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TECHNOLOGY
POLICY

Password policies of most top websites fail to follow best practices

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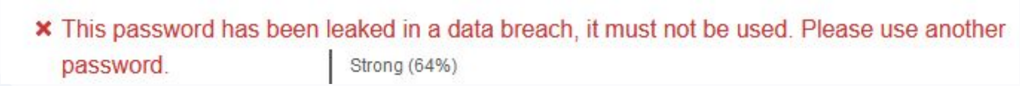
Passwords aren’t going anywhere

- Password strength is still important.
- Best practices from research to encourage stronger passwords:
  - Use blocklists

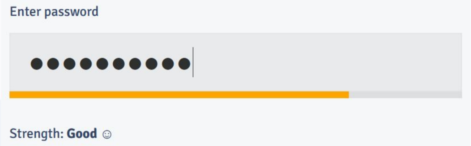


✖ This password has been leaked in a data breach, it must not be used. Please use another password.

Strong (64%)

✓

  - Use a strength meter (that accurately models adversarial guessability)



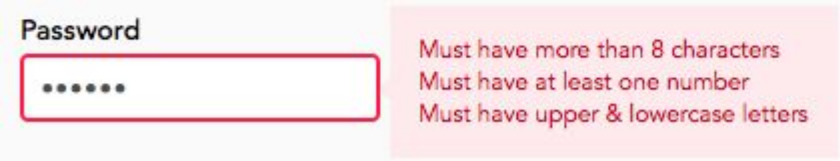
Enter password

●●●●●●●●●●●

Strength: **Good** ☺

✓

  - Don’t require specific types of characters



Password

••••••

Must have more than 8 characters
Must have at least one number
Must have upper & lowercase letters

✗

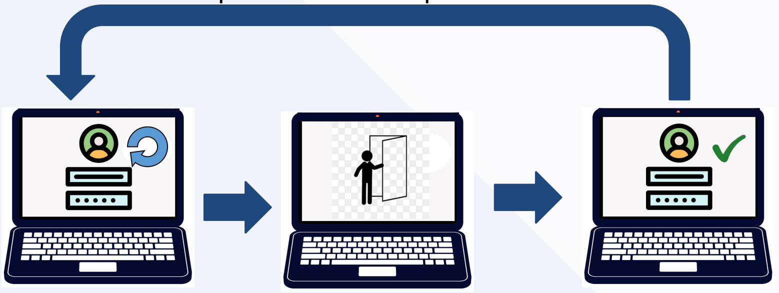
But are websites listening to the research?

- Research questions:
  - Are websites preventing users from using the most common passwords?
  - Are websites using password strength meters to encourage hard-to-guess passwords?
  - What composition rules/policies (PCPs) are used?
- Tested 120 English-language websites among most popular websites in the world (according to Tranco)

Study 1: Are websites preventing setting the most common passwords?

- Best practice: use blocklists to prevent users from choosing bad passwords (Kelley et al., 2012, Shay et al., 2015, Habib et al., 2017).
- We tested 2 sets of 20 passwords:
  - *leaked* passwords (sampled from HIBP-100k most common list)
  - *easiest-guessed* passwords (guessed by an ensemble of password cracking tools, CMU's Password Guessability Service)
  - Websites with identical PCPs (*1class6, 3class8, etc.*) tested with same set of passwords

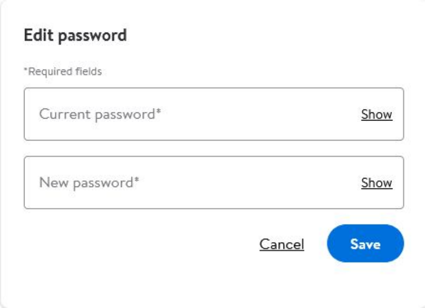
Repeat with different password



Set: `p@ssw0rd`

Log out

Log in: `p@ssw0rd`



Edit password

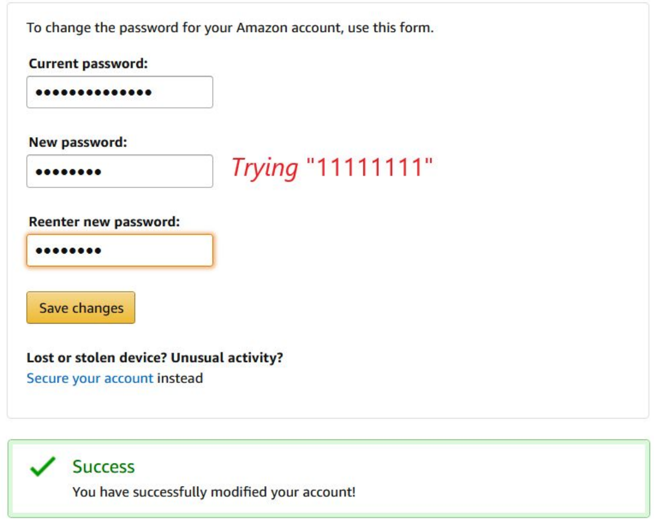
*Required fields

Current password* Show

New password* Show

Study 1: 71 sites allowed all *leaked* and *easiest-guessed* PWs

- 71 websites, including Amazon, TikTok, Netflix, WSJ, allowed all 40 PWs.
  - `123456`, `p@ssw0rd` allowed
  - Sensitive user information stored at these websites
- 19 websites had insufficient strategies, such as only blocking "123"
- Only 22 websites allowed ≤ 5 of the 40 PWs tested



To change the password for your Amazon account, use this form.

Current password: ••••••••••••••

New password: ••••••••

Trying "11111111"

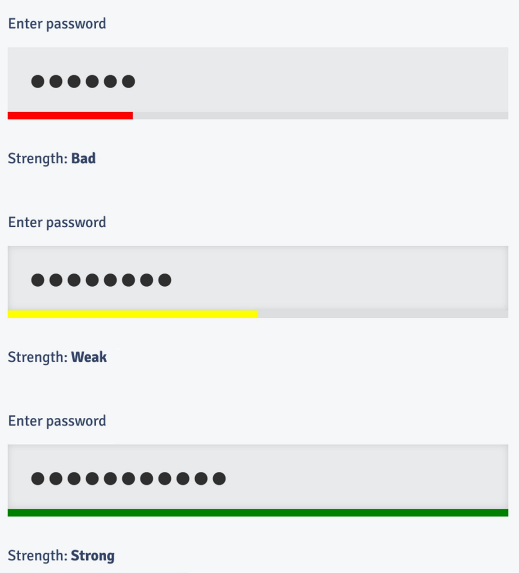
Reenter new password: ••••••••

Lost or stolen device? Unusual activity?
Secure your account instead

✓ Success
You have successfully modified your account!

Study 2: Are websites using strength meters?

- Best practice: use meter to estimate resistance to adversary cracking (guessability), not complexity (Tan et al., 2020, de Carnavalet et al., 2014)
- We tested the password input fields and looked for any feedback.



Enter password

●●●●●●

Strength: **Bad**

Enter password

●●●●●●●●

Strength: **Weak**

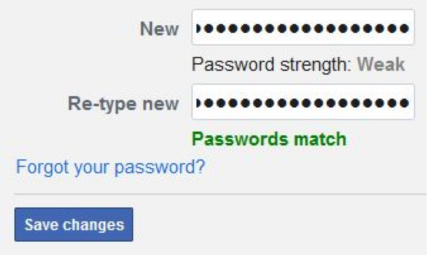
Enter password

●●●●●●●●●●●

Strength: **Strong**

Study 2: Strength meters are not measuring guessability

- Low adoption: only 23 websites were using strength meters at all.
- Of those, 10 use meters as nudges toward character-class PCPs
  - 6 websites have minimum-length PCPs (no character-class reqs) only, so strength meter being used as proxy for character-class PCPs
  - 4 websites use meters to encourage even more complexity than required.
- **Also**: inconsistency with server: 12/23 websites were inconsistent between meter feedback and password acceptance



New ●●●●●●●●●●●●●●●●●●

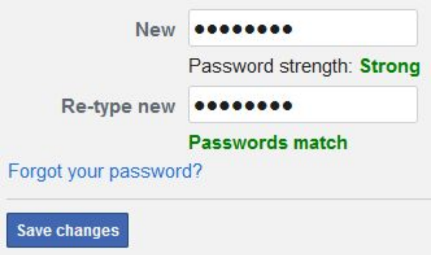
Password strength: Weak

Re-type new ●●●●●●●●●●●●●●●●●●

Passwords match

Forgot your password?

bkmmafwexucnvnsgppdk



New ●●●●●●●●

Password strength: Strong

Re-type new ●●●●●●●●

Passwords match

Forgot your password?

Passw0rd

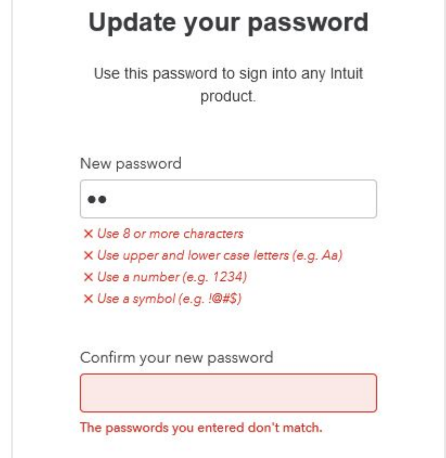
Study 3: Have sites moved on from character-class PCPs?

- Best practice: don’t require specific types of characters in passwords

  (Komanduri et al., 2011, Kelley et al., 2012, Tan et al., 2020).
- We manually extracted and reverse-engineered the PCPs at all 120 websites

Study 3: Character-class PCPs are still widely used

- We found 54 websites still using character-class PCPs, despite all the research and recommendations against using them
- Websites with character-class PCPs are more likely to allow *leaked* and *easiest-guessed* passwords
  - 38/54 (70%) allowed all 40 passwords we tested in Study 1 (compared to 50% for websites with a no character-class requirements)



Update your password

Use this password to sign into any Intuit product.

New password

••

✕ Use 8 or more characters

✕ Use upper and lower case letters (e.g. Aa)

✕ Use a number (e.g. 1234)

✕ Use a symbol (e.g. !@#$)

Confirm your new password

The passwords you entered don't match.

All in all: only 15 websites were following best practices

- **Security:** allows ≤ 5 of the 40 common known-weak passwords we tried (e.g. “12345678”). 22/120

- **Security:** uses a strength meter that accurately models guessability OR requires a minimum length of 8.* 77/120

- **Usability:** does not require specific types of characters. 66/120

- Websites following all three criteria: 15/120

Why is this research-practice gap so large?

- More research is needed!
  - Engage with system administrators to get their perspectives on password security.
- Some hypotheses:
  - Password policy is security theater.
  - Websites have shifted their attention to adopting other authentication technologies, and believe that it is unnecessary to strengthen their password policies.
  - Websites need to pass security audits, and the firms who do these audits, such as Deloitte, recommend or mandate outdated practices.
  - Some other practical constraint that the academic community does not know about.

Recap

- Most top websites are not following best practices in their password policy.
  - Users are either at risk from being allowed to set vulnerable passwords, and/or frustrated from character-class requirements.
  - The research is clear, but it looks like practice lags research.
- Future work: understand why system administrators are not following these best practices

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Thank you!

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