Tracking Secret-Keeping in Emails

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Abstract

How do people communicate with others once they begin harboring a major life secret? Sixty-one adults who started keeping a major secret within the past several years agreed to have their email correspondence analyzed. Changes in emailing frequency and word use between secret keepers and their contacts were identified from before and during secret keeping. Surprisingly, there was no evidence for social withdrawal during secret keeping. Instead, the findings support a hypervigilance hypothesis in which secret keepers communicated more frequently and exhibited more engagement with contacts presumably in an attempt to monitor their social interactions.

Introduction

Secrets are inherently social. We often withhold important events, thoughts, or emotions from others to maintain ongoing social relationships (e.g. Vrij et al. 1994). Because secrets are premised on interpersonal deception, the act of withholding significant information from others is likely to have substantial effects on the dynamics of the larger social network. Even though it is generally believed that keeping large secrets is socially and psychologically unhealthy, research on the dynamics of secret keeping in the real world is difficult to do. That is, if people are invested in keeping a secret, they are reticent to reveal their secret in a way that allows researchers to investigate their social lives to learn more (for an exception, see Caughlin, et al. 2009).

With the archival nature of emails and other social media, it is now possible to examine the actual social network and communication patterns as a secret unfolded (e.g. Gupta and Skillicorn 2006). It is also possible to tap into the language markers of psychological states (such as self-focus, sense-making, and emotions) and of social dynamics (such as engagement and deception; see Pennebaker 2011; Tausczik and Pennebaker 2010) without

directly interviewing either secret keepers or those in their social networks. In this paper, we describe the first naturalistic archival study of emails that uncovers the impact of secret keeping on social networks before and during a major life secret.

Related Work

Extensive research has shown largely negative consequences for the secret keeper. Secrets are difficult and distressing to keep (Lane and Wegner 1995; Larson and Chastain 1990) and have even been associated with physical illness (Pennebaker and Susman 1988). Given such negative effects, secrets can hamper social support and increase feelings of isolation (Kahn and Hessling 2001; Larson 1993). Although, as Kelly (2002) explains, the negative consequences may be attributable to being a secretive person rather than the act of keeping a secret.

Evaluating the consequences of keeping a secret on a secret keeper's relationships to others has been more difficult. As a result, studies have focused on the social impact of a secret once it is revealed, either intentionally or inadvertently. When a secret keeper willingly reveals a secret to a confidant, how the confidant responds has the largest impact on the relationship. If a confidant is supportive, revealing a secret can lessen the burden for the secret target. However, confidants often respond negatively (Coates, Wortman, and Abbey 1979). When someone learns of a secret without being told by the secret keeper, their response varies depending on whether the secret is seen as negative and whether the secret keeper has used more active strategies to keep the secret hidden (Caughlin et al. 2009). Together these studies suggest that secrets tend to have negative consequences on relationships when the secrets are revealed or found out.

In the related literature on topic avoidance, researchers have proposed that withholding information can have a positive effect on relationships (Afifi and Burgoon 1998). For example, Afifi and Guerrero (2000) argue that avoiding certain topics such as relationship issues can help

protect and maintain a relationship. Despite theoretical arguments that topic avoidance may be beneficial, empirical studies have found topic avoidance in a relationship is often associated with relationship dissatisfaction rather than satisfaction (Caughlin and Afifi 2004). One explanation is that deception, or withheld information, in relationships has negative consequences when the deception is revealed or suspected, but may have positive consequences if it is not revealed or suspected (Cole 2001).

The Social Consequences of Keeping a Secret

While the literature on secrets provides insight into aspects of keeping a secret, left unexplored is the impact of keeping a secret on a secret keeper's relationships while the secret is being kept. The biggest difficulty in evaluating the secrets literature is that it has been based on the self-reports of the secret keepers themselves. Because of the delicate situation of the secret keeper, it has been almost impossible to know how the secret keeper actually interacts with others - the strategies that secret keepers actively or implicitly employ to keep a secret - as well as the impact on the secret keeper's relationships.

We propose two competing hypotheses to understand how secret keepers interact with their social network. First, the social withdrawal hypothesis suggests that a secret keeper will withdraw and become distant from his or her contacts while keeping a secret. Secret keepers may withdraw as a strategy to keep the secret hidden, as a response to less rewarding or more stressful interactions by virtue of not being able to talk about the secret (Vrij et al. 2002; Finkenauer and Rime 1998a), or simply because keeping a secret is difficult and distressing, sapping a secret keepers' energy to engage with others (Lane and Wegner 1995).

On the other hand, the hypervigilance hypothesis proposes that a secret keeper will communicate more and enhance engagement with contacts in an attempt to monitor social interactions. Keeping information secret counterintuitively necessitates closely monitoring that same information (Wegner 1994). By paying attention to their contacts, secret keepers can control the conversation to avoid talking about the secret, make sure their contacts have not figured out the secret, and ensure that they are perceived to be acting "normal" (Caughlin et al. 2009).

Even more complex is that keeping a secret may have substantial and varied effects on the secret keeper's relationships. Some people may be unaware of the secret, because the secret keeper willfully conceals the information from them (hereon referred to as secret targets). Other people may become confidants because the secret keeper reveals the information to them or they are involved in the secret (confidants). Lastly, some people

may be unaware of the secret because the secret keeper may not tell them but is not actively concealing or disclosing the information from them as it is not relevant (uninvolved contacts). For example, one participant (secret keeper) in this study was actively keeping her at-home phone sex business from her ex-husband (secret target) with whom she shared custody of their children, freely confiding in her best friend (confidant), and not bothering to mention it to other friends (uninvolved). As described in the next section, both hypotheses, social withdrawal and hypervigilance, make different predictions on the impact of secret keeping depending on the relationship type.

The Current Study

In addition to its frequent use as a part of everyday communication, emails offer naturalistic examination of a large number of relationships over a long period of time without relying on retrospective accounts. In the current study, we analyzed the outgoing emails of 61 anonymous frequent-email users who reported having kept a major life secret. Specifically, we examined email communication patterns and language between 61 secret keepers across the three types of relationships: secret targets, confidants, and uninvolved contacts.

Secret Targets

The social withdrawal hypothesis predicted that the distress arising from keeping a major life secret would be associated with avoidance as evidenced by a lowered frequency of emails to the target, a shorter length of messages, and a longer response time (see Table 1). These are face valid measures of whether a secret keeper is avoiding contact with secret targets. Similarly, drops in linguistic measures of social engagement (Ireland et al. 2011) would also be expected.

Conversely, the hypervigilance hypothesis predicted that secret keepers would attempt to "act normal" by showing no decrease in message frequency, decrease in message length or increase in response time, and no drop in linguistic measures of social engagement. This is in line with previous research that has found that liars talk the same amount when lying as truth tellers do, but change the way they talk in characteristic ways to prevent their communication partner from uncovering the lie (Hancock et al. 2007). Secret keepers may also take an active part in steering conversation away from the secret, and try to detect if the secret target is suspicious. These may be reflected in more present tense verbs, and more second person pronouns (Hancock et al., 2007).

Recipient	Psychological Construct	Communication Markers	Hypotheses	
			Social Withdrawal	Hypervigilance
Secret target	Communication level	*Emails per month, words per email, immediacy*	Decrease	Increase
	Engagement	*Language style matching*	Decrease	Increase
	Deflection	*Second person pronouns, present tense verbs*	No change	Increase

Table 1: Psychological constructs and related communication markers corresponding to the two hypotheses, Social Withdrawal and Hypervigilance from before to during secret keeping.

Confidants

Some confidants may already be involved in the secret, while others are contacts to which the secret keeper discloses their secret. Both the social withdrawal and hypervigilance hypotheses make the same predictions for the secret keepers' relationships to their confidants: the focus will be on the secret because the secret keeper openly shares and discusses their secret, perhaps to unburden the cognitive load of keeping the secret or to make sense of the secret.

Accordingly, because these are the only outlets to discuss the secret we predict that secret keepers will increase in the frequency and length of messages to confidants. Secret keepers should not take longer to respond, and may even be quicker to respond. In confiding about their secret we expect to observe language indicative of disclosing distressing stories, such as an increase in use of first person singular, an increase in use of negative emotion words, and an increase in past tense verbs (see Tausczik and Pennebaker 2010). If secret keepers are engaging in sense making we would further expect to see an increase in markers of cognitive processing (Klein and Boals 2010), such as the use of insight words (e.g., acknowledge, realize, understand), and causal words (e.g., because, effect, if).

Uninvolved Contacts

Since secret keepers were not actively withholding or disclosing secret relevant information to uninvolved contacts, we made no specific hypotheses for communication and language changes to uninvolved contacts.

Method

Participants

Recruitment proved to be challenging, given the nature of the topic, and so individuals were recruited from many sources including flyers in major cities, email listservs, university news pages, Mechanical Turk, craigslist.com, and friends of the researchers' Twitter and Facebook status updates. Participants, who had completed a screening questionnaire, were invited to the study if they had started keeping a major life secret in the past 6-7 years (i.e. the years that Gmail had become widely available and adopted), and if the secret was both rated and described as having been devastating to them or to the lives of others if the secret got out. In addition, participants had to have actively used Gmail to communicate with secret-relevant contacts during that time. Exclusion criteria included being suicidal, being schizophrenic, being younger than 18, being a non-native English speaker, and deleting more than 10% of emails.

A total of 7,640 people visited the website, of those 1,133 individuals completed the screening questionnaire, 179 met the qualification criteria, and 61 agreed to be a part of the study and completed the email portion of the study. Participants ranged in age from 19 to 45 (M = 25, SD = 5.4); 57.4% were female. As compensation, participants were given $50 after providing a sample of their emails and $50 after completing the study.

In order to recruit participants who had kept truly large and distressing secrets, many individuals were excluded either during the recruitment or the screening phases because their secret was not severe enough (e.g. "My life would change only slightly if the secret I kept were revealed to other people in my life.", "Not very disruptive. A bit embarrassing"). Ultimately, it is remarkable that even 61 individuals were willing to provide us with a sample of emails during a time period in their life that was distressing and potentially embarrassing.

Strict selection criteria were enforced in order to avoid sampling biases due to the constraints of our method. Selection criteria were designed to ensure that we were capturing a significant portion of the secret keepers' communication. The vast majority of individuals were excluded because they did not use Gmail regularly, did not communicate with secret relevant contacts via Gmail, or had a secret that had begun previous to the time that Gmail

Secret Category (N)	Perceived Consequences
Romantic/Sexual (43)	*"my credibility and romantic relationship would be ruined"; "it would be embarrassing"; "It would actually be somewhat relieving and vindicating, but also taxing"; "I would be disowned"; "my family would fall apart"; "it would be devastating for the other person if the secret would get out"; "possibly compromise custody of my child"; "the consequences would be dire and might involve getting kicked out of the house, being told often of how disappointing we are, being sent to a religious leader for therapy"; "I might be harassed about it"; "My family would be extremely sad and distressed"*
Physical or Mental Health/Addiction (10)	*"trust between me and friends and family would be greatly disrupted"; "others would no longer see me in the same way"; "it would also make it harder for me to act as if I am fine on a daily basis"; "Theyd demand I go to therapy"; "it would make me extremely unemployable, particularly in any professional job"*
Financial/Work/ Legal (7)	*"the secret had potential to get me kicked out of my graduate program"; "I would lose my wife"; "It would create tension at work"; "My career, the respect of my family and friends, and a future with my significant other would be destroyed"; "It could tarnish my reputation"*

Table 2: Secret keepers' self-reported perceived consequences if a secret got out, categorized by type of secret.

had been available. These constraints were independent of the nature of the individuals' secret and their relationships. However they did impact demographic variables. The primary differences between the Disqualifying (D) and Qualifying (Q) groups among those who completed the screening were that the qualifying group included a significantly higher proportion of people who had completed at least some college (D = 90.6%, Q = 95.5%), as well as a significantly higher proportion of people who had completed at least some graduate or professional school (D = 18.8%, Q = 31.3%). There were no sex or age differences between the Disqualifying and Qualifying groups.

Procedure

Participants completed all portions of the experiment online. Individuals who responded to the ads for the study first filled out a screening questionnaire, which asked about email use and basic elements of the secret. Those individuals who met the criteria for the study were contacted to participate in the study. After giving consent, participants completed a set of questionnaires asking about secret relevant behavior.

There were no restrictions on the type of secret eligible for the study as long as it was rated and described as being potentially devastating to the participant or to the lives of others if the secret got out (e.g. "I would be completely disowned and alienated from my family and some of my friends.", "Arrest. jail. maybe prison."; see Table 2). Participants were never asked to directly reveal their secret as part of the study, although many alluded to the nature of the secret (e.g. sexual assault, homosexual relationships, jail time, suicide attempts). They also rated the category of their secret. Seventy percent of secrets were categorized as being either romantic or sexual in nature,

which is typical of other samples (e.g. Kelly et al. 2001).

Participants then followed a step-by-step procedure to download an Email Extraction Program (EEP) created for this study. Participants logged into their Gmail account using the EEP. Running the EEP, they selected the day, month, and year when their secret began. They also selected at least 5 contacts who were relevant to the secret, either as confidants or as targets, and 10 contacts who were uninvolved in the secret. Participants were encouraged to select contacts who they corresponded with most frequently. Participants also indicated the nature of their relationship with the contacts they selected. In total, selected contacts were most likely to be friends (46%), followed by work partners (work: 18%; family: 14%; acquaintances: 10%; other: 6%; romantic partners: 6%). However, within a relationship category, romantic partners (includes significant others and dating partners, past or present) were the most likely to be categorized as secret targets or confidants. Ninety-one percent of selected contacts who were labeled as romantic partners were categorized as secret targets or confidants. Although there were systematic differences in the relationship types of contacts who were secret targets, confidants, and uninvolved contacts, these differences are controlled for by the within-subject design (see Design and Analyses section).

After selecting contacts, the EEP accessed their Gmail account and collected a year of emails to and from the selected contacts. The EEP collected all emails to and from select contacts starting 1 month before the participant indicated that they started keeping the secret and ending 12 months later. At the same time, participants completed a short questionnaire on each of the selected contacts and indicated whether they had revealed the secret to that contact. Finally, participants completed a follow-up questionnaire to reconfirm the dates of their secret.

Email Corpus

The corpus of the 61 participants' emails included over 59,000 messages to and from 705 mutual correspondents (i.e. both participant and contact sent at least one email to each other). On average, an email was 70 words long (SD = 291). Each of the participants had an average of 11.6 mutual correspondents (SD = 5.04). For this study, analysis was limited to emails sent between only the secret keeper and only individual contacts (i.e. excluding group emails). In addition, for the most part analysis focused only on the emails sent by secret keepers to their contacts. Analysis of emails sent by contacts to secret keepers is left for future research.

Many participants selected the wrong start date because of difficulty setting the date in the EEP and/or difficulty recalling an exact start date. Therefore, emails before the secret began were only available for 43 of the participants, and emails during the secret keeping period were only available for 59 of the participants. All participants had emails at least before or during the secret keeping period and were included in the statistical analyses by using multilevel models (see Design and Analyses section).

Emails were deidentified (see Ethical Considerations) and cleaned to remove all forwards and replies and signatures, leaving only the text of each message only. Text of forwards, replies and signatures were removed using regular expressions. Cleaning steps were checked by hand coding a random sample of emails. After cleaning only between 1.7-4% of emails had extraneous characters that had not been caught.

Ethical Considerations

Due to the sensitive nature of secrets, multiple precautions were taken to fully inform participants of potential risks of participating, to deidentify emails, and to limit access to the collected survey responses and emails. The study was conducted in compliance with the University of Texas at Austin's Institutional Review Board (IRB Protocol #2009-12-0037).

During the consent process, participants were fully informed of the email collection procedure, the intended use of the emails, and the inherent risks. In addition, during the email collection procedure participants were given the opportunity to delete any text within an email. Participants chose to remove content from less than 1% of emails.

Emails were cleaned to remove as much identifying information as possible: During the email collection procedure before emails were securely provided to the researchers, the EEP converted all names and email addresses within the email headers to unique ids. After collection, regular expressions and named entity recognition were used to convert identifying characters to anonymized placeholders. This included names, numbers (e.g. phone numbers, bank numbers), addresses, and websites. A random sample of emails was hand coded to check deidentification; 100% of numbers and websites were obscured and 92% of names were obscured.

Survey responses and emails have been stored on password-protected computers with access only to trained research personnel who were part of the original research team.

Design and Analyses

The hypotheses and specific predictions were tested by examining changes in communication patterns by secret period (during vs. before secret) and by contact type (secret targets vs. uninvolved, confidants vs. uninvolved). Through these comparisons the study used both a within-subject and between-subject design to best utilize available controls. Secret period was treated as a within-subjects variable; communication during a secret keeping period was compared to communication before secret keeping began for each relationship. Communication patterns are idiosyncratic. Large secret keepers in particular are likely to differ dispositionally from non-secret keepers. As mentioned above, there were also systematic differences in the types of contacts that were secret targets, confidants, and uninvolved contacts. Thus communication between each secret keeper and contact pair before the secret keeping period was the best choice as a control for communication between the pair during the secret keeping period. Contact type was treated as a quasi- between-subjects control. We predicted to observe changes in communication to secret targets and confidants but not to uninvolved contacts during the secret keeping period compared to before.

Communication variables were selected based on the predictions (see Table 1) and calculated using Linguistic Inquiry and Word Count (LIWC; Pennebaker, Booth, and Francis 2007). Language Style Matching (LSM; Ireland and Pennebaker 2010) between the secret keeper and contact controlling for word count was calculated for each relationship, as a marker of engagement. Email messages sent by secret keepers were grouped by relationship, separated by secret period (before secret, during secret) and labeled by contact type (secret target, confidant, uninvolved). The frequency of emails per month; words per email; hours taken to reply; language style matching; and the usage rates of second person pronouns, present tense verbs, first person singular pronouns, negative emotion words, past tense verbs, insight words, and causal words were computed. The communication variables were log transformed for the analyses to correct for right skew in the distribution of the communication variables.

	Secret Target		Confidant		Uninvolved	
	Before	**During**	**Before**	**During**	**Before**	**During**
Communication Level						
Emails per month	**0.67 ^{A} (1.12)**	**1.14 ^{B} (1.23)**	**0.49 ^{A} (1.01)**	**1.23 ^{B} (1.39)**	**0.40 ^{A} (0.90)**	**0.62 ^{B} (0.65)**
Words per email	37.1 ^{A} (3.90)	37.5 ^{A} (2.00)	**16.3 ^{A} (2.74)**	**29.6 ^{B} (3.22)**	29.3 ^{A} (2.67)	39.0 ^{A} (1.61)
Response time (hrs.)	13.1 ^{A} (0.22)	4.96 ^{A} (0.38)	4.86 ^{A} (0.27)	1.05 ^{A} (0.36)	**6.91 ^{A} (0.28)**	**7.72 ^{B} (0.40)**
Engagement						
LSM	0.71 ^{A} (0.19)	0.73 ^{A} (0.19)	**0.68 ^{A} (0.20)**	**0.74 ^{B} (0.19)**	**0.68 ^{A} (0.18)**	**0.72 ^{B} (0.19)**
Deflection						
Second person	2.39 ^{A} (0.97)	2.67 ^{A} (0.92)	2.56 ^{A} (1.23)	2.63 ^{A} (0.84)	2.16 ^{A} (1.05)	2.56 ^{A} (0.90)
Present tense	**8.68 ^{A} (1.03)**	**10.0 ^{B} (0.62)**	10.7 ^{A} (1.44)	9.07 ^{A} (0.79)	10.1 ^{A} (0.79)	10.4 ^{A} (0.58)
Distress						
First person singular	**3.44 ^{A} (1.41)**	**5.11 ^{B} (0.95)**	3.90 ^{A} (1.32)	5.49 ^{A} (0.90)	5.11 ^{A} (1.01)	5.96 ^{A} (0.79)
Negative emotion	0.57 ^{A} (0.73)	0.93 ^{A} (0.63)	**0.30 ^{A} (0.57)**	**0.99 ^{B} (0.68)**	0.68 ^{A} (0.73)	0.82 ^{A} (0.70)
Past tense	1.75 ^{A} (1.20)	2.29 ^{A} (0.95)	**0.84 ^{A} (1.14)**	**2.60 ^{B} (0.66)**	1.64 ^{A} (1.12)	1.97 ^{A} (0.86)
Insight	1.53 ^{A} (0.79)	1.86 ^{A} (0.79)	**0.62 ^{A} (0.95)**	**1.89 ^{B} (0.68)**	1.83 ^{A} (0.99)	1.75 ^{A} (0.75)
Cognitive						
Cause	0.90 ^{A} (0.65)	0.92 ^{A} (0.63)	**0.38 ^{A} (0.67)**	**1.18 ^{B} (0.79)**	**0.79 ^{A} (0.75)**	**0.97 ^{B} (0.68)**

Table 3: Secret Keepers' Communication Patterns. Secret keepers' weighted mean (standard deviation) of communication patterns and word use to contacts before and during a secret keeping period. Means values are transformed back into original units from log units. Different superscripts within contact type indicate significant differences in word use during secret keeping period at p = 0.05.

An analysis of communication patterns required a multilevel linear model approach (see Tabachnick and Fidell 2007). There were multiple dependencies within the data (e.g. each secret keeper selected multiple contacts) as well as missing observations (e.g. emails could not be captured before secret period for some secret keepers). Multilevel models were used to control for dependencies within the data, secret period was nested within contact, which was nested within participant. Analyses were performed in R using the lme function of the nlme package, which calculates multilevel linear models. Dependencies were accounted for by making use of random intercepts in the models.

Although these models were at the contact-participant relationship level they were weighted to give equal weight to each participant, regardless of the number of contacts included in the study. For example, some secret keepers had many secret targets, while others only had a few secret targets, weighting ensured that analyses did not over count secret keepers with more secret targets. Thus, the models were weighted to count each secret keeper equally regardless of the number of contacts they provided. Degrees of freedom were based on 61 secret keepers, 705 contacts, and 1,186 observations. These totals were slightly

lower for some word use categories because emails without words had to be excluded.

Planned contrasts were used to directly test specific predictions. Two types of contrasts were computed. Simple effect contrasts were calculated to measure if there was a significant change in a communication variable during the secret keeping period compared to before the secret keeping period for a contact type. For example, a simple effect contrast was calculated to test whether secret keepers sent fewer emails per month to secret targets during the secret keeping period. Interaction contrasts were calculated to measure if the change in a communication variable between secret keepers and either secret targets or confidants was significantly different than the change in the communication variable between secret keepers and uninvolved contacts. For example, an interaction contrast was calculated to test whether the change in emails per month sent by secret keepers to secret targets was greater than the change in emails per month sent by secret keepers to uninvolved contacts.

Results

Although it was hypothesized that secret keepers might withdraw or distance themselves from contacts as a consequence of the emotional stress of secrets, the data do not support this hypothesis. Instead, the results provide preliminary evidence for the hypervigilance hypothesis, in which secret keepers focus more on social relationships in general. That is, the pattern of email behavior and word use suggests secret keepers may be monitoring their relationships with secret targets to prevent the secret from getting out and deepened their relationships with their confidants.

Secret Targets

Secret keepers communicated in ways that provided more support for the hypervigilance hypotheses than the social withdrawal hypothesis. Secret keepers sent significantly more emails to secret targets during the secret keeping period compared to before (see Table 3 and 4). During the secret keeping period secret keepers sent 1.14 emails per month to secret targets compared to 0.67 emails per month before the secret period (see Figure 1). The increase in communication frequency during the secret period from secret keepers to secret targets was not significantly different from the change in communication frequency to uninvolved contacts. A post-hoc comparison, correcting for the number of planned comparisons, showed that there was a significant main effect, in which secret keepers sent a greater number of emails to all contacts during the secret period ($z = 6.66$, $p < 0.001$).

Trends in the length of emails and their response time time during the secret period lend further support to the hypervigilance hypothesis. There was a marginally significant increase in the length of emails sent to secret targets during the secret period. Secret keepers also responded more quickly to secret targets during the secret period, although this difference was not statistically significant. The stability of response time for emails sent to secret targets was in contrast with the statistically significant increase in response time for uninvolved contacts during the secret period. While trends in email length and response time provide only marginal support for the hypervigilance hypotheses, because the trends are in the opposite direction they provide contradictory evidence for the withdrawal hypothesis.

With regard to communication markers of conversational focus, secret keepers used marginally more second person pronouns and significantly more present tense verbs in emails to secret targets during the secret
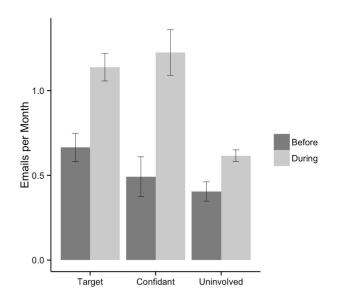
Figure 1: The average number of emails sent per month (S.E.) by the secret keeper before and during the secret keeping period separated by type of email recipient.

period compared to before. A focus on the present and the other person may be a strategy to avoid talking about the secret and to maintain control of conversation topics.

Although not all the results showed strong support for the hypervigilance hypothesis, there was more support for the hypervigilance hypothesis than the social withdrawal hypothesis. The increase in number of emails provides the strongest support for the hypervigilance over the social withdrawal hypothesis and changes in conversational focus also lent support. Surprisingly, although significant differences were observed for emails from secret keepers to secret targets during the secret keeping period, not all of these differences could be distinguished from changes in emailing to uninvolved contacts (see interactions, Table 4). Differences in emailing behavior to secret targets compared to uninvolved contacts may not be as great as predicted.

Confidants

Recall that both the social withdrawal and hypervigilance hypotheses predict that the secret keeper would actively discuss and process the secret with confidants. Indeed, secret keepers markedly changed the way they communicated to confidants while keeping a secret. Secret keepers communicated more to confidants during the secret keeping period compared to before, they sent significantly more emails and wrote longer emails (see Table 3 and 4). Secret keepers and confidants were more engaged with each other, as evidence by higher levels of language style matching during the secret keeping period.

Recipient	Psychological Construct	Communication Marker	Planned Contrasts	
			Simple Effect Before vs. During	Interaction (Change over Time for Recipient vs. Uninvolved)
Secret Target	Communication Level	Emails per month	z = 3.68, p < 0.001	z = 0.22, p = 0.82
		Words per email	z = 1.85, p = 0.06	z = 0.64, p = 0.52
		Response time	z = -0.09, p = 0.93	z = -3.60, p < 0.001
	Engagement	Language style matching	z = -0.01, p = 0.94	z = -2.08, p = 0.04
	Deflection	Second person pronouns	z = 1.71, p = 0.09	z = 0.09, p = 0.92
		Present tense verbs	z = 2.40, p = 0.02	z = 1.65, p = 0.10
Confidant	Communication Level	Emails per month	z = 3.96, p < 0.001	z = 1.53, p = 0.13
		Words per email	z = 3.74, p < 0.001	z = 2.71, p = 0.007
		Response time	z = 1.64, p = 0.10	z = -0.97, p = 0.33
	Engagement	Language style matching	z = 3.03, p = 0.002	z = 1.30, p = 0.19
	Distress	First person singular pronouns	z = 0.35, p = 0.72	z = 0.26, p = 0.79
		Negative emotion words	z = 3.34, p < 0.001	z = 2.71, p = 0.007
		Past tense verbs	z = 3.07, p = 0.002	z = 1.89, p = 0.06
	Cognitive Processing	Insight words	z = 3.11, p = 0.002	z = 2.61, p = 0.009
		Cause words	z = 2.83, p = 0.005	z = 1.36, p = 0.17

Table 4: Changes in Secret Keepers' Communication. Analysis of changes in the secret keepers' communication patterns and word use to their contacts from before vs. during secret keeping.

Secret keepers revealed more distress to confidants, including more negative emotion words, although not more first person singular pronouns. Finally, secret keepers showed evidence of making sense of the secret including using significantly more past tense verbs, more insight words, and more causal words in emails to confidants when keeping a secret compared to before. Moreover most of the changes in communication patterns in emails sent by secret keepers to confidants were significantly different than changes in communication patterns to uninvolved contacts (see interactions Table 4), suggesting that these represent unique ways that secret keepers communicate with confidants while keeping a secret.

Discussion

The present study tracked the impact of keeping a secret on an individual's social network using a large corpus of emails. Instead of social withdrawal, secret-keeping patterns were more consistent with the hypervigilance hypothesis; secret keepers communicate more during the secret keeping period, and are more engaged with confidants.

By analyzing language used in actual email communications before and during secret keeping, we were able to characterize changes in the relationship between secret keepers and secret targets. The results suggest that the secret target may be using active strategies to keep the secret hidden including "acting normal" and increasing communication to secret targets. Whether hypervigilance strengthens the relationship between secret keepers and secret targets is less clear. On the one hand, hypervigilance, may worsen the relationship between secret keepers and targets by creating tension. Word use by secret keepers suggests they may be deflecting attention from themselves and focusing on the present. On the other hand, hypervigilance may strengthen the relationship between secret keepers and secret targets by avoiding the problem areas. Attention by the secret keeper in trying to conceal the secret results in more communication and may be directed toward avoiding topics related to relationship problems. As is hypothesized for topic avoidance, concealing information, or in this case the secret, may protect the relationship as long as the secret is not suspected or know by the secret target (Afifi and Guerrero 2000; Cole 2001).

One positive consequence in this study was a potentially deepened relationship between secret keepers and confidants. Secret keepers wrote emails in a way that suggests they were processing and making sense of their

secret with confidants. Whether confidants responded favorably to these disclosures is not known and left for further research. However, heightened markers of engagement between secret keepers and confidants during the secret keeping period hint that the revelation of the secret is increasing rapport. Although Kelly (2002) argues that revealing secrets should create tension between secret keepers and confidants in practice this may not be true. Secret keepers may be good at selecting confidants that will be supportive or confidants may be good at masking the burden they feel from the secret.

Prior to the study, the authors were warned repeatedly that a study such as this would never be possible. We were asking people holding career- or marriage-ending secrets to have access to a year of their emails. Among those who completed a screening questionnaire, about a third of those with the most damaging secrets had they gotten out completed the project for the modest sum of $100. In many ways, that people are willing to share profoundly personal aspects of their lives speaks to the power of secrets. Consistent with a large literature on secrets (Kelly 2002) and self-disclosure (e.g., Jourard 1974; Finkenauer and Rime 1998b), holding secrets is stressful. When given a relatively safe opportunity, people desire to reveal their darkest sides to others.

Limitations and Future Work

It should be noted that the findings in this study are promising rather than definitive. Analyses were conducted without controlling for family-wise error. Based on an alpha level of 0.05, we can expect that 1.3 of the observed effects were due to chance alone. However, a high degree of error is inherent in the design of this study. Because this was the first study of its kind, and because it is extremely difficult to recruit participants who are willing to release their emails during the keeping of a major life secret, an inclusive design was used; secrets of all types were included and contacts of many roles were grouped together into general contact types. The results indicate that a promising next step will be to focus on uniform categories of secrets (e.g. health vs. cheating) as well as to have better defined roles (e.g. spouse being cheated on vs. affair partner). There were several other limitations with the design of the study, such as a very short period of measurement before a person started keeping a secret, and measurement of communication in a medium (i.e. email usage) that itself was evolving over the data collection period. Despite these shortcomings, the data reveal important ways in which secret keeping affects social networks.

The analyses focused on changes in communication from the perspective of the secret keeper. To fully understand the relationship between secret keepers and their contacts we must also consider that communication from contacts to secret keepers might change. For example, do secret targets act in ways that suggest suspicion? Do confidants act in ways that suggest negative judgment of secret targets? In the interest of space, these issues were not analyzed in this paper, but they will be important in fully understanding how relationships change during secret keeping.

While we argue that the increase in email frequency supports the hypervigilance hypothesis, changes across multiple forms of communication between secret keepers and targets may be more complex. For example, secret keepers may be substituting email communication for more personal forms of communication, such as face-to-face, video or phone communication. Accordingly, it remains to be answered whether the pattern of hypervigilance will hold true for other forms of communication.

As an initial analysis of this data, this paper focused on a priori predictions of changes in email behavior and word use. These predictions relied heavily on empirical and theoretical studies of secret keeping as well as known relationships between deception, psychological states and word use. To complement the findings of this paper, future research should take an atheoretical approach and examine all observed differences in email behavior and language usage by secret targets and confidants while keeping a secret. For example, future work could examine a more complex set of email behaviors, such as topic switching, email thread initiation, group emails, and a larger set of language features. Rather than using planned comparisons, this future research would likely employ machine learning to identify the most relevant features (e.g. can a model be built to predict secret keeping based only on language use in emails?).

This study lays the groundwork for further research on secrets using email or other forms of archived communication. By examining communication patterns via email, changes in the relationships between a secret keeper and a large number of contacts can be assessed without the use of retrospective reports from the sole perspective of the secret keeper.

Acknowledgements

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