question 1: Which of the following best represents the emotional tone of this message?**

___ affectionate
___ aggressive
___ sarcastic
___ witty/humorous

**Question 2: How certain are you of the intended meaning of the message?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Not Certain At All | | | | Absolutely Certain |

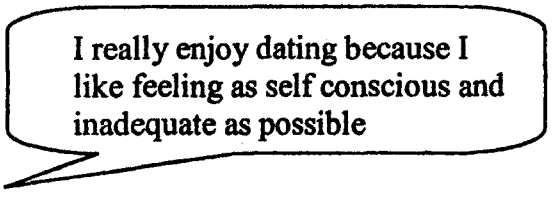



**Question 1: Which of the following best represents the emotional tone of this message?**

___ affectionate
___ aggressive
___ sarcastic
___ witty/humorous

**Question 2: How certain are you of the intended meaning of the message?**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Not Certain At All | | | | Absolutely Certain |

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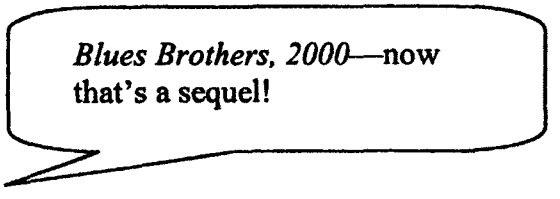


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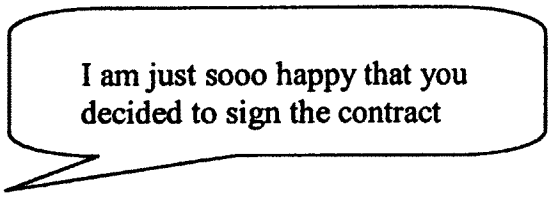


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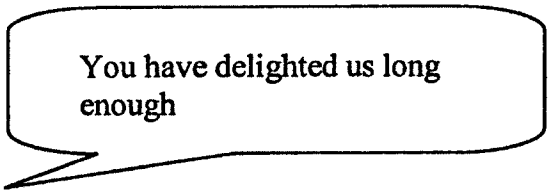


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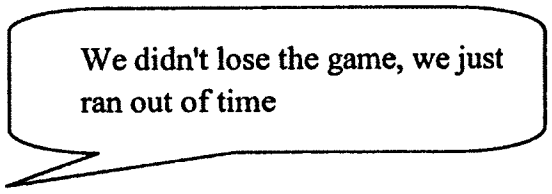


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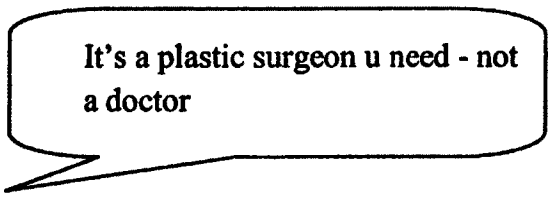


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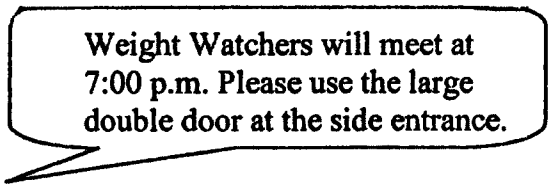


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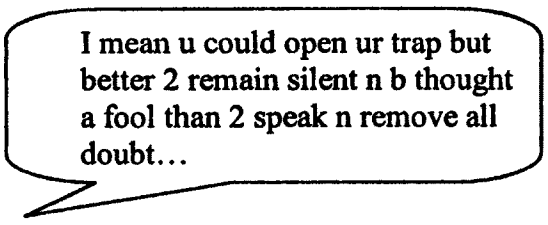


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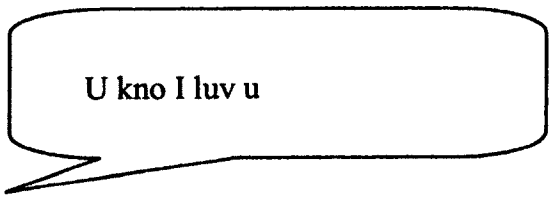


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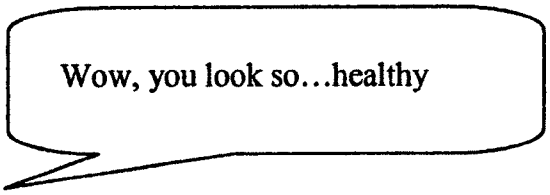


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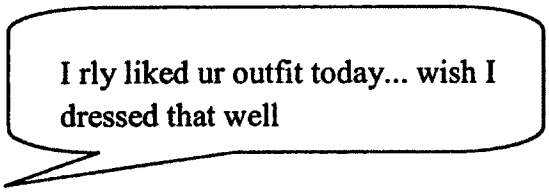


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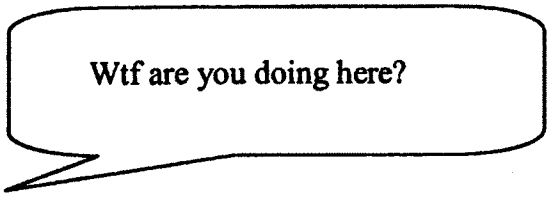


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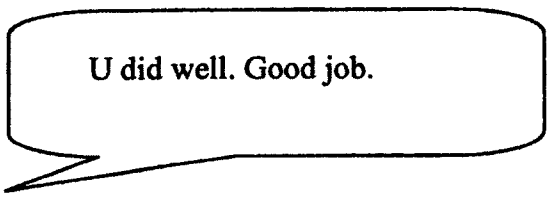


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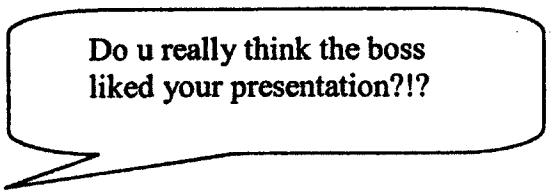


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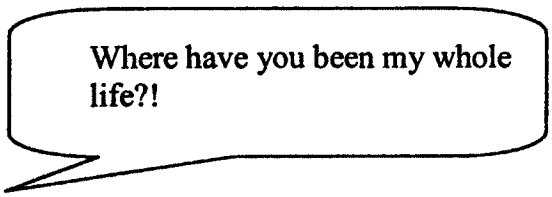


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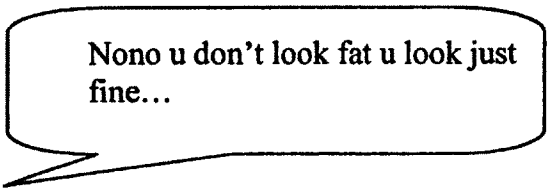


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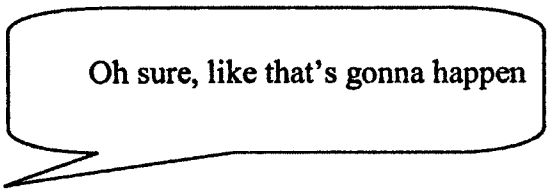


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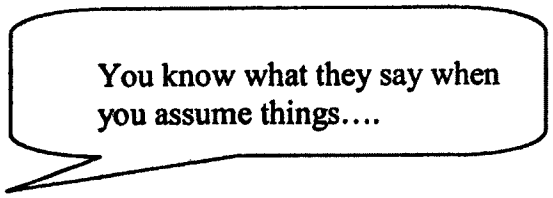


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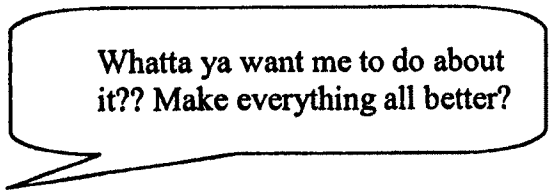


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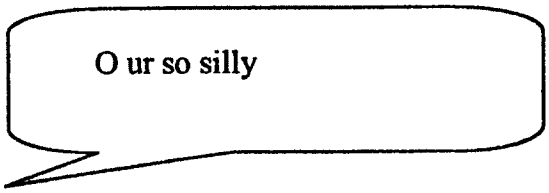


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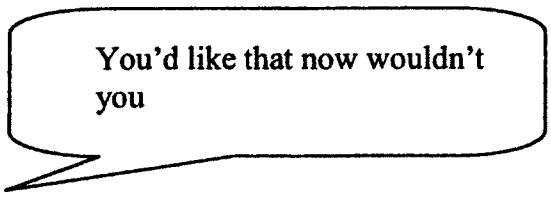


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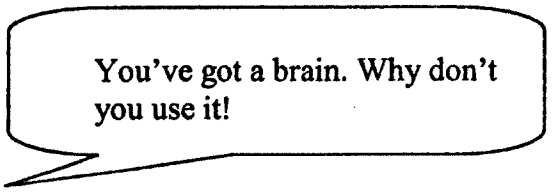


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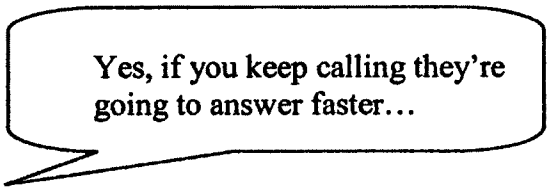


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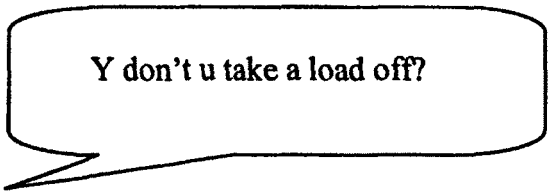


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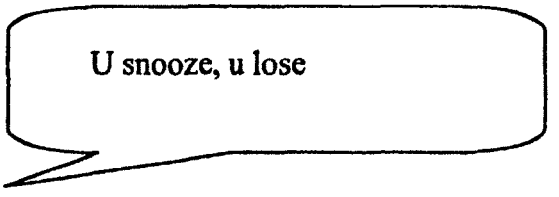


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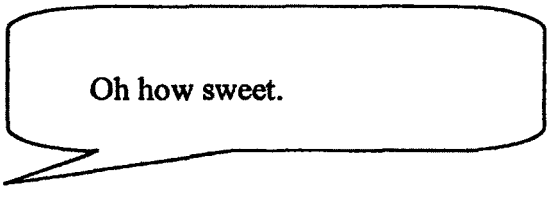


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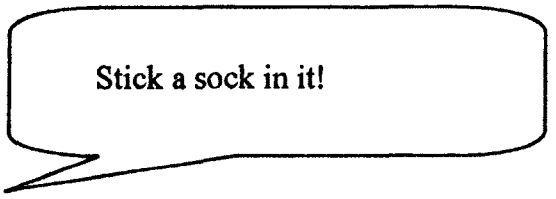


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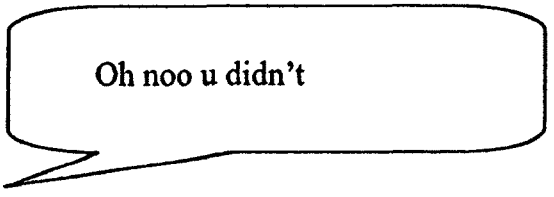


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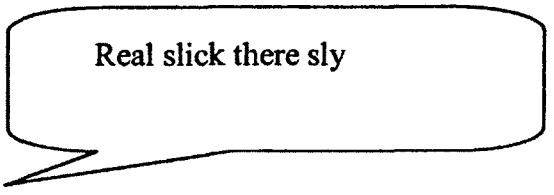


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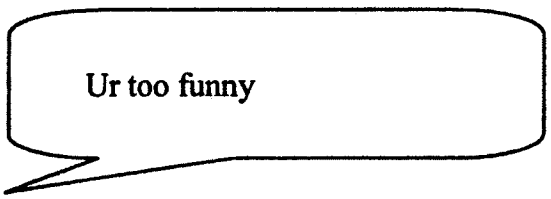


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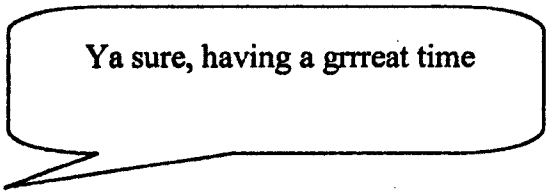


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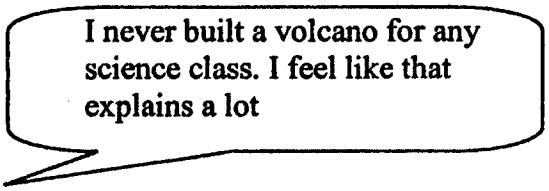


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## Appendix D

Demographic Questionnaire

1. DOB: (DD/MM/YYYY): _____

2. Gender: (pick one)

   _____Male

   _____Female

   _____I do not identify as either/solely male or female

3. Race/Ethnicity: (pick one)

   _____African American/Black

   _____Asian

   _____Caucasian/White

   _____Hispanic (non-white)

   _____Hispanic (white)

   _____Native American/Pacific Islander

   _____Other

4. Native Language: (pick one)

   _____English

   _____Not English

5. Declared Undergraduate Major Area: (pick all that apply)

   _____Arts & Sciences

_____Business

_____Education

_____Health

_____Technology

_____Undeclared

6. Age at which you owned your first mobile phone (#):____

7. Age at which you owned your first computer (#):_____

## Appendix E

Debriefing

Thank you for your participation in this communication study!

I am studying the impact of social cues and messaging medium upon perceived understanding when those messages are intended by the sender to have an affectionate, aggressive, sarcastic, or witty/humorous emotional tone.

If you have any questions or concerns please do not hesitate to contact the researcher or her advisor at the contact below:

Researcher:

Jenicka Hornung
Doctoral Candidate, School-Clinical Child Psychology
Pace University
978.314.3938
jh71712n@pace.edu

Faculty Advisor's Contact Information:

Dr. Leora Trub, Ph.D
212.346.1852
ltrub@pace.edu

## Appendix F

Informed Consent for Actress Participant

Dear Participant,

As a current doctoral student at Pace University, I am conducting a communication research study for my dissertation and am asking for your assistance and participation in this study.

If you choose to participate, you will be asked to dedicate about 1 hour of time to record 36 short audio/video messages with intended emotional tone (sarcasm, wit/humor, affection, aggression) dictated by the sender (researcher). Participants must be 18 years or older in order to partake in the study. Your personal information will not be used in any way; however, it is possible someone may recognize you from your video used in the study.

Your voluntary participation in this communication study is greatly appreciated. Involvement in the study poses no foreseen risk or discomfort to participants. There are no direct benefits for your participation, but your time contribution of approximately 1 hour helps advance communication knowledge through this study.

Participation is completely voluntary and you may choose to withdraw your participation at any time.

By signing this informed consent you are indicating your explicit informed consent to participate in this study by providing recorded audio and video recordings of your image and likeness. A copy of this consent will be provided to you at the time of signing. If you have any additional questions, please do not hesitate to contact the researcher, Jenicka Hornung, at jh71712n@pace.edu at any time.

Thank you for your time and participation.

*The Institutional Review Board (IRB) at Pace University has approved the solicitation of subjects for this study. If you have any questions or concerns, please contact the Office of Sponsored Research at 212.346.1273.*

Jenicka Hornung
Doctoral Candidate, School-Clinical Child Psychology
Pace University
978.314.3938
jh71712n@pace.edu

Faculty Advisor's Contact Information:

Dr. Leora Trub, Ph.D
212.346.1852
ltrub@pace.edu

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**Participant Name (Printed):**

**Participant Signature:** _____ **Date:** _____

**Witness Name (Printed):**

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