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# Information and Communication Technology Sequences and Message Repetition in Interpersonal Interaction

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## Abstract

This study examines the impact of using different sequences of information and communication technologies (ICTs) to deliver repeated messages in the context of an interpersonal influence attempt. Supporting portions of ICT succession theory (Stephens, 2007), the findings suggest that, compared to using the same ICT, using complementary ICTs to deliver a repeated message increases perceptions of information effectiveness and behavioral intentions. A path model was tested to further explore the influence of complementary ICT use. The results suggest that the use of complementary ICTs functions by mitigating perceptions of overload and, in turn, increasing perceived information effectiveness, attitudes, and behavioral intentions.

## Keywords

information and communication technology, ICTs, overload, persuasion, redundant communication, communication channels, ICT sequences, repeated exposure, interpersonal influence

Throughout the course of every day, it is not uncommon for one to encounter various repeated messages. Whether being asked to contribute to a political candidate's campaign, adopt healthier habits, change work hours, or even take out the trash, one may be exposed to the exact same message delivered multiple times using the same or different information and communication technologies (ICTs). Message repetition is one type of communication redundancy that involves repeating the same message content in a series of at least two

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messages—for example, a reminder message. Message repetition has been a longstanding topic of interest in communication scholarship as a key component of information theory (Shannon & Weaver, 1949), in literature on mere exposure (Zajonc 1968), and in research examining noise and comprehension (e.g., Broadbent, 1958; Dahle, 1954; Hsia, 1968; 1977; Paivio, 1990). In advertising and health campaigns, this type of message is considered a repeated exposure (Rogers & Storey, 1987), and when trying to reach a broad audience with mass media, this type of message repetition is often vital for success.

A key consideration in message repetition involves the use of ICTs to deliver a message or a series of messages. The use of media—specifically mass media—to deliver messages has been examined in advertising and health communication campaigns (e.g., Flora, Saphir, Schooler, & Rimal, 1997; Hornik, 2002; Rogers & Storey, 1987). This research has generally found that using combinations of media to reach audiences is more effective in achieving outcomes such as purchase behavior and health behavior change. Yet we have limited research that examines how media are used to facilitate message repetition in the context of interpersonal interaction. While some mass media are used in these contexts, there is considerably more face-to-face communication and use of ICTs that facilitate dyadic interaction (e.g., email, text-messaging).

ICTs such as mobile phones, email, text messaging, and instant messaging have made it increasingly possible to communicate repeated messages over time. Sequential ICT use—which has recently received theoretical and empirical attention in ICT succession theory (Stephens, 2007; Stephens, Sørnes, Rice, Browning, & Sætre, 2008; Westerman, Van Der Heide, Klein, & Walther, 2008)—involves using a variety of ICTs by either repeating the same ICT or by using ICTs with complementary modalities (e.g., text-based or audio-facilitating) to communicate a message. For example, repeated ICT use could involve making two separate telephone calls, whereas complementary ICT use would involve making a telephone call (audio-facilitating) and then sending an email message (text-based). ICT succession theory suggests that using complementary ICTs creates a type of modality expansion, allowing additional modalities to be used to reach and influence message receivers.

The study reported here examines the implications of exposing people to repeated persuasive messages through repeated and complementary ICTs and attempts to achieve several goals. First, we are especially interested in the role that different ICT combinations play in perceptions of, and responses to, an interpersonal influence attempt. Drawing from research on ICT succession theory (Stephens, 2007), we test predictions about message repetition in an interpersonal context using repeated and complementary ICT sequences. Second, because we include two different ICTs (i.e., email and face-to-face communication), we also examine the order effects associated with the four ICT sequences. Third, we incorporate the research on mere exposure to examine the effects of message repetition. Finally, we construct and test a model examining the process through which repeated and complementary ICT sequences affect the outcomes of an interpersonal influence attempt. The following sections discuss background research on message repetition and ICT sequences to develop hypotheses and research questions.

## Literature Review

### *Background on Redundancy in Communication*

The general construct of redundancy—specifically message repetition—received considerable attention in early communication studies research (e.g., Broadbent, 1958; Dahle, 1954). Shannon and Weaver (1949) define redundancy in information theory as a mathematical formula related to entropy or relative information. Theoretically, message repetition is not needed when a communication system is “completely error-free and has an unlimited capacity in case of information overloading” (Hsia, 1977, p. 64). Yet few people would say that these types of communication systems exist, so various types of message repetition are used to compensate for error. Message repetition can be viewed as necessary and noise-reducing or as the introduction of superfluous information (Hsia, 1977). In advertising and mass media campaigns, this message repetition is viewed favorably, especially when trying to reach mass audiences (e.g. Flora et al., 1997; Hornik, 2002; Rogers & Storey, 1987).

In addition to repeating message content, a second type of redundancy is possible in the context of interpersonal interaction. As ICTs that facilitate interpersonal interaction have become increasingly available, it is quite possible that people perceive an additional type of redundancy when ICTs are used repeatedly to communicate a specific message or about a particular message topic. This type of ICT use can be considered sequential ICT use. While ICTs can be used sequentially to send many types of messages, in this study we focus on messages about the same topic that simply repeat the content—like a reminder. In the section that follows, we will review the literature on sequential ICT use and message repetition to help justify the hypotheses and research questions that follow.

### *Sequential ICT Use and ICT Succession Theory*

Scholarship examining the importance of using combinations of ICTs to communicate messages is found in audiovisual (including the education literature), cybernetics, and computer science research (including warning-research science; e.g., Wogalter, 2006). Several scholars have argued and found evidence consistent with the idea that using combinations of ICTs can foster positive outcomes such as learning and recall. Paivio (1990), for example, explains that people process auditory and visual stimuli separately in a process he terms dual coding. His research empirically demonstrates that audio and visual information work together to affect memory and, when they provide similar information, improve interest and recall (Paivio, 1990; Clark & Paivio, 1991; Thompson & Paivio, 1994). This research has led to the inclusion of audiovisual instruction in the classroom (Mayer, 1997; Mayer & Moreno, 1998). Further, Hsia (1968, 1977) showed that message transmission accuracy increases when auditory and visual information is combined. He argues the different modalities (i.e., modalities are features of ICTs, such as the possibility of transmitting sound, that make it possible to convey different types of information) provide supplemental information for one another that allow people to more completely process the information. He calls this type of redundancy between-channel redundancy.

The theoretical perspectives of between-channel redundancy (Hsia 1968, 1977) and dual coding (Paivio, 1990) have examined the simultaneous presentation of information using two different modalities of ICTs. For example, people can see material visually in PowerPoint and hear a professor explain the material at the same time. However, recent theoretical work has begun to identify and predict outcomes related to sequentially presenting information using multiple ICTs (e.g., Munkejord, 2007; Osterlund, 2007; Reinsch, Turner, & Tinsley, 2008; Rice, Hiltz, & Spencer, 2004; Stephens, 2007; Stephens et al., 2008; Turner & Reinsch, 2007; Watson-Manheim & Belanger, 2007). Stephens' (2007) work on ICT succession theory, in particular, makes specific predictions concerning how "maximizing combinations of these modalities" (p. 496) over time might influence effectiveness of tasks, such as persuasion, information giving, and information seeking.

One major proposition of ICT succession theory states that using complementary ICTs (e.g., email followed by face-to-face) in successive communication events leads to more effective communication. *Complementary ICT* use is defined as a specific class of sequential ICT use where the second, or successive, ICT has different yet modality-expanding capabilities (Stephens, 2007). In sequential ICT use, modality expansion occurs by using a successive ICT that has different communication modes—for example, auditory, visual, or textual—than available through the first ICT. ICT succession theory builds on the work from between-channel redundancy (Hsia, 1977) and dual coding (Paivio, 1990) to extend the modality-enhancing benefits of using multiple channels to sequential ICT use. Westerman et al. (2008) applied ICT succession theory and found that people used combinations of mass and interpersonal ICTs to learn information about others. In this more process view of communication, even face-to-face communication can be expanded through the subsequent use of email as a textual mode. This can be contrasted to what we call repeated ICT use or simply using the exact same ICT (with the same modality) multiple times in a row.

ICT succession theory (Stephens, 2007) suggests that using complementary ICTs sequentially to maximize modalities may increase the effectiveness of an interpersonal influence attempt, where one is attempting to influence the beliefs, attitudes, and/or behavior of others. This can occur for two primary reasons. First, given the plethora of messages people receive, using complementary ICTs will increase the likelihood that the message will reach receivers and receivers will attend to the messages. Health campaigns, for example, have clearly identified the importance of exposing people to messages, often through the use of multiple ICTs, because if people do not see or hear the message, it cannot have any influence (e.g., Hornik, 2002; Rimal, Flora, & Schooler, 1999; Rogers & Storey, 1987). In an interpersonal context, using multiple ICTs such as face-to-face and email may also facilitate reach by increasing the likelihood that individuals will receive the message. Beyond becoming aware of the message, complementary ICT use may increase receivers' attention to the message. Using multiple modalities has been shown to increase audience interest (Clark & Paivio, 1991; Paivio, 1990), and interest is often important as a precursor to influence.

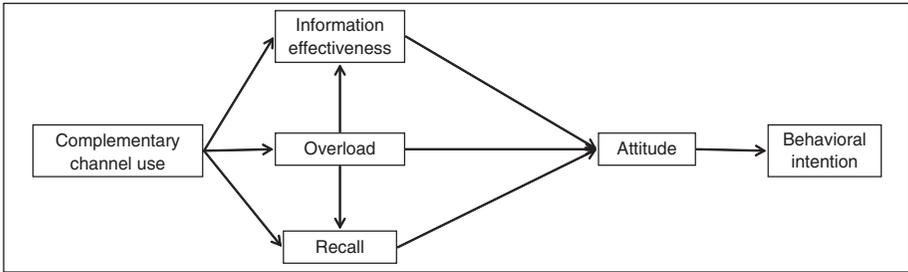
Second, using complementary ICTs maximizes the modalities through which individuals receive information. As such, use of complementary ICT should, in general, be more

likely to facilitate information processing than use of a single ICT repetitively. Maximizing the modalities through which information is presented may serve to target an individual's particular learning style and/or more effectively reinforce the information by presenting it in a different mode (i.e., text based or audiovisual). The education research on dual coding suggests that recall is increased using multiple media simultaneously because messages are reinforced (Hsia, 1977; Paivio, 1990). Although this research has not specifically examined the sequential use of ICTs, it is plausible that similar effects will occur. Individuals who receive an email message (text-based information) about a topic and then receive a phone call (audio information) should achieve similar benefits of having the information presented in multiple modes.

The preceding arguments suggest that use of complementary ICTs, in comparison with repetitive ICTs, may facilitate an interpersonal influence attempt. In making predictions about the specific outcomes of complementary and repetitive ICT use, we draw from both the message learning (Hovland, Janis, & Kelley, 1953) and cognitive response (Petty, Ostrom, & Brock, 1981) approaches to persuasion and attitude change. We recognize the role that learning (i.e., recall) and cognitions regarding an influence attempt play in attitude and, ultimately, behavior change. Accordingly, we hypothesize that using complementary ICTs should result in increased perceptions of message effectiveness, less information overload—defined as a situation where people have more information than they can process (Eppler & Mengis, 2004)—and greater recall about a topic than the use of repetitive ICTs. Further, the use of complementary ICTs should result in more positive attitudes and increased intention to perform an advocated behavior. To test these ideas, we propose the following hypothesis:

*Hypothesis 1:* Using complementary ICTs in successive communication attempts leads to (a) more positive attitudes; greater (b) perceptions of information effectiveness, (c) recall, and (d) behavioral intentions; and (e) less overload than using repetitive ICTs.

Beyond testing the main effects of complementary ICT use, it is also important to consider how the preceding outcomes are interrelated to further understand the process through which complementary ICT use functions. Building from the notion that complementary ICT use facilitates information processing through capitalizing on multiple modalities, we expect complementary ICT use to mitigate information overload, foster learning, and increase perceptions of message effectiveness. Using multiple modalities should encourage receivers to attend to the message, cater to different learning styles, and reinforce message content; thus, individuals should feel less overloaded, be better able to recall information in the message (i.e., increase their recall), and perceive the message to be more effective. Reduced overload should also directly foster increased recall and perceptions of message effectiveness. Overload, recall, and perceived message effectiveness, in turn, should predict attitudes toward a message topic and, ultimately, behavioral intention. To formally test these predictions, the model depicted in Figure 1 is proposed.



**Figure 1.** Predicted model of combinatorial channel use.

Finally, it is important to determine whether any order effects exist stemming from the various combinations of ICTs. Granted that this study focuses on email and face-to-face communication, we pose the following research question:

*Research Question 1:* Are there order effects for the use of the four different combinations of email and face-to-face communication?

### *Message Repetition and Mere Exposure Hypothesis*

In addition to using the modality expansion notion of repetition found in ICT succession theory, it is important to test the effect that repeating a message has on the variables in this study. Assuming a sequence of two messages, research on mere exposure (Zajonc, 1968) suggests that message repetition in a persuasion attempt can foster positive outcomes. The mere exposure effect refers to the propensity for individuals to respond positively to repeated exposures to a stimulus. Mere exposure can be considered a type of conditioning where the repetitive exposure to a stimulus increases perceptions that the message is familiar and creates positive responses (Zajonc, 2001). Bornstein (1989) conducted a meta-analysis of mere exposure research involving a variety of artifacts to which participants were exposed and reported robust findings consistent with the mere exposure hypothesis.

Mere exposure has been used as a theoretical explanation for justifying repeated message exposures in many contexts, especially in advertising. McCullough and Ostrom (1974) found a positive relationship between the attitudes and the number of advertisements with the same message viewed by participants. Similarly, Cacioppo and Petty (1979) conducted two experiments and found a curvilinear relationship between exposure to a persuasive message and attitudes toward a topic. Attitudes peaked after three exposures to the same message.

Although message repetition can have positive outcomes, perceptions of repetitive messages likely change from being one of helpful and message reinforcing to one of being bothersome when many messages are delivered repeatedly (e.g., point of diminishing returns; Ehrensberger, 1945). Particularly in the context of interpersonal interaction, hearing the same message from the same person multiple times may lead a message receiver to respond negatively to the message and source. McCroskey, Larson, and Knapp (1971), for example, explain that redundancy is a way to reduce noise and increase accuracy of the

message delivery, but they also claim that too much redundancy may cause a receiver to feel insulted.

In this study, we explore a two-message sequence to capture the effects of minimal message repetition. Theorizing about the mere exposure effect and message repetition suggests that, in the context of a sequence of two persuasive messages, message repetition will likely foster positive outcomes. In particular, compared to a nonrepeated message, a repeated message will result in increased recall, perceptions of information effectiveness, behavioral intentions, more positive attitudes, and reduced overload.

*Hypothesis 2:* For two sequential messages, message repetition leads to (a) more positive attitudes; greater (b) perceptions of information effectiveness, (c) recall, and (d) behavioral intentions; and (e) less overload than no message repetition.

### *Interaction Between Message Repetition and ICT Sequences*

While both sequential ICT use and message repetition likely affect persuasion-related outcomes directly, it is possible that they interact to affect outcomes related to an interpersonal influence attempt. The effects of message repetition may compliment the redundancy found when using ICT sequences. In particular, two divergent outcomes are plausible for a two-message influence attempt. First, research on the mere exposure effect (Zajonc, 1968, 2001) suggests that presenting a repetitive message using the same ICT may enhance an individuals' response to a message. Using the same ICT should reinforce the similarity of the two messages; thus, recognition and liking of the message should increase. Yet it also seems plausible that the combination of using complementary ICTs and message repetition may lead to the most positive outcomes. ICT succession theory (Stephens, 2007) suggests that the multiple modalities (i.e., visual and audio) present when using complementary ICTs may serve to better cater to different learning styles and reinforce message content. Additionally, complementary ICTs could make the second message appear similar but unique and, thus, help retain the attention of message receivers and ensure that they engage both messages.

Given the competing outcomes possible, we propose the following research question to examine the relationship between sequential ICT use and message repetition. The five outcomes addressed in Hypotheses 1 and 2 focusing on persuasion-related variables will serve as the outcomes for the research question.

*Research Question 2:* To what extent does sequential ICT use interact with message repetition to affect outcomes related to perceptions of and responses to an interpersonal influence attempt?

## **Method**

An experiment was conducted to test the hypotheses and answer the research questions. Participants were exposed to a series of two persuasive messages encouraging them to use

the Career Services facility at their university. The message repetition and ICT sequence factors were manipulated in the messages and the ICT used for message delivery.

## Participants

A total of 148 participants were recruited from undergraduate communication courses at two large southwestern universities. Given that the persuasive messages used in this study focused on career preparation, we feel that undergraduate students are an appropriate sample for this research. Participants ranged in age from 19 to 28 ( $M = 21.70$ ,  $SD = 1.72$ ). Of those who reported their gender, 67% of participants were female and 33% were male.

## Design

A 4 (ICT sequence)  $\times$  2 (message repetition) between-participants design was used in this study.<sup>1</sup> The design was fully crossed. The ICT sequence variable included four groups: email then face-to-face, face-to-face then email, email then email, and face-to-face then face-to-face. The face-to-face/face-to-face and email/email groups were combined to form the repeated (or same) ICT sequence condition, and the email/face-to-face and face-to-face/email groups were combined to form the complementary ICT sequence condition. The two conditions in the message repetition variable included repetition and no repetition.

## Procedure

One participant took part in the study at a time. The study took approximately 25 minutes to complete; the experimental portion of the study lasted approximately 10 minutes, and the questionnaire took participants approximately 15 minutes to finish. All participants were randomly assigned to one of the eight conditions in the 4  $\times$  2 design.

Participants arrived at an office in which Confederate 1 was ostensibly working. When participants inquired about the study, Confederate 1 explained that Confederate 2 would be a little late. Confederate 1 said that he/she was not involved in the study but could help get the participant started. Confederate 1 told the participant that "Confederate 2 is working on a project dealing with career counseling. She/he is trying to find out what people know about the career counseling opportunities here on campus." Confederate 1 asked participants to log-on to their primary email account (there were several computers available in the office) and said, "If you can please verify your email address, I'll email it to Confederate 2. I'm not sure if Confederate 2 will either stop by or email you the information. In the meantime, could you please complete this informed consent document?" As the participant was reading the informed consent information, Confederate 1 sent Confederate 2 a message indicating that he/she should email the participant or come to the office (depending on the condition).

In the email first conditions (i.e., email then face-to-face or email then email), Confederate 2 then sent the participant a form email containing Message 1. In the face-to-face first

conditions, Confederate 2 entered the office and read Message 1. Message 1 was the same for all conditions. The message began with a brief apology and account for running late and an introduction of the purpose of the study (i.e., learning what students know about career counseling on campus). Message 1 contained facts and information about the importance of and opportunities provided by Career Services at each respective university. In the second half of Message 1, four points were made about the services offered by Career Services (e.g., "Career Services can aid in writing your resume. They have a variety of tools to help you write and polish your resume. They can also answer commonly asked questions about professional resumes"). At the end of Message 1, the following explicit attempt was made to influence participants to utilize Career Services: "You should make it a point to visit the Career Services. They are a great resource about career-related information. You can find them on the Web, which can be accessed from the University's Web site, or at their office located . . ." The message concluded with Confederate 2 asking whether the participant had any questions (and, in the email condition, asking participants to send an email letting the confederate know whether he/she did or did not have questions).

After the participant responded to the questions, Confederate 2 segued to Message 2 by writing/saying that he/she wanted to follow-up on opportunities from Career Services. In the email second conditions (i.e., face-to-face then email or email then email), Confederate 2 said, "I have some more information in electronic form; let me send it to you." In the face-to-face second conditions, Confederate 2 said, "I have some more information here, let me get it" and then proceeded to get message two from a folder. In all cases, the time delay between completing delivery of the first message and beginning delivery of the second message was 2 to 3 minutes.

The message repetition factor was manipulated in Message 2. The repetition condition replicated the information from the second half of Message 1. Message 2 repeated—using the exact same words—the four points about the services offered at Career Services in the second half of Message 1. Additionally, Message 2 in the repetition condition concluded with the same call to visit Career Services as in Message 1. In the no repetition condition, Message 2 included content that was different from Message 1 and focused on career fairs. The message included four points about the merits of, and opportunities provided by, career fairs. Message 2 in the no repetition condition closed with a call for students to find out more information about and visit a career fair on campus. The repetitious and nonrepetitious second messages were both approximately 260 words.

Once participants finished reading or hearing the second message, they were directed to complete a Web-based questionnaire containing measures of the dependent variables. Finally, it is noteworthy that 15 different individuals, all blind to the hypotheses, acted as confederates for this study; all confederates were graduate students in communication.

## Measures

Unless otherwise noted, all measures were rated on 7-point scales with the anchors *strongly disagree* (1) and *strongly agree* (7). Larger values for a measure indicate a greater amount of the variable.

**Information effectiveness.** A 7-item measure, created for this study, was used to assess participants' perceptions of the quality of the messages about Career Services ( $M = 5.51$ ,  $SD = 0.89$ ,  $\alpha = .86$ ). Participants rated the degree to which they felt the message was effective, detailed, useful, high quality, well supported, weak, and uninformative. The final 2 items were reverse scored.

**Attitude.** Attitude toward Career Services was assessed with a 6-item measure that was created for this study ( $M = 6.14$ ,  $SD = 0.59$ ,  $\alpha = .78$ ). Participants rated the degree to which they felt that Career Services was helpful to students, a valuable resource, important for getting a job, a good idea for students, has something positive to offer, and a waste of time. The final item was reverse scored.

**Behavioral intention.** Five items, created for this study, were used to measure participants' intentions to use Career Services ( $M = 5.48$ ,  $SD = 1.03$ ,  $\alpha = .88$ ). Participants rated the degree to which they agree with statements indicating that they would visit the Career Services Web site, enroll in at least one workshop offered by Career Services, stop by the Career Services office, learn more about Career Services, and not use Career Services. The final item was reverse scored.

**Information overload.** A 6-item measure from Ballard and Siebold (2006) was adapted for this study to assess participants' perception of information overload ( $M = 2.56$ ,  $SD = 0.94$ ,  $\alpha = .83$ ). Participants rated their agreement with statements indicating that the information they received about Career Services needed too much explanation to be useful, required participants to make too many decisions, had too much information, was more discussion than participants wished, was more information than participants needed, and was about the right amount of information participants needed. The final item was reverse scored.

**Recall.** Participants' recall was operationalized using a 22-item quiz that tested whether participants were able to accurately recall the information about Career Services that was presented by the confederate. All content included in the quiz was information that was addressed in all of the study conditions; information from the nonrepetitive message condition was excluded because not all participants were exposed to that content. The quiz had 16 items consisting of different types of assistance that may or may not be provided by Career Services. Participants were asked to identify the services that (they thought) Career Services actually provided. The quiz also contained 6 true/false items. The total number of correct responses to the quiz made by each participant was summed ( $M = 13.24$ ,  $SD = 2.63$ ,  $\alpha = .73$ ).<sup>2</sup>

**Manipulation checks.** Measures were included to assess the manipulation of the ICT sequence variable and the message repetition variable. To evaluate the ICT sequences variable, participants rated their agreement with a single item indicating that the information about Career Services was presented face-to-face and through email ( $M = 4.33$ ,  $SD = 2.73$ ). A 4-item measure was used to assess the message repetition manipulation ( $M = 3.64$ ,  $SD = 1.42$ ,  $\alpha = .78$ ). Participants rated the degree to which the two messages about Career Services repeated some of the same information exactly, listed information that was exactly identical, listed some similar but not exactly the same information, and were similar but did not list the exact same information. The final 2 items were reversed scored.

## Control Variables

Three control variables were measured and included in the analyses. First, because the study was conducted at two different universities, we included participants' location as a control variable. It is reasonable to assume that there is some variance in the quality and reputation of the Career Services facilities at the two universities. Participants' location (i.e., home university) was coded by the researchers into a single, dichotomous item. Second, the perceived importance of a message about Career Services is likely dependent upon one's job status. Accordingly, we included a single-item measure asking participants to report whether they had secured a job for after graduation. At the time of the study, 9% of participants (who were still enrolled in school) had found postgraduation employment. The third control variable involved participants' previous experiences with Career Services. Participants reported whether they had used Career Services prior to this study. Forty-one percent of participants had prior involvement with Career Services at their respective university.

## Results

### Preliminary Analyses

First, separate confirmatory factor analyses (CFAs) were performed for each of the multi-item measures. The measures were evaluated using the factor loadings, chi-square test of model fit, and Hu and Bentler's (1999) dual criteria of a Comparative Fit Index (CFI) value greater than or equal to .96 and a standardized root-mean squared residual (SRMR) value less than or equal to .10. The factor loadings for the measures of information effectiveness (.45 to .80), attitudes (.40-.88), behavioral intention (.60-.88), and information overload (.51-.82) were acceptable. The CFA models for information effectiveness,  $\chi^2(df = 11) = 20.76, p = .04, CFI = .99, SRMR = .04$ ; attitudes,  $\chi^2(df = 8) = 8.97, p = .34, CFI = 1.00, SRMR = .04$ ; behavioral intention,  $\chi^2(df = 4) = 6.92, p = 14, CFI = .99, SRMR = .02$ ; and information overload,  $\chi^2(df = 5) = 7.30, p = .20, CFI = .99, SRMR = .03$ , adequately fit the sample data.

Next, we inspected the data for outliers. No univariate outliers were identified. However, following the procedures specified by Tabachnick and Fidel (2001), we identified four cases that contained multivariate outliers and removed the cases from the data set.

Finally, checks were conducted for the message repetition and sequential ICT use manipulations. As expected, participants rated the repetitious message ( $M = 4.38, SD = 1.41$ ) as being more likely to contain identical information than the nonrepetitious message ( $M = 2.86, SD = 0.93$ ),  $F(1, 143) = 59.13, p < .01, \eta^2 = .29$ . Additionally, participants in the complementary ICT sequence condition ( $M = 6.82, SD = 0.69$ ) were more likely to report receiving the messages through face-to-face and email than participants in the repeated ICT sequence condition ( $M = 1.92, SD = 1.50$ ),  $F(1, 143) = 661.53, p < .01, \eta^2 = .82$ . These results indicate that the manipulations were effective.

## The Influence of Sequential ICT Use on Study Outcomes

ANCOVAs were conducted to test the hypotheses and answer the research questions. For all analyses, the measures assessing whether participants had secured a postgraduation job at the time of the study, previously visited Career Services, and the university at which each participant was a student were specified in the models as control variables.

Hypotheses 1a through 1e predicted that using complementary ICTs in successive communication attempts fosters more positive attitudes; increases information effectiveness, recall, and behavioral intentions; and decreases overload perceptions more than using repetitive ICTs. The results of two ANCOVAs were consistent with Hypothesis 1. Participants in the complementary ICT condition ( $M = 2.28$ ,  $SD = 0.81$ ) reported being less overloaded than participants in the repeated ICT condition ( $M = 2.82$ ,  $SD = 0.98$ ),  $F(1, 138) = 10.91$ ,  $p < .01$ ,  $\eta^2 = .07$ . Additionally, participants in the complementary ICTs condition ( $M = 5.66$ ,  $SD = 1.01$ ) reported significantly greater intentions to visit Career Services than those in the repeated ICT condition ( $M = 5.32$ ,  $SD = 1.02$ ),  $F(1, 137) = 4.40$ ,  $p = .04$ ,  $\eta^2 = .03$ . However, this finding is qualified by a significant two-way interaction, which will be discussed further in the section addressing the final research question.

Other findings fail to support Hypothesis 1. There were no differences between the complementary ICT condition and the repeated ICT condition in regard to attitudes,  $F(1, 135) = 1.31$ ,  $p = .25$ ,  $\eta^2 = .01$ ; perceptions of information effectiveness,  $F(1, 136) = 1.44$ ,  $p = .23$ ,  $\eta^2 = .01$ ; and recall,  $F(1, 138) = 0.26$ ,  $p = .61$ ,  $\eta^2 < .01$ . Means and standard deviations for the ICT combination conditions are presented in Table 1.

Research Question 1 asked if there are order effects for the four different combinations of email and face-to-face communication on the five dependent measures. The results of the ANCOVAs indicate that there were no order effects for attitudes,  $F(3, 134) = 0.77$ ,  $p = .51$ ,  $\eta^2 = .02$ ; recall,  $F(3, 137) = 1.13$ ,  $p = .34$ ,  $\eta^2 = .02$ ; or information effectiveness,  $F(3, 135) = 1.60$ ,  $p = .19$ ,  $\eta^2 = .03$ . There were, however, order effects for overload,  $F(3, 137) = 4.37$ ,  $p = .01$ ,  $\eta^2 = .08$ , and behavioral intentions,  $F(3, 136) = 2.81$ ,  $p = .04$ ,  $\eta^2 = .05$ . Post hoc analyses,<sup>3</sup> using least significant difference tests, indicate that the email/email condition ( $M = 3.00$ ,  $SD = 0.96$ ) resulted in more overload than the face-to-face/email ( $M = 2.32$ ,  $SD = 0.81$ ) and email/face-to-face ( $M = 2.27$ ,  $SD = 0.87$ ) conditions; the difference between the email/email and face-to-face/face-to-face ( $M = 2.63$ ,  $SD = 0.94$ ) conditions was not statistically significant,  $p = .07$ . In regard to behavioral intentions, participants in the email/email ( $M = 5.01$ ,  $SD = 1.15$ ) condition reported significantly lower intentions to visit Career Services than participants in the other three conditions (face-to-face/face-to-face  $M = 5.60$ ,  $SD = 0.76$ ; face-to-face/email  $M = 5.78$ ,  $SD = 1.06$ ; email/face-to-face  $M = 5.49$ ,  $SD = 1.00$ ).

## Modeling the Effects of Combinatorial ICT Use

Figure 1 depicts a model that was proposed to examine the outcomes of using combinatorial ICTs.<sup>4</sup> The model was specified as follows: Combinatorial ICT use is hypothesized to predict perceptions of information effectiveness, overload, and recall. These three factors

**Table 1.** Means and Standard Deviations for All Dependent Measures Across Experimental Conditions

Dependent Variable	Repetitive ICTs				Complementary ICTs			
	No Repetition ( <i>n</i> = 36)		Repetition ( <i>n</i> = 37)		No Repetition ( <i>n</i> = 35)		Repetition ( <i>n</i> = 37)	
	<i>M</i>	( <i>SD</i> )	<i>M</i>	( <i>SD</i> )	<i>M</i>	( <i>SD</i> )	<i>M</i>	( <i>SD</i> )
Attitude	6.10	(0.67)	6.04	(0.61)	6.16	(0.53)	6.23	(0.57)
Information effectiveness	5.57 <sub>a,b</sub>	(0.79)	5.22 <sub>a</sub>	(1.23)	5.46 <sub>a,b</sub>	(0.80)	5.74 <sub>b</sub>	(0.77)
Recall	12.44 <sub>a</sub>	(2.18)	13.78 <sub>b</sub>	(2.46)	13.57 <sub>a,b</sub>	(3.12)	13.00 <sub>a,b</sub>	(2.52)
Behavioral intention	5.49 <sub>a,b</sub>	(0.94)	5.16 <sub>a</sub>	(1.07)	5.42 <sub>a</sub>	(1.21)	5.89 <sub>b</sub>	(0.71)
Overload	2.82	(1.01)	2.82	(0.95)	2.39	(0.89)	2.17	(0.73)

Note: All measures used 7-point scales, except the measure of recall. The measure of recall was computed based on the results of correct responses to a 22-item quiz. Means with differencing subscripts (across rows) are significantly different at  $p \leq .05$ .

are hypothesized to predict attitudes, and attitudes are hypothesized to predict behavioral intentions. Overload is also predicted to influence recall and perception of information effectiveness. To test the model, a partial correlation matrix was first constructed and is reported in Table 2. To control for the university at which the study was held, prior use of Career Services, and postgraduation employment, the variance associated with these three variables was partialled out of the matrix. EQS was used to test the model. Along with the chi-square test of model fit, Hu and Bentler's (1999) dual criteria for alternate fit indices were used to assess model fit.

The results of the analysis suggest that the hypothesized model did not quite fit the data,  $\chi^2(df = 6) = 14.52, p = .02, CFI = .91, SRMR = .07$ . Although the SRMR is adequate, the CFI does not meet the Hu and Bentler's (1999) fit criteria, and the model chi-square test is significant. An inspection of the path estimates revealed several nonsignificant paths. All nonsignificant paths were trimmed and the model was retested. The results suggest that the revised model, which is depicted in Figure 2, marginally fits the data,  $\chi^2(df = 5) = 11.11, p = .05, CFI = .94, SRMR = .07$ .<sup>5</sup> Although the SRMR meets Hu and Bentler's criteria, the  $p$  value for the model chi-square is at .05, and the CFI is slightly below .96. Accordingly, the results of the revised model should be interpreted tentatively.

### *The Influence of Message Repetition on Study Outcomes*

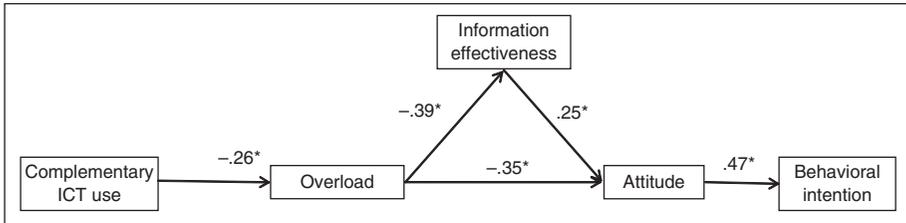
Hypothesis 2 predicted that message repetition will enhance participants' perceptions of and responses to an interpersonal influence attempt. The ANCOVAs fail to support this hypothesis. There were no differences between participants who were exposed to a repeated message and those exposed to a nonrepetitious message in regard to recall,  $F(1, 138) = 0.65, p = .42, \eta^2 < .01$ ; information effectiveness,  $F(1, 136) = 0.05, p = .82, \eta^2 < .01$ ;

**Table 2.** Partial Correlations for Key Study Variables ( $n = 133$ )

	1	2	3	4	5	6
1 Complementary ICT use (coded as 1; repetitive coded 0)						
2 Information effectiveness	.08					
3 Overload	-.26	-.39				
4 Recall	.03	.15	-.10			
5 Attitude	.10	.39	-.45	.12		
6 Behavioral intention	.19	.35	-.37	.17	.47	

Note: The correlations in Table 2 are partial correlations controlling for prior use of Career Services, postgraduation job status, and the university at which the study took place. ICT = information and communication technology.

\* $p < .05$ .



**Figure 2.** Revised model of combinatorial ICT use.

attitudes,  $F(1, 135) = 0.00, p = .97, \eta^2 < .01$ ; intentions to use Career Services,  $F(1, 137) = 0.21, p = .65, \eta^2 < .01$ ; or overload,  $F(1, 138) = 0.87, p = .35, \eta^2 = .01$ .

### The Interaction Between ICT Use and Message Repetition on Study Outcomes

Research Question 2 asked if there was an interaction between sequential ICT use and message repetition on perceptions of and responses to an interpersonal influence attempt. The interaction between sequential ICT use and message repetition was significant for the measures of intentions to visit Career Services,  $F(1, 137) = 5.867, p = .02, \eta^2 = .03$ ; recall,  $F(1, 138) = 4.31, p = .04, \eta^2 = .03$ ; and information effectiveness,  $F(1, 136) = 5.30, p = .02, \eta^2 = .04$ . The means depicted in Table 1 and post hoc analyses using least significant difference tests demonstrated a consistent pattern among the four conditions in the interaction for the measures of information effectiveness and behavioral intentions. Participants in the complementary ICT/message repetition condition were significantly more likely to intend to visit Career Services and felt that the information was more effective than participants in the repeated ICT/message repetition condition. Yet those participants in the repeated

ICT/repetitive message condition showed significantly greater recall than participants in the repeated ICT/no message repetition condition. There were no significant interactions for other outcomes addressed in Research Question 2. The interaction between sequential ICT use and message repetition was not significant for attitudes,  $F(1, 135) = 0.55, p = .46, \eta^2 < .01$ , or overload,  $F(1, 138) = 0.41, p = .52, \eta^2 < .01$ .

## Discussion

This study expands our current understanding of redundancy in communication research by focusing on message repetition and ICT sequences in the context of an interpersonal influence attempt. In particular, it highlights how complementary ICT sequences—email/face-to-face and face-to-face/email—function to expand modalities and affect outcomes related to interpersonal influence. These findings suggest some support for and extension of ICT succession theory (Stephens, 2007). The causal model provides an additional explanation for how complementary ICT use works by identifying the pivotal role played by overload. Although message recall is not increased by complementary ICT use, the findings related to recall tend to support the message repetition predictions based on mere exposure effect (Zajonc, 1968). Here we discuss these findings in detail and suggest directions for future research.

### *Implications of Complementary ICTs and Repetitive Messages*

The most informative results from this study are that using complementary ICTs directly or indirectly fostered more positive outcomes than simply using the same ICT repetitively for all outcomes except recall. The main effects for complementary ICT use and the interactions suggest that there are benefits of using modality-expanding ICTs sequentially during interpersonal influence attempts. It appears that receiving a sequence of two messages about a topic through different—yet modality-expanding—ICTs fostered perceptions that the information was more effective and increased behavioral intentions. These findings are further elaborated through the causal model. Although the model should be interpreted cautiously, it suggests that complementary ICT use led people to perceive the message to be more effective and hold more positive attitudes by mitigating perceptions of overload. Essentially, people felt less overloaded when the message sequence was communicated using a combination of email and face-to-face than when the same ICT was used repeatedly.

The use of modality-expanding ICTs may facilitate information processing by mitigating information overload. Relative to using complementary ICTs, using the same ICT repetitively may be more likely lead message receivers to perceive that they have obtained more information than they can process. Using the same ICT to communicate a sequence of two similar messages may lead people to question and attempt to determine the similarity of the two messages and, thus, increase their perception that they are overloaded. Sending messages through complementary ICTs may not even be perceived as a second message on the same topic; thus, complementary ICTs could more subtly convey the information.

This overload finding extends Hsia's (1968, 1977) findings concerning between-channel redundancy. Hsia claims that simultaneously presenting material using auditory and visual channels does not overload people because the two channels provide slightly different information. This empirical study provides support for his claims and extends them to a sequential ICT use situation.

When people feel less overloaded, they view the message more positively and are more influenced by the content. By sharing information with someone in person and in writing (email in this case), there are unique opportunities to influence that person. One explanation for how modality expansion works is that it engages different senses and more effectively reinforces the preceding message in the sequence. People perceive themselves as being less overloaded because their senses are more proportionally taxed. Modality expansion actually taxes more senses overall, but it minimizes the tax on any one sense.

The tests for order effects associated with the four different sequences of ICTs showed that, of the five outcome variables, there was only one difference between the two repetitive ICT sequences. There were no differences associated with the specific order of complementary ICT sequences (face-to-face then email; email then face-to-face); it did not matter if the message was delivered using email or face-to-face first. There was, however, one difference between the two repetitive ICT sequences in regard to behavioral intentions. The email/email condition resulted in significantly lower behavioral intentions than the face-to-face/face-to-face condition (as well as the other two conditions). What is unique about email, when compared to face-to-face, is that a message receiver only receives content by one mode (a textual mode). Face-to-face communication occurs through at least two modalities (oral and visual), and thus it can be considered a multimodal form of communication by itself. Simply using two emails repeatedly means that a receiver gets two text-only messages, and thus they experience the lowest amount of modality expansion in that condition. Building on the notion that modality expansion functions by increasing the number of senses evoked during a communication attempt, this finding is plausible. Yet we do not think that the results for behavioral intentions undermine the conceptual and empirical distinction between complementary and repetitive ICT. Although there might be some variation within the two classes of ICT sequences (i.e., repetitive or complementary), we expect greater variation between the two types ICT sequences.

The findings from this study have important implications for ICT succession theory (Stephens, 2007) and research on mere exposure (Zajonc, 1968, 2001). These results offer support for ICT succession theory. Although cross-sectional and survey-based studies have been conducted examining the theory (Westerman et al., 2008), experimental research examining complementary and repetitive ICTs is lacking. The results of this study provide some evidence that the sequences of complementary ICTs foster more positive outcomes than simply using the same ICTs in sequence during an interpersonal interaction. Additionally, this study extends ICT succession theory by identifying the potentially important role played by information overload. That is, complementary ICT sequences facilitate information processing through mitigating overload. Presenting messages—even the exact same message repetitively—using a sequence of modality-expanding ICTs serves to make the information easier to process.

The findings regarding ICT sequences have several practical implications. Complementary ICTs may be particularly useful in instances where it is necessary to communicate redundantly or provide reminders. This is potentially important given the contemporary communication environment in which we are exposed to a plethora of messages each and every day. For example, a noteworthy concern in the contemporary workplace is the overload workers feel primarily from the overuse of ICTs like email (Farhoomand, & Drury, 2002). People often wonder if they should repeatedly send a second email when they do not receive a reply from the first, a common topic found under the heading follow-up in an interpersonal sales context (Stephens et al., 2008). This study suggests that people feel less overloaded when the second message is sent using a different ICT. Although this study was conducted in the context of an interpersonal interaction, the implications may extend to campaigns that rely on mass media. In health or political campaigns, for example, using modality-expanding ICTs to deliver repetitive messages may help target individuals with different learning styles and mitigate information overload. The findings regarding behavioral intentions suggests that complementary ICT use may better facilitate behavior change than use of repetitive ICTs—particularly in contexts where the exact same message is repeated.

The results of this study also inform research and theorizing regarding mere exposure (Zajonc, 1968, 2001); yet it is important to note that this study contained minimal repetitions and the sample size was modest. None of the main effects for message repetition were significant. One explanation for this finding is that interpersonal communication is a scope condition for mere exposure; face-to-face communication changes perceptions of exposure. Prior research on mere exposure is largely based on exposing participants to repeated images, symbols, or messages delivered using audio-recorded, written, or photographic materials (see Bornstein, 1989). The fact that this study only contained two repetitions could have obscured the full mere exposure effect. The potential face-threat associated with having a single individual present the same message twice may mitigate the benefits of repetition. Receivers may perceive an individual who presents the exact same appeal twice to be overly impinging on the receiver's time. The significant interactions suggest that the effects of mere exposure are moderated by the nature of the ICTs use to convey the messages. Although the role of ICTs has not been widely considered in prior research on mere exposure, the results of this study indicate that it might be a factor worthy of additional study.

### *Sequential ICT Use, Message Repetition, and Message Recall*

It is noteworthy that the interaction between ICT sequences and message repetition for message recall appears to function differently than the interactions for perceived effectiveness and behavioral intention. Participants demonstrated a greater amount of recall when the same ICT was used to deliver a repetitive message than when the same ICT was used to deliver a nonrepetitive message. It makes sense that hearing/reading the message a second time through the same ICT allowed participants to better grasp and retain the content; yet it is important to note that participants were not told they would be asked to recall this

information. It is also possible that this finding is related to people's tolerance for the use of repetitive messages when they find the information relevant. That is, because the information was highly relevant to participants and they still learned something because they were exposed to the message twice.

It is somewhat surprising that the complementary ICT conditions did not facilitate message recall more effectively than the repetitive ICT conditions. There are several possible explanations for this outcome. First, participants had an overwhelmingly positive response to this message topic. The mean scores for attitudes, behavioral intentions, and information effectiveness are well above the scale midpoint. Participants' interest in the message topic may have encouraged them to pay close attention in all of the study conditions and obscured the combination of message repetitive and complementary ICT use—yet if this were the case, we would expect to see a significant main effect for message repetition on recall. A second explanation for the recall finding is derived by examining studies found in multimodal learning. Studies that have explored multimodal learning examined simultaneous multimodality (e.g., Paivio, 1990), not sequential multimodality. Even though the messages in this study appeared within minutes of one another, there may be a different mechanism occurring with the sequential presentation of material. Yet the results in the remainder of study are fairly consistent with findings that link modality expansion with recall and learning in simultaneous exposure environments (e.g., Clark & Paivio, 1991; Dahle, 1954; Hsia, 1968; Paivio, 1990; Thompson & Paivio, 1994). A final explanation is that the motivation for recalling information (and the way ICTs are used to facilitate that process) is likely different from people's perceptions when they are being influenced interpersonally. When people want to recall information, they might not care if they are overloaded, and having information repeated can foster learning outcomes. Yet in the case of interpersonal influence, repeating information may need to happen more subtly.

## Limitations and Opportunities for Future Research

This study considered the effect that using ICTs sequentially has on an interpersonal influence attempt. While there were several key significant findings, the effect sizes were modest and the causal model should be interpreted cautiously. This study was also conducted in a laboratory setting, which might not transfer to a field context. One particular concern might be that subjects found it odd to have the same person repeat the same message just minutes apart. Although not reported in this study, the questionnaire contained an open-ended component in which participants were asked to list thoughts they had during the study. A review of those data, which included over 500 thoughts, revealed only two thoughts expressing that the message repetition manipulation was artificial or contrived. For this reason, we are fairly comfortable that the laboratory setting did not create a considerable amount of artificiality.

Another limitation of this study is that we only considered a topic that was likely viewed as a fairly desirable request—convincing a student to seek additional information from Career Services to get a job. Researchers should investigate the role of ICT sequences and message repetition with a topic about which participants have a greater range of positive and negative attitudes. Future research should also examine situations where people are

resistant to the persuasive message. This is highly relevant in sales, customer support, health communication, legal communication, and political communication. It is possible that there will be more support for complementary ICT use and message repetition because people might see the messages as different and more deserving of attention. However, it is also possible that people will resent the fact that the message sender tried to introduce another unwanted message.

The overload findings raise additional questions and suggest potential areas for research. In this study, overload was considered a fairly static concept. As we continue studying multiple media use, the conceptualization of overload needs to evolve into a more dynamic concept. For example, time likely plays a key role in how overload functions. Considering the growing importance of this concept (e.g., Eppler & Mengis, 2004; Farhoomand & Drury, 2002), it will be prudent to further explore how overload develops over time, perhaps even develop a more precise scale that captures the changing nature of this concept.

Future studies might also consider examining differences between compelling and non-compelling messages. Zhou (2004) studied audiovisual redundancy and found a difference between compelling and noncompelling messages. The outcomes of recall and recognition suffered when there was no redundancy, and the message was viewed as noncompelling. In audiovisual research, redundancy is typically studied in the context of how well the audio and visual ICTs are synchronized in terms of content. Zhou also defined a compelling or noncompelling message in terms of its visual intensity. This research might be helpful to explain the findings from the current study. If people find a message compelling or especially relevant, ICT sequences and message repetition could function differently. While his study was examining simultaneous ICT effects, it could function similarly for messages received by sequential ICTs.

Examining the use of multiple ICTs to convey messages over time more accurately reflects how the communication process actually happens. As researchers continue examining how to reach audiences using ICTs and messages, it will be important to examine more complex strings of multiple ICT use. The time between repeated messages and the number of exposures to messages could affect these results and should be examined. Some of this research can occur through experimental design, but it is likely that using simulations and computer models are needed to examine more elaborate processes. This study does establish the importance of considering redundancy as being present in both the message and the way the message is delivered. Further explorations of these ICT combinations will likely help scholars and practitioners in many communication subdisciplines better understand how to use messages and ICTs to influence their audiences.

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## Notes

1. A third message condition was included the study, making the original design a  $4 \times 3$ . However, because the message condition is not germane to this project, we do not report it here and did not include participants who were assigned to it in any of the analyses.
2. Although the reliability for this measure is somewhat low, it is consistent with the reliabilities reported in others studies that included a quiz to assess recall (e.g., Rimal & Real, 2003).
3. The control variables were not included in the post hoc analyses.
4. The message repetition variable was not included in the model because the model focuses on explaining combinatorial ICT use.
5. When nonsignificant paths were trimmed from the model, the variable recall no longer remained in the model.

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