Deception and Design:
The Impact of Communication Technology on Lying Behavior

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ABSTRACT
Social psychology has demonstrated that lying is an important, and frequent, part of everyday social interactions. As communication technologies become more ubiquitous in our daily interactions, an important question for developers is to determine how the design of these technologies affects lying behavior. The present research reports the results of a diary study, in which participants recorded all of their social interactions and lies for seven days. The data reveal that participants lied most on the telephone and least in email, and that lying rates in face-to-face and instant messaging interactions were approximately equal. This pattern of results suggests that the design features of communication technologies (e.g., synchronicity, recordability, and copresence) affect lying behavior in important ways, and that these features must be considered by both designers and users when issues of deception and trust arise. The implications for designing applications that increase, decrease or detect deception are discussed.

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Deception, lying, trust, communication, media, CMC

INTRODUCTION
The daily use of a variety of communication technology, such as email, instant messaging, and the mobile phone, is now a fact of life for an increasing number of people, both at work and in their personal life. At work these technologies are relied upon for a wide range of tasks, such as collaborating with colleagues, reporting to superiors and communicating with customers. At home they are used to stay in touch with family and friends, and for involvement in local communities [13].

Research from social psychology suggests that as many as one third of these typical daily interactions involve some

form of deception, [4,8,14,15] which can be defined as a "deliberate attempt, without forewarning, to create in another a belief which the communicator considers to be untrue" [17]. DePaulo and her colleagues [7,8,14], for example, have observed that college students report telling approximately two lies a day, while non-student populations report about one a day. The types of lies observed in these studies vary, from small "white" lies, in which inconsequential lies are told to be tactful or polite (e.g., saying "I love your haircut" when in fact you do not), to more serious lies (e.g., denying an affair).

How does the increased use of communication technologies affect these kinds of deception in our day-to-day social interactions? The design of various technologies creates very different communicative environments that may have important implications for lying behavior. The telephone, for example, allows people in different physical locations to communicate with vocal and prosodic cues intact, while text-based Computer-Mediated Communication (CMC), such as email and instant messaging, eliminates or distorts nonverbal channels and modify the temporal processes of communication [10,16]. Relative to the basic setting of Face-to-Face (FtF) conversations, are speakers more or less likely to lie on the phone, in an email, or during an instant messaging exchange? Are different types of lies more likely to be told in one medium than in others?

The present study examines deception in the three most commonly used daily communication media, the telephone, email and instant messaging, in an effort to determine how the design of these technologies affects lying behavior relative to FtF interactions.

Background
Although previous research has begun to examine the impact of communication technology on related interpersonal processes, such as trust [1,9,19] and deception detection [2,11,12], to the best of our knowledge the effect of communication technology on the *production* of lies has not yet been examined. Theoretical approaches to media effects suggest several possible ways media may affect lying behavior. For example, Media Richness Theory [5,6] assumes that users will choose rich media, which have multiple cue systems, immediate feedback, natural language and message personalization, for more equivocal

communication activities. Because lying can be considered highly equivocal, Media Richness Theory predicts that users should chose to lie most frequently in rich media, such as FtF, and least frequently in less rich media, such as email. In contrast, DePaulo et al. [8] have argued that because lying makes people uncomfortable, users should choose less rich media in order to maintain social distance between the liar and the target, an argument we refer to as the Social Distance Hypothesis. According to this hypothesis, users should choose email most frequently for lying, followed in order by instant messaging, telephone and finally FtF.

Although these two approaches make very different predictions, they both assume that communication technology vary along only a single underlying dimension (i.e., richness, distance) that will influence deception, and ignore other important differences in their design that may have important implications for deception, including:

- the *synchronicity* of the interaction (i.e., the degree to which messages are exchanged instantaneously and in real-time)

- the *recordability* of the medium (i.e., the degree to which the interaction is automatically documented)

- whether or not the speaker and listener are *distributed* (i.e., they do not share the same physical space)

In particular, because the majority of lies are unplanned and tend to emerge spontaneously from conversation [8], synchronous media should increase opportunities for deception. For example, if during a conversation one friend asks another what she thinks of his new shirt, and she does not like it, she is now presented with a decision to lie or not. This type of opportunity is less likely to arise when composing an email. Thus, media that are synchronous, such as FtF and telephone, and to a large degree instant messaging [17], should present more situations in which deception may be opportune. Second, and somewhat obviously, the more recordable a medium is, the less likely users should be willing to speak falsely. Users should be hesitant to state their lies in a medium in which their statements are recorded and are easily reviewable. FtF and telephone conversations are typically recordless, while email records are often saved by both the sender and receiver, as well as by servers hosting the email accounts. Instant messaging conversations are logged for the duration of an exchange and can be easily saved [17]. In order to avoid being caught, speakers may choose to lie more frequently in recordless media, such as FtF and the telephone, than in more recordable media, such as email and instant messaging. Finally, media in which participants are not distributed (i.e., copresent) should constrain deception to some degree because they limit deception involving topics or issues that are contradicted by the physical setting (e.g., "I'm working on the case report" when in fact the speaker is surfing news on the web). Because mediated interactions such as the phone, instant messaging and email involve physically distributed participants, this constraint should be reduced relative to FtF interactions. For a review of these features across media see Table 1.

	FtF	Phone	IM	Email
Media Features				
Synchronous	X	X	X	
Recordless	X	X		
Distributed		X	X	X
Lying predictions				
Feature-based	2	1	2	3
Media Richness	1	2	3	4
Social Distance	4	3	2	1

Table 1. Pertinent features of communication media for deception and predictions for lying production (1 = highest, 4 = least).

According to our feature-based model, the more synchronous and distributed, but less recordable, a medium is, the more frequently lying should occur. As described in Table 1, if these design features of communication media affect deception, then lying should occur most frequently on the telephone, followed by FtF and instant messaging, and least frequently via email. In contrast, Media Richness Theory predicts that lies should occur most frequently FtF, followed by less rich media, the telephone, instant messaging, and lastly email. The Social Distance Hypothesis predicts the reverse order, with users assumed to choose email for deception most frequently; followed by instant messaging, the telephone, and least frequently FtF (see Table 1).

The present study tested these predictions with a diary study, adapted from previously published research [7,8,14], in which participants recorded all of their lies and social interactions for a seven day period. The rate of deception in each medium was calculated by dividing the number of lies in a given medium by the total number of social interactions in that medium.

METHOD

Participants. Participants were students drawn from upper-level Communication courses at a northeastern American university, and they all participated for course credit. There were 30 subjects: 13 males, 17 females, with an average age of 21. Two participants failed to follow the instructions, and their data were discarded, leaving 28 subjects in the analysis.

Materials. The Social Interaction and Deception (SID) form was designed to record and categorize each interaction and lie. The form contained two main sections: information regarding the social interaction and information regarding the lie. The questions and categories of information for each section were derived from the analysis and taxonomy of written diary records reported by DePaulo et al [8].

In the social interaction section, participants reported the gender and number of interaction partners, and in which medium the interaction took place. For the social interaction's duration, participants reported the length of interactions in minutes for FtF, telephone, and instant

messaging interactions, and the length of time required to compose an email.

In the deception section of the form, participants reported their lies in terms of their content, the reason for the lie, the type of lie, and the referent of the lie. The responses to these questions are not reported in the present paper. Participants also completed three Likert-scale items assessing their perceptions of the lie: 1) How planned was the lie, 2) To what degree do you think your partner believed the lie, and 3) How important was the lie. Finally, a blank section was provided for participants to write in notes and/or alternate descriptions of the lie.

Participants also completed a short questionnaire that assessed their computer experience; in particular, the frequency of their use of email and instant messaging.

Procedure. Instructions were administered to participants in one of two one-hour group sessions. Participants were informed that they would be keeping journals in which they would record their social interactions and lies for seven days. It was emphasized that the researchers did not condone or condemn lying, but instead that the researchers were examining lies scientifically to explore lying behavior in daily interactions.

Participants were provided with a four page booklet of instructions for filling out the SID form. These instructions were discussed verbally, and began with an introduction to the key terms of the study, all of which were taken directly from DePaulo et al. [8]. First, what counted as a social interaction was described: "any exchange between you and another person that lasts 10 min or more in which the behavior of one person is in response to the behavior of another person" (p. 981). Consistent with the procedures outlined by DePaulo et al. [8], a minimum criterion of 10 minutes was employed for all synchronous social interactions, including FtF, telephone and instant messaging conversations. Similarly, the minimum criterion for an email to be considered a social interaction was 10 minutes for the composition of the email. Note that participants were instructed to record all social interactions in which a lie occurred, regardless of whether or not the interaction reached the 10 minute criterion.

It is important to note that although the procedures in the present study allowed for the examination of a wider variety of CMC media, such as newsgroups, mailing lists, online videogames and Internet chat, only 2 participants employed any media other than FtF, Phone, Instant Messaging or Email. As such, the media considered in the paper is limited to these four.

To explain what participants should count as a lie, they were provided with the following definition again taken from DePaulo et al [8]: "A lie occurs any time you intentionally try to mislead someone" (p. 981). Many examples were provided, and participants were encouraged to record all lies, no matter how big or small. The only lies that they were instructed not to record were lies such as saying "fine" in response to perfunctory questions such as "How are you?"

Participants were instructed to fill out the SID forms at least once a day. The importance of accuracy and conscientiousness in keeping the records was emphasized throughout the session. Participants were provided with small notebooks and were encouraged to write reminders of their social interactions as soon as possible after the events had taken place. These notebooks were not collected. Email reminders were sent to participants every day during the seven-day period. To ensure anonymity, participants chose their own identification number, which they used throughout the study. At the end of the seven-day recording period, the SID forms were collected, and the participants were debriefed with regard to the primary questions addressed by the study.

RESULTS

Table 2 reflects the descriptive data on the number of lies and social interactions recorded across the four media. A total of 1198 social interactions and 310 lies were recorded by the participants over the seven-day period. On average, participants engaged in 6.11 social interactions and lied 1.6 times per day, suggesting that approximately 26% of the reported social interactions involved a lie.

As expected, the number of social interactions was not equal across the four different communication media, $F(3,81) = 90.59$, $p < .001$, with the overwhelming majority occurring in the basic FtF setting (see Table 2). In order to account for this difference in the number of social interactions across media, the rate of lying in each medium was calculated by dividing the number of lies in a given medium by the number of social interactions that took place in that medium.

	FtF	Phone	IM	E-mail	Total
Social Interactions					
Total	765	181	97	155	1198
Mean/day (SD)	3.90 (1.60)	.92 (.47)	.79 (.69)	.49 (.51)	6.11 (2.03)
Lies					
Total	202	66	27	9	310
Mean/day (SD)	1.03 (.68)	.35 (.24)	.18 (.20)	.06 (.07)	1.58 (1.02)

Table 2. Totals, means and (standard deviations) for social interactions and lies across media.

A repeated measures ANOVA conducted on the rate of lying across the four media revealed a significant overall difference, $F(3,51) = 4.30$, $p < .01$ (see Figure 1). Planned paired-sample contrasts were conducted to compare each medium with the FtF setting. These analyses revealed that telephone conversations involved significantly more lies per interaction than FtF conversations, $t(26) = -2.18$, $p, < .05$ and

that emails involved significantly fewer lies than FtF, $t(21) = 2.66$, $p < .05$. No significant difference in the rate of lying between instant messaging and FtF interactions was observed, $t(20) = 1.23$, n.s.

Self-report perceptions of lies

The self-reported perceptions of the lies in each medium are reported in Table 3. Planned paired-sample contrasts were again used to compare the perceptions of lies in each medium to FtF. Significant differences in the degree to which lies were planned were observed across media, $F(3,21) = 3.96$, $p < .05$. Lies that took place in email were significantly more planned than FtF lies, $t(8) = -2.65$, $p < .05$. The level of planning for phone and IM lies did not differ from FtF lies.

On average, participants were relatively confident that their partner believed their lies ($M = 6.75$ on a 9 point scale). However, the degree to which participants thought that their partner believed their lies did not differ across media, $F(3,21) < 1$, n.s. Similarly, and somewhat surprisingly given the differences observed in the level of planning for the lies, responses to the question of how important the lies were did not differ across media $F(3,21) < 1.43$, n.s. In general, lies were rated as not very important ($M = 5.24$ on a 9 point scale), suggesting that as expected, most lies were of the "white" variety.
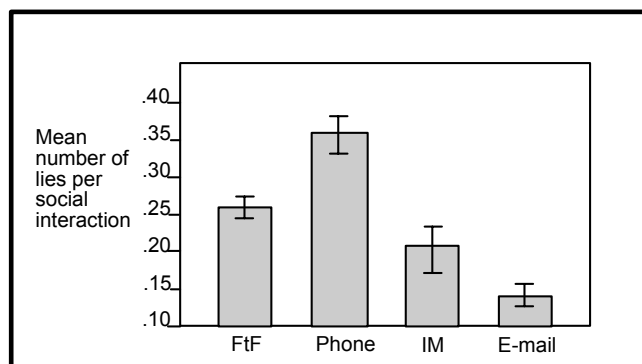

Figure 1. Rates of deception by communication medium.

Media experience and deception

On average, participants reported using email and instant messaging fairly frequently, as described in Table 4. The average use of email and instant messaging was not significantly different, $t(27) = 1.14$, n.s. In an effort to determine whether experience with a medium increased the likelihood of a user lying in that medium, the frequency of use for IM and Email was correlated with the total number of lies a user produced in that medium. The results reveal that the frequency of email use was positively correlated with the frequency of lying in email, suggesting that more experienced email users lied more frequently in email than less experienced users. The same correlation was not significant for experience with IM (see Table 4).

DISCUSSION

The results from the present study are generally consistent with previous research suggesting that lying is an everyday

phenomenon [4, 8, 15]. Participants reported lying approximately 1.6 times per day on average, and that about one out of every four (26%) of their interactions involved a lie. These data replicate DePaulo et al.'s [8] original lying estimates, which indicated that students lied 1.9 times per day on average, and that a third of their social interactions involved some deception.

The primary objective of the present study, however, was to determine the effect of the design of different communication media features on lying behavior during everyday social interactions. Although the total number of lies was greatest in the FtF setting, the highest proportion of lies occurred in telephone conversations, with 37% of phone interactions involving some deception, which was significantly higher than the proportion of lies in FtF conversations (27%). These media-based proportional data are also similar to estimates reported by DePaulo et al. [8], in which participants lied proportionately more frequently in telephone interactions than in FtF conversations. This observation is consistent with the Social Distance Hypothesis, which argues that speakers will choose less rich media when engaging in deception in order to avoid the discomfort associated with lying. However, contrary to the Social Distance Hypothesis, significantly fewer lies were reported in the least rich media, email (14%), than FtF, and no difference was observed between instant messaging (21%) and FtF. Considered together, these data suggest that the social distance of communication technology, and the relief from the discomfort of being deceptive that it may provide, does not predict everyday lying behavior across media.

	FtF	Phone	IM	E-mail
1 = not at all 9 = completely	n = 27	n = 23	n = 13	n = 9
How planned?	3.30 (1.33)	3.34 (1.31)	4.67 (2.50)	6.31 (2.05)
How believed?	6.56 (1.32)	7.25 (1.09)	6.11 (1.89)	7.07 (1.43)
How important?	4.62 (1.48)	5.51 (1.45)	5.60 (2.04)	5.22 (2.77)

Table 3. Means and (standard deviations) of participants' perceptions of lies across media.

How often do you use email/IM?		
	1 = never 5 = all the time	# of lies told in the medium
IM	3.60 (1.20)	$r = .13$, *n.s.*
E-mail	3.89 (0.88)	$r = .43$, $p < .05$

Table 4. Means, (standard deviations) and correlations between medium use and lies told.

The data are also inconsistent with the predictions of the Media Richness Theory [5,6]. Recall that this theory assumes that speakers match the richness of a medium with the equivocality of the communicative task. Given that deception is highly equivocal, speakers should choose the richest media, specifically the FtF setting, to lie most frequently. However, this was not the case; telephone interactions involved significantly more lies than FtF interactions, suggesting that a media's richness is not the primary factor operating in lying behavior across media.

The data from the present study suggest that the shared assumption of the Media Richness Theory and the Social Distance Hypothesis, namely that media vary along a single underlying dimension (i.e., richness, distance) that influences deception across media, appears to be overly simplistic. Communication media can be differentiated along a number of design features that are not captured by richness or social distance. According to our model, the degree to which a medium 1) allows for synchronous interaction, 2) is recordless, and 3) is distributed (i.e., not copresent), the greater the frequency of lying that should occur in that medium.

The data from the present study are consistent with this analysis. Telephone interactions, which are distributed, synchronous and recordless, had the greatest rate of deception. FtF interactions, which are synchronous and recordless but not distributed, involved the next highest rate of deception, while email, which is distributed but not synchronous or recordless, had the lowest rate of deception. Instant messaging, which did not differ in the rate of lying from FtF interactions, is distributed and nearly synchronous, but is recorded in a log file easily saved.

Obviously, additional research is required to determine whether non-technology factors, such as the content of the lies (e.g., about feelings, facts, actions, explanations, etc.) and the relationship to the target (e.g., stranger vs. friend, colleague vs. superior, etc.), play an important role in deception across media, and a larger scale project is currently underway to examine these issues. Nonetheless, the data from the self-report perceptions suggest that the lies did not differ substantially in nature across the four media. Although lies produced in email were more planned than lies produced in more synchronous media, on average lies did not differ in terms of their importance. That is, lies told in email were perceived as no more important than lies told in other media. Similarly, the degree to which participants felt that their partners believed their lies did not differ across the four media. Considered together, these data indicate that, in general, lies told in one medium were not very different from lies told in other media.

An examination of the users' experience with various communication technologies, however, suggests that frequency of use may affect rates of deception. In particular, the positive correlation observed between frequency of email use and email deception frequency ($r = .43$) suggests that increased experience with a communication technology may lead to increased deception with that technology. The correlation between experience and deception, however, was limited to email and was not significant for instant messaging. One possible explanation for this observation is that instant messaging is simply the more novel technology, and users have not had experience with instant messaging comparable to email. It will be interesting to monitor the relationship between experience and deception as instant messaging becomes more widely and frequently used.

Implications and limitations

The results of the present study suggest that the design of communication technology, such as email, instant messaging and the telephone, has an impact on everyday lying behavior. It is important to note that these technologies are not obscure, or limited to only highly sophisticated users, but instead are used by millions of people across the globe on a daily basis. As such, these data have important implications for those of us who use these technologies to accomplish our everyday communicative activities at work and at home [13]. In particular, the results indicate that we are more likely to lie (and to be lied to) on the telephone than in any other medium, and to lie the least in email.

What guidance does this research offer for developers and managers? Our findings suggest that specific design features can be used to influence rates of everyday forms of deception. For example, if the objective in a given situation is to reduce overall deception during social interactions, then a communication medium should be used that is asynchronous and recordable. Also, technologies that support information about distributed communicators' physical context, such as videoconferencing, should reduce deception by reinstating the constraints of copresence (i.e., specifying the user's current physical activity). If, for whatever reason, the goal is to facilitate deception, then our model suggests these factors should be reversed.

These deception production findings may also be useful in the context of automated techniques for deception *detection*. Researchers have begun to examine whether linguistic predictors of deception can be automatically analyzed in large copra of communication, in an effort to detect and intercept criminal or terrorist activity on the Internet [3]. It may be possible that the type of data reported in the present study can provide baseline production frequency measures to an automated detection system. In particular, if a system has information regarding the average frequency in which people lie in a given medium, then its accuracy in detecting those lies may be improved by knowing that, for example, on average people lie in 14% of their emails and 21% of their instant messages. With this information, the system could be calibrated to identify approximately 14% of emails as containing a lie, and 21% of instant messages.

Key limitations of the present study are the use of student participants and a relatively small sample size. Research is needed to determine whether the observed pattern of results generalizes to non-student populations. And, although 310

lies were reported in the present study, a larger sample is required to more carefully examine the specific attributes of lies across different media, such as their content. Also, because participants were reporting their own lies, their may be some concern that their lying behavior was affected (e.g., they recorded fewer lies because they were more conscious of them). While this may have been the case to some degree, two factors suggest this was not a critical problem in the present study. First, the present data are consistent with previous studies employing diary methods [8,14], suggesting that our participants were reporting lies in a manner consistent with other participants. Second, and perhaps more importantly, because the design of the study was a repeated measures design, any effect that might arise from recording one's own lies would not be expected to differ systematically across the four media. As such, it is unlikely that this type of effect would underlie the pattern of results that we observed across media.

Finally, how do the current findings mesh with recent research examining the impact of communication technology on trust [1,9,19], a concept closely related to deception? Several recent studies suggest that the development of trust is inhibited in text-based CMC relative to other media, presumably because CMC increases the sense of social distance between communicators [1,19]. Note, however, that although trust develops most slowly in text-based interactions, the data from the present experiment suggest that, somewhat ironically, participants lied least frequently in text-based interactions, especially email. How this irony will resolve itself over time is an interesting question. Will people begin to lie more frequently as they become more comfortable with text-based media, as suggested by the observed correlation between email use and deception? Or, as communication via text becomes increasingly ubiquitous, will people come to trust others more readily in their text-based interactions?

Research that examines how the design of everyday communication technologies affects these types of interpersonal processes will become increasingly important as these technologies continue to support more and more of our social interactions.

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