Emotional Impact: How Stories Affect Password Behavior

Chris Fennell
Michigan State University
East Lansing, MI, USA
cfennell@msu.edu

Rick Wash
Michigan State University
East Lansing, MI, USA
wash@msu.edu

Abstract
Passwords represent a vital tool in how individuals can interact with various online and computing services. One way individuals learn about passwords is through stories which can contain lessons about computer security habits. In this paper, we wanted to know what emotions individuals felt when they described their own story and if that story lead them to behave differently as a result. We analyzed the survey data from 87 participants and asked them to recall stories about passwords that influenced them. We found individuals reported overall feelings of Nervous, Anxious, Frustrated and Curious but when individuals reported feeling disheartened and dispirited, they reported changing their behavior as a result.

Author Keywords
Passwords; Security; Stories;

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous; K.6.5 [Security and Protection]: Miscellaneous

Introduction
One way to address the problem of improving users password beliefs is to think about the ways in which individuals learn. Past research suggests that many individuals learn

their computer security behaviors from people close to them like family and friends through informal stories [5]. Stories enable readers to identify with the main characters in an easy, knowable way [1]. These stories often contain lessons and enable their readers to learn a desired outcome. Passwords are not the primary purpose for going online or using the computer, but decisions still need to be made about them [8]. Passwords are tools which enable users to access content and authenticate who is using a computer or system. Computer security practitioners often teach individuals about passwords through presenting facts and advice [7]. We, instead, explore how people learn about passwords through stories from peers. Stories, as a learning tool, may offer a way for individuals to learn about threats and alter beliefs.

Related Work
Rader et al. [5] examined and analyzed computer security stories to learn more about where individuals learn their computer security habits. The researchers asked non-expert computer users to submit stories about computer security issues that they heard from others. Since computer security threats can be different, it is very interesting to see in what ways password stories affect individuals behavior. Within these stories, we want to examine is to see any differences when the protagonist is themselves or not. This could provide insight as to the differences in the way individuals learn from their own experience or if they learn from someone else's story.

Another area that we wanted to explore is to see what emotions are invoked after individuals recall a story about passwords. Kay and Loverock [3] have explored the affect computers have on emotions and Rader et al. [5] have examined emotions on computer security behavior. Early psychology research on emotion found that individuals can

be affected by positive (happy, excited) or negative emotions (Anger, frustration) but typically it was thought that one strong emotion would emerge over all others [6]. Research by Larsen, McGraw and Cacioppo [4] showed that emotions are complicated and that individuals can experience many emotions. Not just a unified way but emotions can activate simultaneously [4]. When it comes to computer security, if an individual learned a security behavior through a previous experience, such as being hacked or forgetting a password, we would expect an emotional responses would be tied to such an event. While we expect individuals to tell stories about computer security decisions, we are unsure of the exact impact that they might have on their own emotions.
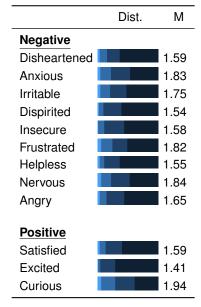
Method
We conducted a short survey in November and December of 2017 where we asked undergraduate students to tell us a story involving passwords. In order to avoid overly simple stories and to make sure we could engage participants in a meaningful way, we decided to adapt the method from Rader et al. [5]. We started by asking participants to think about a number of stories that were password related and from there we asked them to focus on one story (see sidebar). We then asked them a number of questions about that story that they had decided to focus on.

The participants were chosen through self selecting our survey through our student research pool for which they would receive extra credit. We received a total of 87 responses. The respondents were aged between 18-36 (m=20.98, sd=2.761) and they consisted of 54 (62.1%) female and 33 (37.9%) male participants.

Results
Our primary focus for this study was to see if any behavior change came as a result of their story. In addition to the

	Dist.	M
Negative		
Disheartened		1.59
Anxious		1.83
Irritable		1.75
Dispirited		1.54
Insecure		1.58
Frustrated		1.82
Helpless		1.55
Nervous		1.84
Angry		1.65
Positive		
Satisfied		1.59
Excited		1.41
Curious		1.94

Legend
- ■ - 4. Extremely
- ■ - 3. Mostly
- ■ - 2. Somewhat
- ■ - 1. Not at all

Table 1: Emotions means

Security Behavior Intention Scale (SEBIS) questions developed by Egelman and Peer [2], we asked the users simply if they started doing things differently as a result of the story they told. 36% of our participants reported changing their behavior as a result of their stories and 85% reported that they changed their thinking about passwords because of their story. Knowing that many of the participants changed their thinking and their behavior, we asked participants to report the levels of emotions that they felt and examined each emotion against whether or not the decided to change their behavior as a result of their story.

Behavior Change

We separated the emotions into the broad categories of positive and negative emotions from Kay and Loverock [3], 1-Not at all, 2-Somewhat, 3-Mostly, and 4-Extremely. Analyzing the means of the emotions (see Table 1) we can see that for almost all of the emotions the means were between "not at all" and "somewhat" with many of the means leaning towards "somewhat". The top three means were nervous, anxious and frustrated for the negative emotions and Curious for the positive emotions. Using linear regression, we created models for each each emotion (see Table 2) and found that emotions effect behavior change differently.

Perhaps the participants felt that their stories made them feel negative emotions associated with the outcomes of their stories. To investigate this further, we asked the participants open ended questions. For example, some participants (#13, #80) reported that their password was compromised or that someone they new had their password compromised. #35 and #76 reported that they had high levels of anger. However, the highest effect sizes were with the emotions of dispirited (R^2=11.1%) and disheartened (R^2=10.5%). So participants reported high means for nervous, anxious, frustrated and curious but when the story

	Estimate β		R^2	
Negative				
Disheartened	0.419	**	0.111	**
Dispirited	0.363	**	0.106	*
Angry	0.306	*	0.061	*
Nervous	0.322	*	0.053	*
Anxious	0.296	*	0.048	*
Insecure	0.255	*	0.046	*
Irritable	0.278	.	0.043	.
Frustrated	0.237		0.029	
Helpless	0.102		0.007	
Positive				
Curious	0.174		0.016	
Satisfied	0.121		0.015	
Excited	0.079		0.004	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 2: Emotions on Behavior Change. Grouped by emotion valence and sorted by R^2

made you feel disheartened or dispirited it led to a change in behavior with passwords.

After we asked the participants about the emotions they felt during the stories, we asked them to describe one thing that they started doing differently. The response was open ended so we content analyzed them by grouping similar responses for each of the emotions. We picked the emotions that had the greatest effect sizes (R^2) from Table 2 which happened to be Disheartened and Dispirited. To do this analysis, we only picked participants if they reported feeling mostly or extremely for Dispirited and Disheartened and then analyzed and grouped their responses (see Table 3).

	Dispirited	Disheartened
Dont́ Forget passwords	1	1
Write Down passwords	2	3
Create harder passwords	1	2
Dont́ Share passwords		1
Change passwords		1
Change password Freq.	1	
Change ways	1	1
Change password across sites		
Make more memorable		1

Table 3: Responses to Behavior changed in counts.

The table shows the behaviors that participants decided to change as a result of their story. Individuals who felt dispirited wrote reasons like "Don't forget passwords","Write down passwords", and "Create harder passwords". As examples, Participant #11 wrote "Always writing down passwords for myself" and participant #40 "Writing down my passwords". Individuals who felt disheartened wrote similar changes such as "Create harder passwords", "Don't share passwords", "Change passwords" and "Make more memorable". While the small number of participants prevent us from evaluating how frequently each change happened, it is interesting that negative emotions led people to write down passwords or create harder passwords.

Discussion
Our findings are consistent with past research in computer security; when individuals decide to make a behavior change they draw from their beliefs. Stories that leave people feeling dispirited and disheartened lead to behavior change. Looking closer at the participants full stories we can begin to see why. Taking participant #11 as an example (See Sidebar), "losing thousands in theft" can be easily seen as invoking those emotions. The story leaves you feeling disheartened and dispirited because you empathize with the grandmother.

Conclusion and Future work
While many emotions can be associated with computer security stories about passwords, feeling disheartened and dispirited can lead to behavior change. It seems that the emotions that individuals feel can lead them to different types of behavior change. We would like to examine these stories further to see if they can be used as a way to improve individuals password practices and ultimately better computer security behaviors.

Acknowledgements

REFERENCES
1. Jonathan Cohen. 2001. Defining Identification: A Theoretical Look at the Identification of Audiences With Media Characters. *Mass Communication and Society* 4, 3 (aug 2001), 245–264. DOI: http://dx.doi.org/10.1207/S15327825MCS0403_01

2. Serge Egelman and Eyal Peer. 2015. Scaling the Security Wall: Developing a Security Behavior Intentions Scale (SeBIS). *Proceedings of the ACM CHI'15 Conference on Human Factors in Computing Systems* 1 (2015), 2873–2882. DOI: http://dx.doi.org/10.1145/2702123.2702249

3. Robin H. Kay and Sharon Loverock. 2008. Assessing emotions related to learning new software: The computer emotion scale. *Computers in Human Behavior* 24, 4 (2008), 1605–1623. `DOI:` `http://dx.doi.org/10.1016/j.chb.2007.06.002`

4. Jeff T. Larsen, A. Peter McGraw, and John T. Cacioppo. 2001. Can people feel happy and sad at the same time? *Journal of Personality and Social Psychology* 81, 4 (2001), 684–696. `DOI:` `http://dx.doi.org/10.1037//0022-3514.81.4.684`

5. Emilee Rader, Rick Wash, and Brandon Brooks. 2012. Stories as informal lessons about security. In *Proceedings of the Eighth Symposium on Usable Privacy and Security - SOUPS '12*. ACM Press, New York, New York, USA, 1. `DOI:` `http://dx.doi.org/10.1145/2335356.2335364`

6. James A. Russell. 1980. A circumplex model of affect. *Journal of Personality and Social Psychology* 39, 6 (1980), 1161–1178. `DOI:` `http://dx.doi.org/10.1037/h0077714`

7. Rick Wash. 2010. Folk models of home computer security. In *Proceedings of the Sixth Symposium on Usable Privacy and Security - SOUPS '10*. ACM Press, New York, New York, USA, 1. `DOI:` `http://dx.doi.org/10.1145/1837110.1837125`

8. Rick Wash and Emilee Rader. 2015. Too Much Knowledge? Security Beliefs and Protective Behaviors Among United States Internet Users. *Eleventh Symposium On Usable Privacy and Security (SOUPS 2015)* (2015), 309–325. `https://www.usenix.org/conference/soups2015/proceedings/presentation/wash`