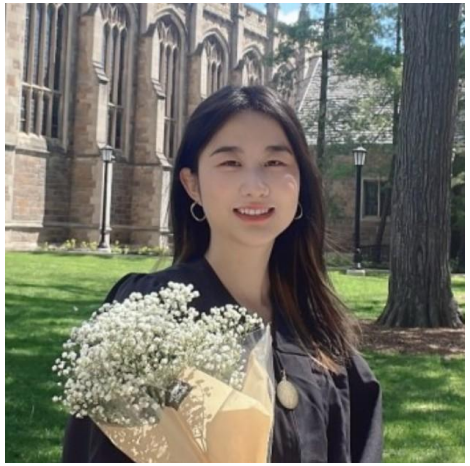
High Expectations:

An Observational Study of Programming and Cannabis Intoxication

Wenxin He, Manasvi Parikh, Westley Weimer, Madeline Endres

University of Michigan



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Updated 13y

It's important to remember that marijuana affects everyone differently. It destroys some people (like me) but vastly improves the quantity and quality of output of others. That said, it was common to smell weed in the parking lot at google.

It probably depends a lot on the company. I doubt very many people are smoking over at linkedIN :P

Upvote · 1

rome · 7y

Related **Do any successful entrepreneurs smoke weed regularly?**

All the time!! I actually smoke right before I start to work. Smoking gets those creative juices flowing for me, so when I design new products this is the only way to do it for me. I also tend to get more done since my brain is on work mode.

Upvote · 13 1

I'm interviewing for a coding job with a well known company that does suspicionless drug tests. How can I ask during the interview stage whether my marijuana use, that doesn't affect my performance, will be an issue for them?

Answer Follow · 3 Request

35% out of ***800*** survey participants had used ***cannabis*** while ***programming***

Professional programmers reported positive views on the impact of cannabis on ***brainstorming***, neutral views on ***coding and testing***, and negative views on ***debugging, design, and documentation***

Anti-cannabis hiring and retention policies are prevalent in software companies.

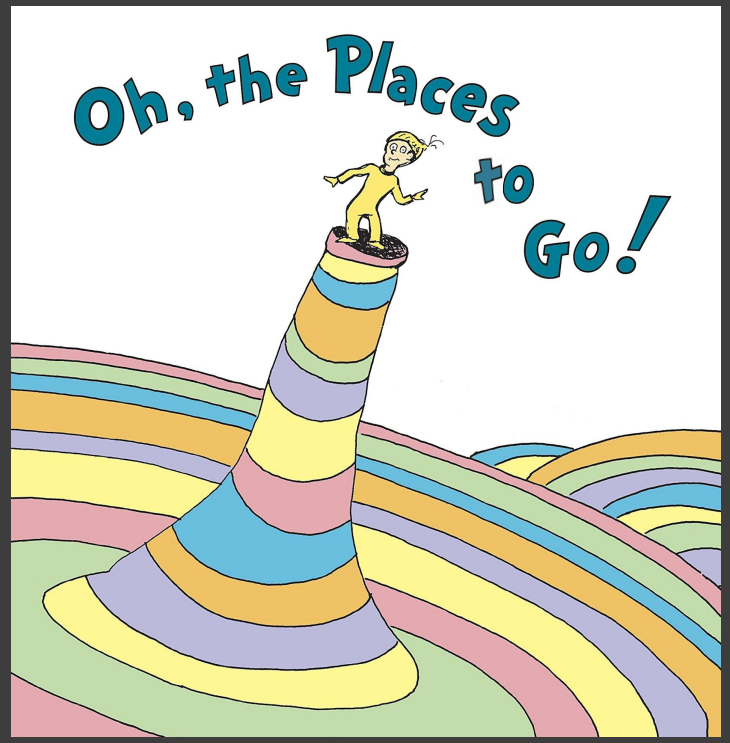
29% *of software developers took* ***drug tests*** *for* ***programming-related*** *jobs*

There is **little empirical understanding of the true impacts of cannabis on programming.**

We want to build a model to be used by individual developers and policy makers in making more informed cannabis and programming decisions

We present results from the **first controlled observational study of cannabis's effects on programming ability**, reporting data from 70+ programmers and answering pre-registered research questions.

TALK OUTLINE

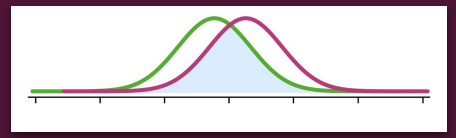


- ✓ Motivation
- Study Design and Experimental Process
- Research Questions Answered
  - Effects on *Program Correctness*
  - Effects on *Programming Speed*
  - Difference in Program Method Divergence
  - Effects of Cannabis Use History
  - Programmers' Stylistic Choices
  - Programmers' *Self-perception*
- Implications and Future Work

DESIGN CONSIDERATIONS

Goal: a rigorous model showing how cannabis use impacts programming

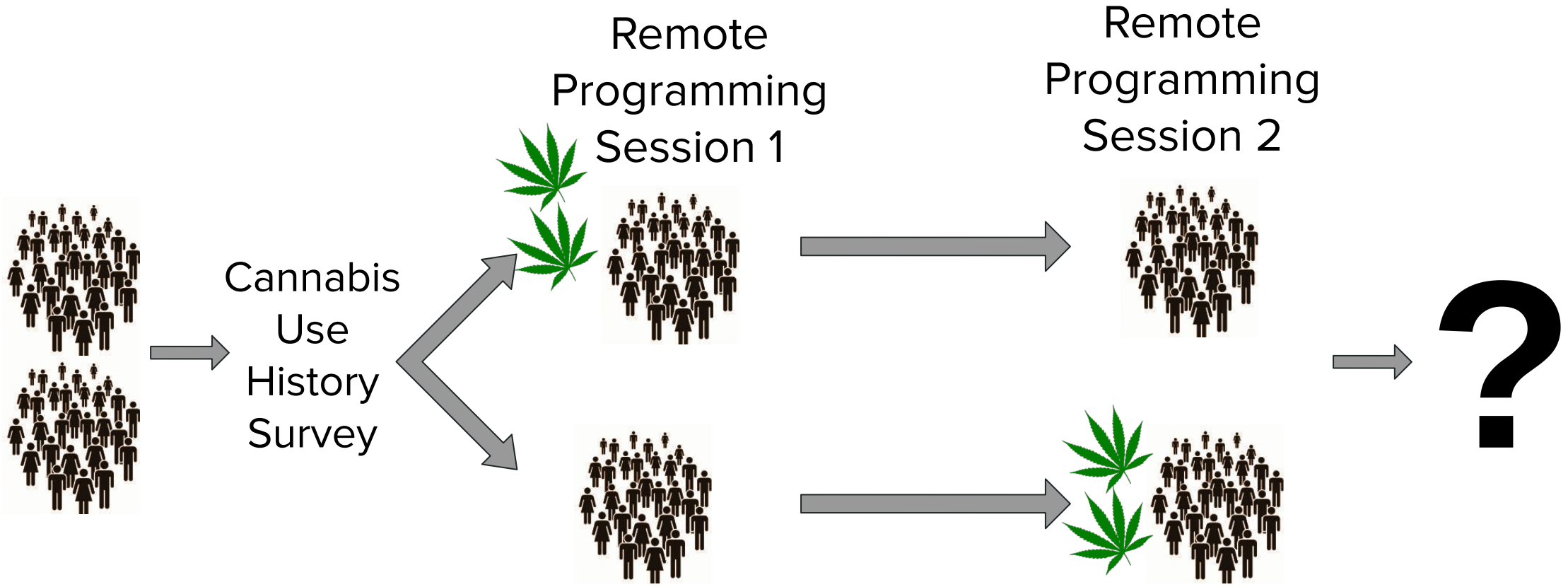
- Achieving **sufficient statistical power** to answer our **pre-registered research questions**



- Balancing **ecological validity** with **experimental control**

- Maximizing participant **privacy and safety**

STUDY DESIGN



STUDY DESIGN

In each session:

1. short programming questions (20min)
2. LeetCode problems (50min)
3. debrief

```
def func(nums):
    x = 2;
    for i in range(len(nums)):
        x += nums[i]
    print(x)

nums = [1, 2, 3, 4]
func(nums)
```

Please click the corresponding letter which best represents the **return value** of the function call below:

```
def func(x, y):
    return (y != x) and (not x or not y)

func(True, 6 < 20)
```

True — A

False — B

Clunker Motors Inc. is recalling all vehicles in its Extravagant line from model years 1999-2002. Given an int variable `modelYear` and a string `modelName`, print "RECALL" if modelYear and `modelName` match the recall details.

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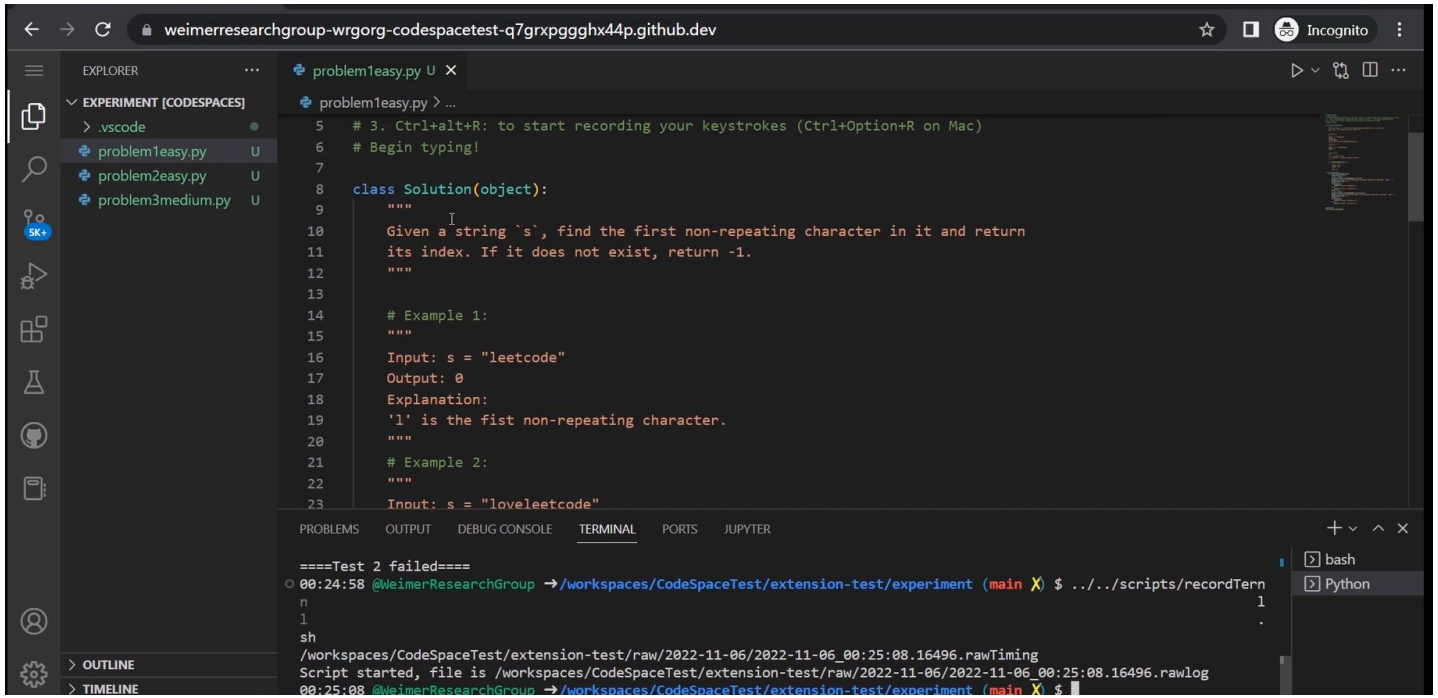
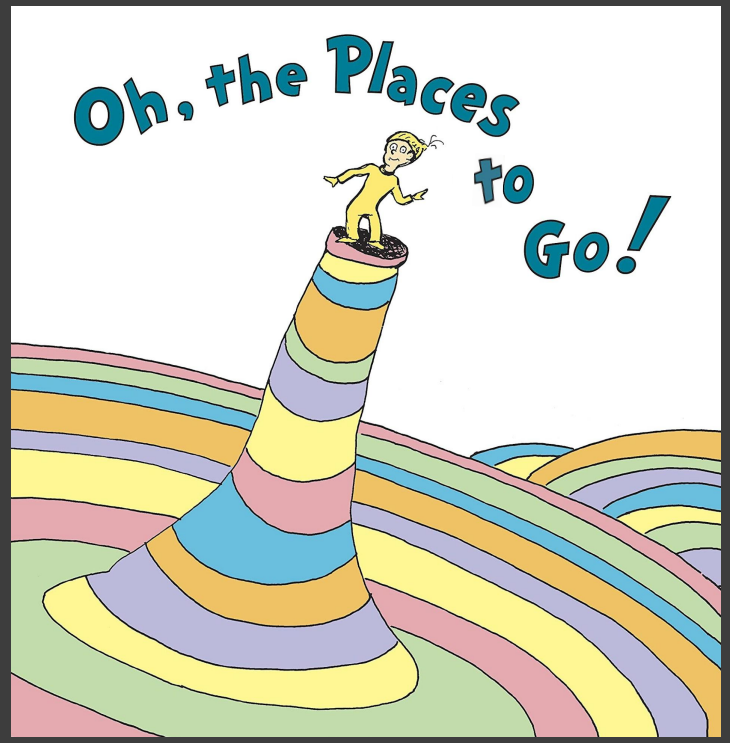


2 easy (15 min each):
1-D array + tree/linked list

1 medium (20 min):
2-D array

TALK OUTLINE



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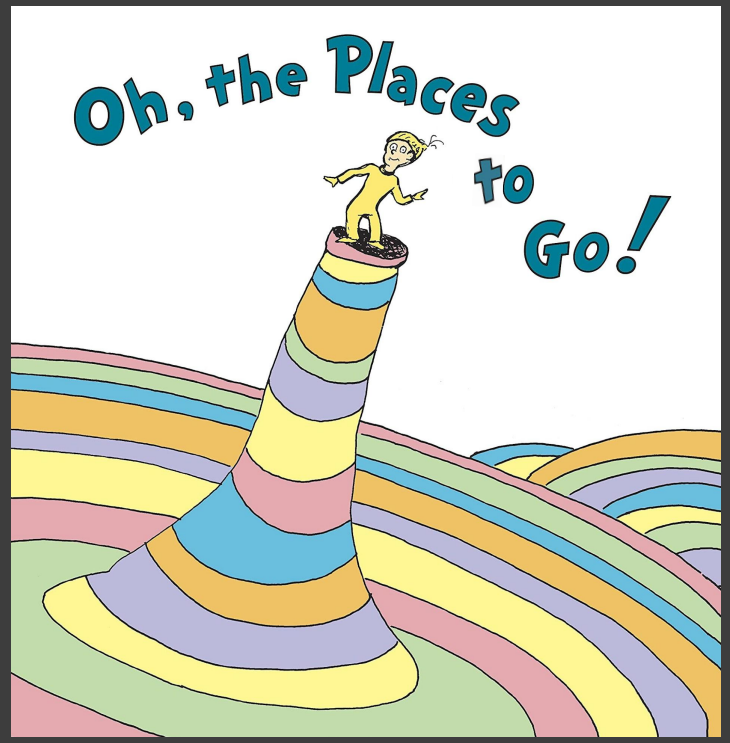

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RQ1: How does cannabis intoxication while programming **impact program correctness**?

- Pre-registered Hypothesis: Programs will be **less correct** when written by intoxicated programmers.

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Problem	Difference	BH-p	d
Short Programming Problems:			
Boolean	-0.5%	0.846	0.03
Code-tracing	**-10.2%**	**0.003**	0.42
Code-writing	**-10.5%**	**0.003**	0.44
“Programming Interview” LeetCode Problems			
Strings and 1-D Arrays (easy)	**-9.5%**	**0.049**	0.28
Recursive Lists and Trees (easy)	**-14.0%**	**0.024**	0.35
2-D Arrays (medium)	-5.5%	0.460	0.15

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Finding: **Cannabis use decreases program correctness** ($0.0005 < p < 0.05$, $0.28 < d < 0.44$, 10 - 14% fewer passed tests).

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- Pre-registered Hypothesis: Cannabis-intoxicated programmers **will take longer to write** programs.

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Problem	Difference	BH-p	d
Short Programming Problems:	(unit : second)		
Boolean	+0.5	0.465	0.10
Code-tracing	**+0.4**	**0.656**	0.06
Code-writing	**+3.0**	**0.130**	0.23
“Programming Interview” LeetCode Problems	(unit: minute)		
Strings and 1-D Arrays (easy)	**+1.4**	**0.039**	0.32
Recursive Lists and Trees (easy)	**+1.2**	**0.039**	0.33
2-D Arrays (medium)	+0.6	0.656	0.11

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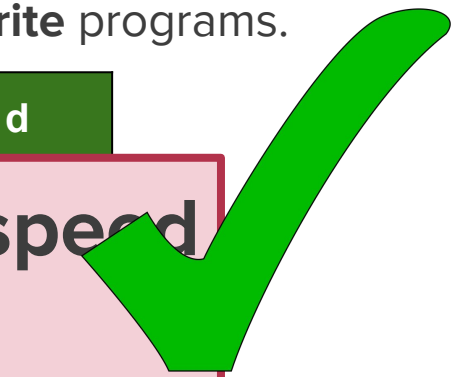


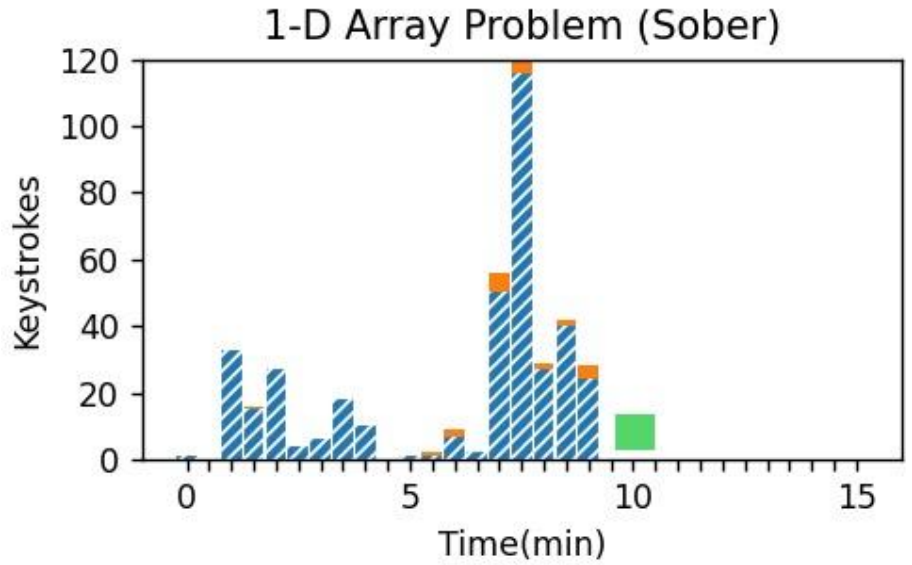
High vs. Sober: How does Cannabis Impair Programming?

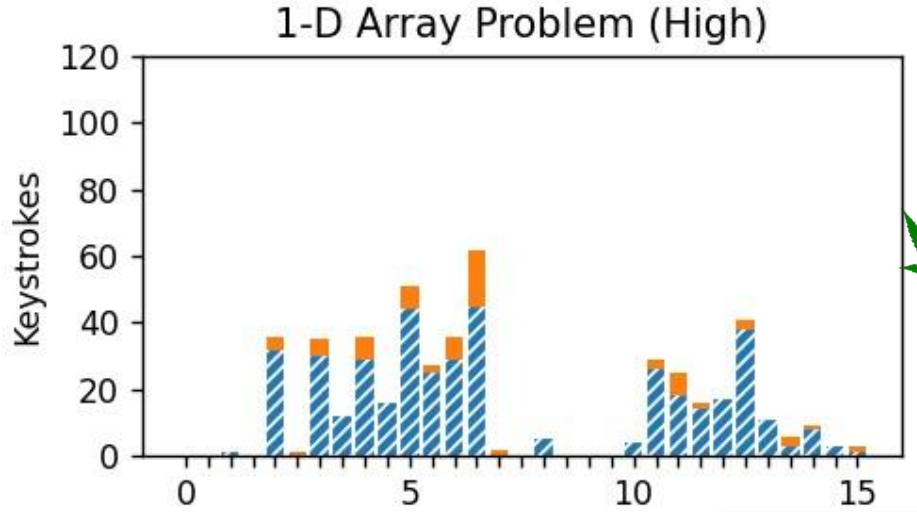
Programming While Sober

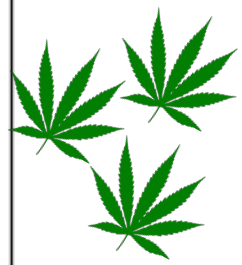
Normal Keystrokes

Delete Keystrokes

Programming While High







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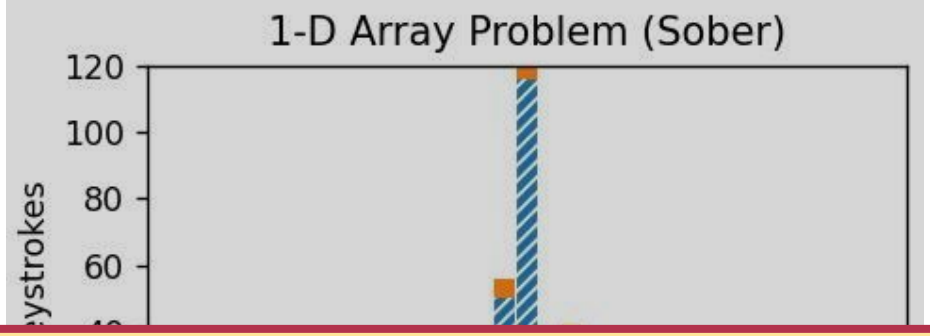
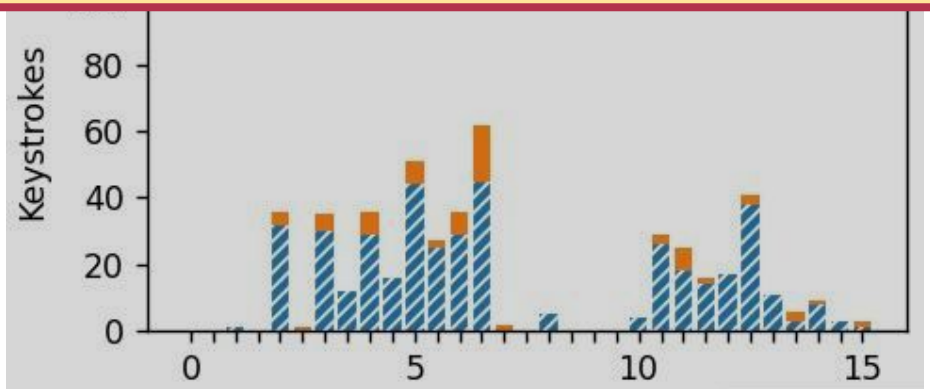
Programming While Sober



This decrease in speed is associated with **typing slower**, **deleting more** characters, and more time spent **not typing**.

Programming While High



RESEARCH QUESTION 3 - Self Perception

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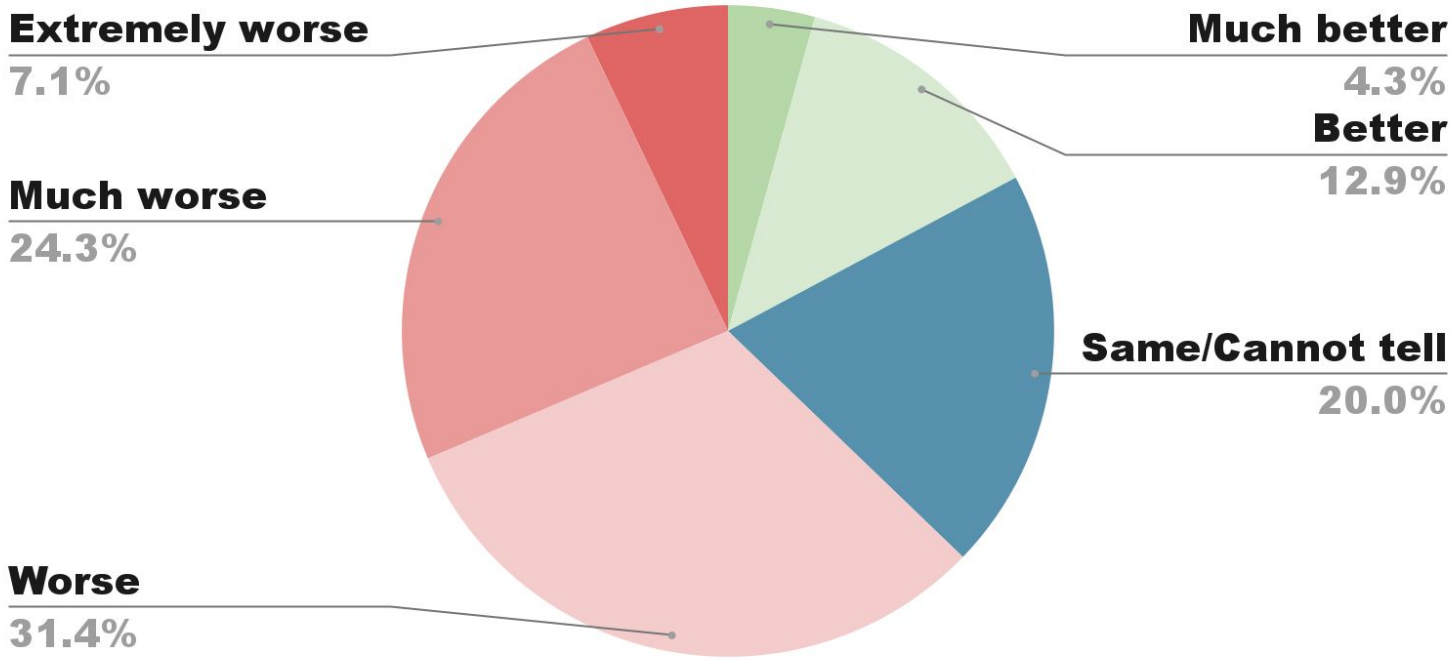

Fig. Self-reported subjective programming performance when high (compared to when sober)

RESEARCH QUESTION 3 - Self Perception

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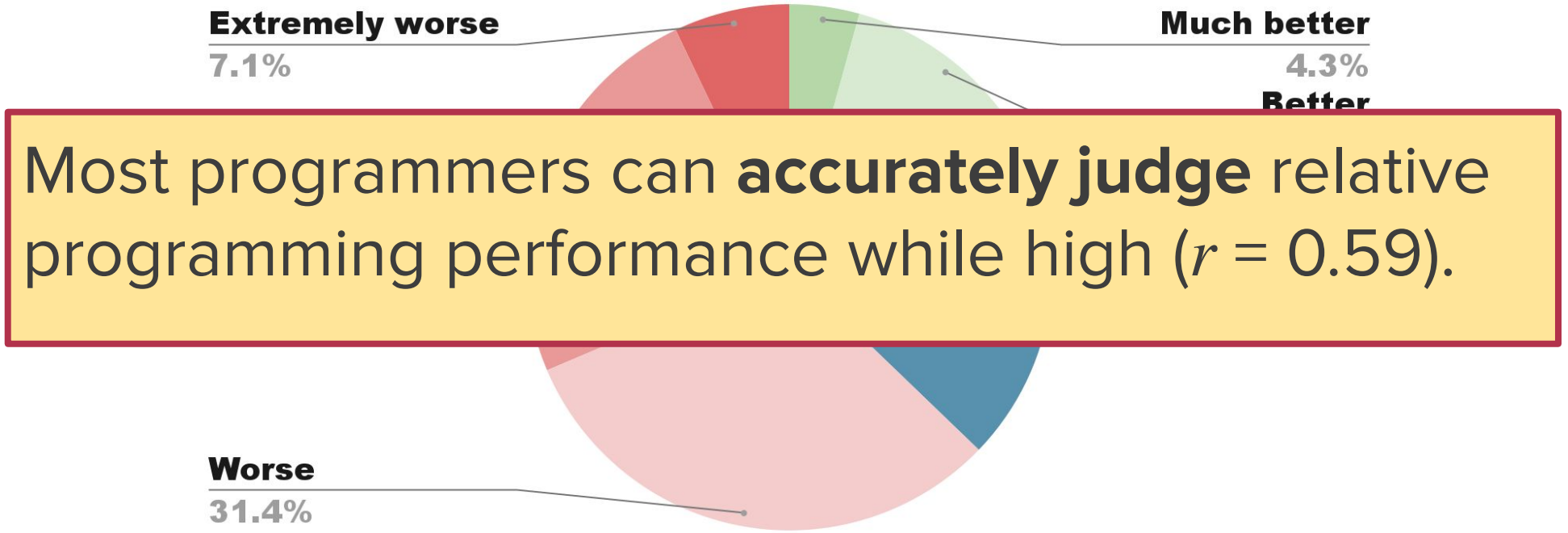
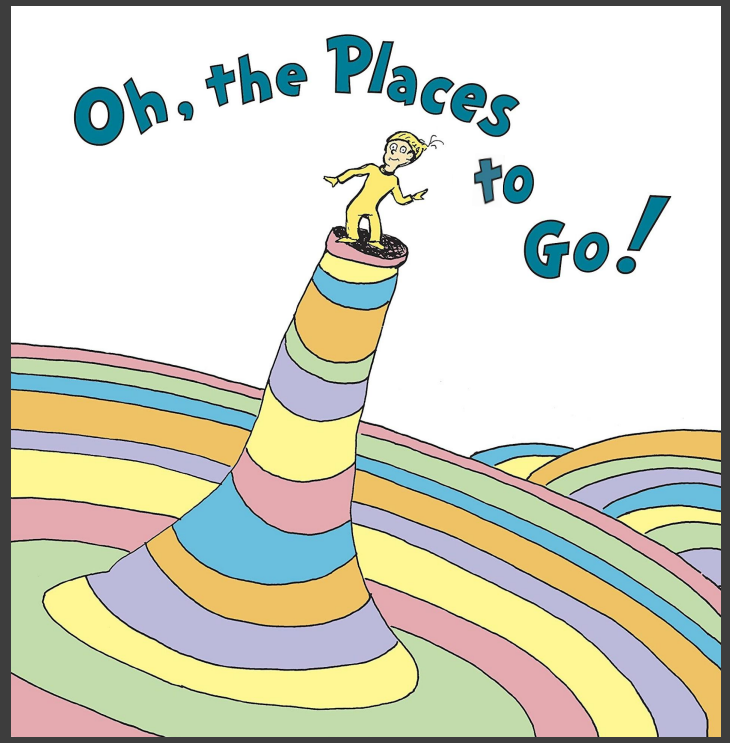


Most programmers can **accurately judge** relative programming performance while high (r = 0.59).

Fig. Self-reported subjective programming performance when high (compared to when sober)

TALK OUTLINE



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Findings Summary

We observe a **significant impairment** associated with ecologically valid cannabis use while programming (10% fewer correct tests, 10% slower programming).

From programmers' debrief:

- harder to focus and easier to get distracted
- more enjoyment, fewer worries, and decent insight into alternative perspectives
- accurate self-perception

Insights for Company Policies and Developers' Decisions

The variance we observe in outcomes for cannabis intoxication is much less than the **productivity variance** already found in new hires.

A 10% difference is not large compared to such **already-existing** variance.

Some programmers in our sample received **full correctness** scores even while high, or performed better when high. Most were able to **accurately recognize** their own cannabis-related impairment or the lack of it.

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The low observed magnitude of cannabis impairment, may indicate that strict drug policies **might not be optimal uses of resources.**

CONCLUSIONS

In a **controlled observational study** with 74 participants,

- At ecologically-valid dosages, cannabis intoxication **impairs both program correctness and speed (10%).**
- Programmers can self-perceive performance differences even when intoxicated.

We hope our results contribute to the development of evidence-based policies and help programmers make informed decisions.

Link to replication package

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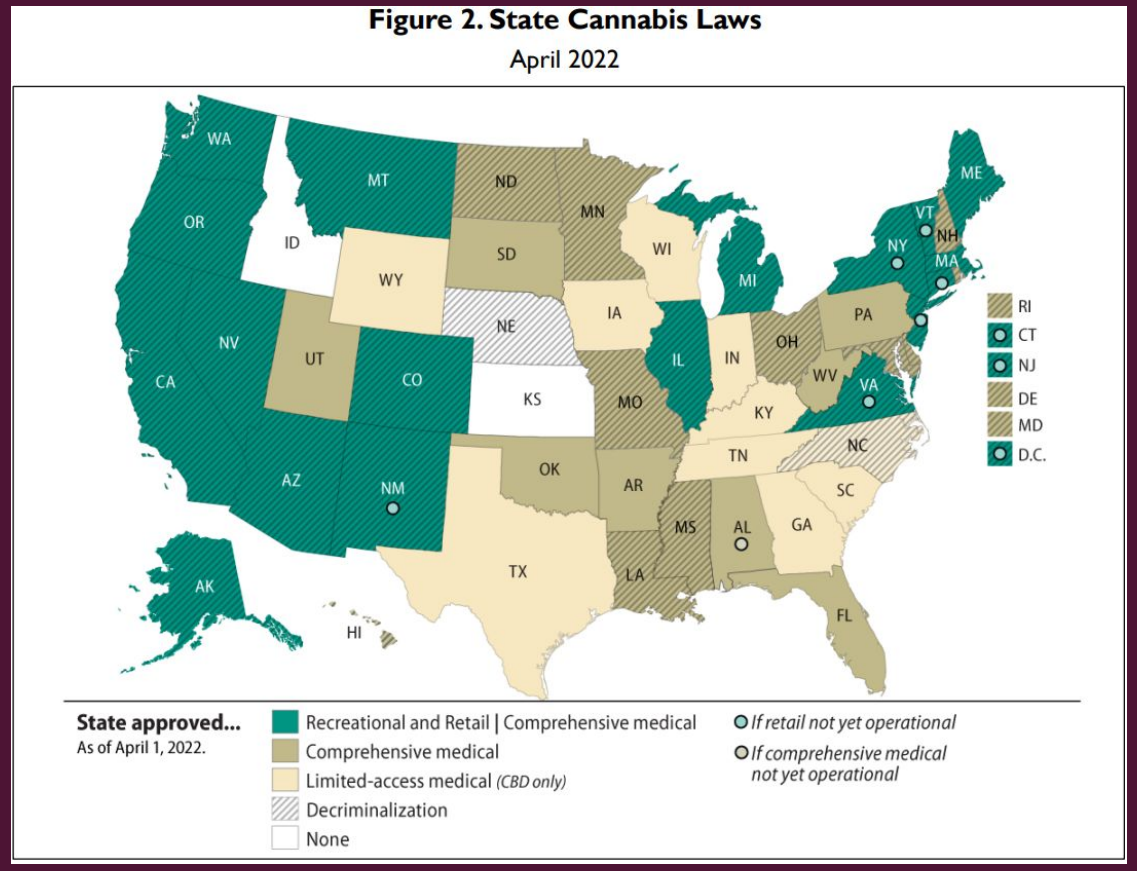
There are several challenges and barriers in conducting cannabis and cannabinoid research



Congressional Research Service
Informing the legislative debate since 1914

INSIGHT

The Schedule I Status of Marijuana

Updated October 7, 2022

The Controlled Substances Act (CSA) places various substances in one of five schedules based on their medical use, potential for abuse, and safety or risk for dependence. The five schedules are progressively ordered with Schedule V substances regarded as the least dangerous and addictive and Schedule I substances considered the most dangerous and addictive. Schedule I substances are considered to have a "high potential for abuse" with "no currently accepted medical use in treatment in the United States." The CSA prohibits the manufacture, distribution, dispensation, and possession of Schedule I substances except for federal government-approved research studies.

Marijuana is listed as a Schedule I controlled substance under the CSA, and has been on Schedule I since the CSA was enacted in 1970 (P.L. 91-513). For background on how marijuana came to be placed on Schedule I, see CRS Report R44782, *The Evolution of Marijuana as a Controlled Substance and the Federal-State Policy Gap*.

The Schedule I status of marijuana means that the substance is strictly regulated by federal authorities. Yet, over the last several decades, most states and territories have deviated from across-the-board prohibition of marijuana, and now have laws and policies allowing for some cultivation, sale, distribution, and possession of marijuana.

On October 6, President Biden announced reform to federal marijuana policy. First, he stated he would "pardon ... all prior Federal offenses of simple possession of marijuana." Second, he urged all governors "to do the same with regard to state offenses." Finally, he requested that the Department of Justice (DOJ) and Department of Health and Human Services (HHS) "initiate the administrative process to review expeditiously how marijuana is scheduled under federal law." He also noted that "important limitations on trafficking, marketing, and under-age sales should stay in place."

Cannabis Session Logistics

- used cannabis 10–15 minutes before the start of the session
- consume cannabis via vaping or smoking
- use the amount they would typically use when programming
- uploaded pictures of the product and indicated the amount

STUDY POPULATION

Eligible participants were at least 21, had used cannabis in the last year, and had smoked or vaped cannabis before.

Demographics:

- 74 participants in total
- 72% Men, 20% Women, 8% Non-binary
- Age: 20 - 49, average 24
- 38%: Currently Employed at a CS-related job
- 50%: Undergraduate Student in CS related field
- 16%: Graduate Student in CS-related field
- 4%: Unemployed or N/A(REMOVE)

Cannabis impairs writing and tracing through programs.

(a) Code produced by participant when sober

```
def is_sorted(integers):
  for i in range(len(integers)-1):
    if integers[i] > integers[i+1]:
      return False
  return True
```

(b) Code from same participant when intoxicated

```
def is_sorted(input_list):
  return helper(None, input_list)

def helper(min_val, input_list):
  if len(input_list) == 0: return True
  if min_val > input_list[0]: return False
  return helper(input_list[0],
       input_list[1:])
```

High programmers often complicate their solutions and add extra conditionals while still missing edge cases

Stylistic Choices

- added comments
- print statements
- helper functions
- additional test cases

We find **no significant style differences** between programs written while high vs. sober ($0.20 \leq p \leq 0.85$).

RESEARCH QUESTION 4 - Method Choice and Divergence

RQ4: How does cannabis intoxication influence programmers' **algorithmic method choice**?

- Pre-registered Hypothesis: Solutions to free-form programming problems by cannabis-intoxicated programmers will exhibit **greater method choice divergence and diversity**.

RESEARCH QUESTION 4 - Method Choice and Divergence

RQ4: How does cannabis intoxication influence programmers' **algorithmic method choice**?

- Pre-registered Hypothesis: Solutions to free-form programming problems by cannabis-intoxicated programmers will exhibit **greater method choice divergence and diversity**.

We found **no statistically-significant evidence** that cannabis intoxication impacts implementation divergence ($p \geq 0.08$).

Cannabis History Survey

Which of the following best captures the average frequency you currently use cannabis?

I do not use cannabis	once a week
less than once a year	twice a week
once a year	3 – 4 times a week
once every 3-6 months (2-4 times/yr)	5 – 6 times a week
once every 2 months (6 times/yr)	once a day
once a month (12 times/yr)	more than once a day
2 – 3 times a month	

How many days of the past week did you use cannabis?

- 0 days
- 1 day
- 2 days
- 3 days

Which of the following best captures the number of times you have used cannabis in your entire life?

1 – 5 times in my life	501 – 1000 times in my life
6 – 10 times in my life	1001 – 2000 times in my life
11 – 50 times in my life	2001 – 5000 times in my life