

Identifying the Dimensions of Secrets to Reduce Their Harms

Michael L. Slepian¹ and Alex Koch²

¹ Management Division, Columbia Business School, Columbia University

² The University of Chicago Booth School of Business

How does the content of secrets relate to their harms? We identified a data-driven model (across five empirical steps), which suggested that secrets are generally seen to differ in how immoral, relational, and profession/goal-oriented they are (Study 1). The more a secret was consensually perceived to be immoral, relational, and profession/goal-oriented, the more that secret was reported to evoke feelings of shame, social connectedness, and insight into the secret, respectively. These three experiences independently predicted the extent to which the secret was judged as harmful to well-being (Studies 2a–c and 3). Reciprocally, reminding participants of the ways in which a secret does not need to be harmful (i.e., across the three dimensions of secrets) bolstered participants' feelings of well-being and efficacy with regard to coping with that secret (Study 4). A final study that examined secrets from romantic partners replicated the effect on perceived coping efficacy, which in turn predicted daily indicators of relationship quality (Study 5).

Keywords: multidimensional scaling, secrecy, well-being, coping efficacy

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Our waking hours are filled with social interactions and conversations. We disclose our thoughts, feelings, past experiences, and future intentions to friends, family, colleagues, and romantic partners, and this is inherently rewarding (Tamir & Mitchell, 2012). Yet, there is plenty that people leave unsaid. A recent paper estimated that 97% of people currently have at least one secret, with the average person holding 13 secrets at any given moment (Slepian et al., 2017). Secrecy correlates with lower subjective well-being, depression, anxiety, and poor health symptomology (Larson & Chastain, 1990; Larson et al., 2015; Lehmiller, 2009; Quinn & Chaudoir, 2009; Quinn et al., 2014). Given how common secrecy is and how harmful it can be, a surprising lack of attention has been paid to different sources of harm to well-being from secrets.

Slepian et al. (2017) define secrecy as the intention to keep self-relevant information from one or more persons, and the information in question is the secret. This intention will be on one's mind not only in social interactions where concealment may be required, but also when mind-wandering outside of those interactions (Slepian, *in press*). When entering the frequencies of mind-wandering to and concealing secrets as simultaneous predictors of the extent to which participants report well-being harm from a secret, only the frequency of mind-wandering to that secret predicted lower well-being from the secret (McDonald et al., 2020; Slepian

et al., 2017; Slepian, Greenaway, et al., 2020; Slepian & Moulton-Tetlock, 2019). Thus, the harm of secrets seems to stem from having to live with and think about them. What, then, is the content of secrets that is linked with harms to well-being?

In seeking to understand the dimensions of secrets that may be harmful to well-being, we turn to the latest research on social dimensional models. According to a recent integration of five models (Abele et al., 2020; Ellemers et al., 2020; Koch et al., 2021), people evaluate groups, others, and the self on two content dimensions with two facets each. First, people may “vertically” appreciate (depreciate) groups, others, and the self by judging that they are (un)assertive (i.e., concerning ambition and confidence) or (un)able (i.e., concerning intelligence and skill). And second, people may “horizontally” appreciate (depreciate) groups, others, and the self by judging that they are (im)moral (i.e., concerning honesty and trustworthiness) or (un)friendly (i.e., concerning warmth and kindness). From this theoretical integration, we might predict that secrets bring harm to subjective well-being because their keepers evaluate the self as unassertive, unable, immoral, and/or unfriendly (see also Brambilla et al., 2011; Goodwin et al., 2014; Leach et al., 2007).

A plethora of empirical research supports the Big Two (i.e., vertical and horizontal), but also related and unrelated dimensions. For example, people differentiate societal groups on the dimensions of agency/socioeconomic success (i.e., a combination of vertical assertiveness and the related dimension socioeconomic status [SES]), conservative-progressive beliefs (i.e., an unrelated dimension), and morality (Koch et al., 2016; Koch, Imhoff et al., 2020; Koch, Dorrough, et al., 2020; see also Imhoff et al., 2018; Koch et al., 2018). When it comes to face perception, people differentiate faces on the dimensions of dominance (i.e., assertiveness),

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Michael L. Slepian  <https://orcid.org/0000-0002-4728-2178>

Alex Koch  <https://orcid.org/0000-0002-6267-8066>

Correspondence concerning this article should be addressed to Michael L. Slepian, Management Division, Columbia Business School, Columbia University, 3022 Broadway, New York, NY 10025, United States. Email: michael.slepian@columbia.edu

trustworthiness (i.e., morality; Oosterhof & Todorov, 2008), and attractiveness (i.e., an unrelated dimension; Sutherland et al., 2013). And when it comes to how people differentiate mental states, they do so on the dimensions of valence (i.e., global appreciation), social impact (which overlaps some with the horizontal dimensions), and rationality (which overlaps some with the vertical dimension, Tamir & Thornton, 2018; Tamir et al., 2016; Thornton & Tamir, 2020).

In sum, these dimensions explain much of social evaluation across target domains (i.e., groups, others, the self, faces, mental states, etc.), but also, they do not explain social evaluation exhaustively in specific target domains. Thus, the present work takes a data-driven approach to the criteria that people use to differentiate the specific target domain of secrets (for related approaches, see Koch, Imhoff, et al., 2016; Pattyn et al., 2013).

The cornerstone of this data-driven approach is instructing participants to rate the similarity of secrets. Why similarity ratings? People must choose some criterion to evaluate how similar the secrets are to one another. For example, secrets about self-harm and physical violence to others may both be seen as immoral and thus rated as similar. Or, the participant might choose to consider how socially relational these two secrets are (no for self-harm and yes for violence), thus rating them as dissimilar. Participants may not be aware of the criterion driving their judgments. But to judge the similarity between secrets, some criterion must be in mind, even if implicitly. Collecting these judgments alone yields a data-driven solution because participants are free to choose any criterion and are not primed by the researchers to choose any particular criterion. That is, similarity ratings are well suited for capturing in a theoretically unrestricted way the criteria that people use to differentiate secrets. After generating the similarity matrix, these criteria can be identified based on additional data, as we will demonstrate in Study 1 (see also, Koch, Imhoff, et al., 2016; Pattyn et al., 2013).

Stimulus sampling is vital for any data-driven approach. As our aim is to determine the criteria that people use to differentiate secrets that are reported as harmful to well-being, we must present to participants secrets that are representative of this target domain. Throughout this article, participants responded to 36 secrets from the Common Secrets Questionnaire (CSQ) developed by Slepian et al. (2017). These authors asked 1,000 participants distributed across the U.S. and with a wide age range (18–77 years) to name one of their current secrets. Through an iterative coding process, coders generated a list of 38 common categories of secrets that described the 1,000 open responses. The coding scheme fit another 1,000 participants' open responses, agreement was high (82%), and only approximately 8% of the 1,000 open responses did not fit any of the 38 common categories of secrets.

The CSQ captures secrets about extra-relational thoughts, physical discontent, poor work performance, infidelity, cheating at work, violating someone's trust, mental health issues, among others (see the Appendix). One striking feature of most of these secret categories is that people view them negatively (Slepian et al., 2017; Slepian, Kirby, & Kalokerinos, 2020). In fact, only two of the categories have clear positive valence: marriage proposals and surprises. Ongoing work suggests that these more "positive secrets," operate in a different manner to secrets more generally. Relative to prototypically negative secrets, positive secrets are rare and atypical, and so models of secrecy often focus

on prototypically negative secrets (Slepian, in press). These secrets are often kept with the intent to be revealed to delighted recipients.

Given that we aim to understand how secrets harm subjective well-being, this article does not examine these two positive secrets, which relatively speaking are 1) numerically rare (negativity is more diverse than positivity; Alves et al., 2017; Unkelbach et al., 2019), 2) are meant to be revealed, and 3) are also not considered harmful. The remaining 36 categories of secrets we examine here capture 91% of the type of secrets people report keeping (Slepian et al., 2017) and are commonly kept: 96% of people keep at least one of the secrets, with the average person having 12 of the 36 categories of secrets at any given moment (Slepian et al., 2017).

The Current Work

Study 1 showed that participants on average used three dimensions to differentiate the secrets, regardless of the similarity rating task (Samples 1a and 1b). Keeping to a data-driven approach, we then reverse-engineered these three consensual and orthogonal dimensions in participants' own terms (Sample 2). The best-explaining triad of labels was: how *immoral* a secret is, how *relational* the secret is, and how *profession/goal-oriented* the secret is (Sample 3).

These dimensions overlap with valence (i.e., global appreciation) and the four theory-driven facets of vertical and horizontal (i.e., assertiveness etc.; Abele et al., 2020; Koch et al., 2021). However, immoral, relational, and profession/goal-oriented better explained how participants differentiated the secrets (vs. valence and the four theory-driven facets; Sample 4), regardless of whether reverse-engineering participants' similarity ratings based on abstract category labels (e.g., "drug use") or concrete exemplars of real secrets (e.g., "When I was in college in the 70's drugs were everywhere. I never told anyone about how extensive my drug use was"; Samples 5a and 5b).

Subsequently, in Studies 2a–c and 3, we examined the predictive validity of the three-dimensional (3D) model. Through knowing where in the 3D model a participant's secret consensually falls, we could predict how ashamed the participant felt about the secret (more immoral secrets), how much social connection it brought them (more relational secrets), and how much insight they had into it (more profession/goal-oriented secrets). Lower shame from, higher connection from, and higher insight into the secret in turn predicted reports of how harmful the secret was to well-being.

Finally, based on the 3D model we developed an intervention in Studies 4 and 5. There is likely some aspect of a secret that is harmful, and some aspect of it that is not. For instance, even if an immoral secret brings someone shame (e.g., lying to someone), perhaps there is no relational harm (e.g., feeling even more connected to someone; Levine & Schweitzer, 2015). Or, even if a non-relational secret does not afford social connection (e.g., poor finances), perhaps its keeper enjoys a profession/goal-oriented benefit (e.g., insight into why they keep the secret). Likewise, even if a secret does not afford self-insight (e.g., not understanding why one has a sexual kink), perhaps in the immorality domain, there is still no harm (i.e., there is no shame in keeping it). Reminding people of three ways in which a secret may not hurt (i.e., offering social connection, insight, or no shame) might increase feelings of efficacy when it comes to coping with that

secret, which is the first step to better coping and improved well-being.

Accordingly, Studies 4 and 5 leverage the 3D model to design reframing interventions to improve feelings of efficacy in coping with secrets as well as reduce harms to well-being.

Sample Size and Statistical Power

For each of the first seven samples, sample size was determined before any data analysis. A recent article recommends 20–40 ratings per stimulus for reliable means (Hehman et al., 2018). In Study 1 (which included data from seven participant samples), we far exceed this, with 400 ratings per similarity between any two secret categories and more than 60 ratings per content of each secret category. Assuming reliable means, our power to detect interpretable (i.e., $r \geq .70$) correlations between the similarity and content of the 36 categories of secrets was $1 - \beta = .90$ (the correlations in the 3D model are all $r_s \geq .80$).

In Studies 2–5, 200 participants per study yielded data on thousands of secrets per study (as participants on average keep 13 secrets). We chose this sample size as prior work in this domain has found it to be adequate (see Slepian et al., 2017; Slepian & Bastian, 2017; Slepian & Greenaway, 2018; Slepian & Moulton-Tetlock, 2019; Slepian et al., 2019; Slepian, Kirby, & Kalokerinos, 2020; Slepian, Greenaway, & Masicampo, 2020).

Participant Samples

U.S. participants were recruited on Mechanical Turk or Prolific Academic. These online platforms provide a level of anonymity and privacy that could not be obtained with a lab study, which was particularly important to Studies 2–5 (and Study 1's Sample 5a) where we examined personal secret exemplars. Moreover, the platforms provide access to more diverse participants (e.g., in terms of age, education, SES, region, and culture) than the typical college student sample (Buhmester et al., 2011). Additionally, participants recruited on the platforms who participate in a study on secrecy (versus those who do not participate in a study on secrecy) do not differ on relevant variables (e.g., subjective well-being; Slepian, Greenaway, et al., 2020). Indeed, Mechanical Turk participants from the U.S. demonstrate similar patterns of, and experience with, secrecy compared with other nationally representative samples (Slepian et al., 2017). We thus expect the results to generalize widely across the U.S. but not necessarily to other cultures.

All measures, manipulations, and exclusions in the studies are disclosed. Occasionally, participants did not complete the study, and we only included participants who completed the study. The only data exclusions were participants who admitted to fabricating responses during a final honesty check (and this is noted when it happened).

Study 1: Data-Driven Dimension Identification

Study 1 collected data from seven participant samples to capture, identify, and validate consensual dimensions of common categories of secrets (see Figure 1), resulting in a data-driven 3D model.

Method and Results

Sample 1a: Pile Sorting of the Secrets

Participants ($N = 200$; 115 women, 85 men; $M_{\text{age}} = 33.86$, $SD = 11.59$) were tasked with sorting the 36 common categories of secrets into piles. Participants dragged and dropped all secrets from a randomly ordered list on the left side of the screen into piles on the right side, with a minimum of two piles being required, and a maximum of ten piles (see Figure 2; Sample 1b lifts these constraints). There were no instructions except: “[...] similar secrets should be sorted into the same category box. Different secrets should be sorted into different category boxes. You can always drag and drop a secret from one category to another.” Given limited space, the full descriptions of each secret did not fit on the screen. Thus, shorthand labels were used, as presented in Figure 2 (e.g., “harming someone”). To ensure participants knew the full description of each secret, they first completed the full-description questionnaire from which the secrets were drawn from (see Appendix; Slepian et al., 2017). Thus, participants first went through the exercise of thinking about each secret (to determine whether it fit one of their own current or past secrets).

For each pair of secrets, if the two secrets had been sorted into different piles versus the same pile this was scored as a 1 versus 0, respectively. Averaging this binary measure across participants yielded the mean probability of ending up in different piles for each pair of secrets (i.e., lower values to indicate the secrets were seen as more similar to each other).

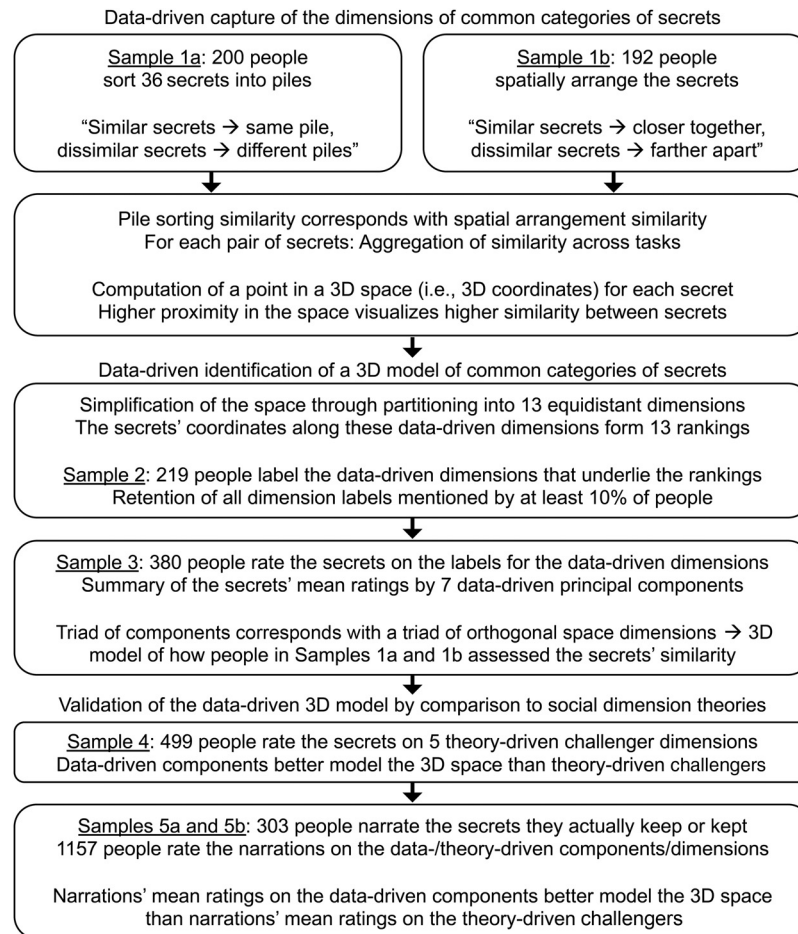
Sample 1b: Spatial Arrangement of the Secrets

After familiarizing themselves with the full description of the common categories of secrets (see Appendix), participants ($N = 192$; 108 women, 84 men; $M_{\text{age}} = 34.09$, $SD = 11.07$) were tasked with spatially arranging them on a blank screen (Hout & Goldinger, 2016; Hout et al., 2013; Koch, Alves, et al., 2016). Specifically, we implemented Q-SpAM (i.e., spatial arrangement method [SpAM] embedded into Qualtrics through JavaScript code; Koch, Speckmann, et al., 2020).

Participants were exposed to a grid in the middle of the screen (nine rows, four columns) wherein the secrets were randomly placed in equally sized boxes. Participants dragged and dropped the secrets to anywhere else on the screen. There were no instructions on how to spatially arrange the secrets except: “[...] you can drag and drop them [the secrets] to different positions anytime during the task” and participants were reminded to “place more similar secrets closer together” and “place more dissimilar secrets farther apart” (see Figure 3).

As in prior research using Q-SpAM (Alves et al., 2016; Imhoff et al., 2018; Koch, Imhoff, et al., 2016, 2020; Lammers et al., 2018), we recorded the spatially arranged Euclidean proximity for each pair of secrets (i.e., the shortest pixel line from secret to secret) divided by the longest possible pixel line (i.e., the screen diagonal). Specifically, each box had the same size, and we calculated the proximity from the center of each box. Averaging this value across participants yielded a mean pixel proximity for each pair of secrets (i.e., lower values indicate the secrets were seen as more similar to each other).

Figure 1
Study 1: From 36 Common Categories of Secrets to a 3D Model of the Secrets



Computation of a 3D Space

The correlation between the 630 unique secret pairs’ pile sorting similarity (Sample 1a) and spatial arrangement similarity (Sample 1b) was very high, $r = .92$. Because rating task (i.e., pile sorting vs. spatial arrangement) did not influence similarity, we collapsed across tasks. Next, we subjected the 630 secret pairs’ cross-task similarity to multidimensional scaling (MDS; we used the ALSCAL algorithm, Young et al., 1978; and we assumed an interval scale [assuming an ordinal scale instead did not change the 3D space interpreted below]). MDS estimated points for the 36 secrets in six spaces with increasingly more orthogonal dimensions. In each space, the Euclidean proximity between the secrets captured their similarity (as pile-sorted or spatially arranged). The spaces retained 68% (1D), 87% (2D), 94% (3D), 97% (4D), 98% (5D), and 99% (6D) of cross-task similarity variance. As can be seen, variance explained leveled off by the 3D space. To proceed with a space as parsimonious as possible when clearing the recommended threshold of 90% variance explained (Jaworska & Chupetlovska Anastasova, 2009; Kruskal & Wish, 1978), we proceeded with validating and interpreting the 3D space.

As for validating the 3D space, we subjected the 630 secret pairs’ cross-task similarity to a novel algorithm for unsupervised (i.e., data-driven) dimension reduction, namely Uniform Manifold Approximation and Projection (UMAP; McInnes et al., 2018). UMAP estimated points for the 36 secrets in 3D spaces in which the Euclidean proximity between the secrets reflected their similarity (as pile-sorted or spatially arranged). UMAP requires setting the hyper-parameter n . “Smaller values will ensure detailed manifold structure is accurately captured (at a loss of the ‘big picture’ view [...]), while larger values will capture large-scale manifold structure, but at a loss of fine-detail structure” (McInnes et al., 2018, p. 23). With 36 secrets, n could vary between 2 and 35. We set n to 30, 10, and 3 to prioritize capturing the big picture, in between, or the details, respectively. Finally, we computed canonical correlations between the 3D spaces computed through UMAP with n set to 30, 10, and 3 on one hand and the 3D space computed through MDS on the other hand. UMAP ($n = 30$) aligned with MDS, $r_s = .97, .91, \text{ and } .88$, UMAP ($n = 10$) aligned with MDS, $r_s = .96, .92, \text{ and } .43$ and UMAP ($n = 3$) aligned with MDS, $r_s = .96, .84, \text{ and } .12$. Compared with the benchmark of UMAP, the 3D

Figure 2
Sample 1a: An Example of Midway Through a Participant's Task of Sorting the Secrets on the Left Into the Piles on the Right

	Secret category 1	Secret category 2
harming someone	extrarelational thoughts 1	drug use 1
habit or addiction	emotional infidelity 2	theft 2
self-harm	sexual infidelity 3	illegal (non-theft) act 3
abortion	being the "other (wo)man" 4	
experience of trauma	romantic desire 5	
telling a lie		
hidden relationship		
violating someone's trust	Secret category 3	Secret category 4
social discontent	physical discontent 1	secret employment 1
mental health		finances 2
romantic discontent		
family detail		
pregnancy		
sexual orientation		
sexual behavior		
not having sex		
a preference		
belief or ideology	Secret category 5	Secret category 6
	personal story 1	profession discontent 1
	hobby 2	cheating at work/school 2
		poor work/school perform. 3

space computed through MDS thus captured both the big picture and details of the secrets' similarity well, but performed better at capturing the big picture versus details.

We validated the 3D space computed through MDS in a second way. The 3D space captured the secrets' pairwise similarity as pile-sorted or spatially arranged on average—that is, averaged across participants in Samples 1a and 1b. Thus, the extent to which the space well-represented how individual participants in Samples 1a and 1b had assessed the similarity of the secret pairs remained to be shown. We correlated the secret pairs' Euclidean proximity (i.e., similarity) in the space with the secret pairs' probability of ending up in the same pile as sorted by Participant 1 in Sample 1a. We computed this correlation for each individual participant in this sample and averaged it across participants in the sample: $r = .35$, $SD = .19$. Further, we correlated the secret pairs' Euclidean proximity in the space with the probability of ending up closer together as arranged by Participant 1 in Sample 1b. We computed this correlation for each individual participant in this sample and averaged it across participants in the sample: $r = .27$, $SD = .15$. Three individual-level variables constrained these correlations: noise due to inattentive responding, noisy assessment of 3D similarity due to binary measurement (pile sorting) and 2D measurement (spatial arrangement), and idiosyncratic similarity assessment. Considering these constraints, the small to moderate correlations showed that participants to some degree consensually assessed the secret pairs' similarity, and the 3D space computed through MDS captured this partial consensus.

As for interpreting the 3D space, while Samples 1a and 1b yielded the space (and the 3D coordinates of the secrets in the

space), the three orthogonal content dimensions that together interpret the space still remained to be identified. That is, what criteria had driven participants' similarity ratings? Samples 2 and 3 answered this question (see Figure 4).

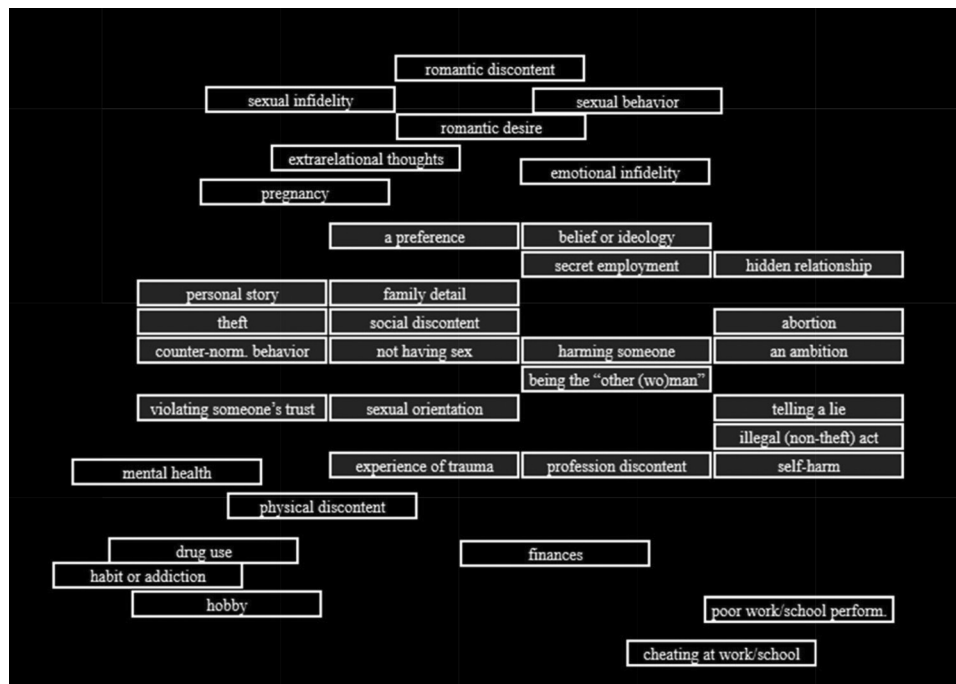
Sample 2: Proposal of Content Dimensions

Participants ($N = 219$; 121 women, 98 men; $M_{age} = 33.64$, $SD = 9.87$) were asked to propose content dimensions that explain where the secrets fall in the 3D space (see Figure 4). To ease this task, we drew 13 rotated dimensions through the space such that no angle between any of these dimensions and another space dimension was greater than 45° (see Figure 5). Because angles of 45° corresponded to space dimension correlations of $r \geq .75$, the dimensions that we drew through the space well represented the space dimensions, and thus encompassed the criteria that Samples 1a and 1b participants had used to similarity-rate the secrets. The secrets had a unique ranking along each of the 13 dimensions that we drew through the space (see Figure 5).

Looking at the 13 secret rankings (or reverse-rankings, counterbalanced) one by one, participants named the content dimension that, in their view, described the respective secret ranking. Participants read that secrets "at the top of the ranking are extremely X," secrets "at the center of the ranking are averagely X," and secrets "at the bottom of the ranking are not all X." We asked participants what X stood for, and thus what content dimension explained this ranking.

Before we presented the 13 secret rankings in a random order, participants were provided with an example of the task ("giraffe, elephant, horse, deer, dog, mouse, and bee", with the suggested content dimension being "tall" or "big"). Participants were free to enter "Do not know" if they could not think of a content dimension

Figure 3
Sample 1b: An Example of Midway Through a Participant's Task to Spatially Arrange More Similar Secrets Closer Together on the Screen



Note. Secrets that had yet to be dragged were grayed.

that explained the ranking. Participants proposed between 56 and 92 content dimensions per secret ranking (65% of all responses; the other responses were “Do not know” or nonsense/a failure to follow our instructions). We collapsed across synonyms, and conservatively retained all 17 content dimensions proposed by at least 10% of participants (see Table 1). The goal of Sample 3 was to factorize these content dimensions and explain the 3D space in terms of three orthogonal, statistically well-fitting content factors.

Sample 3: Modeling the 3D Secret Space

Sample 2 yielded 17 content dimensions. Sample 3 participants ($N = 380$; 163 women, 83 men; $M_{\text{age}} = 34.37$, $SD = 11.53$, 135 missing demographic information due to a programming error) were asked to rate each of the secrets on one of the content dimensions (“How [e.g., criminal] is the content of these 36 types of secrets?”). Participants used 0–10 Likert scales (ranging from *not at all* to *extremely*) to rate the randomly-ordered secrets. We assigned at least 20 participants per content dimension to achieve stable rating means for the secrets (Hehman et al., 2018). We averaged across participants, so that each secret received a mean (i.e., consensual) rating on each content dimension. We then subjected the 17 content dimensions to a principal components analysis using varimax rotation. The scree plot suggested four components. We averaged the content dimensions that clearly loaded on one and the same component (we kept three content dimensions separate because they had a cross-loading of $\geq .50$, see Table 1).

In the last empirical step, we correlated the mean ratings for the 36 secrets on the four content components (i.e., immoral, relational, family/personal, and profession/goal-related) and three

residual content dimensions (i.e., harmful, trivial, and mental health-related) with the coordinates for the secrets on the 13 dimensions that we drew through the 3D space.

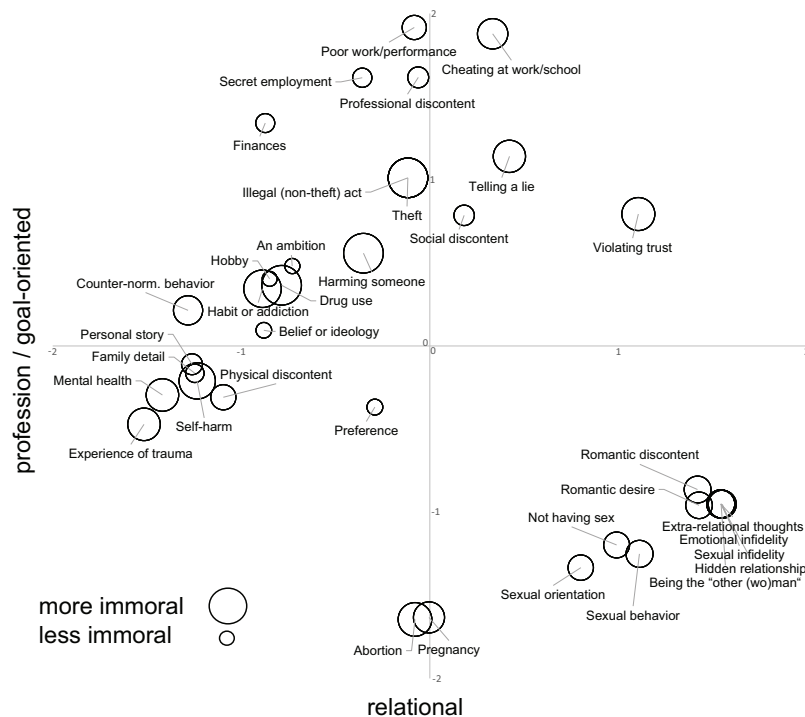
The three content components or residual dimensions that on average most closely aligned to a triad of orthogonal (all $r_s < .36$) dimensions that ran through the 36 secrets’ 3D space were *immoral* (and line 3 in Figure 5), $r = .80$, *relational* (and line 5), $r = .82$, and *profession/goal-oriented* (and line 7), $r = .80$. Achieving this strong correspondence gives us confidence that our multi-step procedure identified the three criteria that participants in Samples 1a and 1b had consensually used to differentiate the secrets.

Table 2 shows the secrets’ mean ratings on the three content components immoral, relational, and profession/goal-oriented, and the secrets’ coordinates on the three orthogonal space dimensions X, Y, and Z that our data-driven model explained in terms of immoral, relational, and profession/goal-oriented, respectively.

Sample 4: Fitting Theory- Versus Data-Driven Dimensions to the 3D Secret Space

As reviewed in the introduction, a recent integration of five models argues that people evaluate social entities vertically, on the facets assertiveness and ability, and horizontally, on the facets morality and friendliness (Abele et al., 2016; Abele et al., 2020; Ellemers et al., 2020; Koch et al., 2021). These four theory-driven facets and the arguably most basic dimension, global appreciation (i.e., negative-positive), provide an opportunity to test the robustness of our data-driven model.

Figure 4
3D Space of Secrets Computed and Interpreted in Study 1



Note. Euclidean proximity between secrets in this space reflects their similarity across two rating tasks. Larger circle size reflects a third dimension, namely that a secret was consensually seen as more immoral.

First, it could be that the triad of orthogonal space dimensions we explained above (i.e., in terms of the data-driven components immoral, relational, and profession/goal-oriented) correlates more strongly with some of these four facets and/or global appreciation (henceforth: the theory-driven challengers) compared with our data-driven components. And second, it could be that three theory-driven challengers correlate more strongly with a different triad of orthogonal space dimensions, compared with the correlation between the triad of dimensions we identified and the data-driven components. If one of these two cases is true, the theory-driven challengers (vs. data-driven components) would better describe the similarities between the 36 secrets.

Sample 4 participants recruited from Prolific Academic ($N = 499$; 221 women, 274 men, two other, two prefer not to say; $M_{age} = 32.85$, $SD = 10.54$) rated the 36 randomly-ordered secrets in the same way as participants in Sample 3, on one randomly selected Likert scale (ranging from 0 = *not at all* to 10 = *extremely*, with the format “how [...] is the content of these 36 types of secrets?”). The morality facet was measured with the items: trustworthy, just, fair, reliable, and considerate. The friendliness facet items were: friendly, caring, warm, empathic, and affectionate. The assertiveness facet items were: persistent, confident, resilient, assertive, and leader-like. The ability facet items were: intelligent, competent, efficient, capable, and clever (for all facets, see [Abele & Hauke, 2020](#)). Finally, global appreciation was measured with the items enjoyable, pleasant, positive, good, and likeable. Per each theory-driven challenger, we averaged ratings across the ($N =$

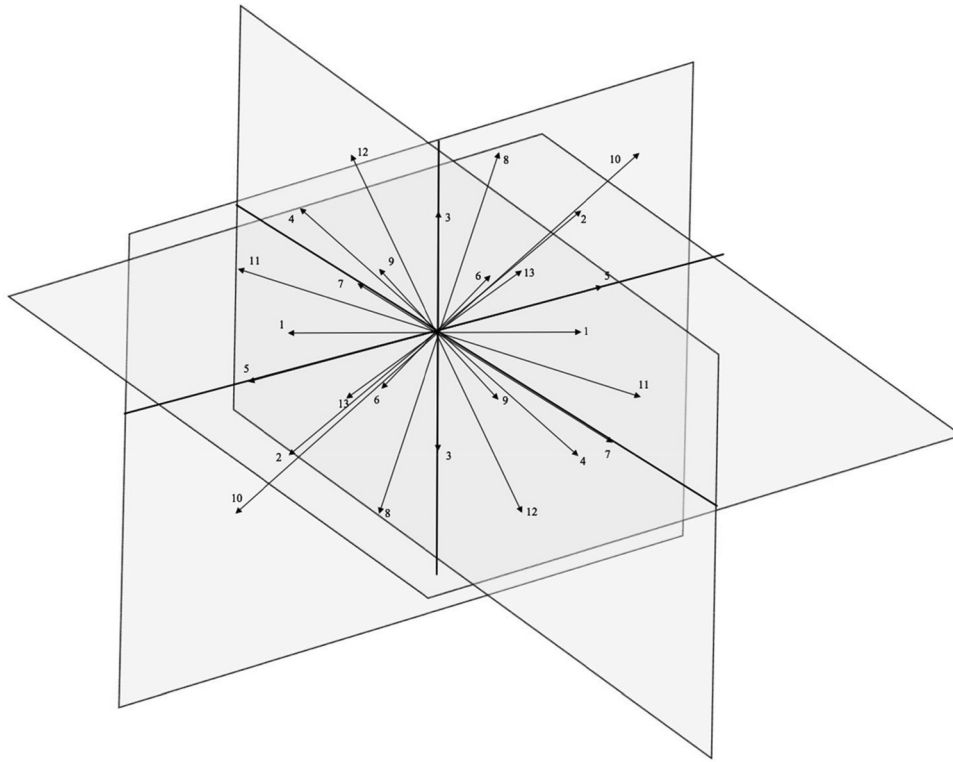
83–122) participants who had rated the secrets on the same theory-driven challenger, yielding mean ratings that indicated where each secret was consensually perceived to fall on each theory-driven challenger.

The theory-driven challengers morality, ability, and global appreciation better aligned with X (vs. Y and Z), the first dimension in the identified triad of orthogonal secret space dimensions, $r_s = -.56, -.39$, and $-.75$, respectively. However, the alignment between X and the data-driven component immoral was better, $r = .80$. Recall that we measured the theory-driven challenger morality with items (trustworthy, just, fair, reliable, and considerate) that differed from those measuring the data-driven component immoral (criminal, dishonest, harmful, illegal, and immoral). The theory-driven challengers friendliness and assertiveness better aligned with Z (vs. X and Y), $r_s = -.54$ and $-.41$, respectively. However, the alignment between Z and the data-driven component profession/goal-oriented was better, $r = .80$. Thus, our data-driven component model prevailed over the theory-driven challengers.

Next, we correlated each theory-driven challenger (five in total) with X, Y, Z as well as the other 10 dimensions that we drew through the 3D space in Sample 2 (13 in total). The best alignments between each of those dimensions and the theory-driven challengers were $r = -.80$ (morality), $-.81$ (friendliness), $-.41$ (assertiveness), $-.56$ (ability), and $-.75$ (global appreciation). Based on the size of these correlations, the theory-driven challengers morality, friendliness, and global perception could, in

Figure 5

The Best-Interpretable Triad of Orthogonal Dimensions of a MDS-Computed 3D Space is the Triad of Orthogonal Dimensions Outputted by the MDS Algorithm or, Importantly, Any Rotation of This Triad of Orthogonal Dimensions



Note. To find the best-interpretable triad, Sample 2 participants labeled/interpreted 13 dimensions that well-represented all space dimensions.

principle, align with a triad of orthogonal space dimensions almost as well as the data-driven components immoral, relational, and profession/goal-oriented, $r_s = .80, .82,$ and $.80,$ respectively. However, morality and friendliness best aligned with the same space dimension (Line 8 in Figure 5), and this dimension and the one that global appreciation best aligned with (Line 3) were not orthogonal either. Accordingly, relative to the theory-driven challengers (Abele et al., 2020; Koch et al., 2020), the data-driven components immoral, relational, and profession/goal-oriented described the similarities between the 36 secrets in a simpler way—that is, in terms of an orthogonal model.

Samples 5a and 5b: Fitting Secret Exemplars to the 3D Secret Space

The stimuli that participants in Samples 1–4 responded to were 36 categories of secrets (e.g., “[secret about a(n)] experience of trauma”; “[...] hidden relationship”; “[...] habit or addiction”; etc.). These category labels are easy to process, but they are depersonalized conceptual abstractions of the secret exemplars that people actually keep and with which they have intimate experience. Thus, it remains to be shown that our data-driven model describes not just the semantic similarities between general secret categories, but also the experiential similarities between specific secret exemplars from real life.

Sample 5a participants ($N = 303$; 142 women, 158 men, three other; $M_{\text{age}} = 30.62,$ $SD = 10.69$) indicated per each of the 36 categories of secrets (as in Samples 1a and 1b, see Appendix), whether they currently had that secret (“I had this experience, keep/kept it secret from someone, and am willing to write five sentences about it.”). For up to four randomly-selected currently-kept secrets, we asked participants to generate text describing their personal experience with the secret. Per each, participants read “You indicated that you keep/kept the following experience secret from someone: [secret category]. Tell us about this secret in detail—use at least five sentences to think aloud about this secret.” Participants typed 200–400 characters of concrete, detailed, and unique language about each of these secret exemplars (see Appendix). We excluded 27 texts that were nonsensical or not describing a secret, leaving us with 1,022 experiential descriptions of secret exemplars from real life ($M = 28.28$ exemplars per category, $SD = 14.21$).

Sample 5b participants ($N = 1157$; 574 women, 571 men, nine other, three prefer not to say; $M_{\text{age}} = 34.41,$ $SD = 12.47$) read 50 randomly selected secret exemplars and rated each on one randomly selected slider scale ranging from 0 = *not at all* to 100 = *extremely*. Three scales measured the data-driven components immoral, relational, and profession/goal-oriented

Table 1
Principal Components Analysis of the Content Dimensions Proposed by Sample 2 Participants Who Looked at the Rankings That Well-Represent the 3D Space of Secrets

#	Content dimension	PC1	PC2	PC3	PC4	Interpretation
1	Criminal	.93	-.04	-.20	.07	Immoral
2	Dishonest	.84	.25	.35	.16	Immoral
3	Harmless	-.71	-.47	-.01	-.04	Immoral
4	Illegal	.87	-.02	-.28	.15	Immoral
5	Immoral	.90	.21	.29	-.01	Immoral
6	Family-related	-.05	.79	.39	.03	Family/personal
7	Harmful to self	.41	.85	-.01	.01	Family/personal
8	Personal	.01	.68	.33	-.45	Family/personal
9	Infidelity-related	.21	.23	.87	-.24	Relational
10	Relationship-related	.01	.24	.85	-.41	Relational
11	Sexual	-.11	.03	.77	-.46	Relational
12	Finances-related	.03	-.16	-.08	.87	Profession/goal-oriented
13	Performance-related	.27	.11	-.31	.80	Profession/goal-oriented
14	Work-related	.07	.02	-.27	.89	Profession/goal-oriented
15	Harmful	.61	.73	.15	.02	Harmful
16	Trivial	-.61	-.68	-.27	-.20	Trivial
17	Mental health-related	.01	.73	-.55	-.20	Mental health-related

Note. PC1 ($\alpha = .90$), PC2 ($\alpha = .80$), PC3 ($\alpha = .93$), and PC4 ($\alpha = .89$) explained 38%, 28%, 12%, and 8% of the total variance in the mean ratings of 36 secrets on the 17 content dimensions respectively.

in terms of the items established in Sample 3 (e.g., “how criminal/dishonest/harmful/illegal/immoral is the content of this secret?”). Five scales measured the theory-driven challengers morality, friendliness, assertiveness, ability, and global appreciation in terms of the items used in Sample 4. Per each secret, we averaged the ($N = 38-517$) ratings, now of personal experiences with real-world secrets, to obtain scores that indicated where each category of secret was consensually perceived to fall on the data-driven components (see Table 1) and the theory-driven challengers (Abele et al., 2020; Koch et al., 2021).

The data-driven components immoral, relational, and profession/goal-oriented aligned well with X, Y, and Z, the triad of orthogonal space dimensions that we explained above, $r_s = .66, .74,$ and $.73,$ respectively. The best alignment between the five theory-driven challengers and X, Y, Z, and the other 10 dimensions that we drew through the 3D space in Sample 2 was considerably worse, all $r_s \leq \pm .57,$ except global appreciation aligning with Line 9 in Figure 5, $r = -.63.$ Thus, the alignment of $r_s = .66-.74$ between X, Y, and Z and the data-driven components immoral, relational and profession/goal-oriented, now operationalized by ratings of secret exemplars, approached the earlier alignment of $r_s = .80-.82$ between X, Y, and Z and ratings of the secret categories along the data-driven components immoral, relational and profession/goal-oriented (see Sample 3). Thus, we conclude that our data-driven model describes not just the semantic similarities between general secret categories, as shown in Sample 3, but also the experiential similarities between specific secret exemplars from real life.

Discussion

Study 1 collected data from seven participant samples to construct and test the robustness of a data-driven model of the criteria that people use to differentiate 36 common categories of secrets,

such as secrets about a habit or addiction, sexual infidelity, and cheating at work. According to this model, people differentiate more versus less immoral secrets (i.e., criminal/dishonest/harmful/illegal/immoral), more versus less relational secrets (i.e., infidelity-related, relationship-related, and sexual), and more versus less profession/goal-oriented secrets (i.e., finances-related/performance-related, and work-related).

Predicting How People Experience Secrecy From the Data-Driven Model

Study 1 (including seven participant samples) found that people naturally see secrets as existing along three dimensions, how immoral they are, how relational they are, and how profession/goal-oriented they are. If people see their secrets as falling along three distinct content dimensions, then when people have such secrets, they should experience them in predictable ways. In the next set of studies, we predicted that each content dimension would uniquely predict an experience with secrecy particular to that dimension. Stated differently, we proposed that from merely knowing the category of secret that someone has (and thus where it falls in the 3D space generated in Study 1), we can predict how someone will experience that secret.

Shame

If one dimension that people naturally and spontaneously see their secrets as falling along is immorality, then we would expect experiences of the moral emotion shame to track this dimension of secrecy. That is, shame has been described as a moral emotion that occurs when one appraises oneself as being someone who engaged in some harm (Ortony et al., 1988; Tangney & Dearing, 2003). And thus, to the extent the secret behavior is seen as immoral, one should perceive the secret as harming well-being through feelings

Table 2

Immoral, Relational, and Profession/Goal-Oriented Well-Explained ($r_s \geq .80$) X, Y, and Z, a Triad of Orthogonal Dimensions That Run Through the Secrets' 3D Space

#	Secret	Immoral	Relational	Profession/ goal-oriented	X	Y	Z
1	Harming someone	6.82	2.97	2.27	1.87	-0.35	0.56
2	Drug use	5.44	2.38	3.95	1.85	-0.79	0.36
3	Habit or addiction	4.44	2.81	3.11	1.45	-0.89	0.34
4	Theft	6.87	1.76	4.29	1.85	-0.12	1.01
5	Illegal (nontheft) act	6.68	2.10	3.15	1.85	-0.12	1.01
6	Self-harm	3.76	1.88	1.70	1.23	-1.23	-0.21
7	Abortion	3.21	4.94	1.46	0.79	-0.08	-1.64
8	Experience of trauma	1.87	2.24	1.85	0.60	-1.52	-0.47
9	Telling a lie	4.01	2.32	2.23	0.59	0.42	1.14
10	Violating [...] trust	4.69	4.47	2.45	0.68	1.11	0.79
11	Romantic desire	1.91	6.75	1.03	-0.24	1.43	-0.96
12	Romantic discontent	2.50	6.38	1.21	-0.22	1.42	-0.86
13	Extra-relational thoughts	3.20	7.11	1.15	-0.05	1.54	-0.95
14	Emotional infidelity	3.92	7.49	1.22	-0.05	1.54	-0.95
15	Sexual infidelity	5.29	8.25	1.32	-0.05	1.54	-0.95
16	[...] "other (wo)man"	4.80	8.57	1.46	-0.05	1.54	-0.95
17	Social discontent	1.91	3.07	1.81	-0.94	0.18	0.79
18	Physical discontent	1.60	2.66	1.33	-0.42	-1.09	-0.31
19	Mental health	2.60	2.62	3.04	0.61	-1.42	-0.29
20	Cheating at work/school	5.19	1.58	5.68	0.28	0.33	1.88
21	Poor work/school performance	2.42	1.19	5.65	-0.53	-0.08	1.92
22	Professional discontent	1.61	1.56	5.82	-0.90	-0.06	1.62
23	Hobby	1.60	1.15	1.29	-1.42	-0.85	0.40
24	Hidden relationship	3.31	7.00	1.34	-0.05	1.54	-0.95
25	Family detail	2.27	2.39	1.39	-1.13	-1.25	-0.16
26	Pregnancy	2.91	5.68	2.36	0.39	0.00	-1.63
27	Sexual orientation	2.05	5.78	1.10	-0.38	0.80	-1.33
28	Sexual behavior	2.54	7.30	1.14	-0.19	1.11	-1.25
29	Not having sex	1.41	5.01	1.00	-0.34	0.99	-1.20
30	A preference	1.88	3.05	1.03	-1.35	-0.29	-0.37
31	Belief or ideology	1.85	1.82	1.27	-1.37	-0.88	0.09
32	Finances	2.67	2.55	5.03	-1.09	-0.87	1.34
33	Secret employment	2.47	1.84	6.55	-1.06	-0.36	1.61
34	An ambition	1.56	1.67	3.84	-1.41	-0.73	0.48
35	Counternorm. behavior	2.52	2.71	2.14	0.10	-1.28	0.21
36	Personal story	1.91	2.71	1.41	-0.91	-1.26	-0.11

of shame¹ (Kim et al., 2011; Orth et al., 2006, 2010). Thus, the more a secret falls along the immoral dimension (identified by the 3D model), the more participants should perceive harm and feel shame from that secret. That is, the immoral dimension should track how wrong people see their secrets, and shame is a moral emotion that occurs specifically when one appraises oneself as being someone in the wrong (i.e., someone who causes harm; Ortony et al., 1988; Tangney & Dearing, 2003).

Connectedness

Secrecy has often been considered as an act of solitude. For instance, secrecy has been associated with loneliness (Frijns & Finkenauer, 2009). Yet, if the content of secrets is seen to exist along a dimension of relationality, some secrets might be seen as connecting people to each other. A secret might involve or even protect another person, and thus it might bring individuals closer together. Thus, we would predict that if people see their secrets as having different levels of how relational they are, those secrets

would be experienced as providing different degrees of social connectedness. At the low end of this experience, we would predict reports of the secret harming well-being as feelings of isolation predict lower health (Cacioppo et al., 2002, 2003; Hawkley et al., 2003; Mellor et al., 2008). At the high end, we would predict reports of the secret benefiting well-being given that social connections and relationships foster well-being (House et al., 1988; Kawachi & Berkman, 2001; Taylor, 2006). Thus, the more a secret's content is relational, the more the secret should be experienced in terms of sociality, and thus prompt feelings of social connectedness.

¹ The reader may wonder: But what about guilt? Given that our eventual goal is to improve participants' well-being from secrecy, it made more sense to target shame rather than guilt because shame is clearly harmful to well-being, whereas guilt has a more complex and heterogeneous relationship with well-being (Schmader & Lickel, 2006; Sheikh & Janoff-Bulman, 2010; Tangney, Wagner, & Gramzow, 1992; see also Slepian & Bastian, 2017).

Insight

One of the great difficulties of secrecy is that by not talking about some ongoing personal issue, one does not get guidance, advice, and insights from others (Liu & Slepian, 2018; Slepian & Moulton-Tetlock, 2019). People may not have good insight into their secret (why they have it, how it affects them, what they can do) when trying to deal with a secret on one’s own.

Recall that the third dimension of our 3D secrecy model is goal-orientation, which often relates to one’s profession, hence the dimension is labeled profession/goal-oriented. An extensive literature finds that profession/goal-oriented behaviors and outcomes are strongly linked to agency and confidence in one’s decisions (Barbalet, 1996; Betz & Hackett, 1986; Boyd & Vozikis, 1994; Keltner et al., 2003; Lent & Hackett, 1987; Martin & Phillips, 2017; Singh & Sirdeshmukh, 2000; Wood & Bandura, 1989). Accordingly, when one’s secret seems based in goal-directed action, we predict this would be associated with feelings of insight (e.g., having clear thinking when it comes to the secret, knowing how to handle it).

Given that people seek insight into meaningful events such as those often kept secret (Segerstrom et al., 2003; Slepian, Greenaway, & Masicampo, 2020; Watkins, 2008) and self-insight predicts improved well-being (Grant, 2008; Stein & Grant, 2014; Knapp et al., 2017), we thus predicted that participants would report the secret would benefit well-being to the extent they reported feelings of insight into the secret.

Studies 2a, 2b, 2c, and 3

We hypothesized that from the data-driven model of secrecy, we can predict how ashamed participants are of their secret, how much they feel it connects them to others, and how much insight they have into it. Additionally, Studies 2a–c and 3 ask participants to report per each secret, the extent to which they perceive it as harming their well-being. We hypothesized that shame from a secret would predict finding the secret as harming well-being, whereas having insight and connectedness would predict finding the secret as benefiting well-being. These studies thus amount to the prediction that from our data-driven 3D model, we can predict not only how people experience their secrets (from knowing what category of

secret they hold), but also through those experiences, the extent to which they report those secrets as harming their well-being.

Method

In Studies 2a–c and 3, per each study (Study 2a: 73 men, 127 women, four other; $M_{age} = 34.37$ years, $SD = 10.84$; Study 2b: 73 men, 136 women; $M_{age} = 33.00$ years, $SD = 9.97$; Study 2c: 60 men, 148 women; $M_{age} = 33.29$ years, $SD = 9.88$; Study 3: 68 men, 154 women, two other; $M_{age} = 36.78$ years, $SD = 11.90$), participants indicated which of the 36 secrets they currently were keeping (see Appendix for exact wordings).

For each secret that participants currently had, participants completed measures of how ashamed they were of the secret (Studies 2a and 3), how much insight they felt they had into it (Studies 2b and 3), and how much social connection it brought them (Studies 2c and 3).

The shame items were drawn directly from Tangney and Dearing (2003); whereas the connectedness and insight scales were created for the current work (drawing from prior work on secrecy and social connection and on meaning-making; Slepian et al., 2019; Slepian, Greenaway et al., 2020). Each subscale has high reliability, and in Study 3 (where participants completed each scale), a factor analysis demonstrated the three predicted distinct factors (see Table 3).

Per each secret, participants also completed a measure of the perceived impact of the secret on well-being (from Slepian et al., 2017; Slepian, Greenaway, & Masicampo, 2020; Slepian & Moulton-Tetlock, 2019), ranging from –6 (has made my life and well-being worse) to 6 (has made my life and well-being better), midpoint 0 (has had no effect on my life and well-being).

Single-item subjective measures of well-being have been shown to have high test–retest reliability and validity, often outperforming multi-item measures and those tracking ostensibly more objective variables (see Diener et al., 2002). Importantly, to understand which secrets cause more harm than others, we needed to take our measure of well-being at the level of secret, rather than person. Participants thus report on their entire set of secrets, allowing for the opportunity to differentiate the secrets that are reported to cause more harm to well-being from those that cause less harm. Thus, in the tradition of stress and coping research, participants rated the perceived impact per each secret on their well-being (see DeLongis et al., 1988; Kubany et al., 2000).

Table 3
Experiences With Personal Secrets (i.e., How Does It Feel to Have the Secret)

Study 3 item order	Rating experience with one’s personal secret	Study 3 factor 1 shame	Study 3 factor 2 insight	Study 3 factor 3 connectedness
2	When it comes to this secret, I feel like I am a bad person.	.84	–.15	.10
5	When it comes to this secret, I feel worthless and small.	.89	–.22	.04
8	When it comes to this secret, I feel helpless and powerless.	.80	–.27	.09
3	I know how to handle this secret.	–.18	.85	<.01
6	My thinking is clear when it comes to this secret.	–.25	.87	.02
9	I have good insight into this secret.	–.19	.87	.05
1	This secret protects someone else.	.20	–.04	.71
4	This secret brings me closer to someone.	–.02	.08	.80
7	I am keeping this secret with someone else.	.02	.03	.82

Note. Shame (Study 2a $\alpha = .84$, Study 3 $\alpha = .85$); Insight (Study 2b $\alpha = .94$, Study 3 $\alpha = .87$); Connectedness (Study 2c $\alpha = .75$, Study 3 $\alpha = .68$). From 1 (not at all) to 7 (very much). Factor analysis was not possible in Studies 2a, 2b, and 2c as participants rated only shame, connectedness, or insight, respectively—that is, not all three experiences as in Study 3. Predicted factors in bold.

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Table 4

Study 2a: Predicting Participants' Shame From Their 2,939 Secrets' Data-Driven Model Coordinates (as Determined by Study 1), and Subsequently Reports of the Impact of the Secret on Well-Being

Predictor	<i>b</i>	95% CI	<i>SE</i>	<i>df</i>	<i>t</i>	<i>p</i>
Predicting shame: $M = 2.58, SD = 1.70, 95\% CI [2.51, 2.64]$						
Immoral	0.37	0.21, 0.53	0.08	31.21	4.62	.0001
Relational	0.09	-0.08, 0.25	0.08	30.86	1.02	.32
Profession/goal	-0.04	-0.20, 0.13	0.09	32.90	-0.42	.68
Predicting well-being: $M = -0.40, SD = 2.56, 95\% CI [-0.49, -0.30]$						
Shame	-0.68	-0.74, -0.63	0.03	2826.32	-24.74	<.0001
Immoral	0.11	-0.13, 0.35	0.12	31.68	0.90	.38
Relational	0.14	-0.11, 0.39	0.13	30.90	1.09	.28
Profession/goal	0.22	-0.03, 0.47	0.13	32.99	1.69	.10

Note. Predicted relationships in bold.

This measure of the perceived well-being impact of the secret has been validated in prior work; it predicts general life satisfaction as well as global reports of physical health (see Slepian et al., 2017; Slepian & Moulton-Tetlock, 2019; Slepian, Greenaway, & Masicampo, 2020), and the present work replicated this validation (see Appendix).

Study 3 extended Studies 2a–c by examining all experiences simultaneously. That is, while Studies 2a (shame), 2b (insight), and 2c (connectedness) explored one experience at a time, Study 3 had participants complete each scale to examine all experiences simultaneously.

Results

Analysis Strategy

Given multiple observations per each category of secret and per each participant, we analyzed our data via multilevel modeling. We used R-packages lme4 and lmerTest to run multilevel models using Satterthwaite approximation tests to calculate *p*-values (estimating degrees of freedom to approximate the *F* distribution, which are thus fractional and differ by predictor; Kuznetsova et al., 2013). Specifically, the covariance matrix was unconstrained, and fit models used the REML (REstricted Maximum Likelihood) criterion. The multilevel models are cross-classified (i.e., secrets are not nested within participants because the same secret can be had by multiple participants, and participants will not have every secret). Per each study, we implement these models, entering random intercepts for participant and category

of secret, and the coordinates of the particular secret—on immoral, relational, and profession/goal-oriented, as determined in Study 1—as simultaneous fixed factors, predicting the participant's experiences with that secret.

The studies were continually reposted which occasionally led to a few participants over the $N = 200$ recruitment goal. When this happened, we included such participants, thus analyzing all participants' data. At the end of each study, we included an honesty check (asking whether participants fabricated answers about their secrets; honesty was encouraged to help the researchers, and compensation was promised no matter their answer). Participants, $N_s = 7, 7, 2,$ and $3,$ who admitted to fabricating answers in Studies 2a, 2b, 2c, and 3, respectively, were thus excluded from analysis. Participants on average had 14 to 15 secrets (of the 36 categories of secrets). Across Studies 2a, 2b, 2c, and 3, we therefore collected data on 12,456 secrets kept by our participants.

To conservatively approximate achieved statistical power, we used Westfall's (2015) online application for Power Analysis in General ANOVA designs (PANGEA). Per each study, we set ($N = 200$) participants as a random factor, and we set the three dimensions as within-subjects fixed factors with two levels each (i.e., high vs. low on immoral, high vs. low on relational, and high vs. low on profession/goal-oriented). We set replications per each unique combination of fixed factor levels to 1, meaning that each participant had $2 * 2 * 2 * 1 = 8$ secrets in total. These settings returned achieved statistical power of $1 - \beta = .959$ for finding main effects of the fixed factors with a size of $d = .2$.

Table 5

Study 2b: Predicting Participants' Feelings of Insight From Their 3,152 Secrets' Data-Driven Model Coordinates (as Determined by Study 1), and Subsequently Reports of the Impact of the Secret on Well-Being

Predictor	<i>b</i>	95% CI	<i>SE</i>	<i>df</i>	<i>t</i>	<i>p</i>
Predicting insight: $M = 5.43, SD = 1.72, 95\% CI [5.37, 5.49]$						
Immoral	-0.004	-0.13, 0.12	0.06	32.66	-0.07	.95
Relational	0.08	-0.04, 0.21	0.06	32.10	1.32	.20
Profession/goal	0.21	0.08, 0.34	0.07	35.41	3.22	.003
Predicting well-being: $M = -0.33, SD = 2.94, 95\% CI [-0.44, -0.23]$						
Insight	0.76	0.70, 0.82	0.03	3099.34	25.51	<.0001
Immoral	-0.35	-0.60, -0.11	0.13	32.13	-2.80	.009
Relational	0.12	-0.14, 0.37	0.13	31.77	0.89	.38
Profession/goal	0.21	-0.05, 0.47	0.13	34.52	1.56	.13

Note. Predicted relationships in bold.

Table 6

Study 2c: Predicting Participants' Feelings of Connectedness From Their 3,117 Secrets' Data-Driven Model Coordinates (as Determined by Study 1), and Subsequently Reports of the Impact of the Secret on Well-Being

Predictor	<i>b</i>	95% CI	<i>SE</i>	<i>df</i>	<i>t</i>	<i>p</i>
Predicting connectedness: <i>M</i> = 2.71, <i>SD</i> = 1.85, 95% CI [2.65, 2.78]						
Immoral	0.08	−0.16, 0.33	0.12	32.44	0.68	.50
Relational	0.23	−0.02, 0.48	0.13	32.14	1.78	.08
Profession/goal	−0.27	−0.52, −0.02	0.13	33.40	−2.08	.05
Predicting well-being: <i>M</i> = −0.42, <i>SD</i> = 3.01, 95% CI [−0.52, −0.31]						
Connectedness	0.23	0.16, 0.29	0.03	3020.08	7.12	<.0001
Immoral	−0.38	−0.68, −0.08	0.15	32.32	−2.45	.02
Relational	0.08	−0.23, 0.39	0.16	31.81	0.52	.61
Profession/goal	0.26	−0.06, 0.58	0.16	34.14	1.60	.12

Note. Predicted relationships in bold.

Study 2a: Shame

The more a secret fell higher on the immoral dimension (as determined by Study 1 participants), the more participants felt ashamed of their secret (see Table 4). In contrast, how relational and profession/goal-oriented it was according to the model did not predict how ashamed participants were of their secret (see Table 4).

Study 2b: Insight

We found that the more a secret fell higher on the profession/goal-oriented dimension (as determined by Study 1 participants), the more participants felt they had insight into their secret (see Table 5). In contrast, how relational and immoral the secret was according to the model, did not predict how much insight participants felt they had into their secret (see Table 5).

Study 2c: Connectedness

The more a secret fell higher on the relational dimension (as determined by Study 1 participants), directionally, the more participants felt the secret made them socially connected (although this effect did not reach the threshold of significance; Table 6). Unexpectedly, the less profession/goal-oriented the secret according to the model, the more participants indicated the secret made them feel connected to others (at the threshold of significance), and the immoral dimension did not predict experienced connectedness (see Table 6).

Studies 2a–2c: Perceived Impact on Well-Being

Next, independent of the secrets' coordinates on the immoral, relational, and profession/goal-oriented dimensions, we found that each experience with secrecy predicted the extent to which the secrets were reported to harm well-being. The more shame participants felt from their secret, the more they indicated the secret hurt their well-being (see Table 4). The more insight participants felt they had into their secret, the less they indicated the secret hurt their well-being (see Table 5). The more participants felt the secret connected them to others, the less they indicated the secret hurt their well-being (see Table 6).

Discussion

These studies conformed to each of our predictions, with the exception of Study 2c. How relational the secret was (as determined by another group of participants) was not significantly predictive of reports of social connectedness, and the less profession/goal-oriented

the secret (as determined by another group of participants), the more connectedness participants felt from the secret (at the threshold of significance). This led us to examine the relationships again, and this time critically, capturing all experiences simultaneously.

Study 3: Shame, Insight, and Connectedness

While the dimensions from the model are approximately orthogonal to each other, the experiences related to the dimensions may not be orthogonal to each other, particularly as they are all related to reports of the impact of the secret on well-being. By having Study 3 participants rate each experience, we can examine their independent effects.

As Study 3 participants reported shame, insight, and connectedness, we were able to examine the data-driven coordinates of the particular secret as simultaneous predictors of each experience with secrecy, accounting for the other two experiences (see Table 7). This revealed that independent of the other two experiences, only the immoral dimension predicted how ashamed participants were of their secret. Likewise, independent of the other two experiences, only the profession/goal-oriented dimension predicted how much insight participants felt they had into their secret. And finally, independent of the other two experiences, only the relational dimension positively predicted how much the participant felt their secret connected them to others (there was an unexpected negative directional relationship between the profession/goal-oriented dimension and feelings of connectedness, but this did not reach the threshold of significance). Thus, when accounting for all experiences simultaneously, we only see the predicted dimension-experience relationships. Additionally, each of shame, insight, and social connection from the secret independently predicted the extent to which participants reported the secret harmed their well-being (see Table 7).

Discussion

In Study 1, we obtained coordinates for where each of 36 common categories of secrets are seen to consensually fall into a data-driven space spanned by the three dimensions: immoral, relational, and profession/goal-oriented. Studies 2a–2c and 3 then validated the model, examining how people experience their real-world personal secrets.

From the 36 secrets' coordinates on the three dimensions, immoral, relational, and profession/goal-oriented, we can predict how people, who have such secrets, experience those secrets. That is, we can predict (a) how ashamed they are of their secrets from where those secrets fall along the immoral dimension of the model. We can predict (b)

Table 7

Study 3: Predicting Participants' Feelings of Shame, Insight, and Connectedness From Their 3,248 Secrets' Data-Driven Model Coordinates (as Determined by Study 1), and Subsequently Reports of the Impact of the Secret on Well-Being

Predictor	<i>b</i>	95% CI	<i>SE</i>	<i>df</i>	<i>t</i>	<i>p</i>
Predicting shame: $M = 2.67$, $SD = 1.81$, 95% CI [2.61, 2.74]						
Immoral	0.33	0.19, 0.46	0.07	30.18	4.81	<.0001
Relational	0.04	-0.10, 0.18	0.07	29.47	0.59	.56
Profession/goal	0.03	-0.11, 0.17	0.07	31.56	0.37	.71
Insight	-0.42	-0.46, -0.39	0.02	3,160.45	-23.50	<.0001
Connectedness	0.13	0.10, 0.16	0.02	3,117.79	8.04	<.0001
Predicting insight: $M = 5.38$, $SD = 1.62$, 95% CI [5.32, 5.44]						
Immoral	-0.01	-0.08, 0.06	0.03	34.76	-0.33	.75
Relational	0.02	-0.05, 0.09	0.03	30.93	0.65	.52
Profession/goal	0.09	0.02, 0.16	0.04	34.75	2.52	.02
Shame	-0.34	-0.37, -0.31	0.01	3053.37	-23.49	<.0001
Connectedness	0.09	0.06, 0.12	0.01	1,885.01	6.55	<.0001
Predicting connectedness: $M = 2.83$, $SD = 1.83$, 95% CI [2.77, 2.90]						
Immoral	-0.04	-0.27, 0.20	0.12	32.78	-0.29	.77
Relational	0.30	0.05, 0.54	0.13	32.23	2.36	.02
Profession/goal	-0.23	-0.47, 0.02	0.13	33.23	-1.77	.09
Shame	0.15	0.11, 0.19	0.02	3221.24	8.05	<.0001
Insight	0.13	0.09, 0.17	0.02	3171.49	6.38	<.0001
Predicting well-being: $M = 0.02$, $SD = 2.83$, 95% CI [-0.08, 0.12]						
Shame	-0.53	-0.59, -0.48	0.03	3222.36	-18.98	<.0001
Insight	0.50	0.44, 0.57	0.03	3110.60	16.30	<.0001
Connectedness	0.23	0.18, 0.28	0.03	3078.96	8.99	<.0001
Immoral	-0.17	-0.37, 0.03	0.10	32.15	-1.69	.10
Relational	0.12	-0.08, 0.33	0.10	30.81	1.19	.24
Profession/goal	0.13	-0.08, 0.34	0.11	33.21	1.21	.24

Note. Predicted relationships in bold.

how much insight participants have into their secrets from where those secrets fall along the profession/goal-oriented dimension. And we can predict (c) how much participants feel their secrets connect them to others from where those secrets fall along the relational dimension.²

Additionally, through each of those experiences (shame, insight, connectedness), we were able to predict participants' well-being reports. Thus, each separable dimension of the secret space (how immoral the secret is, how relational, and how profession/goal-oriented) had a unique experiential pathway to the reported impact of that secret on well-being.

It is important to note that the secret space dimensions should not be considered as trade-offs to one another. For example, a secret can be high on multiple dimensions. A secret about an emotional infidelity may be perceived as highly immoral but also highly relational, with resulting feelings of shame predicting reports of lower well-being, but perhaps offset some by potential feelings of connectedness. The 3D model points specifically to this possibility. A secret can exist anywhere along the three separable dimensions, with three unique corresponding experiences, each related to reports of well-being from the secret.

Reframing Interventions From the Data-Driven Model: Studies 4 and 5

Study 1 took a data-driven approach, identifying three dimensions of secrets (immoral, relational, and profession/goal-oriented), and Studies 2a–c and 3 demonstrated the model's predictive validity, predicting reports of shame, insight, and connectedness felt from secrets with another group of participants. Moreover, each of those

experiences reliably predicted reports of the well-being impact of the secret (including when controlling for the other two experiences), which raises an important prospect. If secrets are seen to vary on these three dimensions, each of which independently relates to reports of well-being (through their experiential correlates), this suggests a way to reframe individuals' secrets. Studies 4 and 5 take this approach.

Study 4 introduces a new *framing endorsement intervention* that increased feelings of efficacy in coping with a secret, and thereby a sense of well-being. Study 5 then implemented this intervention again, but with a repeated measures design (and examined secrets kept from romantic partners), finding that the effects on reports of coping efficacy related to daily indicators of relationship quality.

Study 4: A Framing Endorsement Intervention

Method

Study 4 had a procedure similar to that in Studies 2a–c and 3, whereby participants (75 men, 128 women; $M_{age} = 33.93$ years, $SD = 11.38$) were provided with the list of 36 common categories of

² An additional study reported in the SOM confirms that we can predict participants' content ratings of their own secret from merely knowing the category of the secret (and thus where it falls in the three-dimensional space generated in Study 1). Specifically, the immoral dimension uniquely predicts how much a person sees their secret behavior as wrong and harmful; the relational dimension uniquely predicts how much a person sees their secret as involving another person, and the profession/goal-oriented dimension uniquely predicts how much a person sees their secret as tied to one's agentic behaviors and aspirations.

secrets (that fit the 3D model) and per each current secret they had, participants completed a series of measures. Specifically, per each secret participants had, they completed a measure of perceived efficacy in coping with that secret (from Slepian & Moulton-Tetlock, 2019): (a) “How capable do you feel in your ability to cope with this secret?”; (b) “How much do you feel in control over this situation?”; and (c) “How well do you feel like you are handling the secret?” from 1 = *not at all* to 7 = *very much* ($\alpha = .92$).

Preceding the coping efficacy measure, for a randomly determined half of participants’ secrets, we presented a new framing endorsement manipulation that allowed the participant to self-tailor their (randomly assigned) framing intervention (described next). Finally, participants also completed the same measure of the secret’s perceived impact on well-being from the preceding studies (scale ranging from -6 [has made my life and well-being worse] to 6 [has made my life and well-being better]).

For a random half of participants’ secrets, presented first, there was no framing manipulation. Subsequently, for the random remaining half of participants’ secrets, they were asked, “Which option fits your situation best?” Options: (a) “This secret protects someone I know”; (b) “There is no harm in having this secret”; or (c) “I have good insight into this secret (why I have it and/or how to handle it).” These options paralleled the three experiences with secrecy we predicted from the model, connectedness, shame (reversed), and insight. Thus, the framing intervention (when presented) put participants into the mindset of choosing a framing that was most available to them, and the intervention appeared before the measures of perceived coping efficacy and well-being.

Why provide participants a choice like this? The risk of reframing interventions is that if participants feel they cannot endorse the provided framing, then in making that very judgment, they are contrasting their situation away from the intended influence of the framing (see Slepian, Masicampo, et al., 2016). For instance, if a participant feels that they are lacking insight into a secret, we suggest that a simple suggestion to *think about when you have had insight into the secret* would not be particularly useful; in such a context, asking a participant this question is likely to lead to contrast effects.

Instead, we simply ask the participant which reframing they can endorse best. When combined with experimentally presenting the framing or not, the researcher retains experimental control (i.e., the comparison between framing vs. a no framing baseline condition), while also allowing the intervention to be flexible enough to be more universally useful. By asking participants to choose the item that is most available to them, the participant is put into an endorsement mindset, and picks the resource deemed most available for coping with the secret. Irrespective of what they choose, this should serve to increase feelings of efficacy in coping with the secret and accordingly reduce the extent to which the secret is perceived to harm well-being.

We predicted the presence (vs. absence) of the framing endorsement manipulation would improve feelings of efficacy in coping with the secret, which in turn would reduce the extent to which participants report the secret is harmful to their well-being.

Results

Participants had on average 13.91 secrets of the 36 categories ($SD = 6.58$, 95% CI [13.00, 14.83]), with 197 participants having at

least one of the secrets. Participants in total had 2,783 secrets. As in the earlier studies, we included an honesty check at the end of the study, and three participants who admitted to fabricating answers were excluded from analysis.

As in Studies 2a–c and 3, given multiple secrets per participant, we analyzed the data via the same multilevel modeling approach used in the prior studies, entering random intercepts for participant and category of secret, and whether the framing intervention was presented (1), versus not (0) as a fixed factor, predicting reported efficacy in coping with the secret.

We used Westfall’s (2015) PANGEA application, setting ($N = 200$) participants as a random factor and reframing intervention as a within-subjects fixed factor with two levels (that is, yes versus no). We set replications per each unique level of the fixed factor to 4, meaning that each participant had $2 * 4 = 8$ secrets in total. These settings returned achieved statistical power of $1 - \beta = .836$ for finding a main effect of the fixed factor with a size of $d = .2$.

The framing intervention increased feelings of efficacy in coping with the secret, $b = .34$, 95% CI [.25, .42], $SE = .05$, $t(2613.73) = 7.42$, $p < .0001$. Additionally, the framing intervention improved feelings of well-being, $b = .54$, 95% CI [.36, .73], $SE = .09$, $t(2643.53) = 5.80$, $p < .0001$.

Ample evidence suggests that interventions that directly target coping efficacy improve well-being outcomes (for example, Antoine et al., 2019; Bodenmann & Shantinath, 2004; Chirico et al., 2017; Hilpert et al., 2016; Zemp et al., 2017). Thus, it is possible that the beneficial effect we found is, in part, explained by increased perceptions of efficacy in coping with the secret. If so, we would expect a relationship between feelings of perceived efficacy in coping with the secret and the well-being impact of that secret (after accounting for experimental condition). Indeed, we found this relationship.

When entering both reported efficacy in coping with the secret and the framing intervention as simultaneous predictors of the reported well-being impact of the secret, feelings of coping efficacy significantly predicted the reported well-being impact of the secret, $b = .90$, 95% CI [.83, .97], $SE = .03$, $t(2759.51) = 26.02$, $p < .0001$; and so did the framing intervention, $b = .25$, 95% CI [.08, .41], $SE = .08$, $t(2628.89) = 2.95$, $p = .003$. This suggests the possibility that the framing intervention offers benefits, as function of increasing feelings of coping efficacy, but also that the intervention offers additional benefits beyond fostering coping efficacy (for example, such as fostering increased hope, Feldman & Dreher, 2011; or reducing perceptions of stress, Jamieson et al., 2018).

Discussion

The 3D model predicts multiple ways through which a secret may be harmful to well-being, from which we developed a new framing endorsement intervention. The intervention was experimental in that it was randomly presented or not. When it was presented, participants were asked which framing was most applicable. To endorse a framing was, by design, theoretically similar to endorsing a corresponding resource for coping. Indeed, the presence of the manipulation increased feelings of coping efficacy with respect to the secret, and in turn predicted reductions in the extent to which participants reported the secret harmed their well-being. But would this have effects beyond just the moment of the intervention? Study 5 was a repeated measures study addressing this very question.

Study 5: Reframing Secrets Kept From Romantic Partners

Study 4 found that the new reframing intervention based on our data-driven model of secrecy increased feelings of efficacy in coping with the secret. When people feel they have higher coping efficacy, they become more motivated to improve their coping, which sets in motion a set of processes that indeed improve coping (Kneeland et al., 2016). A large literature demonstrates the well-being benefits of feeling efficacious, including enhanced physical and mental health (Alloy et al., 1984; Brown & Siegel, 1988; Godin & Kok, 1996; Greenaway et al., 2015; Helliwell et al., 2013; Langer & Rodin, 1976; Peterson & Stunkard, 1989). Thus, if captured across time, the increased feelings of efficacy that follow from our intervention may relate to better daily coping.

Recall that in the introduction we cited evidence that what seems most harmful about secrecy is not moments of concealment, but rather having to live with and think about a secret. That is, when examining the two simultaneously, only the frequency of mind-wandering to secrets, not concealing them, predicts the extent to which participants report lower well-being from the secret (McDonald et al., 2020; Slepian et al., 2017; Slepian, Greenaway, & Masicampo, 2020; Slepian & Moulton-Tetlock, 2019).

Building from this insight, we proposed that our intervention might relate to better coping, as indicated by the frequency with which participants mind-wander to their secret. Repetitive mind-wandering is a form of maladaptive coping (Ottaviani et al., 2013; Slepian & Moulton-Tetlock, 2019; Wayment et al., 2015). Prior work has related mind-wandering to a secret to reports of the well-being harm of that secret (Slepian et al., 2017), and hence, mind-wandering to secrets may predict daily negative outcomes.

Prior work finds that when someone is keeping a secret, interaction quality with the person whom the secret is kept from can suffer (Newheiser & Barreto, 2014; see also Newheiser et al., 2015). Secrecy has been associated with both lower interaction quality and reduced intimacy (Newheiser & Barreto, 2014). Thus, in our final study we examined secrets from partners, and we measured daily relationship closeness, relationship satisfaction, positivity of social interactions with one's partner, and negativity of social interactions with one's partner.

Method

Anticipating participant attrition across days, we increased our recruitment to 300 participants. Additionally, in examining the effects of reframing a secret over time, rather than reframing multiple secrets per participant, now participants recalled a single secret that they were keeping. Consistent with prior work using this method (Slepian et al., 2017), to reduce error variance we held the target (whom the secret is kept from) constant. We recruited participants on Mechanical Turk (105 men, 195 women; $M_{\text{age}} = 35.12$ years, $SD = 10.95$) who were in a committed relationship and asked them to think of a secret that they were purposefully keeping from their partner.

As a series of manipulation checks, we asked participants whether their partner was aware of the secret (if yes, it was a

failed manipulation check), and at the end of the study, whether they described a real secret (if no, it was a failed manipulation check). Participants who passed both checks ($N = 251$) were invited to take part in the study, and 235 signed up (77 men, 158 women; $M_{\text{age}} = 35.19$ years, $SD = 11.00$). Participants were incentivized to complete five nightly installments of the study by being paid a monetary bonus if all five nights were completed. If participants registered responses on a given night, they were invited for the next night; 178, 125, 115, 106, and 101 participants completed Days 2, 3, 4, 5, and 6, respectively.

Day 1: Reframing Intervention and Perceived Coping Efficacy

Once participants indicated that they would take part in the multi-day portion of the study, we randomly presented the Study 4 reframing intervention, or not, and then measured perceived efficacy in coping with the secret, using the measure from Study 4.

We used Faul et al.'s (2009) G*POWER application, setting ($N = 235$) participants as a random factor and reframing intervention as a between-subjects fixed factor with two levels (that is, yes versus no). These settings returned achieved statistical power of $1 - \beta = .332$, $.629$, and $.862$ for finding a main effect of the fixed factor with a size of $d = .2$, $.3$, and $.4$, respectively.

Days 2–6: Experiences With Secrecy and Downstream Outcomes

On Day 2, upon entering the study—to reinforce the manipulation one time only—for those randomly assigned to the reframing condition, we again presented the three options, and asked if they recalled which they chose, and why they chose it. Per each night of the study (Days 2–6), participants answered questions with respect to what happened that day: how frequently participants spontaneously thought about the secret (when not with their partner; that is, mind-wandering frequency), and how frequently participants had to conceal their secret when interacting with their partner (that is, concealment frequency; from Slepian et al., 2017). Additionally, rather than measure subjective global well-being per each day, we sought more specific indicators of relationship and social interaction quality. We asked, “How satisfied in your relationship did you feel today?”; “How close did you feel to your partner today?” (1-not at all to 7-very much); “How many of your interactions with your partner today were negative in nature?”; and “How many of your interactions with your partner today were positive in nature?” (1-none of them to 7-most of them)

We predicted that the reframing intervention (when presented versus not) would increase feelings of efficacy, as in Study 4. We predicted that as a function of this increase, we would see reductions in daily repetitive mind-wandering to the secret (as repetitive mind-wandering is a reflection of maladaptive coping; Ottaviani et al., 2013; Slepian & Moulton-Tetlock, 2019; Wayment et al., 2015).

Additionally, reframing interventions that reduce rumination, can—in the context of coping with the difficulties of romantic relationships—promote relationship quality (see Finkel et al., 2013). Thus, we predicted that repetitive mind-wandering to the secret from one's partner would predict daily indicators of relationship quality.

Results

Perceived Efficacy in Coping With the Secret

On Day 1 of the study, participants completed a measure of perceived efficacy in coping with the secret. As in Study 4, the presence (vs. absence) of the reframing intervention increased feelings of efficacy (see Table 8).

Daily Mind-Wandering to and Concealment of Secrets

We next examined whether the resulting feelings of efficacy in coping with the secret predicted how frequently participants mind-wandered to and concealed their secrets across each day (implementing the multilevel modeling approach from the earlier studies).

We examined whether Day 1 reports of coping efficacy predicted daily mind-wandering and concealing frequencies, while including the reframing intervention (presented versus not) as a fixed factor along with day of study (including a random intercept for participant). This revealed that feelings of coping efficacy (which varied as a function of reframing versus not), independently predicted reduced daily mind-wandering to the secret as well as reduced daily concealment of the secret (see Table 8).

Daily Indicators of Relationship Quality

Finally, we examined whether the four relationship quality items formed a reliable scale (reverse scoring the one negatively-worded item). Indeed, this was the case ($\alpha = .86$), and a scree plot indicated one factor. We thus calculated an average of the four items as a measure of daily indicators of relationship quality, and entered all other variables as simultaneous predictors of the relationship quality composite (see Table 9).

Mind-wandering frequency uniquely predicted daily indicators of relationship quality. Interestingly, while perceived efficacy in coping with the secret was associated with reduced concealment as well, concealment frequency was not associated with daily indicators of relationship quality. This is consistent with past work, which found that only the frequency of mind-wandering to secrets from one’s partner (not concealment) predicted lower relationship quality (Slepian et al., 2017).

The preceding analysis replicates the general pattern seen in prior work, which is that mind-wandering to secrets is uniquely

associated with reports of harm to well-being, whereas concealment is not (McDonald et al., 2020; Slepian et al., 2017; Slepian, Greenaway, et al., 2020; Slepian & Moulton-Tetlock, 2019).

Discussion

From a set of three options paralleling the three dimensions of secrets (found in Study 1, and validated in Studies 2a–c and 3), participants chose a reframing for their secret, which pointed out a way in which their secret did not have to hurt them. As predicted, in Studies 4 and 5, reframing the secret in this way (versus no framing) fostered feelings of efficacy in coping with that secret.

With increased perceptions of coping efficacy, people become more motivated to expand effort to improve their coping, including through confronting negative affect, regulating one’s emotions, reappraising a stressor, and finding healthier ways to think through the stressor for improved well-being (Kneeland et al., 2016). Repetitive mind-wandering is a form of maladaptive coping (Ottaviani et al., 2013; Slepian & Moulton-Tetlock, 2019; Wayment et al., 2015). And indeed, Study 5 found that reported coping efficacy, which varied as a function of the intervention, predicted this measure of maladaptive coping, which in turn predicted daily indicators of relationship quality.

General Discussion

Prior work on secrecy suggests that it is not concealment during social interactions that is most harmful, but having to live with and think about a secret (McDonald et al., 2020; Slepian et al., 2017, 2020; Slepian & Moulton-Tetlock, 2019). Whereas the actions people take to conceal a secret in conversation should be same across secrets (that is, monitoring and expressive inhibition, and alteration; Critcher & Ferguson, 2014; Slepian, in press), the content of the secret, and thus the content of where people’s minds so frequently wander, will of course vary. We leveraged the diversity of the common kinds of secrets people keep to explore how the content of such secrets relates to the reported well-being harm of the secret.

In Study 1, we uncovered three separable dimensions by which people naturally see common categories of secrets as varying along. Secrets are seen to differ in how immoral they are (is the secret behavior wrong and harmful?), how relational they are (does

Table 8

Study 5: Predicting Coping Efficacy (Measured on Day 1) From the Reframing Intervention (Day 1), and Subsequent Mind-Wandering to and Concealing the Secret Over the Course of the Multi-Day Study

Predictor	<i>b</i>	95% CI	<i>SE</i>	<i>df</i>	<i>t</i>	<i>p</i>
Predicting coping efficacy: <i>M</i> = 5.86, <i>SD</i> = 1.27, 95% CI [5.70, 6.03]						
Reframing (yes vs. no)	0.39	0.06, 0.71	0.17	231	2.35	.02
Predicting daily mind-wandering to secret: <i>M</i> = 1.68, <i>SD</i> = 2.38, 95% CI [1.48, 1.88]						
Coping efficacy	−0.29	−0.56, −0.01	0.14	134.29	−2.06	.04
Reframing (yes vs. no)	−0.09	−0.77, 0.58	0.35	167.94	−0.27	.78
Day of study	−0.07	−0.17, 0.04	0.05	422.96	−1.28	.20
Predicting daily concealing of secret: <i>M</i> = 0.60, <i>SD</i> = 1.05, 95% CI [0.51, 0.69]						
Coping efficacy	−0.15	−0.26, −0.03	0.06	128.16	−2.50	.01
Reframing (yes vs. no)	−0.11	−0.40, 0.18	0.15	155.52	−0.75	.45
Day of study	0.02	−0.03, 0.07	0.03	422.62	0.71	.48

Note. Predicted relationships in bold.

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Table 9
Predicting Daily Indicators of Relationship Quality, Study 5

Predictor	<i>b</i>	95% CI	<i>SE</i>	<i>df</i>	<i>t</i>	<i>p</i>
Predicting daily indicators of relationship quality: $M = 5.67$, $SD = 1.39$, 95% CI [5.58, 5.77]						
Mind-wander freq.	-0.10	-0.14, -0.05	0.02	478.56	-4.03	.0001
Conceal freq.	0.03	-0.07, 0.13	0.05	483.92	0.53	.59
Coping efficacy	0.08	-0.07, 0.24	0.08	44.87	1.07	.29
Reframing (yes vs. no)	-0.36	-0.74, 0.03	0.20	141.86	-1.83	.07
Day of study	0.02	-0.04, 0.07	0.03	416.82	0.55	.58

Note. Predicted relationships in bold.

it relate to a relationship or involve another person?), and how profession/goal-oriented they are (is it tied to one's agentic behaviors and aspirations?).

We then theorized how these three dimensions would in turn predict reports of well-being from the secret, by identifying three related experiences. Indeed, Studies 2a–c and 3 found, from the respective secret dimension coordinates, that we could predict how ashamed participants were of their secrets, how much the secrets offered social connection, and how much insight they felt they had into their secrets. Each of these experiences, in turn, independently predicted the extent to which participants reported the secret as harmful to their well-being.

Subsequently, we conducted two experiments, Studies 4 and 5. Providing participants with three potentially helpful framings (that is, ways in which a secret does not have to hurt) fostered feelings of efficacy in coping with the secret (participants were asked to endorse the most helpful framing). Study 4 found that this perceived efficacy predicted a reduction in the perceived harm of the secret on well-being, and Study 5 found that this related to improved coping (that is, reduced daily mind-wandering to the secret), which in turn was related to daily indicators of relationship quality.

The 3D Model of Secrets: Overlaps With Social Evaluation and Mental State Dimensions

A natural question one might ask is: Why do the dimensions immoral, relational, and profession/goal-oriented best describe the content of commonly kept secrets? Strikingly, these three dimensions resemble the dimensions in content models that describe social evaluation across target domains (Abele et al., 2016, 2020; Brambilla & Leach, 2014; Goodwin et al., 2014; Koch et al., 2020; Landy et al., 2016; Wojciszke, 1994), and also resemble the three primary dimensions of mental states (valence, social impact, and rationality; Tamir & Thornton, 2018; Tamir et al., 2016; Thornton & Tamir, 2019a, 2019b, 2020; Thornton et al., 2019).

Thriving as an individual requires winning others' trust and forming alliances as well as building skills and asserting them. Thus, people evaluate the extent to which groups, others, and the self are moral (signaling trustworthiness), friendly (signaling opportunities for socializing and forming alliances), able (signaling resourcefulness), and assertive (signaling willingness to compete). Some models of social evaluation subsume these dimensions under two higher-order dimensions, popularly labeled the "Big Two" dimensions of social cognition, such as communion and agency (Abele & Wojciszke, 2014; Koch et al., 2016), warmth and competence (Cuddy et al., 2009; Fiske et al.,

2002, 2007), horizontal and vertical (Abele et al., 2020; Ellemers et al., 2020; Koch et al., 2021).

A recently posed theoretical question is why models of social judgment, evaluation, and representation are so often summarized as two broad constellations of human attributes. Why do people tend to perceived humanity as if it has two broad ways of being? Martin and Slepian (2020) have recently argued that the answer lies in human history. For millennia, there have been historically two very different kinds of people engaged in very different kinds of behaviors: males and females. Even in the modern world, where gender equality is on the rise, still people often slot themselves into gender roles, women nurturing and caring for children (the first dimension capturing moral traits like compassion and caring), and men, relative to women, are still overrepresented in leadership roles and engaged in violent behavior (the second dimension capturing traits like agency and assertiveness).

Proponents of the horizontal and vertical model (Abele et al., 2020) argue that depending on the target domain and other contextual variables, modeling three or four, rather than two dimensions, may be advisable. For example, morality and friendliness items load on separate factors when people evaluate their ingroup or an outgroup (Brambilla et al., 2011; Leach et al., 2007; see also Landy et al., 2016). Morality and friendliness overlap with immorality and relationality in our 3D model. Thus, the model is consistent with the horizontal dimension, and secrets are another target domain in which separating morality and friendliness/sociality is advisable. Interestingly, ability and assertiveness overlap with profession/goal-orientation in our 3D model, also making it consistent with the vertical dimension. However, for reasons that future research should reveal, separating ability and assertiveness does not better describe the target domain of secrets.

An entirely separate stream of research, with very different methods, finds three dimensions of mental states more broadly. Tamir et al. (2016) conducted a neuroimaging study that asked participants to consider a person experiencing a variety of mental states. On each trial, they considered one mental state from a set of 60. Using a combination of multivoxel pattern analysis and multi-dimensional scaling, they found three dimensions predicted neural activation during mental state representation: valence, social impact, and rationality. Multiple follow-up studies replicated this result (for example, Tamir & Thornton, 2018; Thornton & Tamir, 2019a, 2019b, 2020; Thornton et al., 2019). Additionally, these three dimensions were compared to 58 different candidate dimensions for describing mental states (each drawn from other theories), and not a single combination did better at predicting how the brain represents mental states than the three dimensions of valence, social impact, and rationality (Thornton & Tamir, 2020).

That these three dimensions map onto the present work is notable as the data sources are entirely different (that is, similarity ratings of secrets versus neuroimaging data during mental state representation). Likewise, both map onto the primary dimensions of person traits: morality and sociality (horizontal and communal traits), and competence and assertiveness (vertical and rank-based traits; Abele et al., 2016). Indeed, a final (SOM) study further demonstrates this overlap. From the 3D model, we could also predict how much participants rated their behavior as wrong and harmful, based in sociality, and based in agency.

To be human is to navigate the balance of getting along (sociality/relationality), getting ahead (agency/profession/goal-orientation), and doing the right thing (morality, valence). Just as we see human traits and mental states as existing along these three dimensions, the very behaviors we keep secret are seen to fall along the same three dimensions.

Future Directions and Limitations

The present work found with a theoretically unconstrained approach that secrets are naturally seen to vary along three dimensions. This finding is novel in and of itself as it revealed that there is some consensus about the content of people's secrets. An alternative possibility would be that there is no latent structure to how people think about their secrets, and that what people keep secret is idiosyncratic. Our dimensional model of secrecy thus shifts a psychology of secrecy away from an idiographic approach to a nomothetic approach. This shift answers a pressing theoretical question. What is it about secrecy that predicts reports of harm to well-being? The current work finds three independent answers to this question. We find that secrets can be seen to refer to immoral behaviors, associated with shame; secrets can be seen to refer to experiences that are devoid of sociality, associated with feelings of reduced connectedness; or secrets can be seen to refer to experiences that are low in terms of agency and goal-directed action, associated with feelings of reduced insight into the secret. Each experience, in turn, was independently associated with the extent to which participants reported that the secret hurt their well-being.

Future work could explore a range of questions from our 3D model of secrets (including the coordinates of where common categories of secrets fall in that space, which we provide in Table 2). For instance, while the present data indicate the dimensions are orthogonal to each other (Study 1), there is the possibility that these dimensions of secrets interact to predict downstream experiences. While interactive effects were not the focus of the present work, there was one reliable interaction across all Study 2 and Study 3 analyses. Specifically, in both Studies 2 and 3, there was an interaction between where a secret was consensually perceived along the immoral dimension and the profession/goal-orientation dimension in predicting reports of shame. At all levels of profession/goal-orientation, the higher the immoral coordinates of the secret, the more shame participants reported from their secret. Yet, as the secret was more profession/goal-oriented, the immoral coordinates less strongly predicted how much the secret caused the participant shame. It seems that as immoral secrets are more related to clear agentic goals and aspirations, people experience them as less shame-inducing (see SOM for a full report of all interaction tests).

Additionally, any individual difference question one might have for secrecy becomes far more tractable when recognizing that secrets are seen to exist along three primary dimensions. Questions of how the content of secrets varies across age, gender, and culture are far more tractable when recognizing secrets are seen to differ on three dimensions.

Perhaps most critically, finding that the three dimensions of secrets predicted experiences that relate to reports of well-being suggested three different coping resources that could be available to someone with a secret. That is, helping someone recognize that their secret is not wrong should reduce shame; helping someone recognize that their secret is relational should reduce feelings of isolation; and helping someone recognize that their secret is based in agency or is goal-oriented should increase feelings of insight into the secret.

Finding three dimensions by which people naturally see their secrets as falling along suggested that we could present people with three different beneficial framings that might be available to them (versus no intervention). By simply having participants select which framing was most available to them, we put participants in a mindset of identifying a dimension in which their secret was not hurting their well-being. Indeed, this intervention fostered feelings of efficacy in coping with the secret (Studies 4 and 5), and this increase was in turn associated with reduced daily harms of secrecy (Study 5).

Future work would benefit from exploring other aspects of well-being. Given that our participants had multiple secrets, the present work took this measure at the level of secret, and in the tradition of stress and coping research, measured the perceived impact of that secret on well-being. Yet, another approach is to measure well-being at the level of person. For instance, prior work found that the more frequently individuals mind-wandered to a secret kept from their partner, the lower their overall satisfaction with life was (Slepian et al., 2017). Prior work has also demonstrated that reports of the well-being impact of a secret predicts person-level well-being measures like life satisfaction and physical health (Slepian et al., 2017; Slepian & Moulton-Tetlock, 2019; Slepian, Greenaway, & Masicampo, 2020). Yet, the present work did not link the three dimensions of secrets to these person-level well-being outcomes. Future work on the three dimensions of secrets would benefit from examining global well-being.

A particularly novel aspect of this work that could be translated to other domains is taking a data-driven approach to identify the primary dimensions by which people experience a phenomenon, with an eye toward linking these to reports of well-being. We uniquely translated this bottom-up approach into an intervention that is scalable in the sense that it can be implemented easily online, without knowing anything about someone's secret. Simply asking people to choose one framing (from a larger set) offers the desirable feature of leading individuals to endorse one of those beneficial framings, which we found fostered feelings of efficacy in coping with the secret. Simply feeling more capable in one's coping can have beneficial influences on the coping process, improving well-being (Alloy et al., 1984; Brown & Siegel, 1988; Godin & Kok, 1996; Greenaway et al., 2015; Helliwell et al., 2013; Langer & Rodin, 1976; Peterson & Stunkard, 1989).

In sum, through multiple layers of validation, we present a 3D model of secrets. Along with each of the secret's coordinates, this new model allows for testing a range of questions about the nature

of people's secrets and how they relate to important variables like relationship quality, life satisfaction, health, and any other variable of interest.

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Appendix

CSQ-36

Included in brackets are the category names for the secrets used in the pile sorting tasks. Completing the CSQ-36 with the extended descriptions ensured participants were familiar with each category of secret.

These are the kinds of things people tend to keep secret.

We want to know whether AT ANY TIME if YOU have ever kept any of the following things secret.

Carefully read each item.

Have *YOU* (not someone that you know) ever done one of these things, and at some point kept it a secret? Choose what best fits per each of the below items.

Again, this is about things that YOU have kept secret (not other people's secrets).

Response options:

I have had this experience, and keep it secret from everyone.

I have had this experience, and keep it secret from some people.

I have had this experience, and once kept it a secret, but it is not a secret anymore.

I have had this experience, but I have never kept it a secret.

I have never had this experience.

- Hurt another person (e.g., emotionally or physically hurt someone), and kept this secret from someone else [**harming someone**]
- Used illegal drugs, OR abused/addicted to a legal drug (e.g., alcohol, painkillers) [**drug use**]
- Had a habit or addiction (but NOT involving drugs) [**habit or addiction**]
- Stolen something from someone or someplace [**theft**]
- Engaged in something illegal (other than drugs or stealing) [**illegal (nontheft) act**]
- Physically harmed yourself [**self-harm**]
- Had an abortion [**abortion**]
- Had a traumatic experience (other than the above) [**experience of trauma**]

- Have lied to someone. [**telling a lie**]
- Violated someone's trust (but NOT by a lie) for example, by snooping, revealing information about someone, breaking or losing something that belongs to someone without telling them, and so forth) [**violating someone's trust**]

• Had romantic desires about someone (while being single) for example, a crush, in love with someone, wanting relations with a specific person . . . while being single [**romantic desire**]

- Unhappy in a romantic relationship [**romantic discontent**]
- Thought about having relations with another person (while already in a relationship) [**extra-relational thoughts**]
- Committed * emotional * infidelity (NOT involving actual sexual infidelity)

for example, having an inappropriate emotional connection with someone, or engaging in something other than sex, such as flirting, kissing, and so forth [**emotional infidelity**]

- Committed * sexual * infidelity (engaged in sexual relations with someone who was not your partner) [**sexual infidelity**]
- At some point was in a relationship with someone who themselves actually had a partner (that is, the person was cheating on their partner—with you) [**being the "other (wo)man"**]
- Dislike a friend, or unhappy with current social life [**social discontent**]
- Dissatisfied with something physical about yourself [**physical discontent**]
- Had mental health issues, or dissatisfied with something about yourself other than physical appearance (e.g., fears, anxieties, depression, mental disorders, eating disorders) [**mental health**]
- Cheated or did something improper at work (or school), or having lied to get a job (or into a school) [**cheating at work/school**]
- Performing poorly at work (or school) [**poor work/school perform.**]
- Dissatisfied with your situation at work (or school) [**profession discontent**]

(Appendix continues)

Similar to the above, these are things sometimes people hide from others.

Have YOU ever at any time hidden these things from other people?

Please choose the option that corresponds to the status of this secret today.

Response options:

Yes, I have something like this that I keep secret from everyone.

Yes, I have something like this that I keep secret from some people.

Yes, I have something like this, and once kept it a secret, but it is not a secret anymore.

Yes, I have had something like this that some people tend to keep secret, but I never kept it secret.

I have never had something related this that people tend to keep secret

- Did you ever hide a hobby or possession? [**hobby**]

- Did you ever hide a current relationship, or keep a past relationship secret? [**hidden relationship**]

- Have you ever kept a detail about your family secret? [**family detail**]

- Have you ever been pregnant and didn't tell some people? [**pregnancy**]

- Have you ever concealed your sexual orientation/gender identity? [**sexual orientation**]

- Sexual behavior that you keep secret? (other than sexual orientation)

(e.g., porn, masturbation, fantasies, unusual sexual behavior, etc.) [**sexual behavior**]

- Kept secret a lack of having sex? (i.e., that you are not, or were not, having sex at some point) [**not having sex**]

- Kept secret a preference for something?

(e.g., not liking something that people think you like, or liking something people do not know you like) [**a preference**]

- Kept a belief secret?

(e.g., political views, religious views, views about social groups, prejudice) [**belief or ideology**]

- Keep secret details about finances (or amount of money you have)? [**finances**]

- Kept secret a job or employment that you have (or school activity)? [**secret employment**]

- Kept a secret ambition, secret plan, or secret goal for yourself? [**an ambition**]

- An unusual behavior (unrelated to *any* of the above categories, in this section and the above section) secret? [**counter-normative behavior**]

- A specific story you keep a secret (unrelated to *any* of the other categories, this section and the above section)? [**personal story**]

Shorthand Labels for Categories of Secrets (Study 1)

- harming someone
- drug use
- habit or addiction

Table A1
Measured Reports of General Health (Studies 2a–c, 3)

Study	M	95% CI	SD
Study 2a	60.17	[59.41, 60.92]	20.83
Study 2b	55.83	[55.05, 56.61]	22.38
Study 2c	60.44	[59.62, 61.27]	23.50
Study 3	58.34	[57.55, 59.12]	22.82
Combined	58.66	[58.27, 59.06]	22.50

- theft
- illegal (nontheft) act
- self-harm
- abortion
- traumatic experience
- telling a lie
- violating someone's trust
- romantic desire
- being unhappy with romantic situation
- having romantic thoughts about someone who is not your partner
- committing emotional infidelity
- committing sexual infidelity
- romantically involved with someone who is cheating on their partner
- being unhappy with social situation
- being unhappy with physical appearance
- having mental health issues
- cheating at work/school
- performing poorly at work/school
- unhappy with profession/job
- having a hobby
- hidden relationship
- family detail
- pregnancy
- sexual orientation
- sexual behavior
- not having sex
- having a preference
- belief/ideology
- finances/money
- employment
- having an ambition
- having an unusual behavior
- having a personal story

Validation of Well-Being Measure

In Studies 2a–c and 3, we found that we could predict how participants experienced their secrets from knowing the secrets' coordinates on each of the three dimensions in our secrecy space. Each of those predicted experiences (shame, connectedness, and insight), in turn, predicted a measure of secret-level well-being that asked participants to report on the extent to which the secret influences their well-being. As such, this measure

(Appendix continues)

Table A2

Relationship Between Perceived Impact of a Secret on Well-Being and z-Scored Reports of General Health (Studies 2a–c, 3)

Study	<i>b</i>	95% CI	<i>SE</i>	<i>df</i>	<i>t</i>	<i>p</i>
Study 2a	.01	[.001, .02]	.004	171.16	2.35	.02
Study 2b	.01	[–.002, .02]	.005	187.44	1.48	.14
Study 2c	.02	[.01, .03]	.005	194.80	3.67	.0003
Study 3	.02	[.01, .02]	.004	195.21	3.82	.0002
Combined	.01	[.01, .02]	.002	763.23	5.66	<.00001

of well-being is subjective. Well-being is a subjective and perceived state, and thus most well-being measures accordingly require a subjective judgment. Moreover, it is the subjective judgments that predict health outcomes, rather than more “objective markers” (Cacioppo et al., 2002; Cacioppo et al., 2003; Hawkey & Cacioppo, 2003; Mellor et al., 2008).

Importantly, prior work has validated the present measure. That is, reports of the well-being impact of a secret predicts outcomes that we would expect to vary by well-being. Specifically, prior work finds that this measure predicts reports of physical health (Slepian et al., 2017). We replicated this validation in the present work. Participants completed the commonly-used general

health subscale from the RAND 36-Item Health Survey (Hays et al., 1993). Scores of the five-item general health subscale range from 0 to 100 (for example, “my health is excellent,” “I seem to get sick a little easier than other people” (reversed)).

Our measure of the perceived well-being impact of a secret varies at the level of secrets (i.e., per each secret, participants judged its impact on their well-being), whereas general health varies at the level of individual. Accordingly, responses to the general health measure (Table A1) need to be modeled as a predictor of well-being from secrets (i.e., otherwise one cannot predict a value that is constant per individual). In each study, there was indeed the predicted positive relationship between well-being from secrets and physical health outcomes; it was significant in Studies 2a, 2c, and 3, but not Study 2b (Table A2). An analysis of a pooled dataset across these studies (labeled as Combined in Table A2) demonstrated an overall reliable relationship.

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