Share and Share Alike? An Exploration of Secure Behaviors in Romantic Relationships

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ABSTRACT

Security design choices often fail to take into account users' social context. Our work is among the first to examine security behavior in romantic relationships. We surveyed 195 people on Amazon Mechanical Turk about their relationship status and account sharing behavior for a cross-section of popular websites and apps (e.g., Netflix, Amazon Prime). We examine differences in account sharing behavior at different stages in a relationship and for people in different age groups and income levels. We also present a taxonomy of sharing motivations and behaviors based on the iterative coding of open-ended responses. Based on this taxonomy, we present design recommendations to support end users in three relationship stages: when they start sharing access with romantic partners; when they are maintaining that sharing; and when they decide to stop. Our findings contribute to the field of usable privacy and security by enhancing our understanding of security and privacy behaviors and needs in intimate social relationships.

1. INTRODUCTION

Sharing digital accounts is a common practice for various social groups and individuals. Recent Twitter discussion among members of the UK's Parliament sharing their account credentials shows that password sharing is widespread even among groups that require maximum levels of information security [23]. Studies report employees share account credentials with their colleagues, as sharing can facilitate trust and productivity [7, 24, 30]. Sharing is more common among intimate social groups such as families and friends. Researchers found people share accounts to overcome resource limitations [41], while convenience, combined with proximity, also motivates sharing [14, 34]. In a broader context, sharing has been recognized as a token of "trust," which enables a society to perform its functions [8, 30, 34, 41].

Sharing is gaining traction in security research community as the emphasis on the "human side" of computer security is growing [1, 35, 40]. Researchers are beginning to focus on designing secure systems that accommodate sharing. Still, many designs of online systems assume a single user – an assumption that would be considered ridiculous if those systems were situated in an offline environment. More than a decade ago, Grinter et al. showed that a home entertainment system designed for a single user can be unsuitable for a multi-user scenario and even create conflict among household members [18]. Recent work by Matthews et al. shows that while households may share devices and accounts in daily use, there is scarce support for sharing among current technologies [34].

In this regard, research on the sharing practices of couples in romantic relationships can inform future designs of security technologies that afford sharing behaviors. Further, dyadic romantic relationships are the most pervasive social constructs, but they have been left mostly unexplored concerning cybersecurity.

To address this gap in the literature, we conducted an online survey in 2017. The survey was distributed on Amazon Mechanical Turk, targeting people who have experienced romantic relationships. We collected quantitative data on what accounts people share with their partners, demographics, relationship duration, cohabitation duration, and qualitative responses on how and why they share. We were interested in 1) how sharing behaviors differ individually and 2) how tendencies of sharing for various types of accounts differ with the progress of a relationship.

We found that account sharing among couples emerges both from needs to fulfill functional goals such as sharing finances, as well as from desires to satisfy each other's emotional needs. Our findings suggest that account sharing plays a critical role in the progression of romantic relationships, supporting the notion of creating affordances for shared usage in online accounts. We also report hiding behaviors and examine underlying rationales. Finally, we present design recommendations to support sharing in different stages of a relationship.

The contributions of our work are as follows:

- We provide a snapshot of account sharing behaviors of people in romantic relationships.

- We extend the literature on account and password sharing to the context of romantic relationships.

- We provide guidelines for designers and developers of security systems to better support account sharing behaviors of romantic couples in different relationship stages.

2. RELATED WORK
2.1 The Social Context of Security Behaviors
We are applying a social psychology lens to problematic security behaviors. This framing specifically builds on the work of Das et al. [9, 10, 11, 12] in gathering and analyzing empirical data about end users' triggers for security behavior change. These triggers include observations of friends' and loved ones' security behaviors, social sensemaking of security practices and beliefs, pulling pranks and otherwise demonstrating to peers and family various security behaviors, and sharing account access and passwords with close ties. Das' findings have been echoed by others such as Redmiles et al. [39], who found in a 2016 census-representative survey of N=526 U.S. residents that family and friends, along with media, were the most prevalent sources of security advice.

Other authors have also examined security behaviors in a social context. Singh et al. [41] reported results of a 2005-2006 qualitative study of how people in Australia use banking services and manage money in the context of their personal relationships and in their broader socio-economic contexts. The data collected through open-ended interviews with a total of N=108 Australians of largely European heritage, indigenous "yarning circles" and focus groups of people with disabilities found that couples in relationships share PINs as an expression of trust and that sharing of confidential or private security information is inevitable under certain life circumstances, such as when accessing a service, is difficult due to factors such as remoteness or disability.

More recently, Matthews et al. [34] found in a 2016 mixed-methods study that households' sharing of devices and accounts is common. Participants in a survey of N=99 households, followed by a 25-day diary study of N=25 individuals and interviews with N=24, reported a fluid boundary of what is perceived as "personal," such as mobile devices lying around the house. Trust and convenience were found to be major influences on sharing. These findings are congruent with those of boyd [8] and Singh et al. [41] among others on how family environments socialize family members to share passwords, and other researchers such as Herley on how end users judge costs and benefits in applying security behaviors [21]. Additionally, Matthews et al. developed a taxonomy of sharing with six categories (borrowing, mutual use, setup, helping, broadcasting, and accidental) that suggests a guide for our interpretations of participant sharing data.

Our work extends this literature on the social context of security behaviors to the specific context of romantic relationships. While couples have comprised a subset of the participant groups in prior work, ours is among the first studies, and is the first that we are aware of, to focus exclusively on romantic partners as a user population.

2.2 Password Sharing
Singh et al. and Kaye were among the first HCI researchers to specifically examine reasons for and methods of password sharing. Singh et al., [41] in the study noted above, found that the distance and difficulty of travel to a physical bank branch were major factors that led to password shar-ing among those with physical disabilities and inhabitants of remote and poor villages in Australia. Participants who shared accounts with partners or family also needed to share passwords to facilitate their access to the accounts.

Kaye's sample, by contrast, was drawn from a U.S.-based convenience sample of friends, family and their own ties reached through online communication and social media. In his primarily qualitative study with N=122 participants published in 2011 [28], he reported that gender and age were positively correlated with password sharing, with password sharing the highest among men ages 46-49. Participants who were in a relationship or married had on average 2.8 (SD=3.5) instances of password sharing, whereas people who were single and not in a relationship had on average 1.4 (SD=1.5) instances. This data suggests that password sharing is becoming a behavioral norm in the U.S. for those in romantic relationships and/or heads of households, for which older men traditionally have managed finances and account logistics.

In a 2013 YouGov Norway survey of N=1003 employees age 18 to 64, Helkala and Bakås [20] found that 31% of participants said they share passwords with a partner. The authors noted that many were confused or misguided about how to create and manage strong passwords, reusing passwords across accounts and showing a lack of understanding as to which accounts contained confidential or private information.

Separately, Whitty et al. [43] found in a 2013 online survey of N=497 U.K. professionals age 18-72 that younger people were more likely to share passwords than older people. High scores on scales measuring certain personality traits (lack of perseverance, suggesting boredom or unenthusiasm for tasks; and the tendency of self-monitoring, which implies sensitivity to social and situational cues) were positively correlated with password sharing. However, knowledge of cybersecurity was not correlated with password sharing. This suggests that social and individual psychological factors may be as important, if not more so, than training or access to information about best practices for understanding some individuals' security behaviors.

Our work builds on this prior research by contributing data from a sample population of romantic couples about their password and account sharing behaviors.

2.3 Partner as "Insider Threat"
At least one participant in Kaye's 2011 study reported having a negative experience with password sharing, as her now-ex-boyfriend made use of his knowledge to send threatening emails and delete accounts [28]. Such experiences with intimate-partner harassment and even abuse or violence using shared security information and device access are sadly not uncommon [15, 16]. Freed et al. advocate incorporating safety reviews for such types of attacks into UI evaluations and penetration testing protocols [16], though they acknowledge the difficulty of designing systems to hamper usability for intimate-partner attackers while preserving usability for targeted or third-party users, all of whom may reside in the same households.

In a 2013 study, Muslukhov et al. [36] reported 12% of those surveyed or interviewed reported a negative experience

with unauthorized access of their smartphone, for instance a housemate looking at personal photos and making costly calls while the phone's owner slept. The authors argued for expanding the adversarial threat model used by smartphone security designers and engineers to include threats posed by "insiders (e.g., friends)" who have proximity to users' smartphones and/or knowledge of their everyday behavior. Follow-up studies [31, 32, 42] from the same research group reinforce the notion that perpetrators of security intrusions can be among our most intimate ties, as Marques et al. estimate that as many as 1 in 3 people have snooped on someone else's smartphone, and Usmani et al., that more than 1 in 5 have snooped on someone else's Facebook account. The latter authors identified fun, curiosity, jealousy, animosity and utility as motivations for these intrusions [42].

End users may become more aware of threats, and more likely to hide some data even from intimate partners, due to their increased use of computing devices for social media [32] and for employment activities. Kang et al. [27] found that social media users who are younger and more educated put more personal information online, but also seek more anonymity and hide more components of their identity than those older or less educated or both. In their comparison of a survey sample drawn from Amazon Mechanical Turk and one more representative of the broader U.S. population, the U.S. MTurk users were found to be more likely to seek anonymity and hide identity and to be more worried about their online information than the U.S. public, regardless of their age, gender, education, and social media use. They also found that MTurk workers hide more information from family members, a romantic partner, friends and coworkers than other groups.

Our work attempts to extend this prior research by adding to the knowledge of "hiding" as a distinct user behavior for partners in romantic relationships. While our survey does not specifically address snooping or intimate partner abuse or violence, our findings on hiding could contribute to the overall understanding of the spectrum of possible antisocial security behaviors by users that designers and developers should take into account.

3. METHOD
We used Amazon Mechanical Turk to reach a broader sample of participants in a variety of relationship and cohabitation situations. Although our results may not be generalizable to the entire population, we did not want to limit our scope geographically. Past study has also shown that MTurk subjects are more representative than student and local convenience samples [6], hence supporting our choice of crowdworkers as a primary survey target.

3.1 Survey Design
The survey[1] consisted of three parts; first, we asked our participants what accounts they own; second, we looked into security and account sharing behaviors for each account; and third, we asked participants about their demographics. Before these questions, for screening purpose, we asked our participants for their relationship status, relationship duration, and cohabitation duration.

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[1] http://cmu.ca1.qualtrics.com/jfe/form/SV_ beZL6a2GYEOjgwt

We initially drafted a list of popular websites in the U.S. from Alexa.com[2]. However, as it did not provide distinct groupings, we reorganized accounts based on their usages and created 17 original categories. For each category, we selected 15 websites ranked most popular by Alexa.com. The list of categories and accounts is in Appendix 1.

3.2 Survey Items
Once participants completed screening, they were asked to select accounts they own from our list. For each chosen account, we asked for its ownership, the usage of an account by both participants and their partners, and the access to an account by partners. Participants were also prompted to enter up to 3 additional accounts if they did not find any account they own from the given list, but those additional entries were excluded from the analysis.

For ownership, we asked participants whether an account is owned by them, by their partner, jointly by both them and their partners, or separately as individual accounts. For the usage of an account, we asked how frequently participants and their partners use an account respectively. We then assessed how easily a partner can access an account. In each of 17 categories, we asked participants to write a short response describing their reasons and methods for sharing any accounts, and the same for hiding any accounts. Lastly, we asked for participants' demographics, which included: age, gender, ethnicity, sexual orientation, household income, and education level. Detailed questions are in Appendix 2.

3.3 Recruitment and Participants
Between August 30 - September 6, 2017, 244 participants were recruited in three batches on Amazon Mechanical Turk. Participation was limited to the U.S. residents aged above 18 with an approval rating over 95% and had more than 1,000 tasks approved. The survey was titled "Romantic Couples and Cybersecurity," and had a description as the following: "What online accounts and devices you and your partner own and share with (or hide from) each other? You must 1) have ever been in (or are in) a romantic relationship; 2) been in a relationship for > 1 month or broke up < 1 yr ago; and 3) aged 18 or more." Once Turkers accepted the HIT, they were redirected to the Qualtrics survey.

Participants were notified that their participation is voluntary and they can terminate their sessions at any time. Before publishing the survey, we pilot-tested the survey with 25 people and asked them to provide feedback on survey taking experience. Based on the received feedback, we made minor modifications to the interface and the flow of the survey. We estimated the survey to take about 25 - 30 minutes to complete and paid $4 to each participant. On average, participants took 36.9 minutes (SD=37.4) to finish the survey, and the median session duration was 26.7 minutes.

3.4 Data Cleaning
From the total of 306 responses, we removed 25.1% of responses (N=77) which were incomplete or entered by Turkers outside the U.S. We also excluded 34 logically faulty responses which included accounts being used by neither participants nor their partners from the rest of 229 responses. We analyzed the remaining 195 responses each from a unique participant. Only 4 among 195 responses did not report any
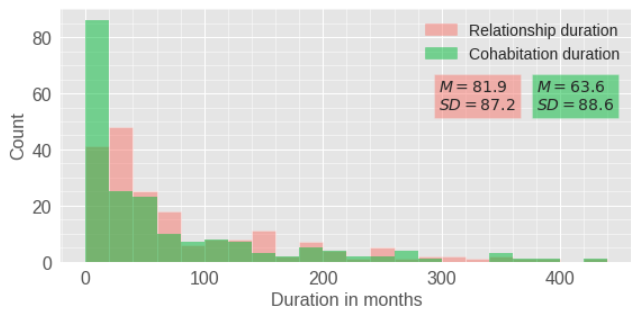
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[2] https://www.alexa.com/topsites/countries/US

Figure 1: Distributions of relationship duration and cohabitation duration with respective means and standard deviations (N=195).

Figure 2: Distributions of a total number of accounts, number of shared accounts, and the ratio of sharing (N=195).

account. We removed 265 duplicate entries of accounts from the total of 3,686 accounts to prevent double-counting. We also refined our account categories as our initial categorization of accounts was ambiguous and not suitable for the analysis. The new categories are in Appendix 1.

Whether an account is shared or not was determined with the following criteria. While a partner must have ready access or be able to access whenever needed, 1) a partner must use an account more than never if a participant owns an account, or 2) a participant must use an account more than never if a partner owns an account, or 3) an account is jointly owned by both a participant and his/her partner.

For hiding, an account was considered actively hidden if a participant selected "Partner doesn't know and I'm actively hiding the account" for the question asking partner's access to an account. However, we noticed many participants mentioned hiding in their open-ended responses although they did not explicitly indicate active hiding of accounts in prior questions.

4. RESULTS

We examined what factors affect sharing of accounts with quantitative data and identified themes that categorize people's motivations and methods for sharing from qualitative responses. 3 authors participated in iteratively developing the taxonomy of sharing reasons from the textual data.

4.1 Sample Characteristics

In our sample, 4% of participants (N=8) were not currently in a relationship, 62% (N=122) were dating someone, and 34% (N=65) were married. 140 participants responded that they are currently living together with their partners and 55 responded they are not. The relationship duration of the participants varied from the minimum of two months to the maximum of 434 months (M=81.9, SD=87.2). Cohabitation duration also varied widely from zero for those who are not living together to the maximum of 434 months (M=63.6, SD=88.6). Figure 1 shows distributions of relationship duration and cohabitation duration.

Previous studies have shown that U.S. Turkers are distinct from the general U.S. population. Researchers found Turkers tend to be younger, more educated, less wealthy, more white, and predominantly females [22, 26, 33, 37]. The characteristics of our survey sample are mostly consistent with that of MTurk populations studied in the past. Ages of our participants ranged from 19 to 63 years old, with 33 as the median (M=34.2, SD=8.91). 81 participants re-
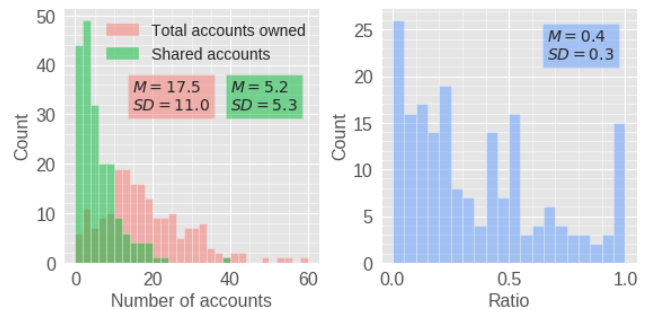
ported education above bachelor's degree, and the median level of education was an associate or technical degree with 120 participants above the median. Our sample consisted of 111 males and 83 females (male/female ratio=1.34), and one who reported being non-binary. The median income range was $40,000 to $59,999 with 55 participants, and the largest number of participants belonged to the range of $20,000 to $39,999 with 65 of them in the group. 153 participants in our sample identified themselves as white, followed by 18 black or African American, 13 Asian or Pacific Islander, 6 Hispanic or Latino, 1 Native American or American Indian, and 6 other ethnicities. Overall, our sample was younger, less wealthy, and more educated compared to the general U.S. public. Appendix 3 shows differences in demographics of our sample and the U.S. population in greater detail.

4.2 Factors Affecting Sharing

To eliminate the chance of difference in sharing across groups stemming from one group having more accounts than the other group, we used the ratio of sharing (the number of shared accounts divided by the number of owned accounts) as our response variable instead of the absolute number of shared accounts. In doing so, we hypothesized based on findings from the security literature that who are younger and more educated will share less [25, 27, 28], while who have less income and were in a relationship/cohabiting for a longer time will share more [34, 41]. As we tested multiple hypotheses simultaneously, we applied Bonferroni correction and used the critical value of 0.05/22=0.0023.

The number of accounts owned and accounts shared were distributed as shown in Figure 2. Overall, 84.6% (N=165) participants out of 195 were sharing at least one account, and one participant sharing 39 accounts was the maximum. The median for number of shared accounts was 4 and sharing ratios were distributed as shown in the right subgraph of Figure 2.

4.2.1 Individual differences based on demographics and relationship characteristics

In our analyses, we used the subset of 174 participants excluding 8 participants who were not in a relationship, 8 with outlying ages, 4 who did not report any account, and 1 participant of non-binary gender. With binary variables including gender, marriage, and cohabitation, we compared the ratio of sharing across two groups (male vs. female, married vs. unmarried, and cohabiting vs. not cohabiting). For categorical or continuous variables such as income, education, age, relationship duration, and cohabitation duration, we

Table 1: Differences in sharing due to demographics and relationship characteristics (N=174).

Explanatory variables	Summary statistics								
	U	p	d	N_1	SD_1	Mdn_1	N_2	SD_2	Mdn_2
Gender (1=female, 2=male)	3719	0.98	0.00	75	0.27	0.27	99	0.32	0.25
Age (1=above median, 2=below median)	3883	0.77	0.03	86	0.26	0.27	88	0.33	0.25
	724	0.82	0.03	37	0.27	0.25	38	0.28	0.31
	1306	0.54	0.07	46	0.30	0.36	53	0.34	0.23
Marriage (1=married, 2=unmarried)	4426	0.001*	0.30	59	0.27	0.43	115	0.31	0.21
	843	0.13	0.21	35	0.24	0.41	40	0.29	0.21
	1292	0.001*	0.44	24	0.27	0.47	75	0.32	0.22
Cohabitation (1=cohabiting, 2=not cohabiting)	4350	<0.001**	0.52	130	0.28	0.39	44	0.32	0.07
	590	<0.001**	0.68	64	0.26	0.33	11	0.28	0.05
	1617	<0.001**	0.49	66	0.29	0.41	33	0.33	0.07
Relationship duration (1=above median, 2=below median)	4902	<0.001**	0.30	87	0.27	0.42	87	0.32	0.21
	692	0.91	-0.02	37	0.24	0.27	38	0.30	0.29
	1730	<0.001**	0.41	49	0.29	0.42	50	0.33	0.14
Cohabitation duration (1=above median, 2=below median)	4977	<0.001**	0.32	86	0.27	0.42	88	0.32	0.20
	870	0.07	0.24	36	0.24	0.41	39	0.29	0.22
	1843	<0.001**	0.50	49	0.27	0.43	50	0.33	0.10
Education (1=above median, 2=below median)	3442	0.31	-0.09	84	0.26	0.24	90	0.33	0.31
	620	0.47	-0.10	32	0.22	0.24	43	0.30	0.30
	265	0.84	-0.05	6	0.12	0.28	93	0.33	0.25
Income (1=above median, 2=below median)	3060	0.80	0.03	47	0.27	0.33	127	0.31	0.24
	593	0.91	0.02	22	0.26	0.35	53	0.28	0.24
	957	0.80	0.04	25	0.27	0.33	74	0.34	0.24

† ** $p<0.001$, * $p<0.0023$. For each major row except gender, the top subrow shows the result of a test including both males and females, while the middle and the bottom subrows show results of tests with only females or males respectively.

‡ Column 1 through 3 under summary statistics each show a U-statistic for Mann-Whitney U test, a p-value, and Cliff's delta (effect size). Column 4 through 6 are sample size, standard deviation, and median sharing ratio for group 1, and column 7 through 9 are the same but for group 2.

split the data at corresponding medians to get two groups: one above the median (group 1) and one below the median (group 2). Although splitting data at the median age of 32 or the median relationship duration of 50.5 months is arbitrary, it was necessary for testing differences across variables which were distributed non-normally. For the same reason, we used the nonparametric Mann-Whitney U test instead of the t-test. The summary of results is in Table 1.

The results show that there are no significant differences in sharing due to gender, age, education, and income. Only marriage, cohabitation, relationship duration, and cohabitation duration were significant with positive effect sizes.

One explanation is that marriage and cohabitation, per se, work as a "leap of faith" that triggers a considerable proportion of sharing. Researchers have noted the linear progression of self-disclosure in the developmental trajectory of personal relationships [4, 17, 38], which explains positive associations of relationship duration and cohabitation duration with sharing. Another interesting observation is

variables that positively affect sharing show greater significance in males than females. While many factors may be in play, it is possible that our results reflect the tendency of males being registered owners of jointly owned properties in relationships traditionally.

4.2.2 Combined effects of variables

Hierarchical logistic regression was conducted with the same subset of 174 participants to study combined effects of variables on sharing. We used the variable indicating if the ratio of sharing is above or below the median of 0.258 (25.8%) as our dependent variable. Transforming sharing ratio to a binary variable rather than treating it as a numeric variable led to a loss of information. However, a linear model with numeric sharing ratio as its dependent variable did not meet assumptions required for a general linear model, e.g., the normal distribution of residuals and the zero mean of residuals, and failed to provide satisfactory explanations for our data. We also tried log-transforming sharing ratio after adding 1 to all values, but the distribution of ratios

Table 2: Hierarchical logistic regression to test effects of multiple variables on sharing (N=174).

Model	Marriage	Cohabitation	Age	Rel. duration	Cohab. duration	Gender	Income	Education	R^2
				Independent variables					
1	2.11 (1.22, 3.63)*	-	-	-	-	-	-	-	0.032
2	-	1.50 (1.06, 2.13)*	-	-	-	-	-	-	0.022
3	1.82 (0.90, 3.70)	1.16 (0.73, 1.84)	-	-	-	-	-	-	0.033
4	2.47 (1.18, 5.15)*	4.17 (1.83, 9.49)*	0.96 (0.94, 0.98)*	-	-	-	-	-	0.101
5	2.48 (1.05, 5.89)*	4.18 (1.82, 9.61)*	0.96 (0.94, 0.98)*	1.00 (0.98, 1.02)	1.00 (0.98, 1.02)	-	-	-	0.101
6	2.50 (1.05, 5.96)*	4.43 (1.91, 10.30)*	0.96 (0.94, 0.99)*	1.00 (0.99, 1.02)	1.00 (0.98, 1.01)	0.67 (0.33, 1.35)	-	-	0.106
7	2.46 (1.02, 5.92)*	4.38 (1.88, 10.22)*	0.97 (0.94, 0.99)*	1.00 (0.99, 1.02)	1.00 (0.98, 1.01)	0.66 (0.32, 1.34)	1.33 (0.61, 2.93)	0.65 (0.33, 1.27)	0.113

† * $p<0.05$. The table shows odds ratios with 95% CI in brackets. An odds ratio is significant at 0.05 level if the confidence interval does not contain 1.0.

‡ Marriage, cohabitation, gender, income, and education are binary variables, while age, relationship duration, and cohabitation duration are numeric variables.

was still non-normal. Hence we performed logistic regression with sharing ratio as a binary variable and observed the positive/negative directions of odds ratios. For independent variables, we used marriage, cohabitation, age, gender, relationship duration, cohabitation duration, income, and education. The results are summarized in Table 2.

When marriage or cohabitation is the only predictor, it predicts the ratio of sharing above the median positively and is highly significant. This outcome reaffirms results we obtained from hypothesis tests and is intuitive as married or cohabiting couples are likely to share more accounts than unmarried couples, with more of their life and activities overlapping.

However, neither marriage nor cohabitation is significant when they are both included as predictors. The reason is likely that cohabitation is a confounding factor associated positively with both marriage and sharing. When participants are grouped by marriage and cohabitation, the largest group is who are cohabiting but not married with 72 participants. On the contrary, only one participant is married but not cohabiting. Remaining 101 participants are either married and cohabiting (N=43) or just dating (N=58). This incongruence in cohabitation and marriage is likely due to people's propensity to cohabit before marrying, to experiment the viability of a more committed relationship. Thus, including cohabitation along with marriage in the model decreases the overestimated effect of marriage on sharing.

Marriage and cohabitation are significant with positive odds ratios when age is added as a third predictor in the model, which is also significant but with a negative effect. This is in contrast to our observation that the ratio of sharing is not significantly different across groups above and below the median of age. However, Whitty et al. studied password shar-

ing practices in the UK and also found that younger people have higher chances of sharing passwords. They suggested that a younger population may have more family and friends active online compared to an older population, hence have more opportunities to share accounts [43].

None among relationship duration, cohabitation duration, gender, income, and education is neither significant nor affects the power of marriage, cohabitation, and age in the model. Hypothesis tests have shown that gender, income, and education do not contribute to differences in sharing, but the insignificance of relationship duration and cohabitation duration opposes our previous observations. This result may indicate that sharing of accounts does not undergo drastic changes during a relationship, but occurs at a specific point, e.g., after a couple decides to cohabit or marry. Research on self-disclosure has also shown successful couples often engage in a higher level of interaction earlier in their relationships then exhibit a decline in disclosure after establishing a sufficient level of confidence [5, 19].

4.3 Account Types and Sharing

In our data with 3,421 accounts, 29.8% accounts were shared (N=1,019), and among them, 39.5% were joint accounts (N=402). Figure 3 shows accounts shared by at least ten participants and Figure 4 shows proportions of shared accounts for each category of accounts.

We defined joint account as an account that is set up solely for sharing, owned by both participants and their partners. As we collected data on different types of accounts, we were interested in knowing whether sharing behaviors differ with types of accounts. For example, are some accounts more likely to be shared than other accounts? Also, are people more likely to share a particular type of account when they are earlier/later in their relationships? To answer these
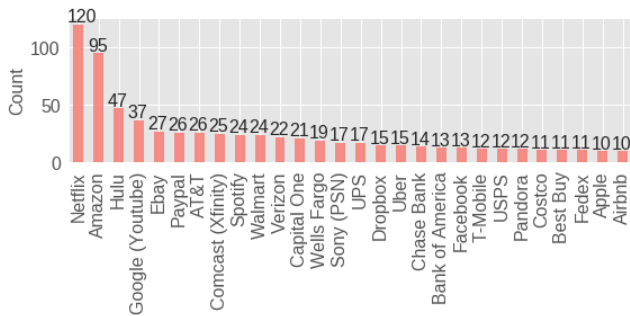
Figure 3: Number of users for accounts shared by more than ten participants.

Figure 4: Proportions of accounts shared by categories of accounts.

questions, we analyzed the effect of relationship duration on different types of accounts. The contingency table summarizing the results of the analysis is in Appendix 4.

We defined new relationships as relationships less than 7 months in their duration, based on an observation that infatuation and fusion, the first stage of a romantic relationship, lasts about 6 months [13]. With this definition, we calculated Chi-square tests of independence and found that people new in relationships share significantly more entertainment accounts ($\chi^2[1,1019]$=15.7, p<0.0001), but significantly fewer finance accounts ($\chi^2[1,1019]$=7.29, p<0.01). For other types of accounts besides entertainment and finance, we did not find a statistically significant relationship between the stage of relationship and sharing. We also found people who are not new in relationships share more joint accounts with their partners ($\chi^2[1,1019]$=15.8, p<0.0001). These results suggest people first share information of less importance such as entertainment accounts before they disclose more private information that carries a higher personal value.

4.4 Taxonomy of Reasons for Sharing

To understand why romantic couples share accounts, we conducted an iterative coding of participants' open-ended responses with 3 of the authors. Initially, 25 reasons for sharing emerged from all the responses, and 6 codes grouping together a set of reasons were identified. Then coders independently coded 50 randomly sampled responses and discussed their rationale. This process was repeated with a new sample until the acceptable level of inter-rater reliability was reached. Once consensus seemed sufficient, we proceeded to code all responses on sharing. Table 3 shows the breakdown of themes and needs with Krippendorff's alphas for each code. The list of reasons for sharing and associated codes are in Appendix 5.

We identified two overarching goals for account sharing from this analysis: *functional* and *emotional*. Specifically, four themes emerged: *convenience* and *household maintenance*, to fulfill a couple's functional needs, and *trust* and *relationship maintenance*, to satisfy their emotional needs. Among the four themes, relationship maintenance and household maintenance contain subcategories: relationship well-being and support within relationship maintenance, and economics and logistics within household maintenance. While convenience, economics, logistics, and trust were observed in previous studies, maintaining relationship well-being and providing support as reasons for account sharing are our novel findings, which we are the first to report according to our
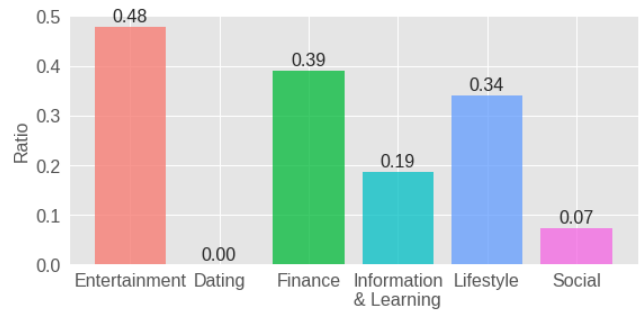
knowledge. Note that these categories are not mutually exclusive. Therefore, the total proportion of categories does not add up to 100%.

4.4.1 Sharing theme 1: Convenience

In our data, 63.8% of responses mentioned sharing accounts with romantic partners for simplicity and ease of access or usage. They mentioned not wanting the hassle of creating and maintaining a separate account as a reason for sharing. It may also occur by default if two people share a device, and hence, the account on the device. Example comments about sharing because of convenience:

> *"These are common streaming accounts that we share. There is no need for us to have our own accounts when it comes to streaming."*

> *"We both use the prime account part of Amazon, and it is easier for both of us to have the email and passwords."*

Unlike [34], we did not see a clear distinction between borrowing and mutual use in our responses. This may be due to cognitive interdependence, a unique characteristic of romantic relationships where individuals in a relationship have greater perceived unity of self and partner [3]. Therefore, sharing of devices and accounts occurs naturally. This is reflected in phrases often used in the responses, such as *"[sharing] just makes sense"* and *"there's no need [to create separate accounts]."*

4.4.2 Sharing theme 2: Household maintenance

Household maintenance (85% of responses) refers to sharing accounts in order to complete house-related or financial tasks. House-related chores include running the household and making daily arrangements, e.g., food, clothing, shelter, and travel. We labeled these activities logistics (67.3% of responses). An example of this: *"We choose to share this account because we both use [it] for ebay.com purchases and returns."*

Financial tasks are those that involve currency, such as paying utility bills, managing bank accounts, collecting/using reward points, and managing properties and/or investments. These are grouped as a sub-category named economics (60.1% of stories). Here is an example of economics: *"We both use it [the Amazon account]/share the Prime account to keep costs down ..."*

In our analysis, we found that logistics and economics often overlap (147 comments – 58.6% of logistics comments; 65.6% of economics comments). For example:

Table 3: Taxonomy of 4 themes for why couple share accounts – identified from open-ended questions.

Needs	Themes (Description)	Codes (IRR)	% sharing stories (N=373)
Functional	Convenience (for simplicity and ease of access or usage)	Convenience (0.72)	63.8%
	Household Maintenance (to complete house-related or financial tasks)	Economics (0.79)	60.1%
		Logistics (0.49)	67.3%
Emotional	Trust (to establish trust – intimacy and belief)	Trust (0.75)	45.3%
	Relationship Maintenance (to improve relationship well-being or to provide and receive support)	Relationship Well-Being (0.53)	20.9%
		Support (0.67)	5.6%

> *"We have been married for 7 years so far and have 2 kids. We both need to know what we have in the accounts in order to make purchase and pay bills. It[']s important we have a working knowledge of the money we share."*

Convenience and household maintenance are part of the functional needs to share accounts.

4.4.3 Sharing theme 3: Trust

We characterize sharing out of trust as a statement about intimacy and belief in the partner and the relationship. 45.3% of responses mentioned trust as the reason to share. For instance:

> *"I choose to share for utilities because I trust my partner, and believe both people should have access to them."*

Other variations in expressions of trust include *"… we are in this together,"* *"… because we are married,"* and *"It [sharing accounts] is … transparent and makes us feel comfortable to know what the other is doing."* This theme is also found in similar works in the past [34, 41].

4.4.4 Sharing theme 4: Relationship maintenance

Relationship maintenance refers to sharing accounts as a measure to improve relationship well-being or to provide and receive support. It accounts for 24.4% of total responses.

Relationship well-being (20.9% of total responses) happens when people actively put in the effort to maintain and improve the quality of a relationship. This often takes the form of sharing activities together. For example: *"[We share accounts] to discuss sports and see highlights of the night before. [We] use [it] for different content also."* Relationship well-being differs from trust in that relationship well-being suggests active effort, while trust is a reflection of the state of a relationship. Another way to differentiate between them is that relationship well-being can be framed as "we-do" statements, e.g., *"we travel together,"* and trust is "we-are" statement, e.g., *"we are in this together."*

The other component of relationship maintenance is support (5.63% of responses), which we defined as the act of receiving and providing help to a partner. An example comment of support:

Provide support: *"I already had a netflix account before we started dating. … I gave her my password so she could watch when we weren't together."*

Receive support: *"He does not use them but we share them because he knows he can use them and that they exist. I share them because I want him to know about them and have access to them if anything happens to me."*

While relationship well-being is bi-directional (e.g., sharing activities together), support is unidirectional and may be non-reciprocal (e.g., I help my partner without my partner helping me).

4.5 Reasons for Hiding

In contrast to responses on sharing, only 13 responses mentioning active hiding of accounts were collected. We used the same iterative coding procedure from reasons for sharing to code reasons for hiding and found three main reasons for hiding an account: hiding relationships with other people, hiding what could bring up an argument or damage their relationship, and hiding what is irrelevant to the relationship. These three reasons were distributed as 69.2%, 76.9%, and 23.1% in responses. Examples are as follows:

Hiding relationships: *"I just do not want them to see what I post or to see my conversations with other people. "*

Avoid conflict: *"I choose to hide my Peebles[credit card] account because my partner is unaware that I have opened it. She would be angry if she found out I took on another bill when we can barely afford the bills we have."*

Irrelevant to a relationship: *"I don't see a reason for her to know about my Tinder account, I'm sure she has one to[o] but I don't see the point in bringing it up."*

All three reasons for explicit hiding involve a motivation to conceal what a partner may consider wrongdoing [2]. This observation is not surprising considering conventional circumstances where hiding most frequently occurs, such as in illicit liaisons. However, other responses reveal hiding can occur due to reasons that are not necessarily undesirable. Although some of these responses were not marked for active hiding, we find them worthy of mentioning as they reveal neutral or even positive aspects of hiding, as opposed to our intuitions. For example, the following responses demonstrate how hiding occurs to maintain one's personal space:

> *"I choose to hide these accounts by not telling her about it. I choose to do this because [I] want my social media accounts separate and for my own view only."*

> *"I have a separate gmail account... sometimes, it's okay to have an account that's just yours and yours only..."*

As observed in past studies, individual privacy is an essential matter for couples in romantic relationships [29, 38]. Concerning studies on intimate partner abuse and a partner as an "insider threat," above responses put further emphasis on designing technologies that provide better defined personal boundaries [15, 16, 32].

While above responses display conventionally expected motivations for hiding, other responses reveal rare instances where hiding comes from a good-natured motivation:

> *"I am not hiding anything besides when I am trying to get her a surprise gift. I just try to make sure the browser is closed."*

> *"I don't usually hide my Amazon account but my partner doesn't have the password to it. I do make sure there isn't any e-mails from Amazon if I'm buying a gift for my partner and want it to be a surprise."*

As shown, hiding can be employed as a device to strengthen one's relationship by facilitating gift giving. Another response shows hiding can also serve a protective function:

> *"My spouse spends money badly so I do not want him to spend everything."*

Similar to parent-children relationships, adult relationships can involve restrictions intended to promote healthier attitudes that can mutually benefit who are involved in a relationship.

4.6 Sharing Methods

Among the open-ended responses, 49.7% of responses reported methods of sharing. These methods can be categorized under eight general sharing methods, with the most common methods being: 1) keeping the account logged in so it is automatically signed in when needed, 2) storing passwords in a password manager, and 3) sharing/storing the passwords digitally in files or via digital communication, e.g., email. Table 4 shows the eight categories and their frequencies in our responses.

Of concern to us were the 11.8% of the responses that mentioned sharing methods that do not follow general best practices for account security. These included using a familiar or easy password (4.28% of responses), using passwords based on personal information (3.21% of responses), reusing common password-ID combinations (10.7%), and sharing through email. This supports a need to encourage more secure password sharing.

5. DISCUSSION

Our study paints a rich picture of how romantic relationships influence security behaviors and extends the existing knowledge of how individuals approach cybersecurity in social contexts [9, 10, 12, 28, 34, 41]. With the majority of our participants either dating, living with a partner, or married, our data show the array of accounts and behaviors that result from combining lives with another person. We have found it difficult, in coding many of the open-ended responses, to disentangle pragmatic from emotional reasons for sharing behaviors, or even for methods – for instance, is

Table 4: Account sharing methods observed in open-ended responses.

Sharing methods	# (%) sharing stories (N=376)
Auto sign-in	58 (31.0%)
Password manager	35 (18.7%)
Electronically stored/shared	31 (16.6%)
Reusing common password/id	20 (10.7%)
Memorizing	17 (9.09%)
Creating credentials together	12 (6.42%)
Writing down on paper	11 (5.88%)
Verbally telling password to partner	6 (3.21%)

a couple's practice of creating passwords together from personal information more for the ease of memorization, or for the pleasure of memorializing their emotional bond in everyday activities? Often our answer was, "It could be both practical and emotional," which we argue is a complete perspective to bring to security research.

At the very least, our data show the need for security designers and engineers to consider socio-cognitive factors when generating ideas for system features, evaluating the usability of security systems, and conducting user evaluations with romantic couples and family households, not just with individuals. Our research has identified four factors motivating online account sharing among couples – relationship maintenance, household maintenance, trust, and convenience – that echo prior works among platonic roommates and other social groups [10, 12, 34, 41]. Security user interface and architecture designers can use these as criteria for evaluating whether the proposed or developed systems or features support usability for those in romantic relationships both as individuals and as a couple. They are also likely to help those in other sharing situations, such as people with disabilities who rely on household helpers for errands or extended families who share resources and logistical burdens such as shopping or banking.

Moreover, decisions about whether and to what extent to share access to accounts and devices with a partner (either by intent or default) are not products of a single moment. They occur in stages and follow the life cycle of the romantic relationship itself. We offer the following observations and suggestions for security design for this relationship lifecycle, broken into three stages: the start of relationship sharing, the maintenance of relationship sharing, and the end of relationship sharing.

5.1 Design Recommendations for Couples

The start of relationship sharing is characterized by individuals starting to grant partner access to some, though not all, of their individually owned accounts and devices. Our data showed that people in the early stage of relationship share significantly more entertainment accounts and fewer finance accounts. Sharing can happen either proactively, e.g., actively sharing passwords, or by default, e.g., watching the same TV.

Sharing at the first stage may be uncertain. In our data, one

participant commented that *"[w]e don't share any [accounts] yet. We're trying to figure that out as our relationship moves on."* We recommend building security features that ease the feeling of uncertainty at the beginning of relationship sharing. For example, allowing multiple PINs or passwords for a single device can segment device accessibility, preserving the access of new romantic partners to some apps while fencing off access to others. Another way to facilitate relationship sharing at this stage is to prompt the account's original owner, on a regular basis, to review his or her current security settings and account sharing status. This can remind users that their accounts are currently being shared and offer options to revoke sharing access if necessary.

Unsurprisingly, our data suggest that couples who have been in a longer-term relationship or who are cohabiting or married tend to share more accounts than those who are in the early stages of a relationship and that they begin to create accounts for joint use. Couples in our study who had been dating longer or who were cohabiting or married indicated sharing more financial accounts, such as individual or joint banking accounts and investment accounts. However, certain accounts remain personal, with participants reporting keeping individual banking accounts and email accounts. Hiding behaviors are likely to occur to preserve privacy and maintain personal spaces.

A design recommendation for this relationship-maintenance stage is to establish a model where multiple users can share one account while user profiles remain independent of each other. Existing services such as Netflix and Hulu allow users to create individual profiles, but this feature is not implemented pervasively. In our data, participants' comments about their practices of account sharing imply benefits they may enjoy if existing services adopted such one-account-multiple-user-profile structure more widely:

> *"The amazon account is automatically signed in. We both use it/share the Prime account to keep costs down and use our own credit cards attached to it."*

This shows there exists a demand for account sharing among the users of services that currently employ one account-one user model. Anecdotally, another example where the current one account-one user model breaks down is two-factor authentication for joint accounts. Authentication information is typically sent to one phone number that is not shared between two people.

Given the popularity of shared account usage and shortcomings in the current implementation of many accounts for couples' needs, it is worth considering a wider range of user configuration options in a one account-multiple-users model, where individuals in a relationship have the freedom to customize their account information and security settings while being able to maintain only one login information. Such account might appear as a single account on the surface, but it would allow each user to maintain his or her personal security settings under the hood, e.g., viewing access to personal information, possibly with an additional layer of identification (e.g., 2FA). It can further help alleviate the "insider threat" of a vengeful or negligent partner being able to sabotage or failing to safeguard account information by limiting access of the partner while still sharing the same account login. Another benefit of this account sharing model is that

it can assist its users to monitor for malicious attacks on partners' account, even if it is not actively requested.

Another issue with the current account sharing is that people grant access to their existing individual accounts to their partners. This sharing behavior carries security concerns because login information to individual accounts may contain personal information unique to their original owners. To address this issue, future security systems could make use of machine learning algorithms to identify when users have been sharing access with a romantic partner for an extended period and timely prompt them to review account settings, such as password, viewing permissions, emergency contact, or beneficiary.

A separate aspect of the maintenance of account sharing is safe and secure password sharing. From our data, we noticed many insecure password sharing practices, e.g., reusing passwords for convenience and sharing through email. This poses an opportunity for security researchers to innovate different methods to enable secure sharing of passwords between romantic couples. Equally important may be the need to educate users on secure password sharing protocols.

5.2 Supporting Users in Breakups

Of course, many relationships will not endure forever. At this third stage, individuals are likely to attempt to remove or disable a partner's access to accounts and will need to split up jointly owned property. In our qualitative data, one participant mentioned resetting passwords to all their accounts after breaking up with their ex-partner. Currently, this is a tedious and challenging process and poses security concerns if the user forgets which accounts are shared and which are not. We suggest that the design of account sharing should support users to effortlessly separate their accounts from their partners' and help owners monitor their accounts for ex-partners' login attempts. One design recommendation is to develop login notifications to notify account owners if individuals without sharing access are getting into accounts.

Furthermore, devices in a home network or personal mobile devices should be set, by default, to send notifications to private emails or text accounts about any installation of keyloggers, GPS trackers or other spyware. Accounts should also periodically prompt users to review their security settings. This will trigger owners' memory and help them retrieve access permissions from ex-partners.

Many times, the end of account sharing also triggers account ownership issues, i.e., who should own accounts that are used to be joint accounts? Account sharing features for romantic couples can keep track of the frequency of individual activities and show this information to couples to help them make an ownership decision. Alternatively, an account splitting feature can also help mediate this issue.

In general, sharing between romantic couples is a complicated behavior involving many nuances. While the majority of relationships are fulfilling and desirable, there are many examples of poor relationships, such as "insider threat" and domestic abuse. It is essential to consider these various contexts when designing account sharing and hiding features for romantically involved individuals and how different people will use the features. Supporting couples' practical and emotional needs while maintaining security for each user should

be the cornerstone of designing account sharing features for romantic couples.

6. LIMITATIONS AND FUTURE WORK

Only U.S. residents participated in our study and our findings are not representative of all sharing behaviors. We lacked data on individuals of non-binary gender and non-heterosexual couples and excluded their responses from quantitative analyses. Responses to hiding are tame given their small quantity. A future study may put greater emphasis on hiding and extend its scope to sharing among marginalized groups to amend these issues.

Self-reported responses may have resulted in an inaccurate recall and social desirability bias. The vague wording of the question asking for "active" hiding possibly misled some participants to overlook reporting past behaviors. As our work is exploratory, our design recommendations are non-technical and speculative. In general, our work could benefit from a more thorough exploration of behaviors and their diverse contexts. For example, we did not ask our participants in an open-ended question what types of online accounts they have, and likely have missed some online accounts (e.g., an online account for a municipal library) and associated account sharing behaviors.

Nevertheless, our work opens up an ample room for future works, which may look into: sharing behaviors violating terms and conditions if any, differences between sharing of remote accounts and machine (device) accounts, sharing of phone unlock patterns, and comparison of sharing behaviors between romantic relationships and other close relationships such as family and friends.

7. CONCLUSION

Security design choices often fail to take into account users' social context. Our work is among the first to examine security behavior in romantic relationships. We surveyed 195 people on Amazon Mechanical Turk about their relationship status and account sharing behavior for a cross-section of popular websites and apps. We examined differences in account sharing behavior at different stages in a relationship and for people in different age groups and income levels. We also constructed a taxonomy of sharing motivations and behaviors based on the iterative coding of open-ended responses, many of which are excerpted in this paper.

Based on this taxonomy, we presented design recommendations to support end users in three relationship stages: when they start sharing access with romantic partners; when they are maintaining that sharing; and when they decide to stop. Our findings contribute to the field of usable privacy and security by enhancing our understanding of security and privacy behaviors and needs in intimate social relationships and providing empirical evidence of the need to move beyond a simple one-user-one-account model of security design and system development.

8. ACKNOWLEDGMENTS

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APPENDIX

1. Categories and Accounts

Table A1. The list of 17 categories and accounts as presented in the survey, with categories revised for the analysis.

Revised categories	Initial categories	Accounts
Finance	Banking and Real Estate	Chase Bank, Bank of America, Wells Fargo, Capital One, American Express, Discover, U.S. Bank, TD Bank, SunTrust Banks, PNC, Zillow, Realtor, LoopNet, Trulia, Redfin
	Financial Services	Fidelity, Vanguard, American Century Investments, T. Rowe Price, Geico, Charles Schwab Corp., TD Ameritrade, TIAA, Progressive, Allstate, State Farm, Esurance, Metlife, Paypal, Venmo
	Utilities	Comcast (Xfinity), AT&T, Verizon, T-Mobile, Sprint, CenturyLink, MetroPCS, Con-Edison, People's Natural Gas, California Edison, Ameren UE, Georgia Power, National Grid, Eversource Energy, North American Power
Social	SNS, Blogging, and Forum	Facebook, Twitter, Instagram, Linkedin, MySpace, Wordpress, Imgur, Pinterest, Reddit, Tumblr, Snapchat, Blogger (Blogspot), Flickr, Squarespace, 4chan
	Social, Lifestyle, and Art	Meetup.com, Change.org, Patreon, HappyCow, Cohousing.org, Petfinder.com, Jw.org, Lds.org, Flexjobs.com, Skype[2], WhatsApp, Viber, Discord, Telegram, imo.im
	Web Portal (1)	Google - Gmail, Google Drive, etc.[1], Microsoft (MSN) - Outlook Mail, Bing, MS Onedrive, Office.com, etc.[2], Yahoo - Yahoo Mail, Yahoo Answers, etc., AOL - Aol Mail, etc., Apple - iCloud Mail, etc.[3], Easy.com, Lycos, Excite, Craigslist
Entertainment	Video/Music Streaming	Youtube[1], Vimeo, Hulu, Netflix, Soundcloud, Amazon Prime Streaming (Amazon)[4], Spotify, Pandora, Bandcamp, Tidal, Apple Music (iTunes)[3], Directv, Pandora, Google Play[1], iHeartRadio
	Sports, Gaming, and Entertainment	ESPN, MLB.com, NBA.com, NFL.com, Goal.com, Bleacher Report, CBS Sports, Steam, Roblox.com, Battle.net, Xbox.com, Ign.com, League of Legends, Sony Entertainment (Playstation Network), Twitch.tv
Lifestyle	E-Commerce	Amazon[4], Target, Best Buy, Ikea, Macy's, Kohl's, Walmart, The Home Depot, Costco, Staples, Lowe's, Ebay, Etsy, Groupon, Salesforce
	Logistics and Delivery	UPS, Fedex, USPS, DHL, Postmates, Grubhub, Seamless, DoorDash, OnTrac, Blue Apron, GoPuff, Foodler, EatStreet, Instacart, XPO Logistics
	Transportation and Rentals	Uber (UberEATS), Lyft, Uhaul, Penske, Budget, Hertz, Zipcar, Megabus, Greyhound, BoltBus, United Airlines, American Airlines, Delta Airlines, Southwest Airlines, JetBlue
	Fitness and Health	WebMD, Myfitnesspal.com (Under Armour), Mayo Clinic, Drugs.com, Medscape.com, Strava, Prevention.com, Self.com, 24 Hour Fitness, Gold's Gym, American Council on Exercise (Acefitness.org), Freeletics, Freetrainers.com, Peak Pilates, Men's Health
	Leisure and Travel	Booking.com, TripAdvisor, Expedia, Hotels.com, Kayak.com, Marriott.com, Priceline, Hilton.com, easyJet, VRBO, Orbitz, Lonely Planet, Couchsurfing.com, Airbnb, Yelp (Yelp Eat24)
Information & Learning	Creativity and Productivity	Github, Adobe Create Cloud, DeviantArt, unity3d.com, Autodesk.com, Shutterstock, Fanfiction.com, Instructables, MindTools, Framer, VSCO, Epicurious, Allrecipes, Wix.com, Sketch
	Learning and References	Coursera, Duolingo, Codecademy, edX.org, Lynda.com, Khan Academy, Udacity, Stack Overflow, Quora, Wikia, IMDb, MIT Opencourseware, Alison.com, Masterclass.com, Wikipedia
	News and Magazine	CNN, NYTimes, The Guardian, The Washington Post, Forbes, Fox News, Bloomberg, USA Today, The Wall Street Journal, CNBC, Time, The Atlantic, Buzzfeed, Wired, Queerty

Web Portal (2)	Amazon - Amazon Drive, Amazon Web Services, etc.[4], Oracle - Oracle Cloud Storage Service, etc., Dropbox, Box.com, Mega.nz, SpiderOak
Dating	OkCupid, Happn, Coffee Meets Bagel, Bumble, Tinder, Down, Lulu, Match.com, Zoosk, Grindr, Hinge, eHarmony, Badoo, PlentyofFish, Ashley Madison

* Web portal was later grouped under two revised categories. Accounts with email features were grouped under social and the rest were grouped under information & learning. Dating was left as a separate category.

[1] Google - Gmail, Google Drive, etc., Youtube, Google Play were coded as Google (Youtube).

[2] Microsoft (MSN) - Outlook Mail, Bing, MS Onedrive, Office.com, etc. and Skype were coded as Microsoft.

[3] Apple - iCloud Mail, etc. and Apple Music (iTunes) were coded as Apple.

[4] Amazon, Amazon Prime Streaming, and Amazon - Amazon Drive, Amazon Web Services, etc. were coded as Amazon.

2. Survey Questions

Note: We only present here questions relevant to the analysis. Questions here are renumbered for presentation, and visual details are removed for concision.

Screening

1. Have you ever been in (or are currently in) a romantic relationship?
☐ Yes, I have been in (or am currently in) a romantic relationship.
☐ No, I have never been in a romantic relationship.

2. Are you currently in an exclusive romantic (dating/marital) relationship?
☐ Yes, I am currently dating someone.
☐ Yes, I am currently married.
☐ No, I am not currently in an exclusive romantic relationship.

3. Have you been in your current relationship for more than a month?
☐ Yes, I have been in my current relationship for more than a month.
☐ No, I have not been in my current relationship for more than a month.

4. If you are not currently in a relationship, did you end your last relationship more than a year ago?
☐ Yes, I broke up from my last relationship more than a year ago.
☐ No, I did not break up from my last relationship more than a year ago.

5. Did your previous relationship last longer than one month?
☐ Yes, my previous relationship lasted longer than one month.
☐ No, my previous relationship did not last longer than one month.

Relationship Details
1. How long have you been in your current relationship? Years ____ Months ____
2. Are you currently living together with your partner? ☐ Yes ☐ No
3. For how long have you been living with your partner? Years ____ Months ____
4. How long did your previous romantic relationship last? Years ____ Months ____
5. Did you live together with your last romantic partner? ☐ Yes ☐ No
6. For how long did you live with your last romantic partner? Years ____ Months ____

Account Usage and Access

Note: There were 17 sections and each section corresponded to a category. A section had two pages, and an introductory paragraph was shown at the beginning of the first page to remind participants about definitions of terms we used throughout the survey. Following questions recurred for each account selected by participants. The part on devices was structured similarly, but we do not explain in detail as it was excluded from the analysis.

1. Do you have any [category] accounts that you commonly use? Choose all accounts that you OR your partner own from the following list. As a reminder…
- By accounts, we mean any website which you use an ID and password to access services or content.
- By sharing, we mean any situation in which you and your partner use a single account/device, either at the same time or taking turns.
- By own, we mean either you own and your partner accesses or that your partner owns and you access. While the questions assume you own the account, you should treat the questions similarly if your partner is the primary owner.
- By joint accounts, we mean any accounts which you and your partner have set up solely for sharing, owned by both you and your partner. Also, if you have any accounts which you share with or hide from your partner, you will be asked to write few lines to describe why and how you share or hide those accounts.

☐ Account 1	☐ Account 2	☐ Account 3
☐ Account 4	☐ Account 5	☐ Account 6
☐ Account 7	☐ Account 8	☐ Account 9
☐ Account 10	☐ Account 11	☐ Account 12
☐ Account 13	☐ Account 14	☐ Account 15

2. For each account which you selected or entered on the previous page, pick statements those best describe how you and your current/last partner use(d) an account. From each column: 1) choose a statement indicating ownership of an account, 2) choose a statement describing how your partner use(d) an account, and 3) choose a statement about how you use(d) an account.

	Partner regularly uses this account (once a week or more)	Partner sometimes uses this account (once a month)	Partner rarely uses this account (once every few months)	Partner never uses this account
Account	☐	☐	☐	☐

	I am the primary owner of this account	My partner is the primary owner of this account	This account is a joint account	We have separate accounts
Account	☐	☐	☐	☐

	I regularly use this account (once a week or more)	I sometimes use this account (once a month)	I rarely use this account (once every few months)	I never use this account
Account	☐	☐	☐	☐

3. For each account which you selected or entered on the previous page, pick a statement that best describes how your current/last partner access(ed) an account.

	Partner has ready access to this account (e.g. knows password)	Partner can access this account if needed (e.g. can guess password or knows where you store passwords)	Partner doesn't have easy access to this account (i.e., has to ask you, or you login manually)	Partner doesn't know about this account but I'm not actively hiding it	Partner doesn't know and I'm actively hiding the account
Account	☐	☐	☐	☐	☐

4. If you share any [category] accounts with your partner, then could you describe why you choose to share those accounts with your partner, and how you share passwords? (e.g., By using a password manager, by keeping accounts signed in, etc.) You can skip this question if you don't share any accounts.

_____

_____

_____

5. If you are actively hiding any [category] accounts from your partner, then could you describe why you choose to hide those accounts from your partner, and how you hide them? (e.g., By using incognito mode, by deleting the browsing history, by physically hiding the usage, etc.) You can skip this question if you don't hide any accounts.

_____

_____

_____

3. Comparison of Survey Sample and the U.S. Population

Table A2. The comparison of demographic characteristics of the survey sample and the U.S. population.

	U.S. population	Survey sample
N	**249M**	**191**
Age		
18-24	12.4%	7.3%
25-34	17.8%	53.9%
35-44	16.3%	25.7%
45-54	17.1%	9.4%
55-65	16.6%	3.7%
65+	19.7%	0%
Education		
High school or less	39.7%	17.3%
Some college	29%	36.1%
College and more	31.3%	46.6%
Income		
Less than $19,999	45.1%	11.5%
$20,000 to $39,999	24%	34%
$40,000 to $59,999	11.6%	27.7%
More than $60,000	19.3%	26.7%
Gender		
Female	51.3%	43.2%
Male	48.7%	56.8%

* Percentages for the U.S. population were calculated from 2016 American Community Survey (ACS) 1-year Estimates that was released September 14, 2017. 2016 ACS 1-year estimates are based on data collected from January 1, 2016 to December 31, 2016.

4. Differences in Sharing of Entertainment Accounts and Finance Accounts

Table A3. Contingency table for the number of finance accounts and entertainment accounts shared in different stages of a relationship.

Count Total % Col %	Is not new in a relationship	Is new in a relationship	Total
Is not an entertainment account	655 64.3% 66.7%	13 1.28% 35.1%	668 65.6%
Is an entertainment account	327 32.1% 33.3%	24 2.36% 64.9%	351 34.5%
Is not a finance account	704 69.1% 71.7%	34 3.34% 91.9%	738 72.4%
Is a finance account	278 27.3% 28.3%	3 0.29% 8.11%	281 27.6%

Note: The first two rows of the table are comparing the number of entertainment accounts and non-entertainment accounts shared by those who are new in relationships and those who are not. For example, the first column of the first row shows who are not new in relationships share 655 non-entertainment accounts, which constitute 66.7% of accounts they share. Comparing that with 327 in the row below, which is the number of entertainment accounts shared by who are not new in relationships, shows who are not new in relationships share more non-entertainment accounts than entertainment accounts. On the contrary, the second column shows the reversed pattern of entertainment account sharing for who are new in relationships, with 64.9% (24) of accounts shared by them being entertainment accounts, while only 35.1% (13) of accounts shared are not entertainment accounts. Numbers in bottom two rows show that who are new in relationships share more non-finance accounts than who are not new in relationships (91.9% vs. 71.7%), while who are not new in relationships share more finance accounts that who are new in relationships (28.3% vs. 8.11%).

5. Reasons for Sharing

Table A4. List of 25 reasons for sharing with descriptions and associated codes (C=Convenience, E=Economic, L=Logistics, T=Trust, R=Relationship well-being, S=Support).

Reasons (Associated codes)	Description	Example
1 - Joint finance (T, E, C)	Sharing an account because of merged finance	*... We share these accounts to help keep track of our spending. This allows us to budget for the whole month. We both need to know how much money is being spent.*
2 - To keep track of activities (C, L)	Sharing an account to keep track of activities such as spending and order shipments	*We both order and ship stuff and log in to these from time to time to deal with the tracking and history aspects. I keep them logged in but she knows the passwords.*
3 - Similar interest (R, L)	Sharing an account because of shared interests, but not necessarily doing same activities or for same contents	*My [partner]loves those kinds of websites for reading, so everything is in his name. I have access and go on too read it when I want to.*
4 - Simultaneous activities (C, L, R)	Sharing an account to engage in some activity simultaneously	*We both use the Directv information since we like to watch TV together and we can also check on specials this way. He will sometimes access my Google Play if we are going to watch a movie together.*
5 - Shared devices (C, T, E, L)	Couples share an account as they share a device that uses the account	*We keep the accounts signed in on the devices that they are used on. We also know each others passwords to the account should they get signed out.*
6 - Shared friends/family (T, C)	Couples share an account as it lets them connect to shared friends/family	*It's easier when dealing with family and mutual friends to use our joint gmail account. We both keep track of our own passwords.*
7 - Easier management/usage (C, E, L)	Sharing an account to make its management or usage convenient	*Both of our names are on this joint account and it's our main credit card we use. We decided to share and create the password together in order t make it easier to manage account and payments. We use passwords that both of us can remember based on personal information and it is saved in a file.*
8 - For transparency (T)	Sharing an account for transparency/openness	*I share my SNS account passwords with my partner because I don't have anything to hide from him. We are completely open with each other so there isn't any reason why I would not allow him to access my accounts. Since we share the same laptop and I sometimes use his smartphone, I am usually already signed into my accounts so he can access them as well.*
9 - To know what the other is doing (T)	Sharing an account to know what the other is doing	*All passwords for these are often saved on sign in and are accessible by both of us. We choose to share accounts because we share devices and play the same games most of the time. We have the same friends and play buddies so it is much easier for us to manage one account rather than two. It is also transparent and makes us feel comfortable to know what the other is doing.*
10 - Because of relationship/marriage (C, T, E, L)	Sharing an account as it makes their marriage or relationship stronger	*Even though we don't live together, we spend the majority of our time together. It just makes life easier to share these accounts now, since we do plan on marrying in the next year.*
11 - No reason to hide/no sensitive information (T)	Sharing an account as there is no reason to hide, the account contains no sensitive information	*I share the Pacific Gas & Electric and AT&T accounts with my partner because there is NO reason to hide anything ...*

12 - Mutual usage (C, L)	Couples share an account as they mutually use the account (or its contents), but not necessarily at the same time, or for the same purpose	*We share an Uber account so that we can both get around the city. It just makes it easier to have the same account so that it charges to the same card.*
13 - Shared objectives (R, L)	Couples share an account to achieve a mutual goal or purpose	*I like all of our pictures in one place, so I have given my partner the password to Dropbox*
14 - Trust (T, R)	Sharing an account because of trust, or for trust	*I shared my google account password with my partner because trust my partner. My partner know this password and saved in web-browser for easy access.*
15 - Shared business/investments (E, L)	Sharing an account for a shared business, or for shared investments	*WE share it so we can both sell things on it and have a better rating we both know the password for the account*
16 - To help/get help (T, S)	Sharing an account to get help or give help	*Everything is in my name in our marriage, so we share everything. He helps pay bills and helps deposit money so it makes sense for him to have access to all of the accounts. \n\nAlso he likes to make sure I'm not spending too much on my credit cards.*
17 - For emergency (T, S, L)	Sharing an account in preparation for an emergency	*We share these accounts so that either one of us can call if we have problems or questions. We both know the passwords to each account.*
18 - To care for the other (S, L, R)	One shares an account to care for the other	*i share the account so that my fiance could keep up on current events with me and so that he can read funny articles. i share the password by just telling him what it is so that he always has access to it.*
19 - To reduce costs/share benefits (E)	Couples share an account as sharing reduces costs or increases benefits earned from using the account	*I choose to share this account because it would save us a lot of money if we used this individually which makes sense. If we have to put a password in, it is in our little notebook we have to check.*
20 - Living together (C, L)	Couples share an account as they live together	*There is no need for both of us to have a Netflix account since we live in the same house. We stay signed in to this account.*
21 - Because there is a feature that support sharing (C, L)	Sharing an account because it has a feature that supports sharing	*We share the account because we pay for the account together and can have multiple users. There would be no reason to pay for two accounts. We usually just stay signed in on the account on the tv.*
22 - To delegate responsibilities (merged with 16)	Couples share an account to delegate responsibilities besides paying bills when needed	*I share this account with my husband cause sometimes I work late and he needs to order groceries from the app. With my job, I cannot stop and get on my phone to order. I let him know the password when I initially signed up.*
23 - No reason to make a new account (removed)	One sees no reason to make a new account or is reluctant to create a new account	*These are common streaming accounts that we share. There is no need for us to have our own accounts when it comes to streaming. We both know the password and both use these accounts regularly.*
24 - Because sharing was necessary/was asked to do so (removed)	Sharing an account as it was necessary or were asked when creating the account	*In the case of Groupon, I use it far less frequently than my wife and she often forwards me deals that may be of interest to me. Therefore, there is little point in my creating my own account when I can simply use hers. For Costco, we were asked to create a single account when we became Costco members, and it was easy for my wife to remember the username and password.*
25 - Laziness (C, L)	Sharing an account because of laziness/don't want to create a new account	*We share the accounts out of laziness mostly. She uses Ebay and Etsy though, while I don't have any interest in them.*