THE GEORGE WASHINGTON UNIVERSITY

WASHINGTON, DC

User Perceptions of Five-Word Passwords

Xiaoyuan (Owen) Wu, Collins W. Munyendo, Eddie Cosic, Genevieve A. Flynn, Olivia Legault, Adam J. Aviv

Weak Passwords Are Widely Used

Image source: Security Blanket by Lorrie Faith Cranor

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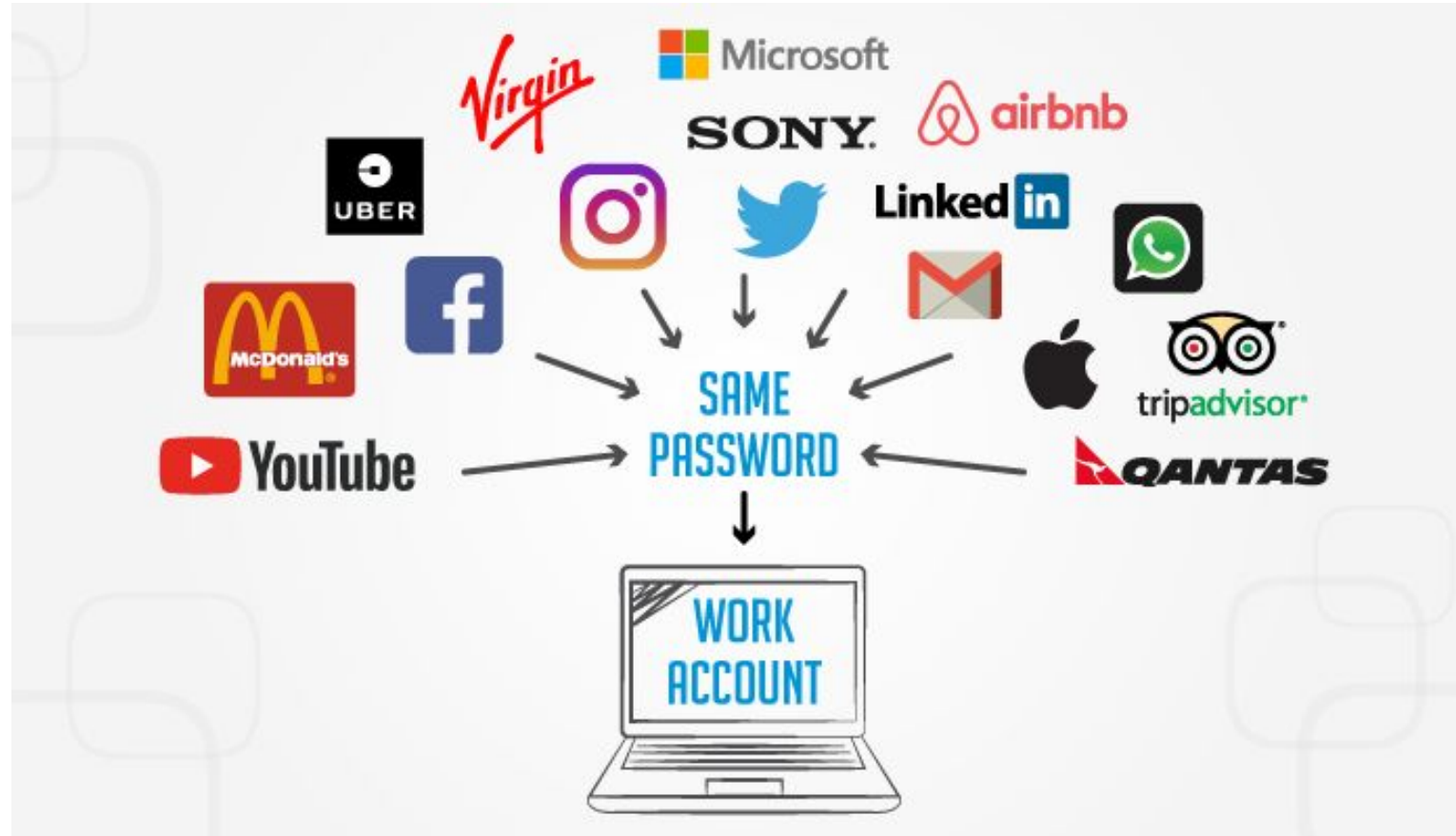
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People Tend to Reuse Passwords

Image source: https://computerone.com.au/reusing-old-passwords-spells-future-trouble/

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Randomly Generated Password

1XSHuX2@48Xr

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Familiar Words Form a Passphrase

this.could.bee.your.password

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Who Is Using Passphrase?

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Five-Word Password

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Research Questions

❖ RQ 1: How **memorable** are five-word passwords?

❖ RQ 2: How different methods of creating five-word passwords affect **memorability and security**?

❖ RQ 3: What are users' **perceptions** of five-word passwords?
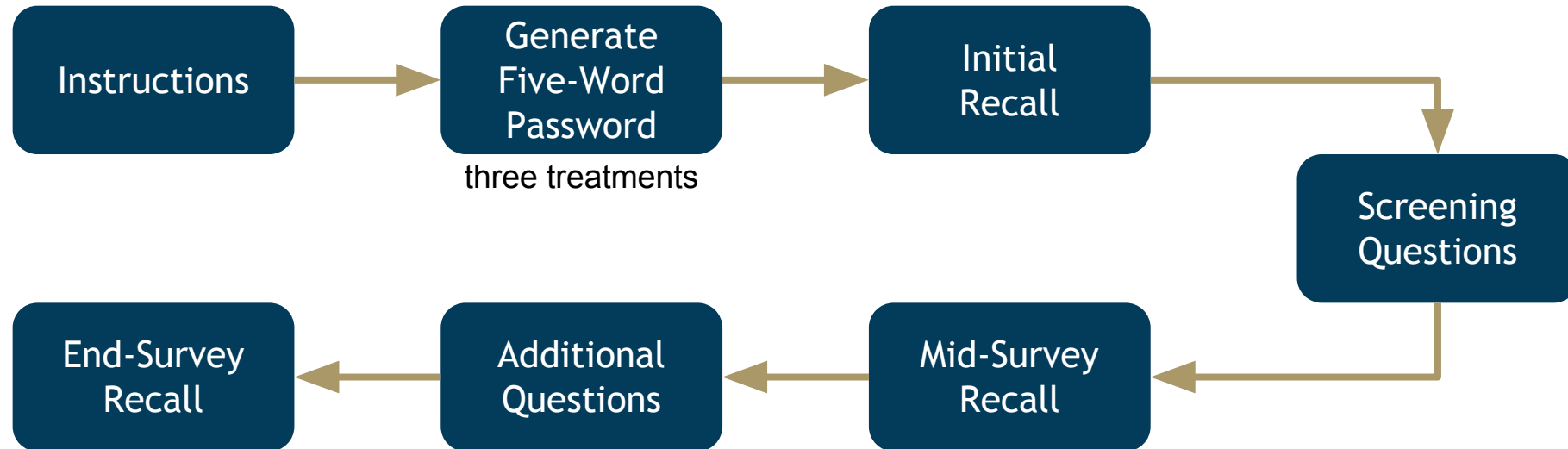
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User Study and Goals

Part One

- ❖ **Short** term memorability

- ❖ **Different** methods of creating five-word passwords

Part Two
Two Weeks Later

- ❖ **Long** term memorability

- ❖ **Perceptions** of password generated in part one

- ❖ **Thoughts** on five-word passwords in general

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Part One -
150 Participants Recruited through Prolific

Instructions → Generate Five-Word Password (three treatments) → Initial Recall → Screening Questions → Mid-Survey Recall → Additional Questions → End-Survey Recall

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Treatment 1 - All Five Words at Once

dealer.many.bend.borrow.hear

Generate Another Password   Choose this Password

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Treatment 2 - Option to Change Each Word

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Treatment 3 - Create Your Own

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Create Password

Restrictions:

1. All five words in dictionary of 1,630 words.

2. Four dots in-between five words.
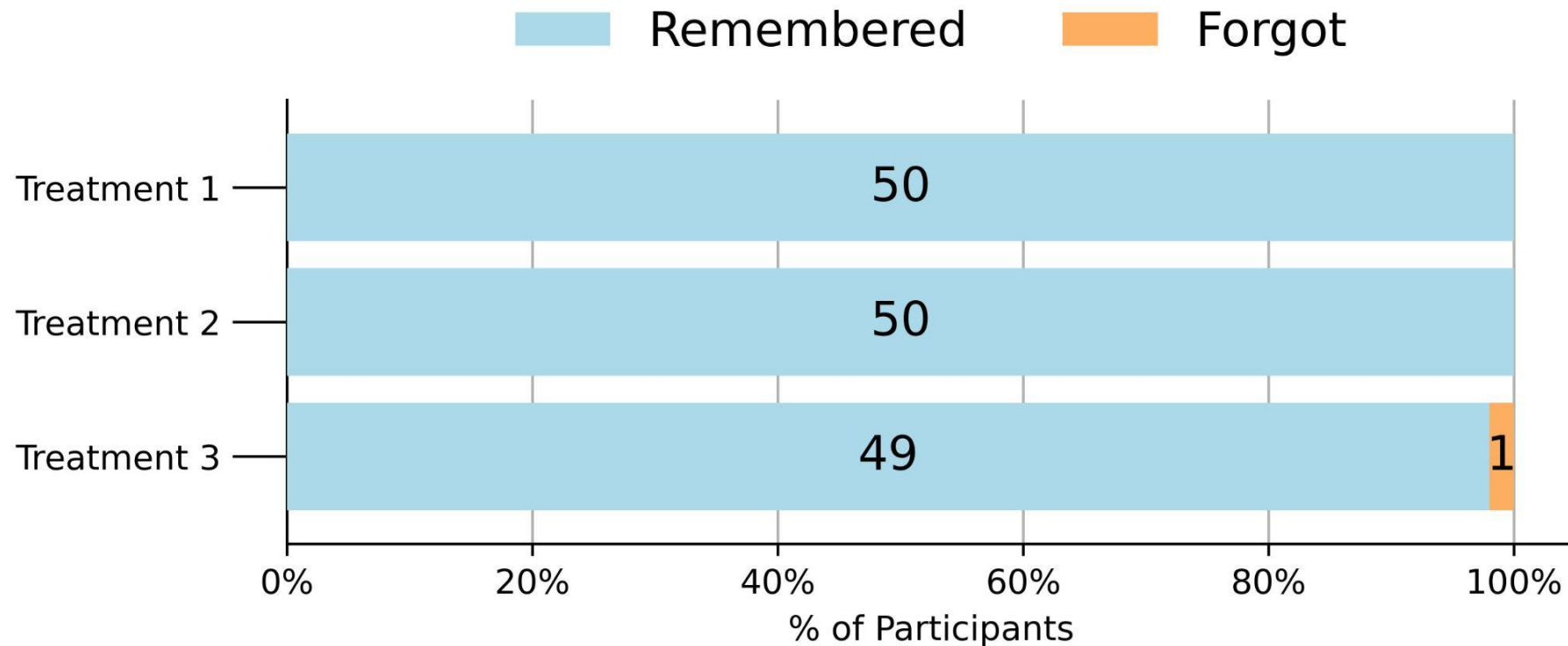
3. Five words are unique.

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Part Two - Two Weeks Later
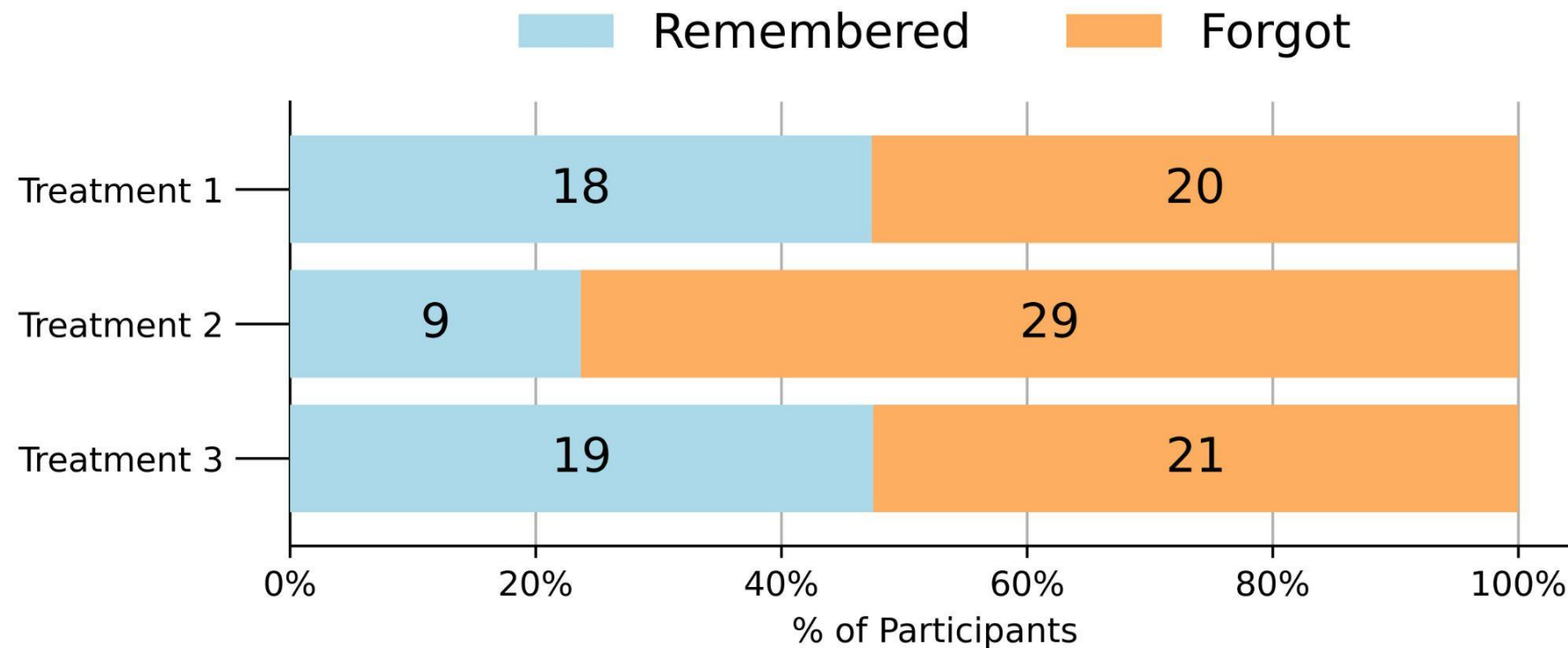## 116/150 Participants Returned

Instructions → Recall Password → Specific Questions → General Questions

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RQ 1: How memorable are five-word passwords?

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Participants Remembered Five-Word Passwords at the End of the First Part

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Less than Half of the Participants Remembered Five-Word Passwords after Two Weeks

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Without External Help, few Participants Remembered Five-Word Passwords after Two Weeks

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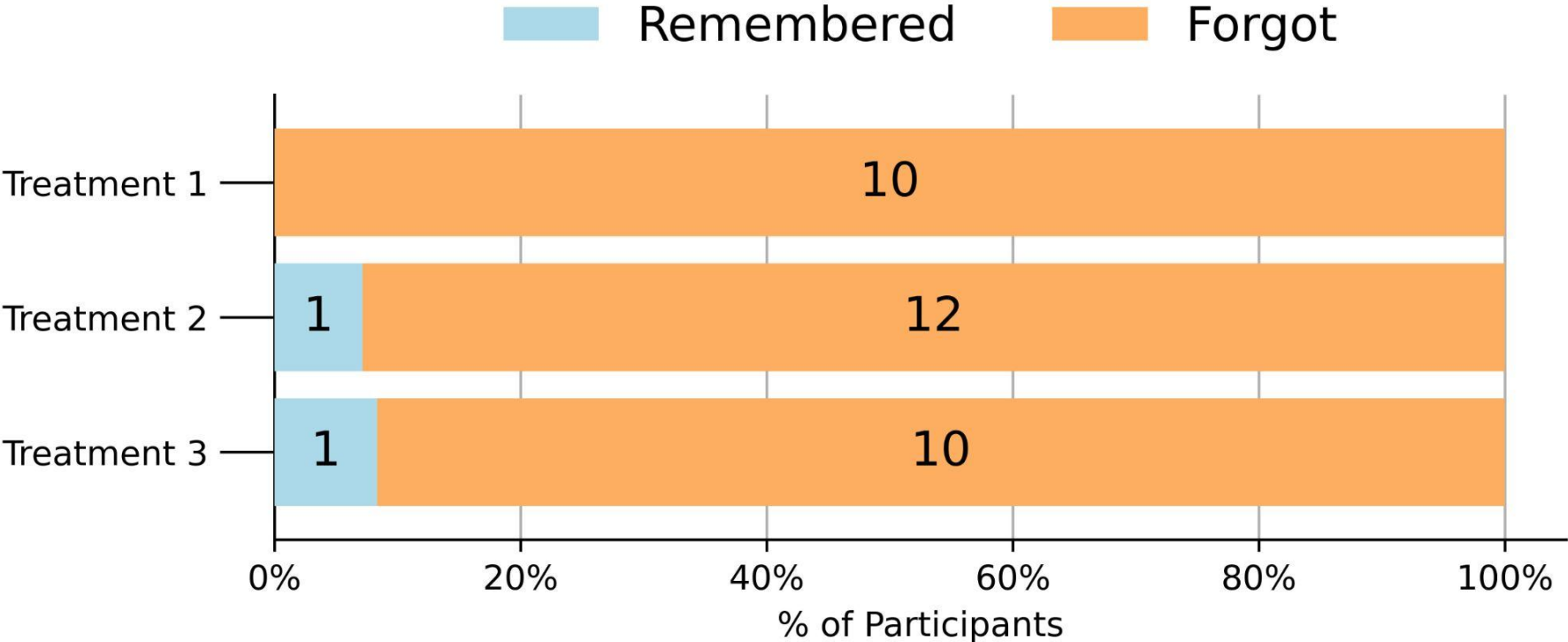
RQ 2: How the three methods of creating five-word passwords affect security?

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Computer Generated Five-Word Passwords Are Random, thus Secure

❖ 227 unique words were used by 50 participants from treatment 1 (all five at once).

❖ "escape", "letter" and "pair" used by three different participants,
17 words used by two participants
207 words used by one participant

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With the Option to Change Each Word, Still Random, thus Secure

❖ 240 unique words were used in treatment 2 (change each word).

❖ "mood" used by three different participants,
8 words used by two participants
231 words used by one participant

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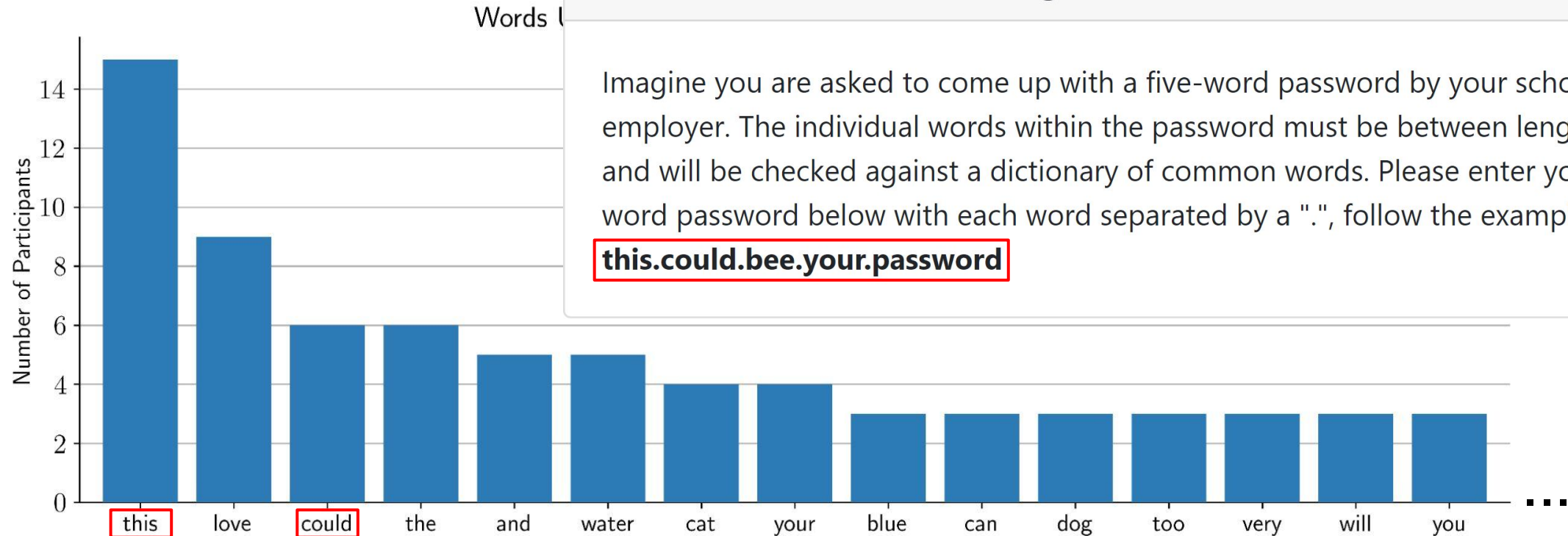21

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Human Created Five-Word Passwords Are Less Random

❖ Users tend to use words more familiar to them.

❖ 162 unique words were used in treatment 3 (create your own).

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Human Created Five-Word Passwords Are Less Secure

Context for Generating a Five-Word Password

Imagine you are asked to come up with a five-word password by your school or employer. The individual words within the password must be between length 3 and 8 and will be checked against a dictionary of common words. Please enter your five word password below with each word separated by a ".", follow the example:
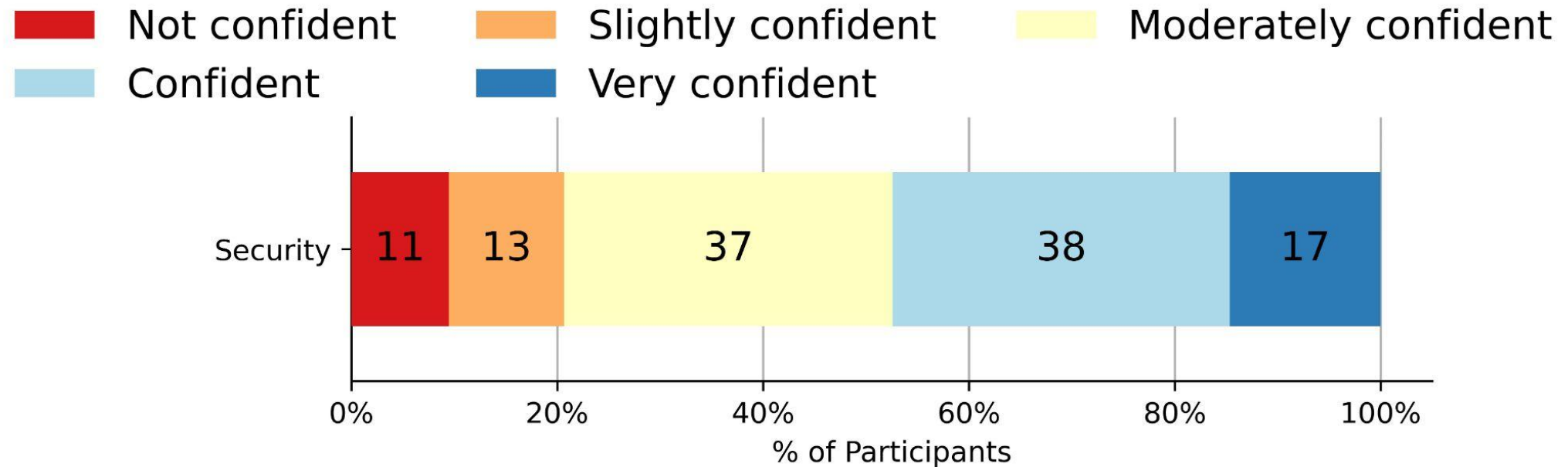
this.could.bee.your.password

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RQ 3: What are users' perceptions of five-word passwords?

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Participants Were Confident in Five-Word Passwords Keeping Accounts Safe

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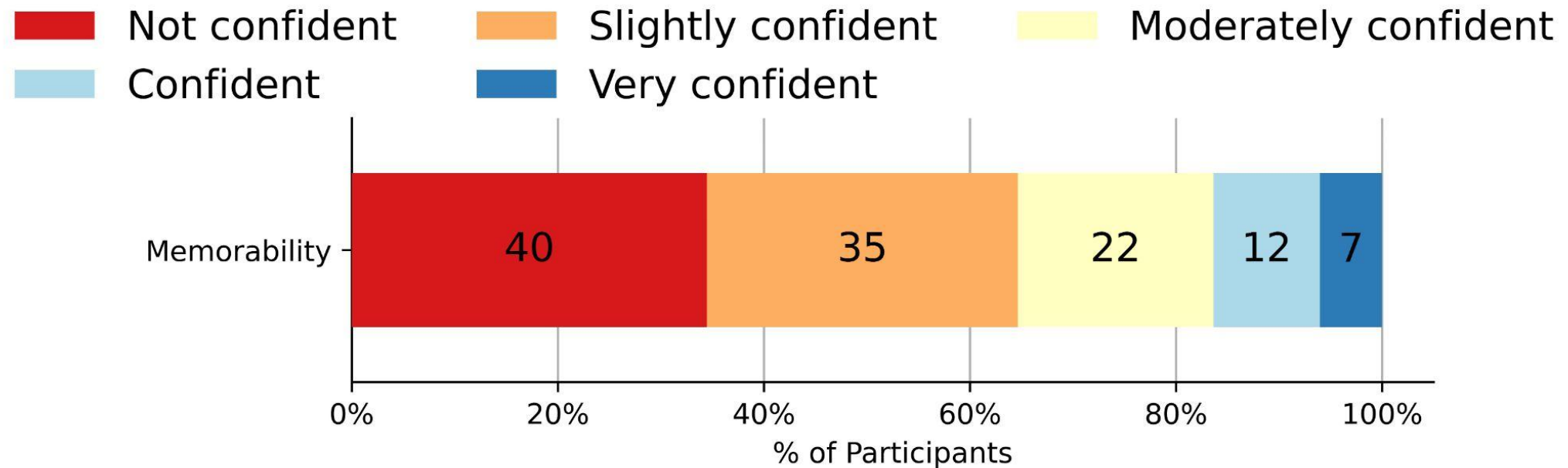
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Participants Were Confident Because:

P174:

"*I think people usually make up passwords that don't have the periods or with five words.*"

P181:

"*because of the length of the password. The amount of words and the periods add a decent amount of complexity to the password.*"

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Participants Were Less Confident in Remembering Multiple Five-Word Passwords

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Participants Were Less Confident Because:

P39:

"If used regularly it wouldn't be that hard if you treat it like a phrase. I could see some difficulty remembering multiple sets of five words."

P221:

"No. I'm not confident about remembering that many large passwords without some digital way to store them."

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RQ 1: How Memorable Are Five-Word Passwords?

❖ **99%** of participants remembered five-word password in the first part of the survey.

❖ **40%** of participants remembered two weeks later

❖ **6%** of participants who did not use external help remembered after two weeks

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RQ 2: How Different Methods of Creating Five-Word Passwords Affect Memorability and Security?

❖ User created five-word passwords did not result in better memorability over computer generated ones.

❖ Computer generated five-word passwords are more diverse, thus more secure then user created ones.
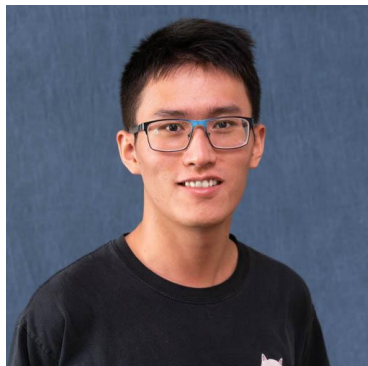
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RQ 3: What Are Users' Perceptions of Five-Word Passwords?

❖ Participants were confident in five-word passwords' ability to keep online accounts safe.

❖ They were less confident about remembering them, especially multiple unique ones.

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Conclusions

❖ Five-word passwords are memorable in the short term. They are challenging to remember in the long term.

❖ User created five-word passwords did not result in better memorability over computer generated ones.

❖ Participants were confident in security, but less so in memorability.

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Thank you!

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Demographics

		Part 1	Part 2
Gender	Female	74	61
	Male	70	50
	Non-binary	6	5
Age	18 - 24	38	31
	25 - 34	66	51
	35 - 44	22	16
	45 - 54	19	15
	55 - 64	4	3
	Prefer not to say	1	0
Education	High School or equiv.	18	16
	College or Trade	39	35
	Associate's degree	8	7
	Bachelor's degree	45	32
	Master's degree	33	22
	Doctorate	6	4
	Prefer not to say	1	0
Background	Technical	46	30
	Non-Technical	98	82
	Prefer not to say	6	4

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Word Length by Treatments

❖ Average length of 1,630 words is 4.78 characters.

Word Length	Treatment 1	Treatment 2	Treatment 3	Total
Length 3	40	27	59	126
Length 4	86	65	101	252
Length 5	61	83	63	207
Length 6	63	75	27	165
Avg. Length	4.59	4.82	4.23	4.55

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Number of Clicks

	Average	Minimum	Maximum
Treatment 1	10.84	1	87
Treatment 3	1.04	1	2
Treatment 2			
Word 1	4.94	1	57
Word 2	5.18	1	78
Word 3	3.44	1	32
Word 4	4.08	1	41
Word 5	6.84	1	144

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Semantic Meaning

❖ Given choice to change each word:
    teach.three.little.green.girl (144 clicks on word 5)

❖ User created:
    cat.dog.fish.boy.run
    this.winter.would.very.cold

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What Platform(s) Participants would Use a Five-Word Password

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