Better managed than memorized?

Studying the Impact of Managers on Password Strength and Reuse

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USENIX Security Symposium
Baltimore, August 15th, 2018

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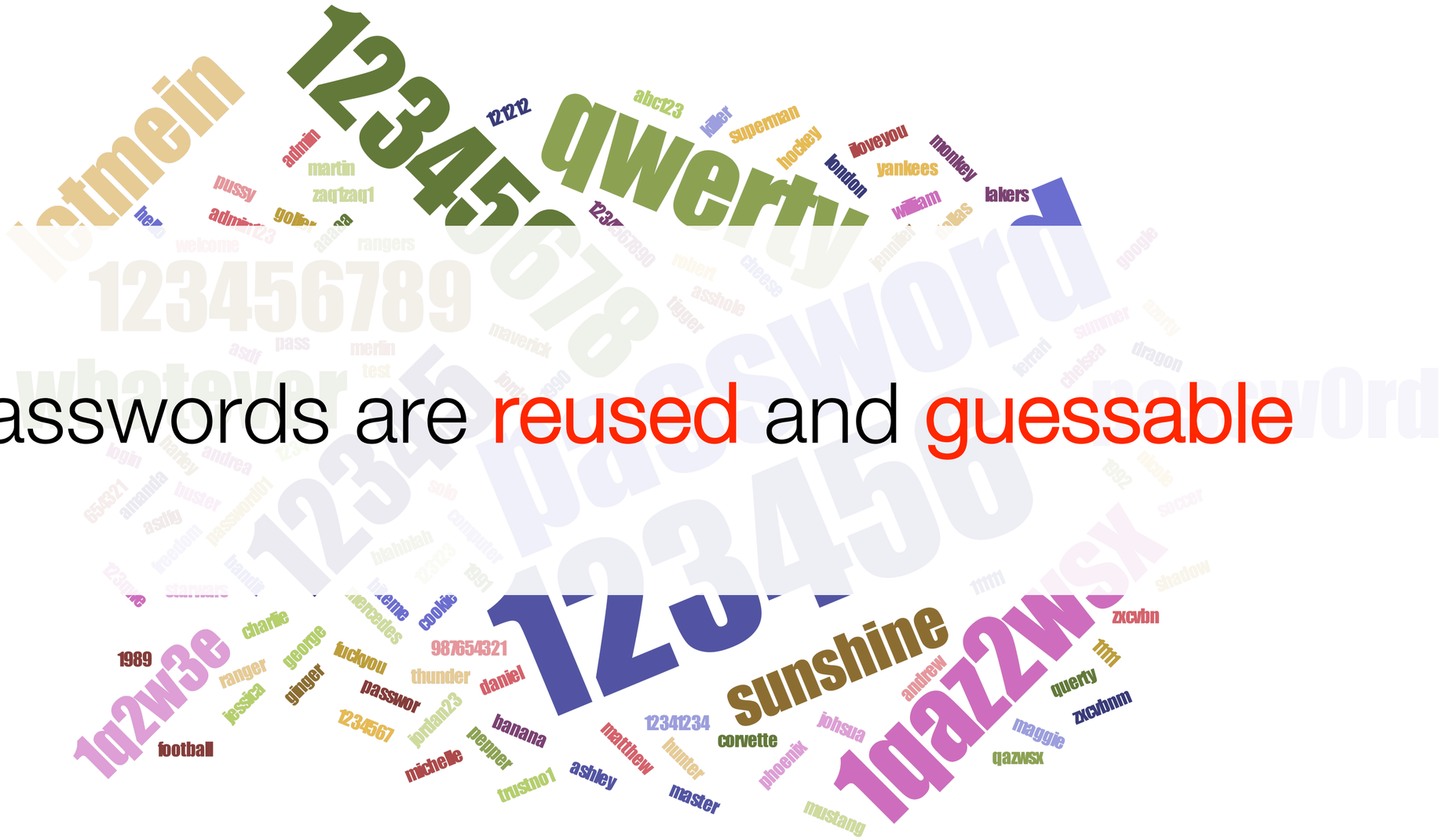
Where there’s an account there’s a password



Passwords are reused and guessable

Password managers to the rescue!

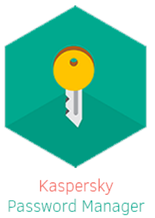




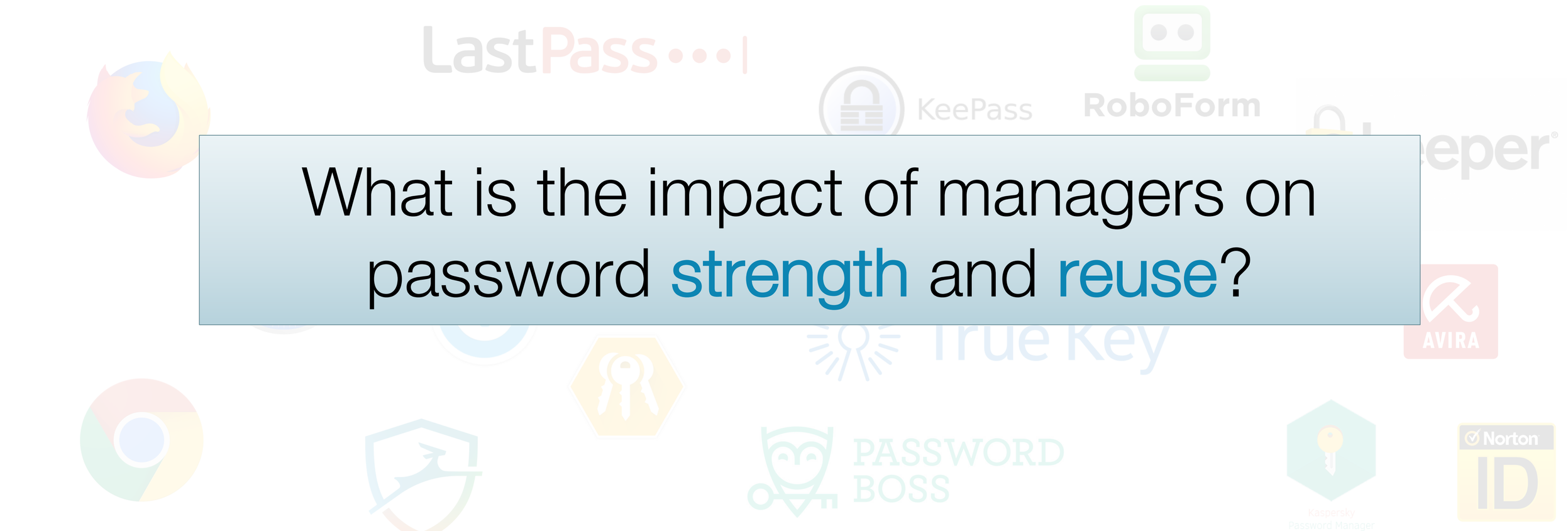






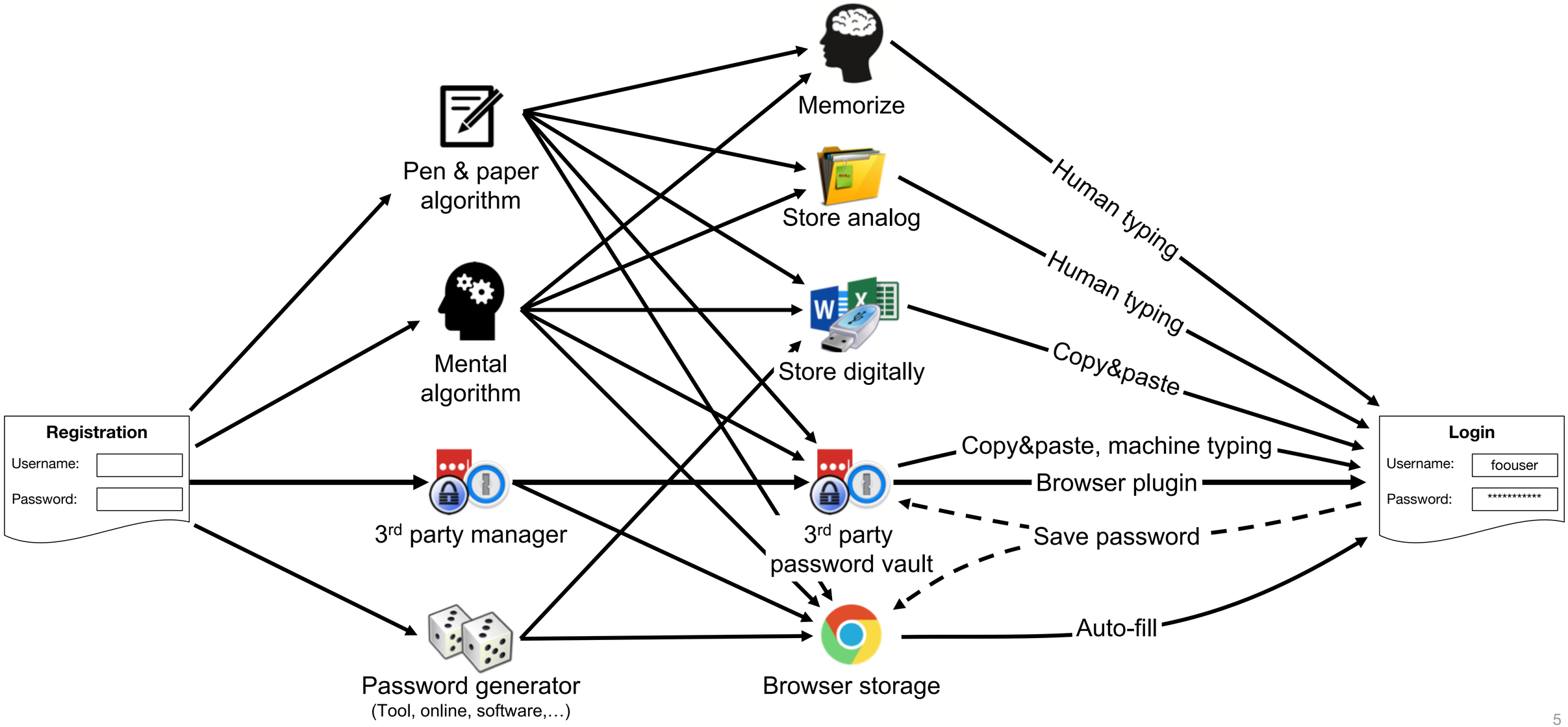




~~Password managers to the rescue!~~ ?

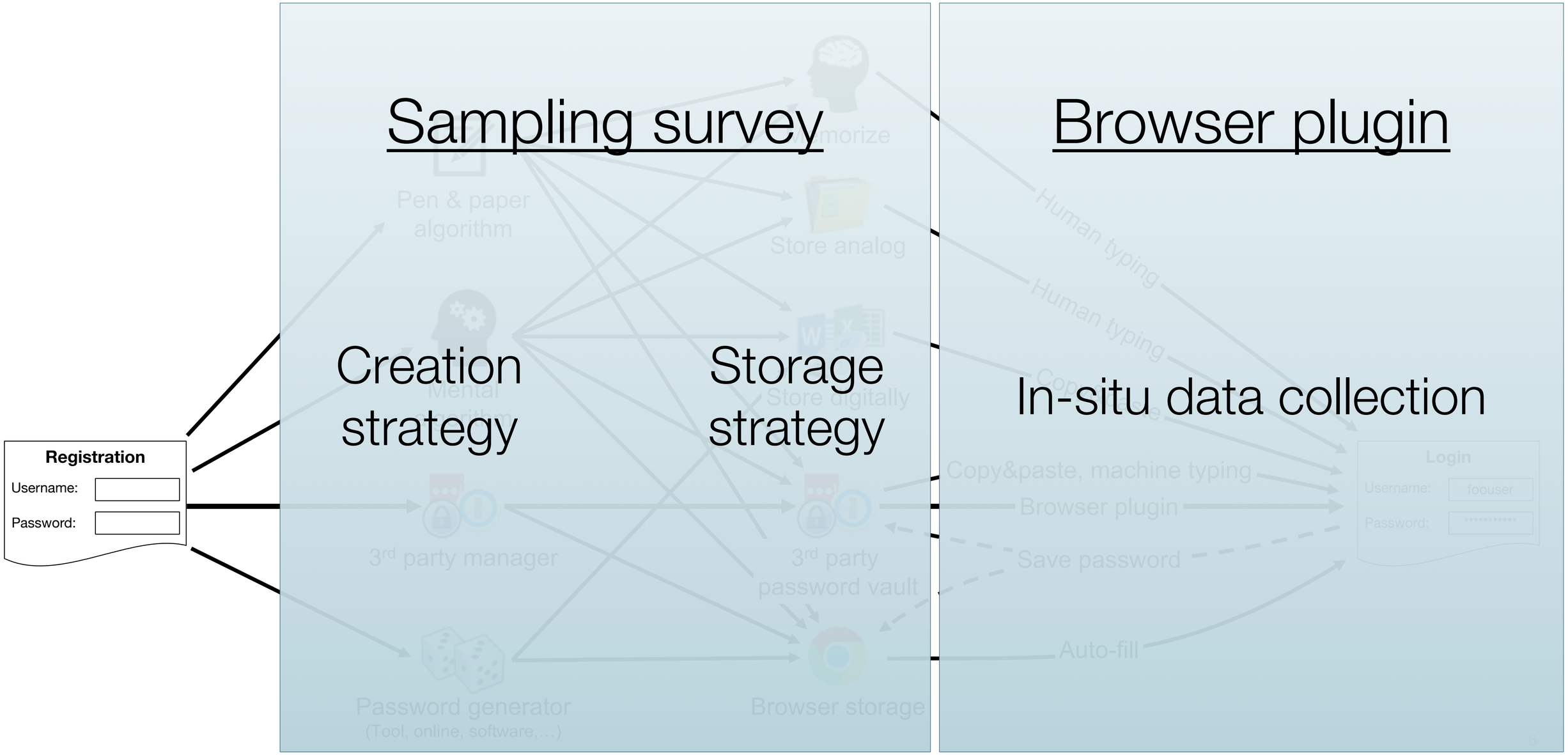


What is the impact of managers on password strength and reuse?

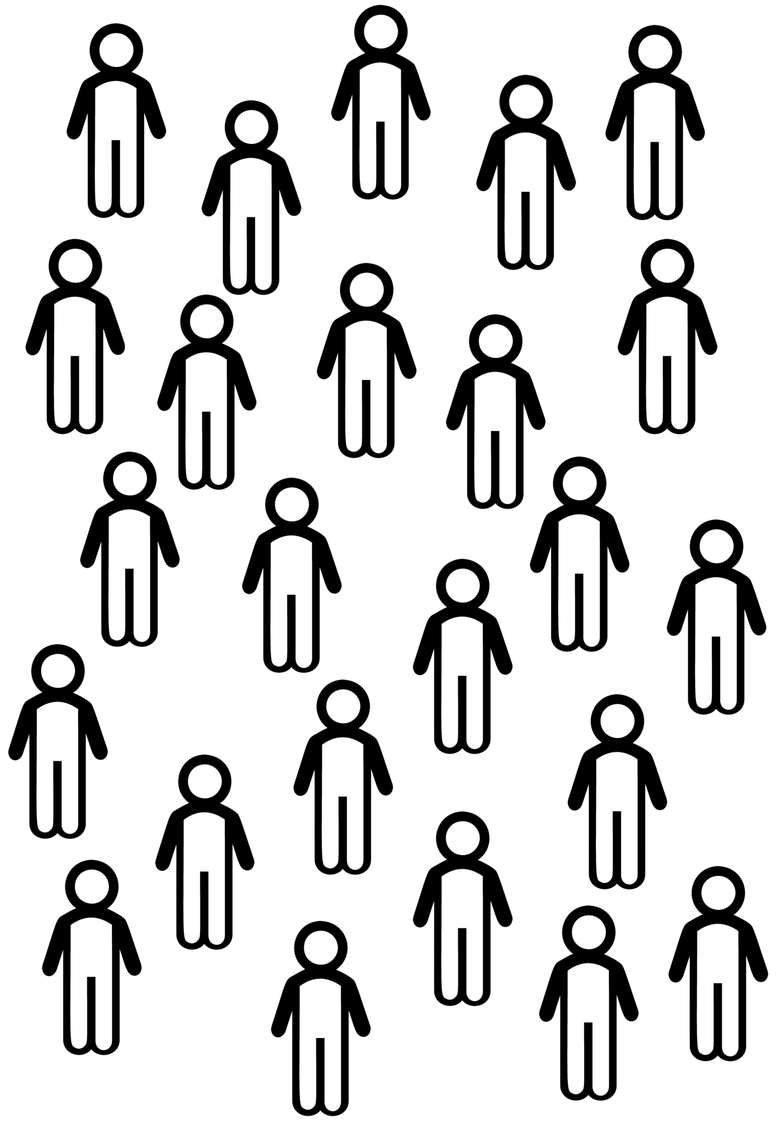
Research Method



Research Method



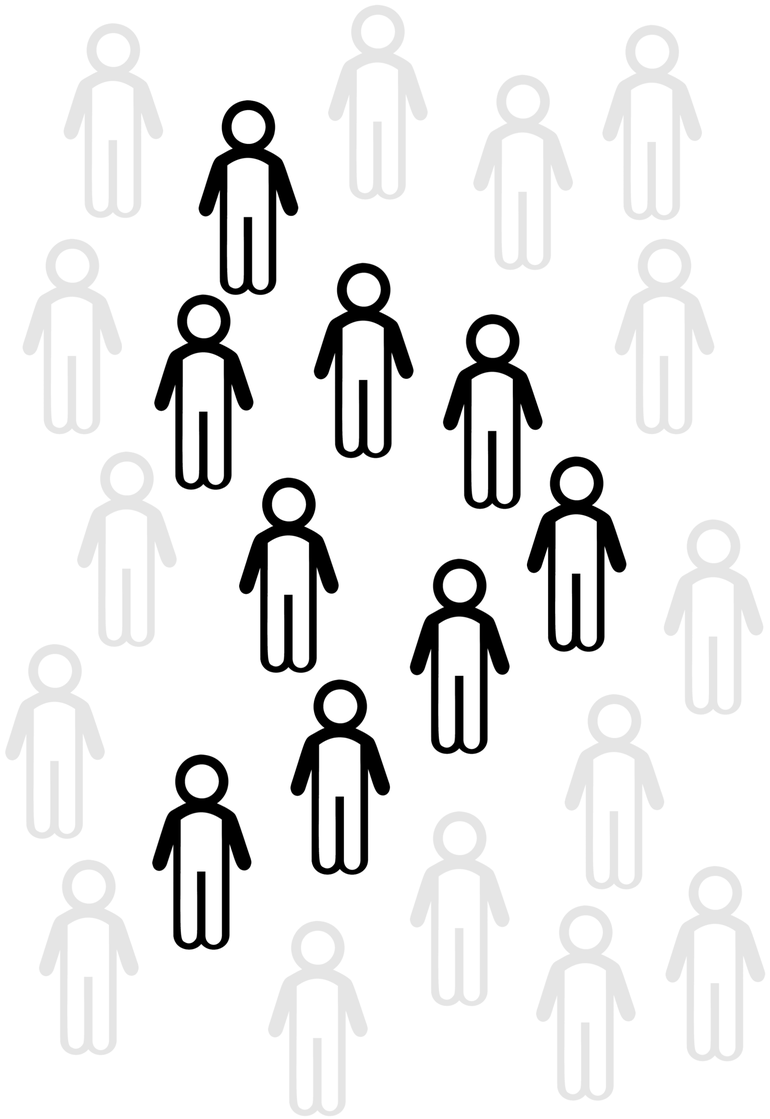
Sampling Survey



Demographics

- 476 participants from Amazon MTurk
- Gender: 57.6% male
- Age: ranges from 18 — ≥71, 75.2% younger than 40
- Education: 44.0% at least bachelor's degree (36.6% bachelor's degree)
- 80.9% use Chrome as primary browser
- Attitude towards passwords: 76.7% believe in importance of passwords
- Prior password leaks: 31.1% experienced password leak (29.0% not aware of)

Browser Plugin Data Collection



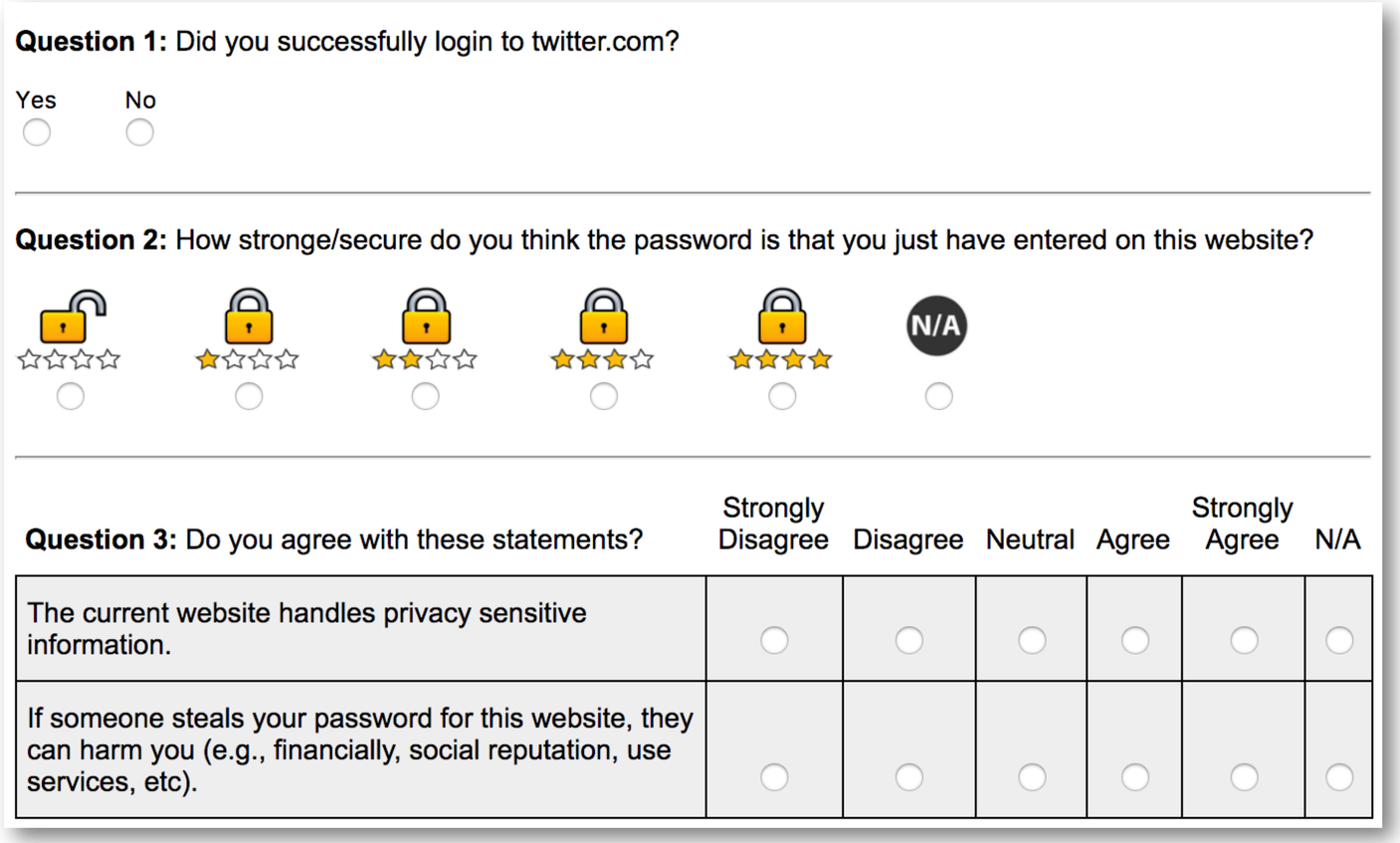
Demographics

- 170 participants completed follow-up study
- No indication of opt-in bias from survey participants

Types of data collected

- Hashes of passwords and 4-character substrings
- Password strength (zxcvbn), length, and composition
- Website category
- Entry method of password
- In-situ questionnaire

In-situ Questionnaire



Question 1: Did you successfully login to twitter.com?

Yes ○ No ○

Question 2: How stronge/secure do you think the password is that you just have entered on this website?

Question 3: Do you agree with these statements?	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
The current website handles privacy sensitive information.	○	○	○	○	○	○
If someone steals your password for this website, they can harm you (e.g., financially, social reputation, use services, etc).	○	○	○	○	○	○

- Firsthand knowledge about the entered password's value and self-reported strength
- Three-question questionnaire presented to participants one-time on login to a new website

Summary Statistics

- Collected 1,767 passwords (1,045 *unique* passwords)
- Average participant…
  - has 10.39 different accounts
  - has 6.15 distinct passwords
  - reused 70.56% the passwords
    (min: 0% ; max: 100%)

  → underlines rampant password reuse in general

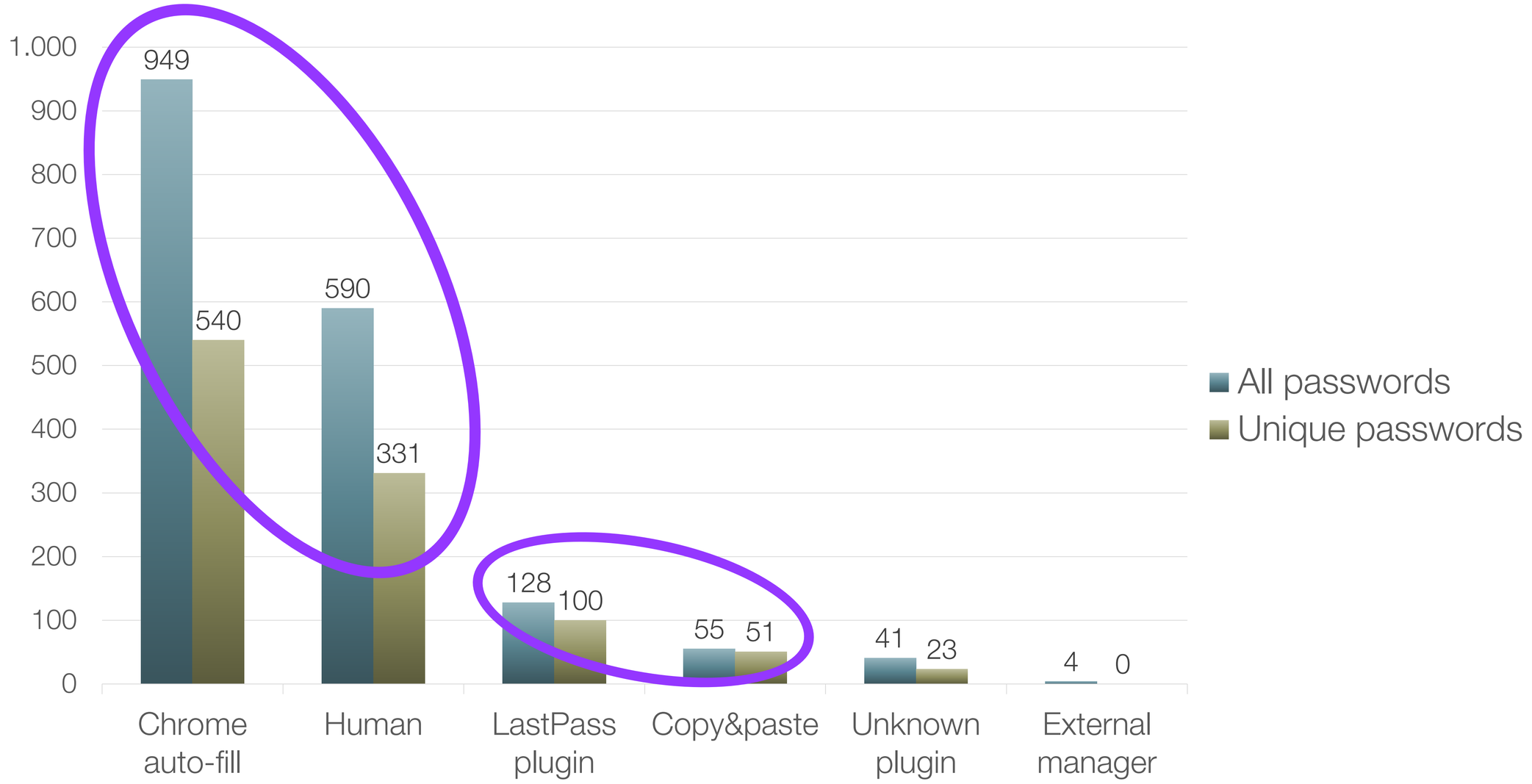
  - has average zxcvbn score of 2.20 (out of 4)
    (min: 0.67 ; max: 4.0)

  → unsatisfying general password strength

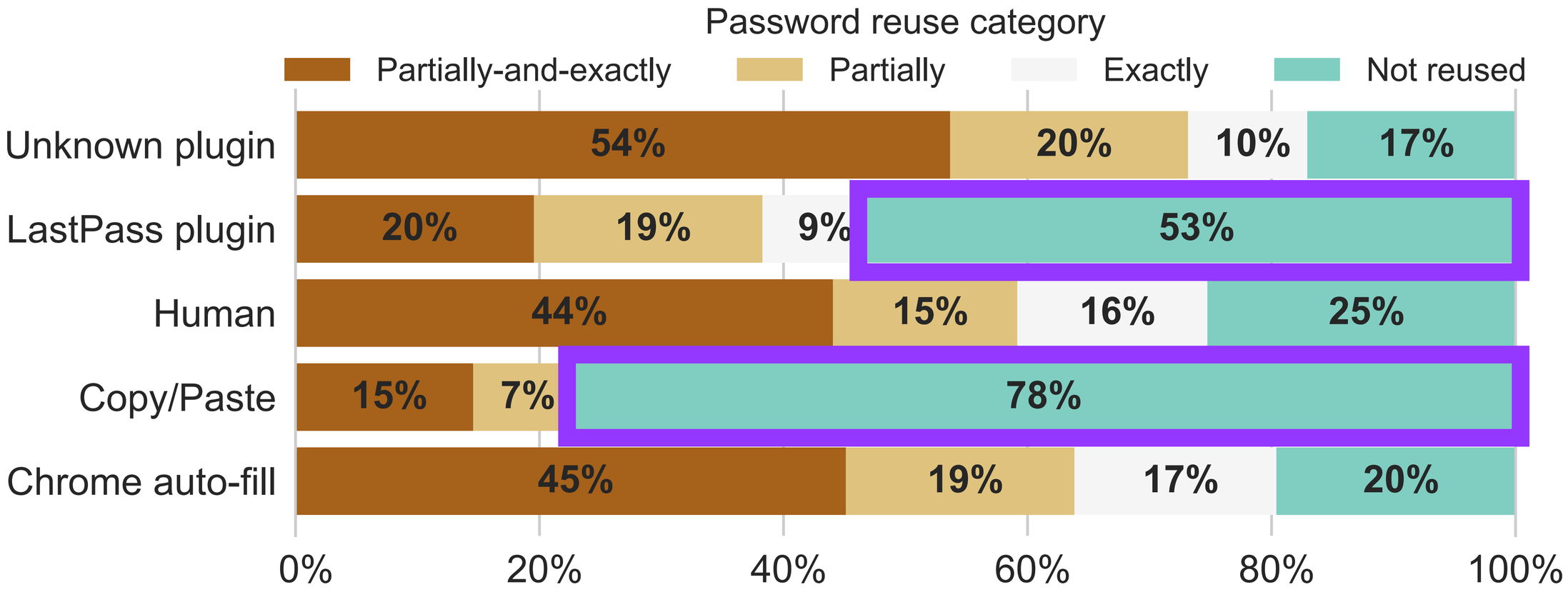
  - entered passwords with 2.24 different entry methods
    (min: 1 ; max: 4)

  → mixed storage strategies

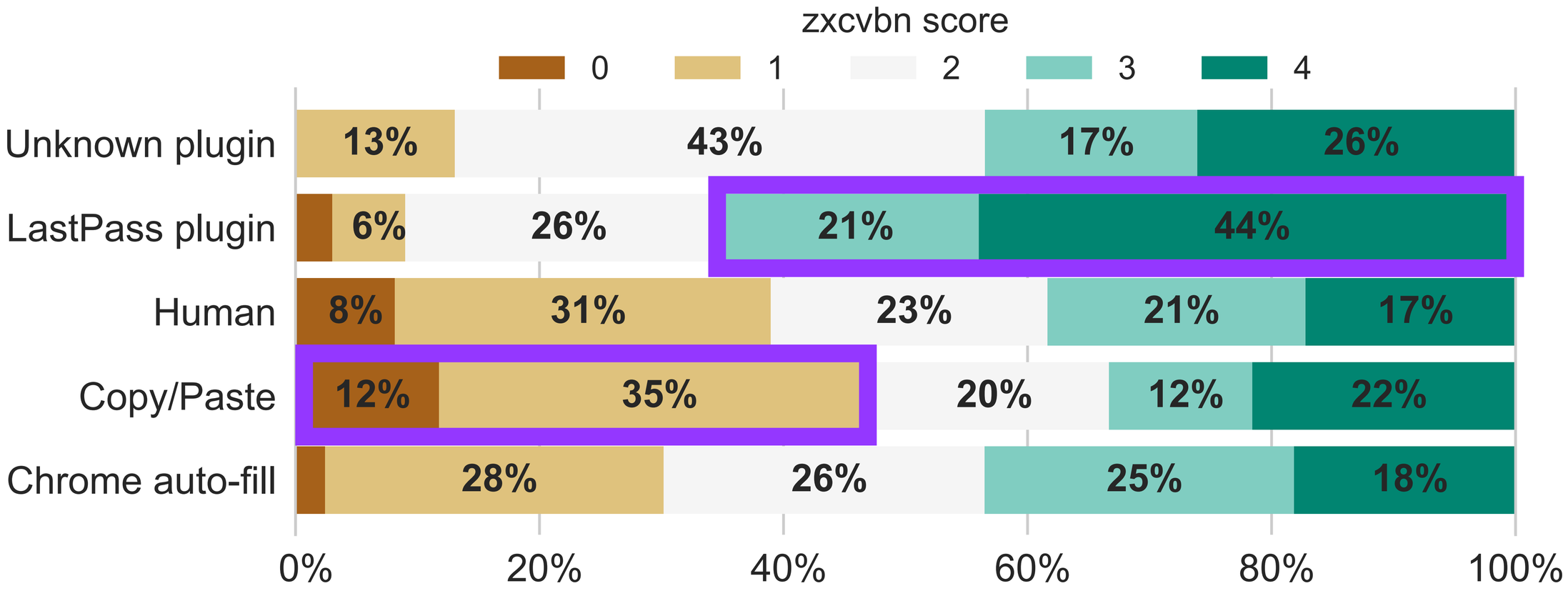
Entry Methods



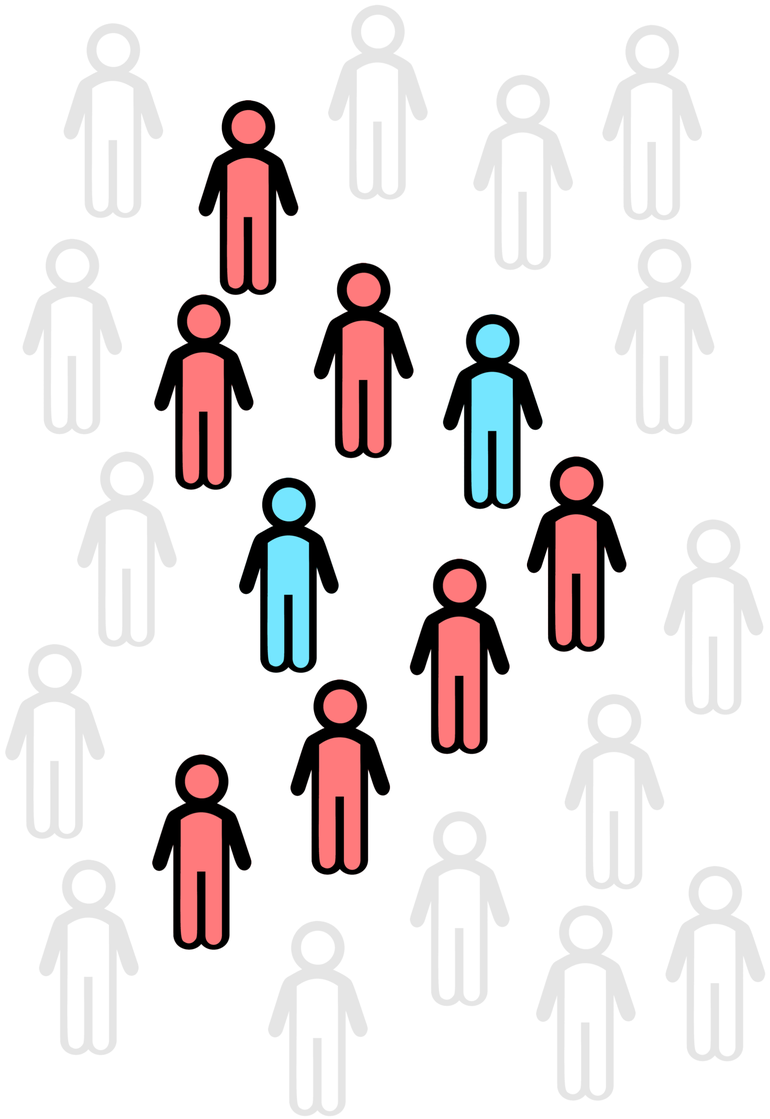
General Password Reuse



General Password Strength



Participant Groups



Grouping based on self-reported creation strategy

Group 1: Password managers
(45 or 26.5%)

“I use lastpass.com, which automatically creates and saves very strong passwords.”

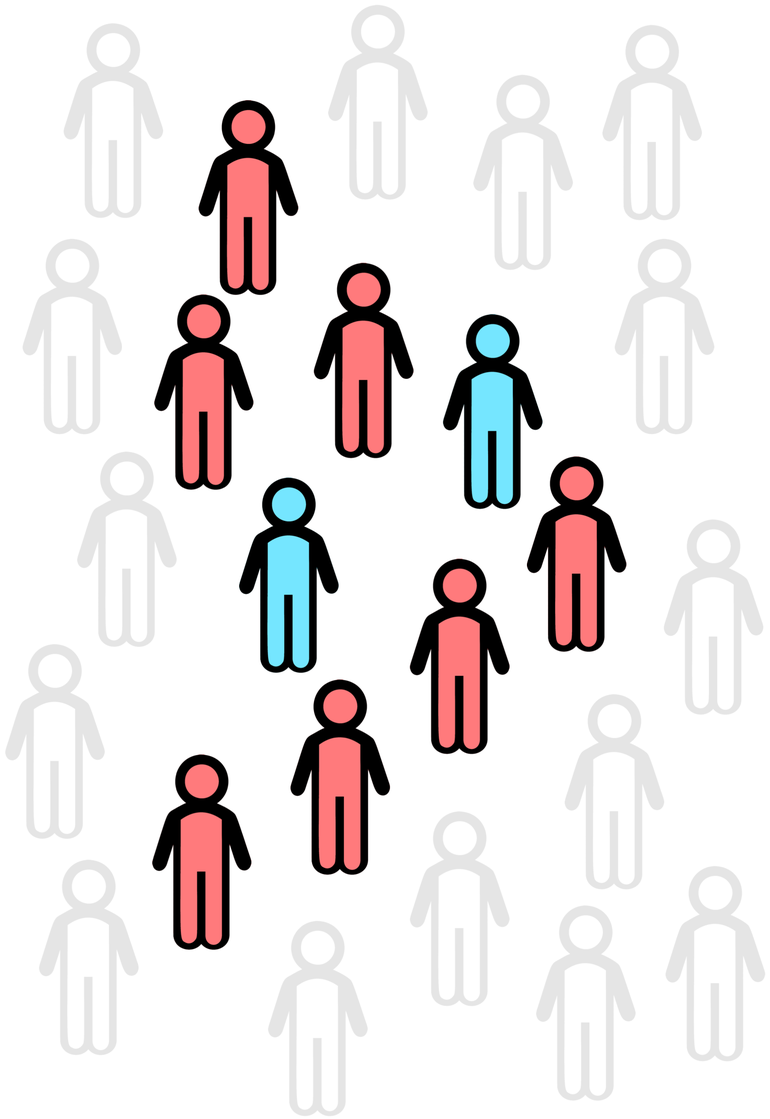
“I use a password creation and storage-related browser extension that also is related to an installed password manager application in my personal computer.”

Group 2: Human-generated
(121 or 71.2%)

“try to come up with a (random) combination of numbers, letters, characters”

“I think of a word I want to use and will remember like. mouse. I then decide to capitalize a letter in it like mOuse. I then add a special character to the word like mOuse@. I then decided a few numbers to add like mOuse@84”

Participant Groups



Grouping based on self-reported creation strategy

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(45 or 26.5%)

Group 2: Human-generated
(121 or 71.2%)

Both groups entered weak and reused passwords

More balanced distribution of password strength

Clear tendency towards weak passwords

High fraction of not-reused passwords

Low fraction of not-reused passwords

Regression Models

- Based on password metrics, answer to in-situ questionnaire, entry method, user variables from sampling survey

- Ordinal multi-level model predicting the zxcvbn score of a password
- Logistic multi-level mode predicting if a password is reused or not

Regression Models — Summary

“Creation strategy is key”

Use of a password generator in combination with Chrome auto-fill, LastPass plugin, and Copy&paste lead to stronger passwords

Use of a password generator reduced chance of password reuse independently of the entry method

Passwords entered with Chrome auto-fill were more likely to be reused independently of creation strategy

Regression Models — Additional Results

“In-situ user reports differ from lab studies”

Self-reported, in-situ password strength was significant predictor for measured password strength
(Participants had a clear view on their entered passwords’ strength)

Better generated and managed ~~than memorized~~?

- Measuring impact of password managers requires a broader view including user strategies and detailed detection of password entry methods
- Users of password generators are closer to a desirable situation, but still far from ideal

Where can we go from here?

- Extend study to walled garden ecosystems (Apple) and mobile domain
- Where do weak and reused passwords in managers come from
  (default passwords, pre-existing, required on devices not managed by the user,…)
- Users of copy&paste strategy warrant further investigation

Questions?