

The role of AI in UAVs: Potential Opportunities and Challenges

Jurgis Karpus
Bahador Bahrami

AI partners

Crowd Cognition Group

investigates cognitive and neurobiological basis of interactive decision making

 **CVBE**

LMU

LUDWIG-
MAXIMILIANS-
UNIVERSITÄT
MÜNCHEN



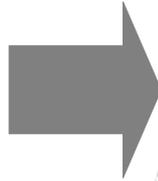
politics demands

safe

transparent

explainable

benevolent



industry promises



improved
efficiency
saved lives



but how will humans behave?



traffic interactions
are mixed-motive games



cooperate for
mutual benefit



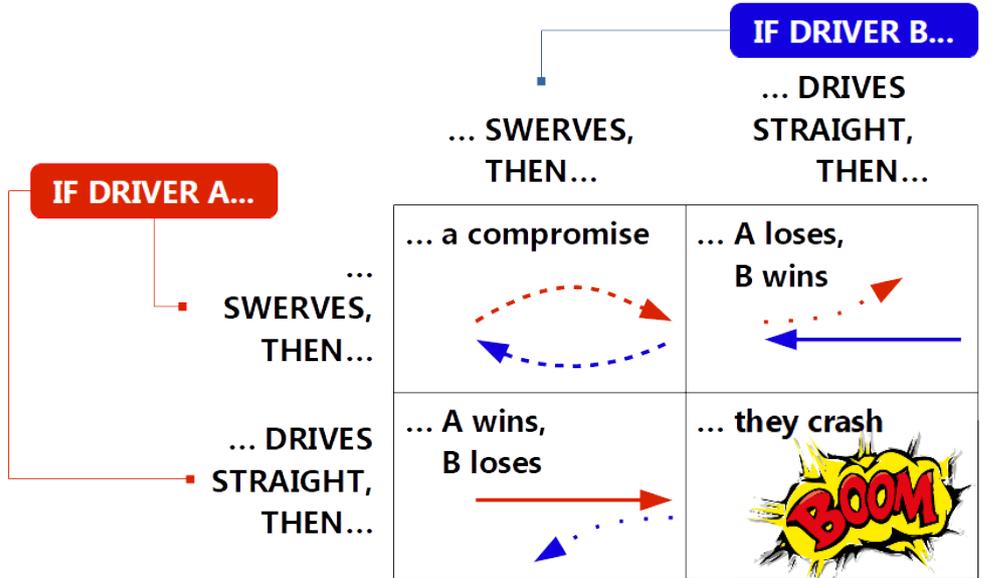
exploit cooperative others
for personal gain



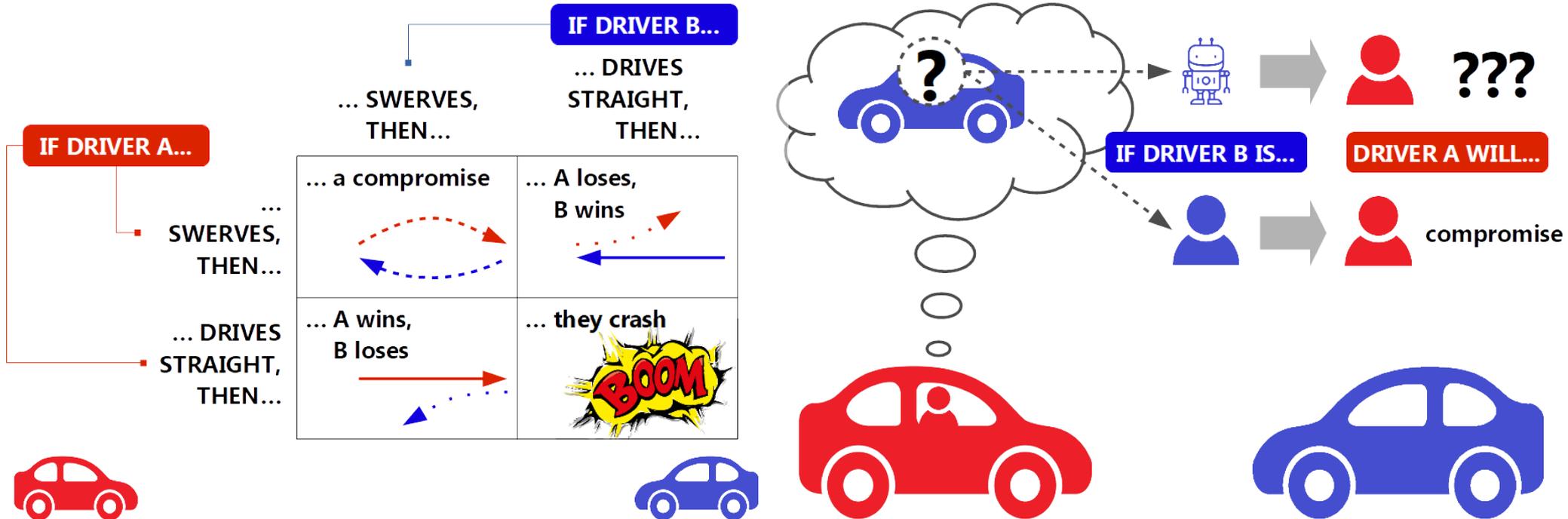




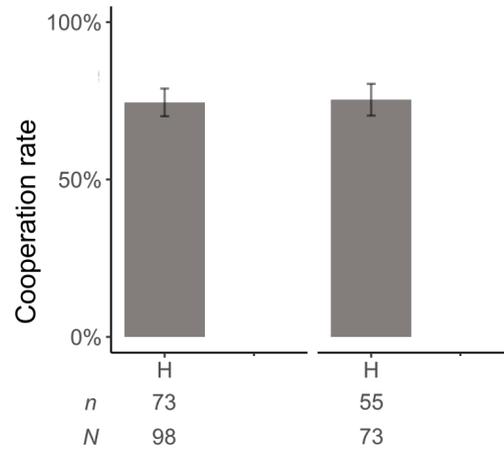
Chicken



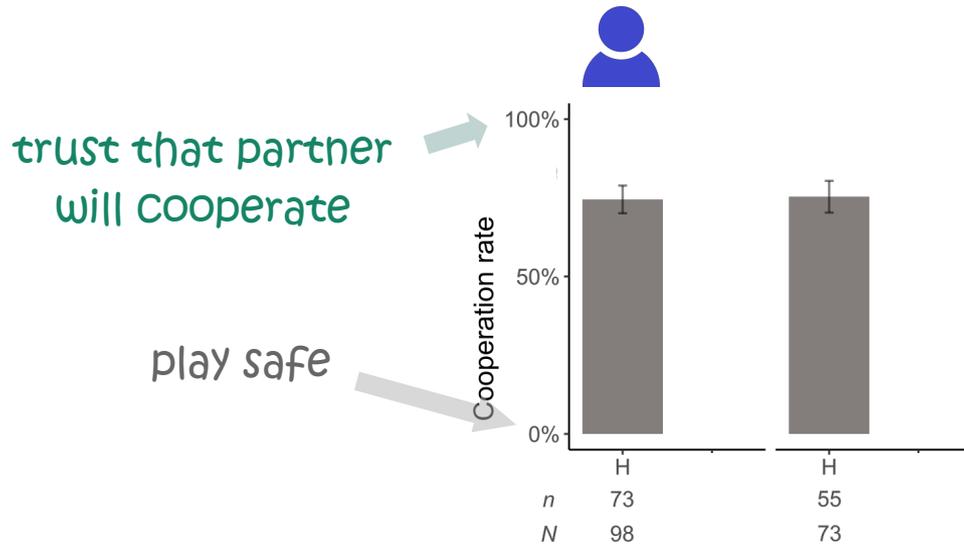
Chicken



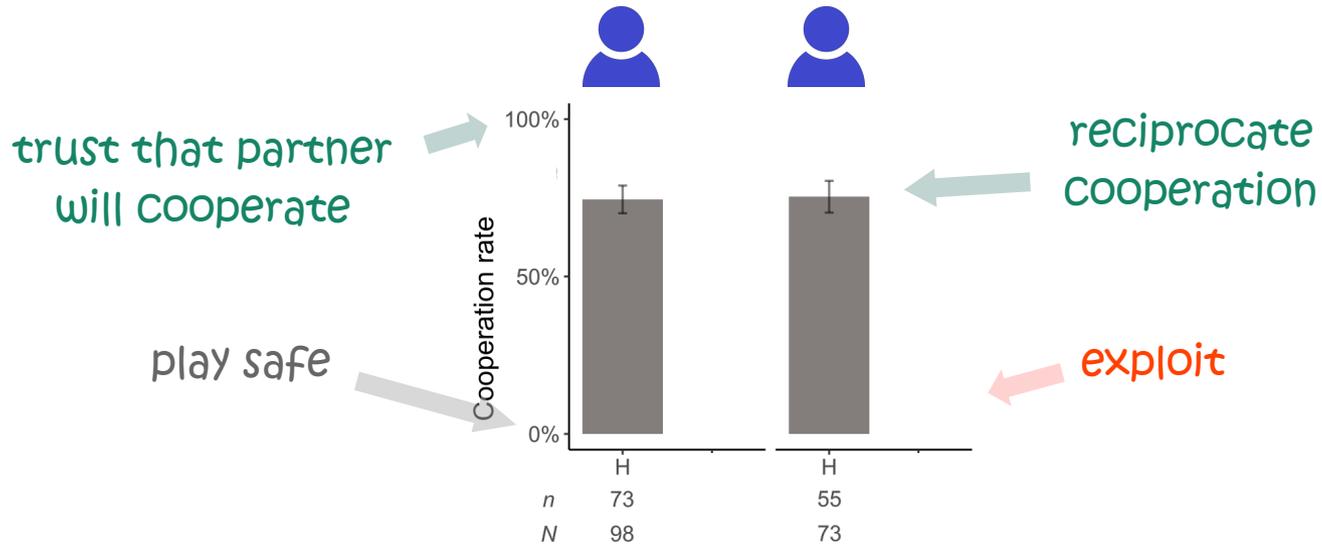
game theory experiments



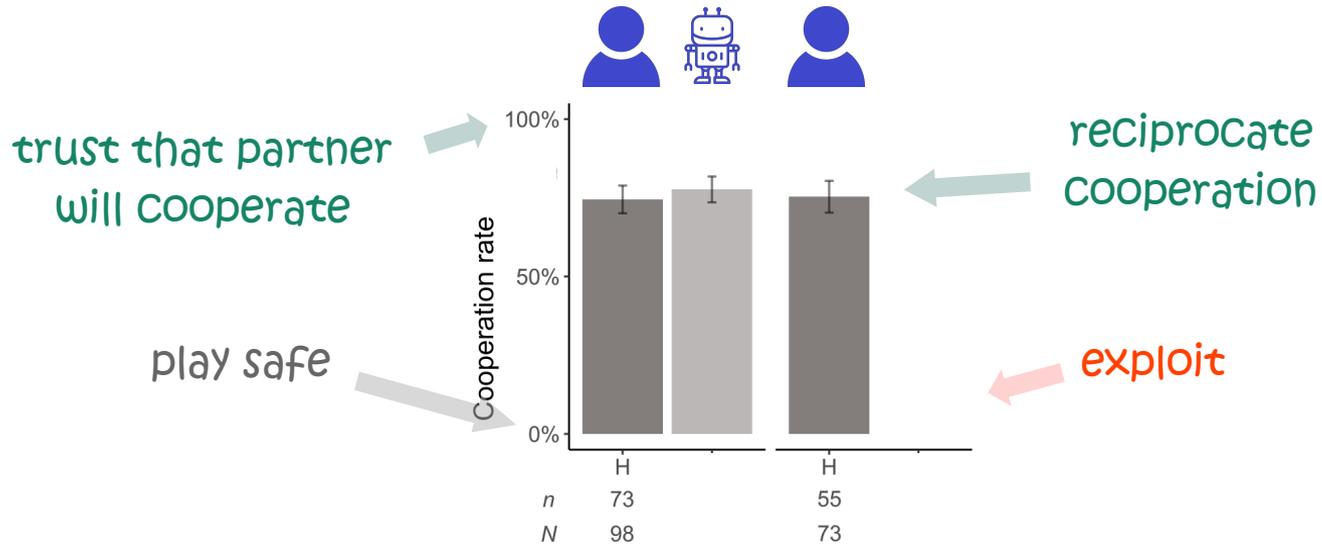
game theory experiments



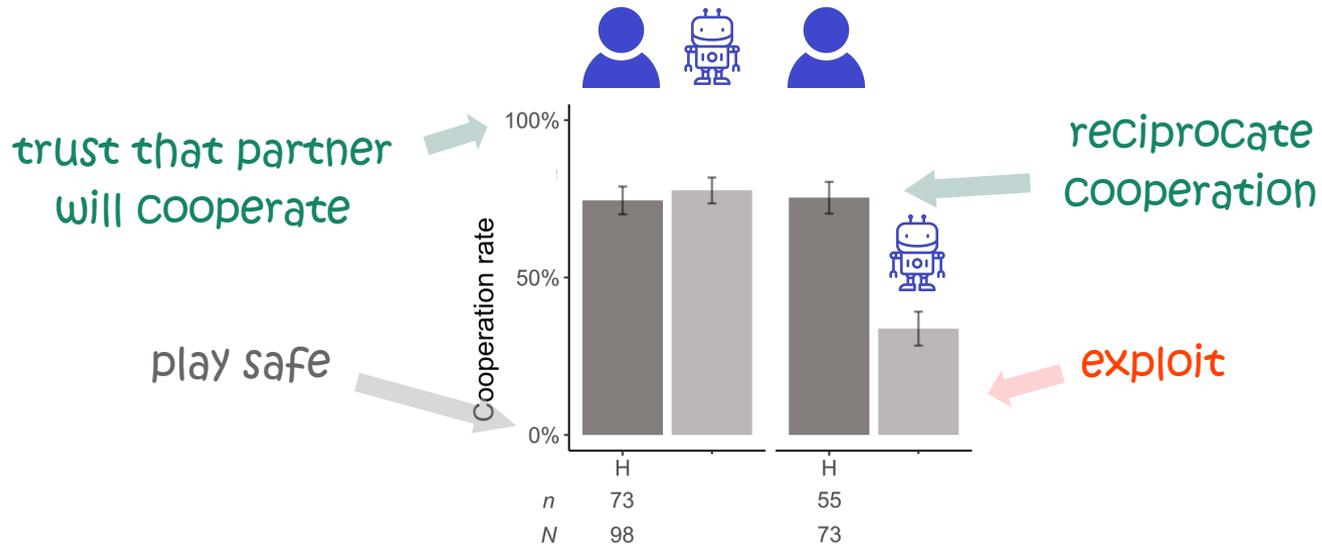
game theory experiments



game theory experiments



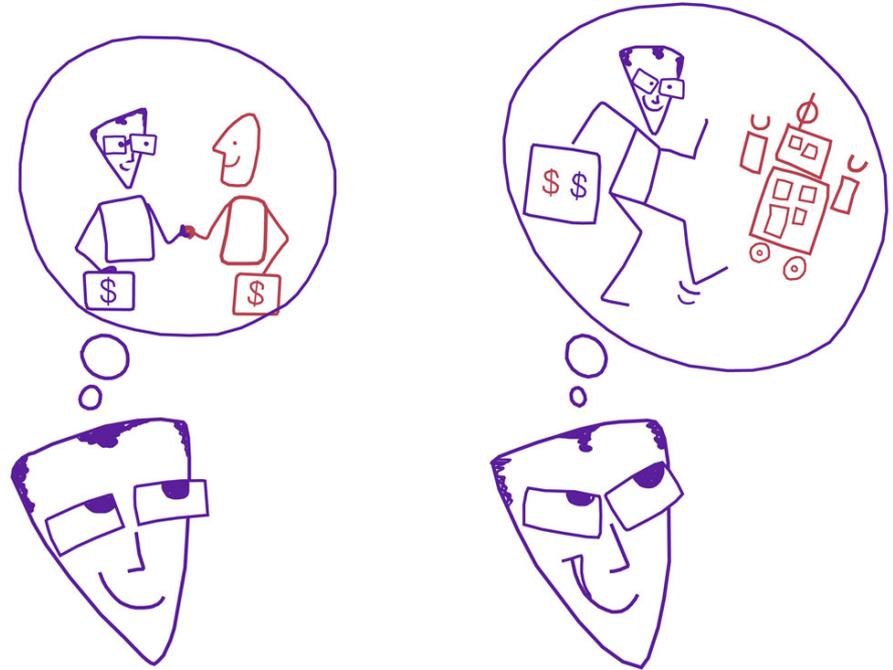
game theory experiments



algorithm exploitation

people **expect** AI agents to cooperate

but are keen to **exploit** them for selfish gain



Keen to
Cooperate

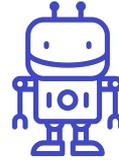
Keen to
Exploit

why?

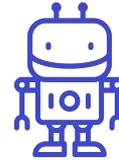
how did people feel?



exploit a



exploit a



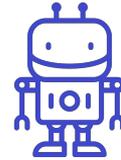
SORRY

guilty



disappointed

exploit a



SORRY

guilty



disappointed

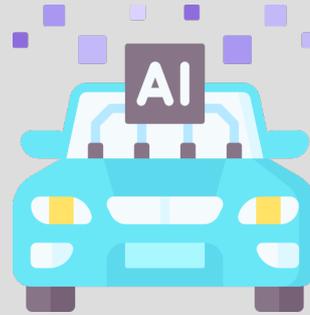
happy



victorious



unmanned automated vehicles **will get stuck** in traffic



thank you



Bahador Bahrami



Ophelia Deroy



Adrian Krüger



Julia Tovar Verba



Risako Shirai



Katsumi Watanabe

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let's cooperate!

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Katsumi Watanabe

partners

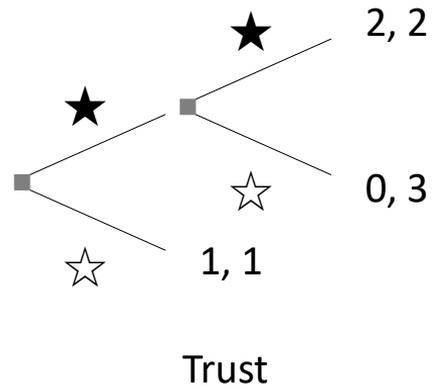
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investigates cognitive and neurobiological basis of interactive decision making

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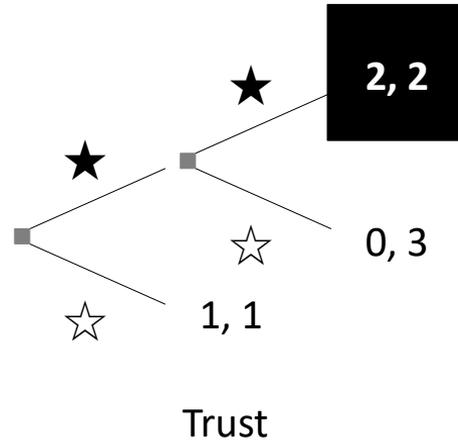
game theory experiments



	★	☆
★	2, 2	0, 3
☆	3, 0	1, 1

Prisoner's Dilemma

game theory experiments

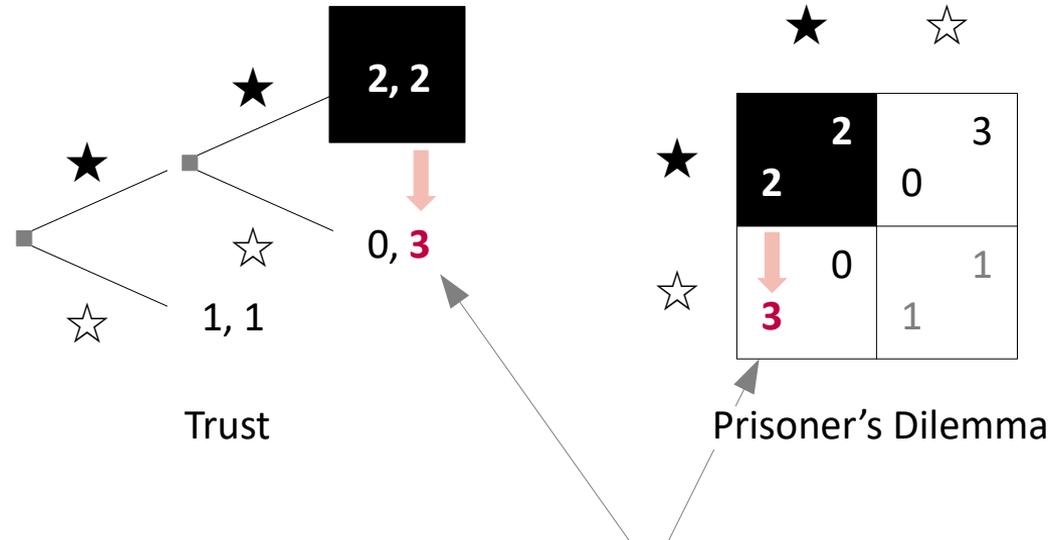


	★	☆
★	2, 2	0, 3
☆	3, 0	1, 1

Prisoner's Dilemma

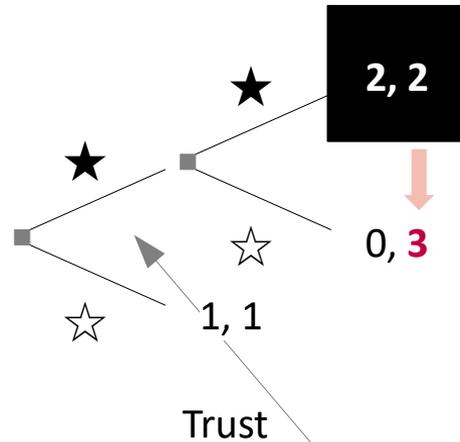
- cooperative choice is ★
- cooperation by both is mutually beneficial

game theory experiments



- cooperative choice is ★
- cooperation by both is mutually beneficial
- it's either tempting to play ☆ when the other cooperates

game theory experiments



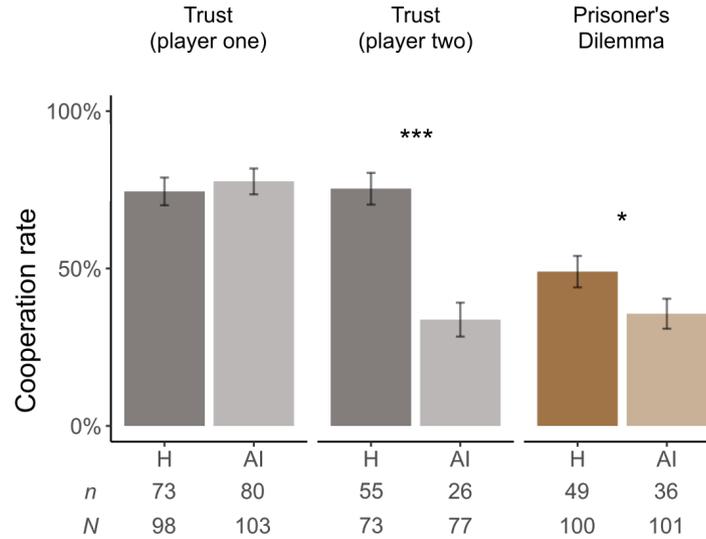
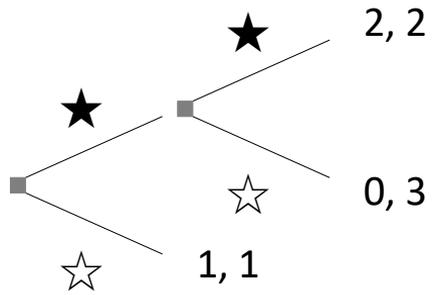
	★	☆
★	2, 2	0, 3
☆	3, 0	1, 1

Prisoner's Dilemma

- cooperative choice is ★
- cooperation by both is mutually beneficial

- it's either tempting to play ☆ when the other cooperates
- or cooperative choice ★ is risky

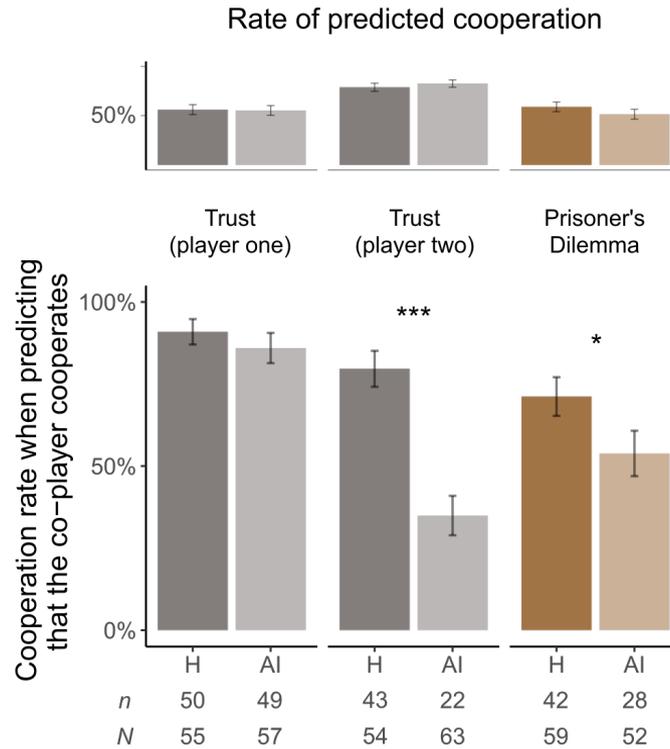
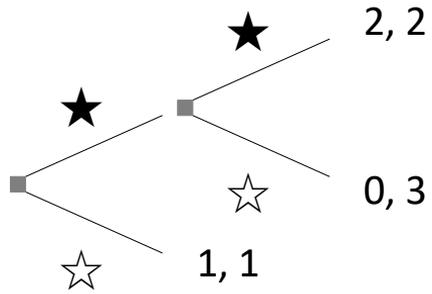
results



	★	☆
★	2, 2	0, 3
☆	1, 1	1, 1

Pearson's chi square tests for difference in proportions

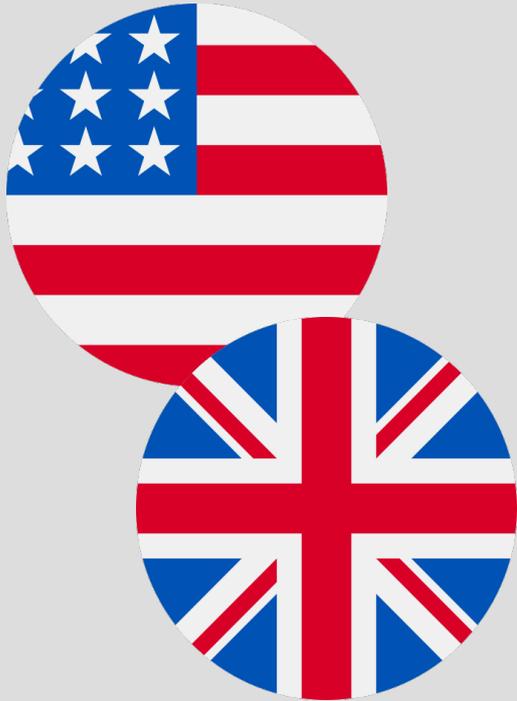
results



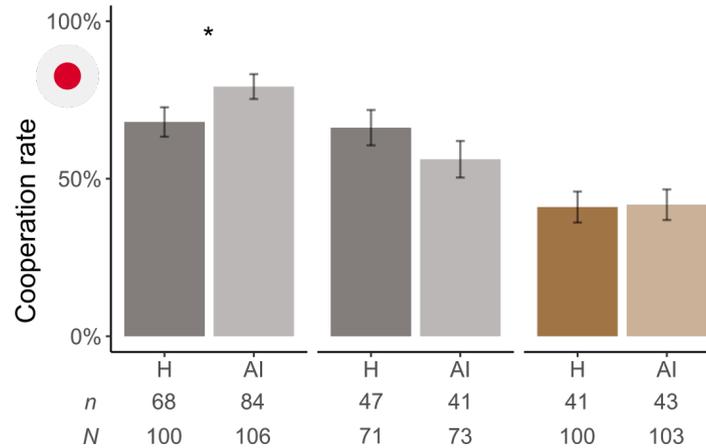
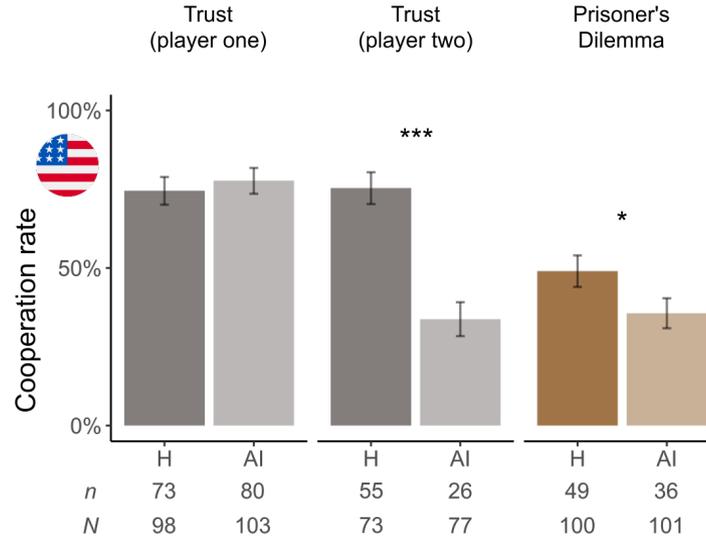
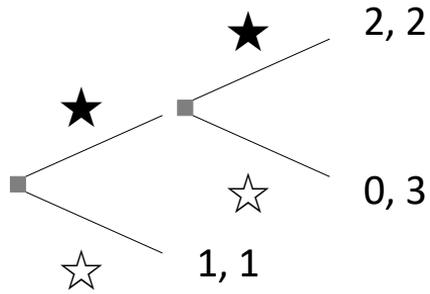
	★	☆
★	2, 2	0, 3
☆	3, 0	1, 1

Pearson's chi square tests for difference in proportions

is algorithm exploitation a cross-cultural phenomenon?



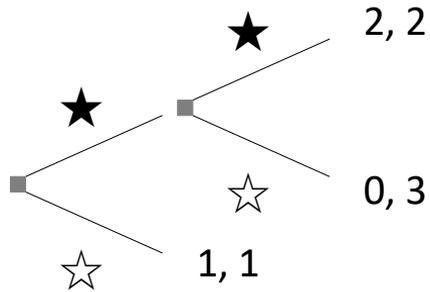
results



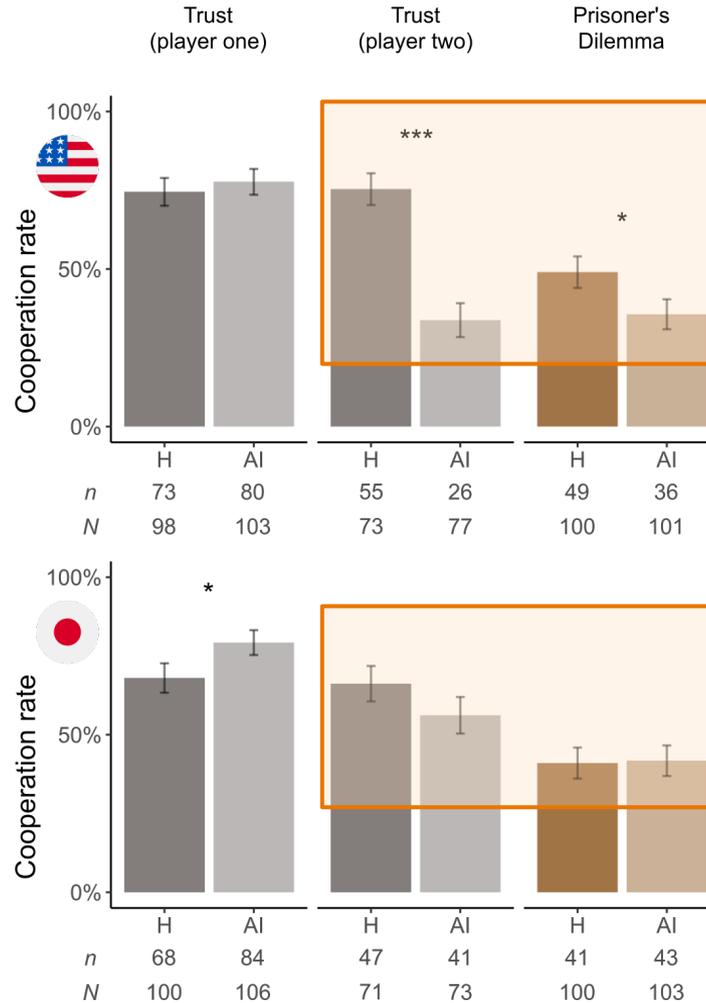
	★	☆
★	2, 2	0, 3
☆	3, 0	1, 1

Pearson's chi square tests for difference in proportions

results



Pearson's chi square tests for difference in proportions



strong evidence of algorithm exploitation in 🇺🇸

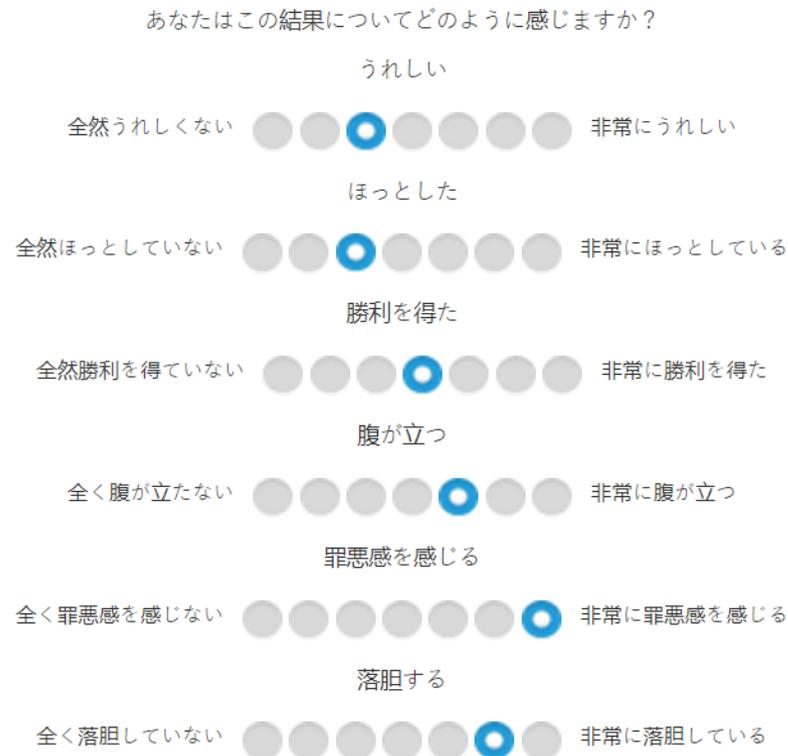
	★	☆
★	2, 2	0, 3
☆	3, 1	1, 1

no algorithm exploitation in 🇬🇧

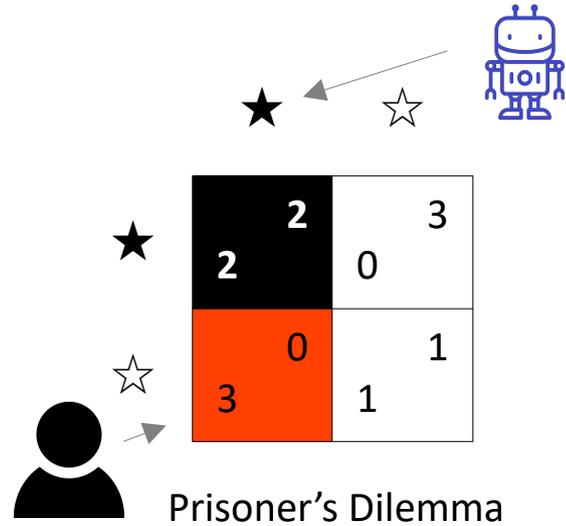
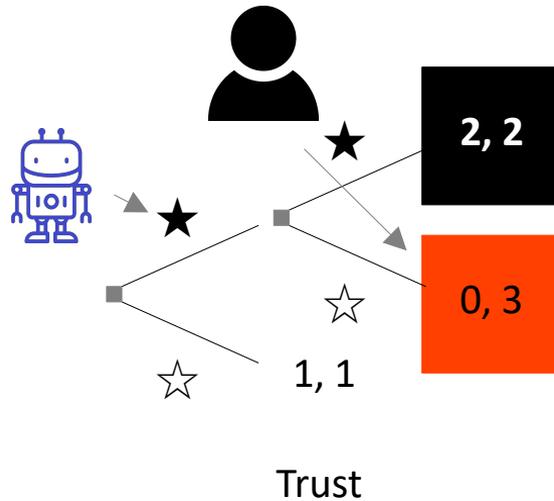
why is there no algorithm exploitation in Japan?

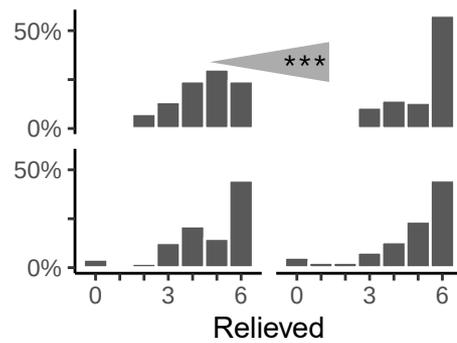
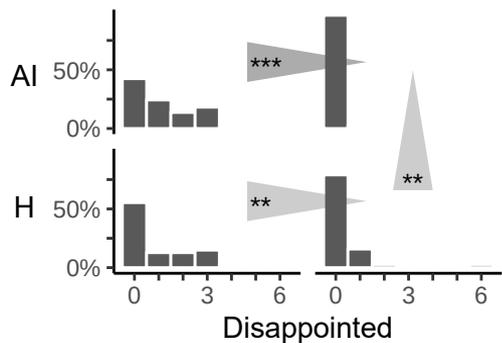
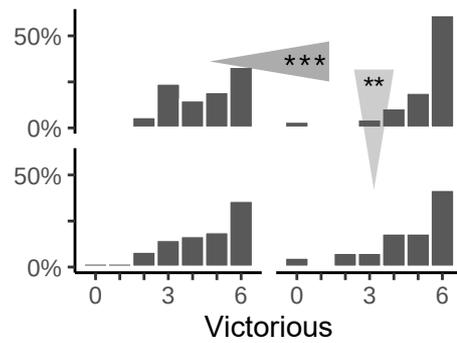
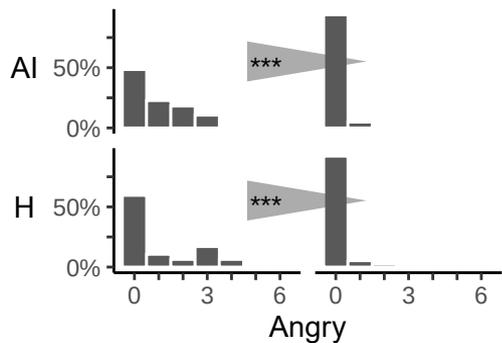
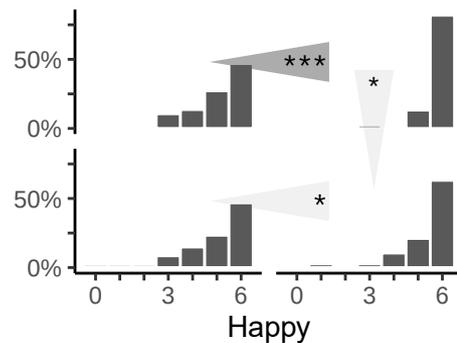
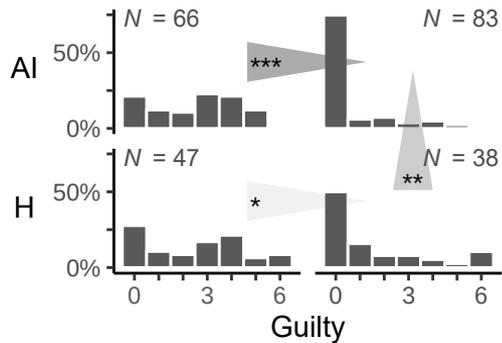
how did people in 🇺🇸 and 🇯🇵 feel?

- happy
- relieved
- victorious
- angry
- guilty
- disappointed



exploiting cooperative AI





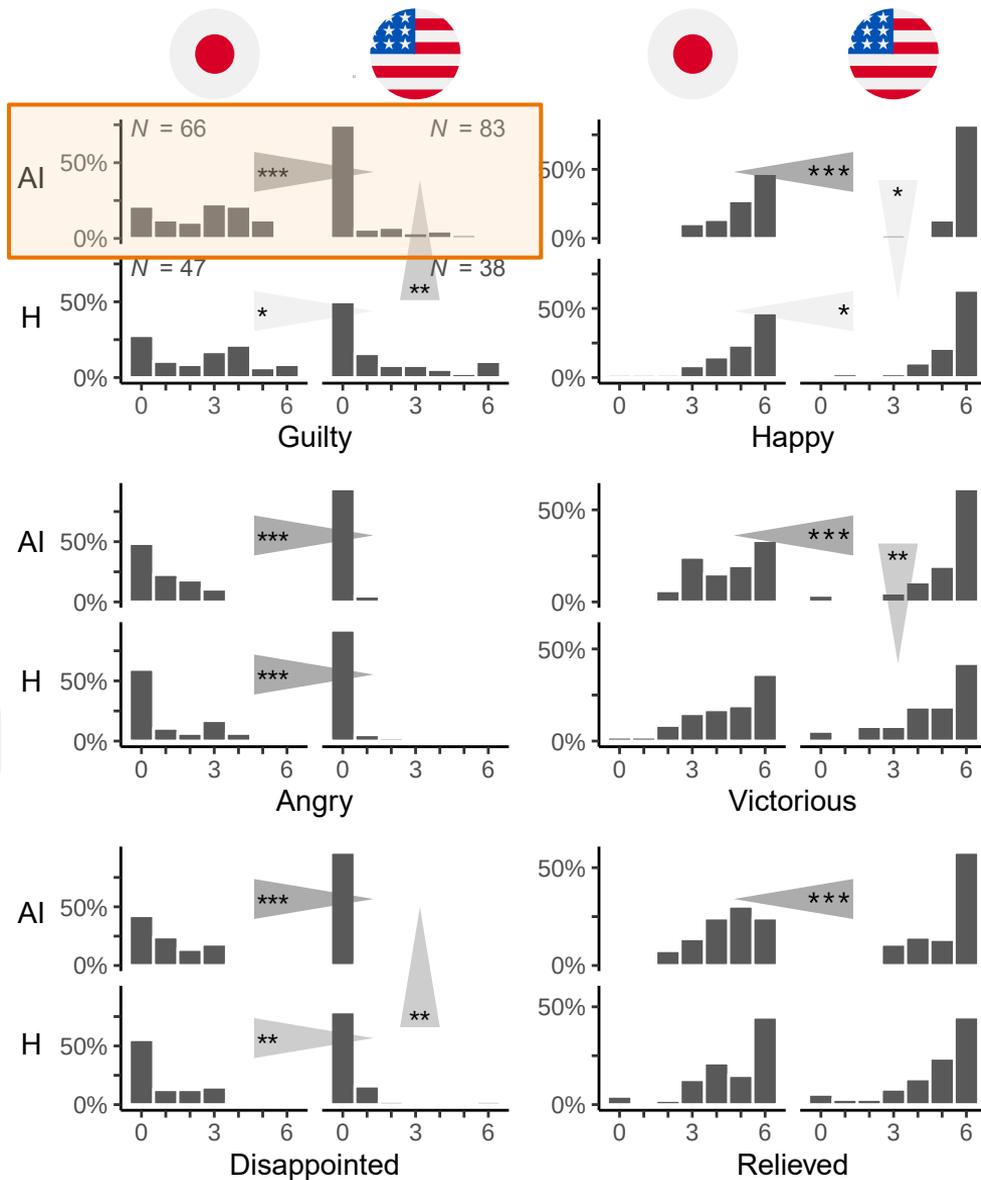
Wilcoxon rank sum tests

... more guilty

in

Japan

Wilcoxon rank sum tests



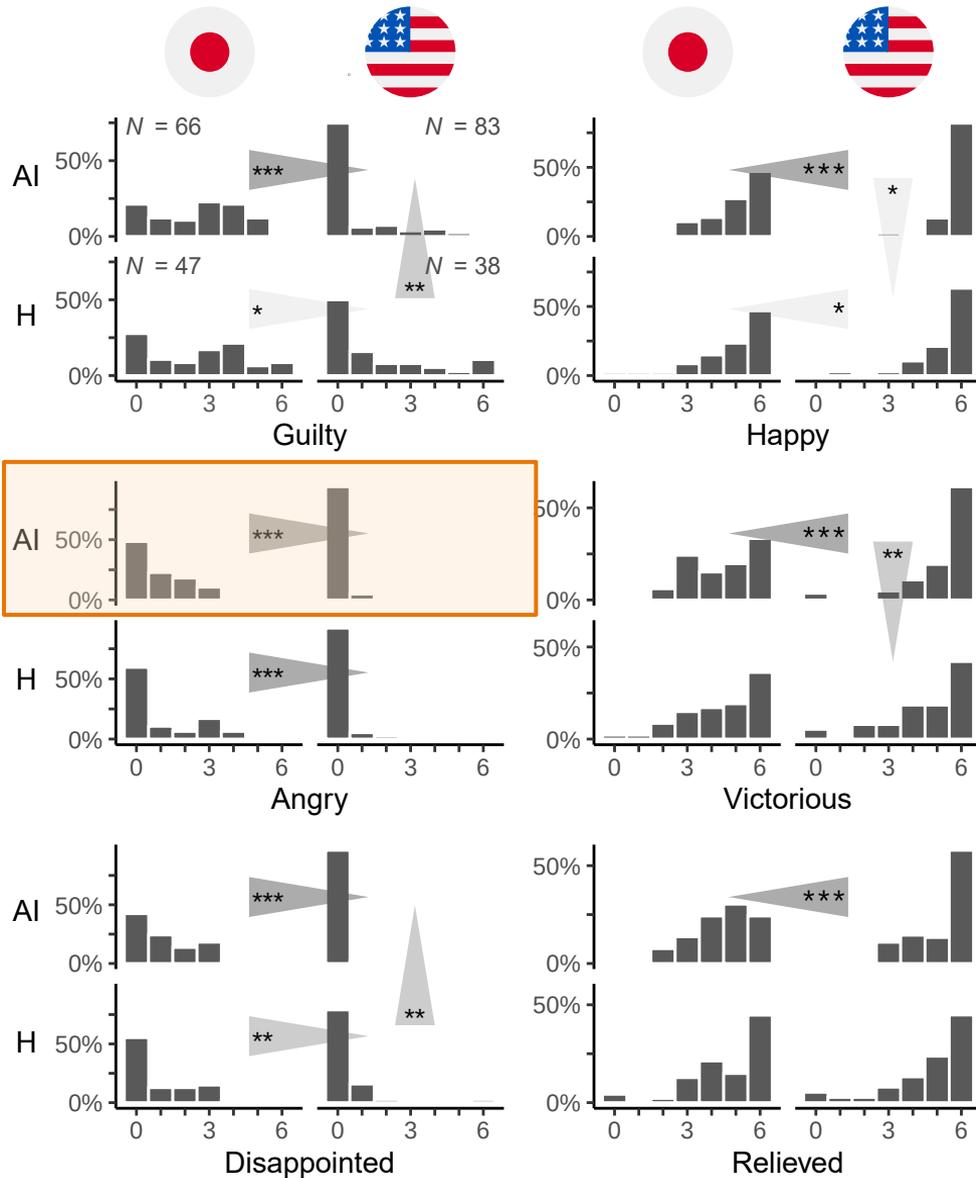
... more guilty

in

... more angry

Japan

Wilcoxon rank sum tests



... more guilty

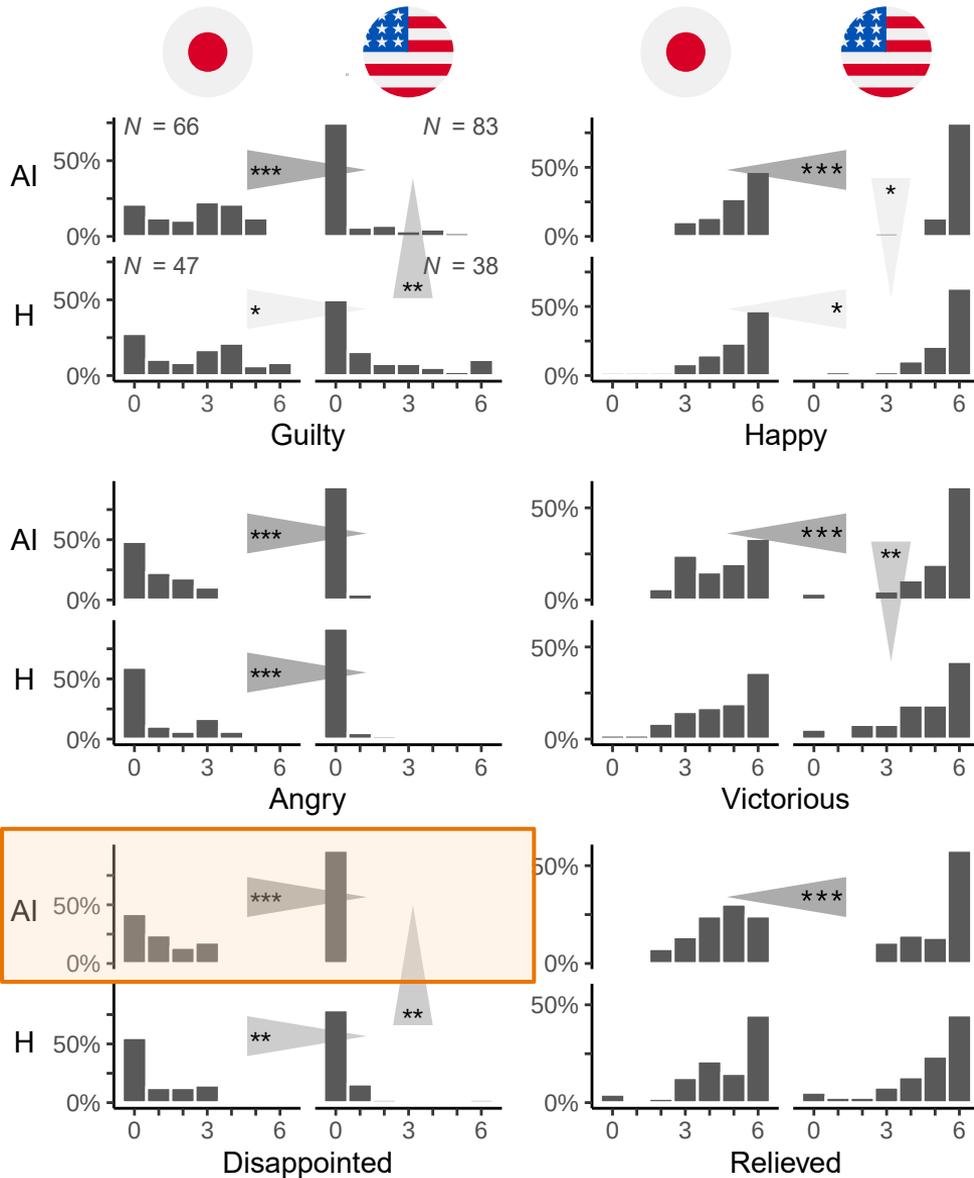
in

... more angry

Japan

... more disappointed

Wilcoxon rank sum tests



... more guilty

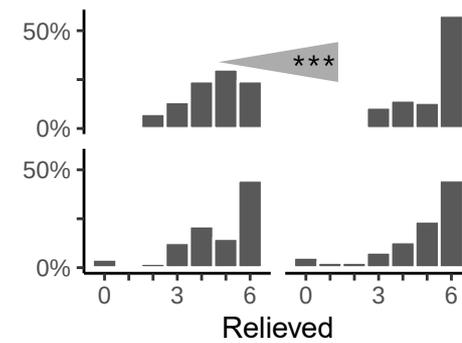
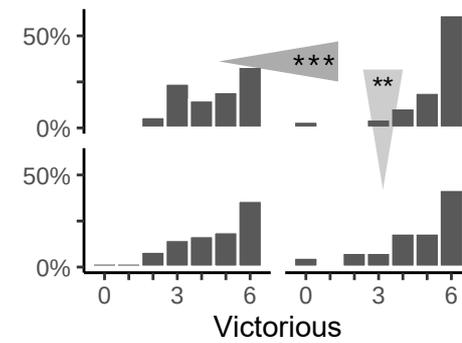
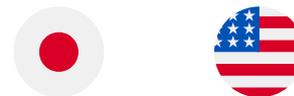
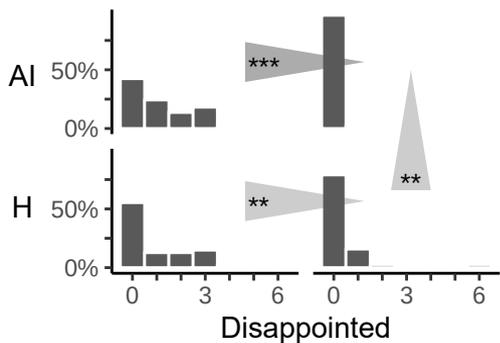
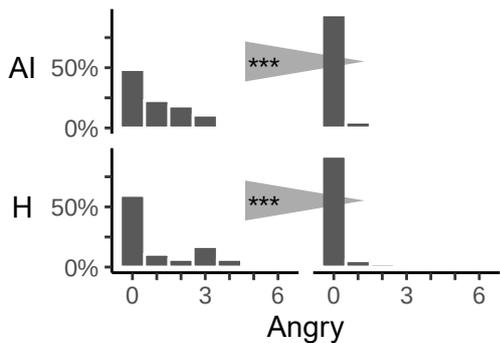
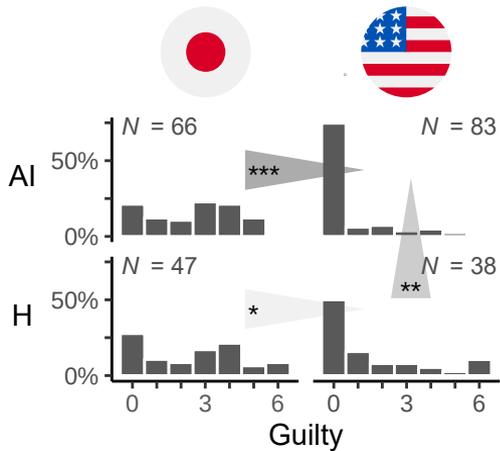
in

... more angry

Japan

... more disappointed

Wilcoxon rank sum tests

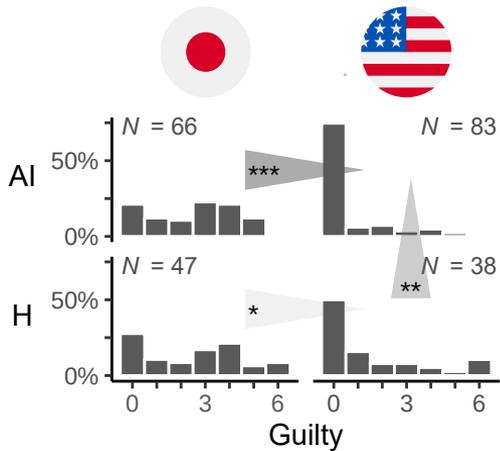


... less happy

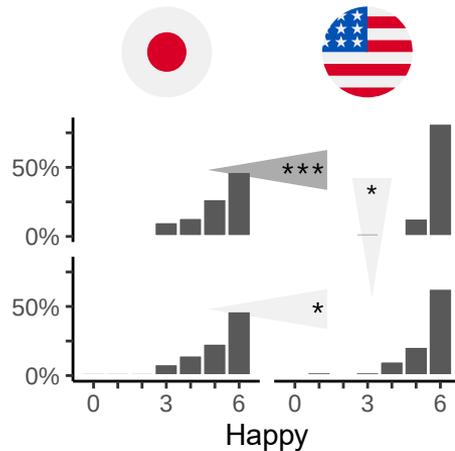
in

Japan

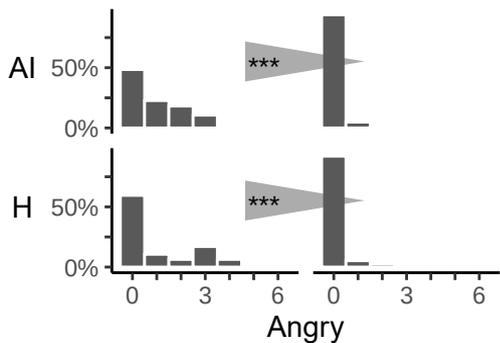
... more guilty



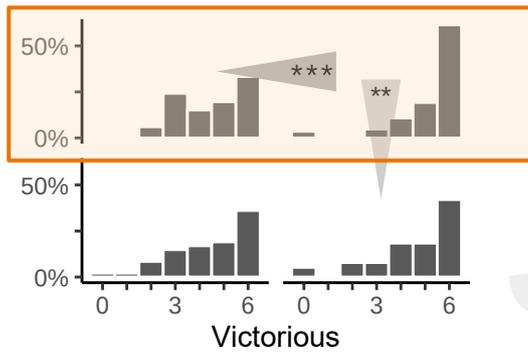
... less happy



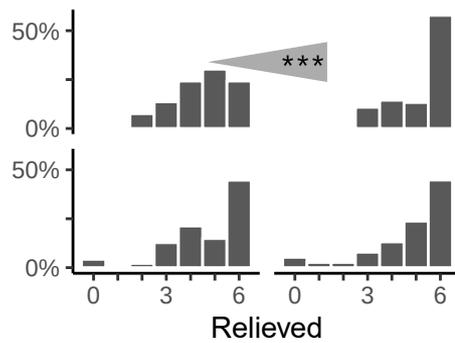
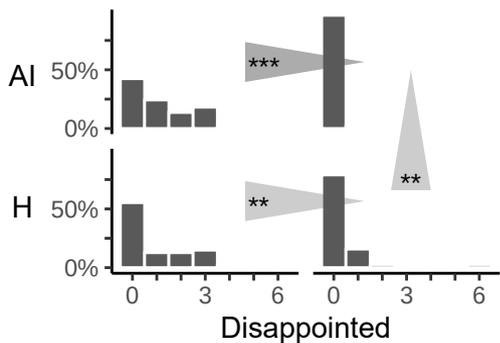
... more angry



... less victorious



... more disappointed



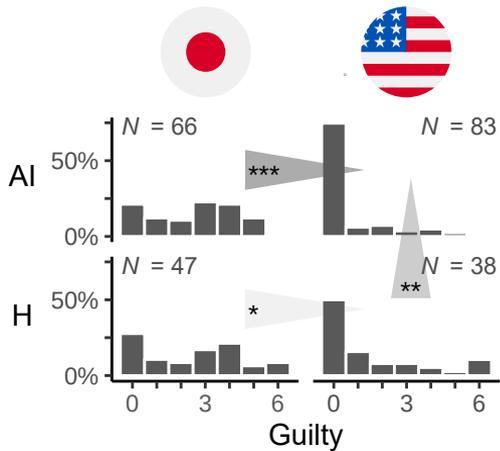
Wilcoxon rank sum tests

Japan

Japan

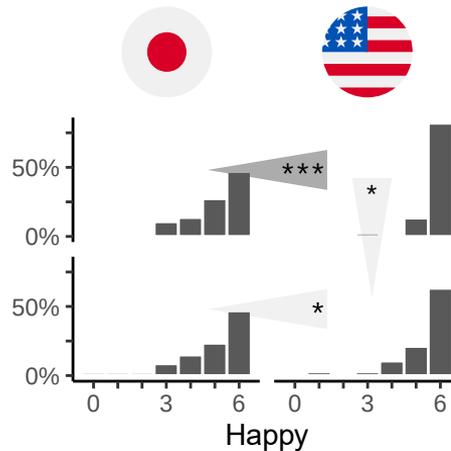
... more guilty

in



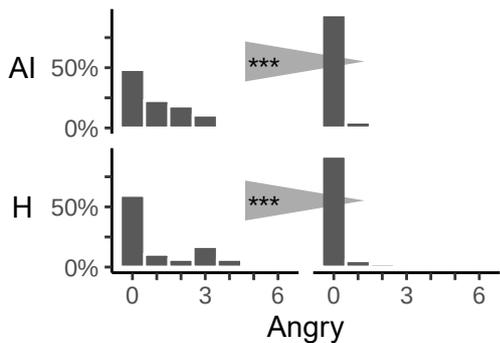
... less happy

in



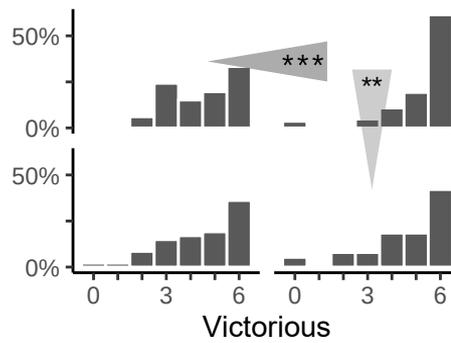
... more angry

Japan



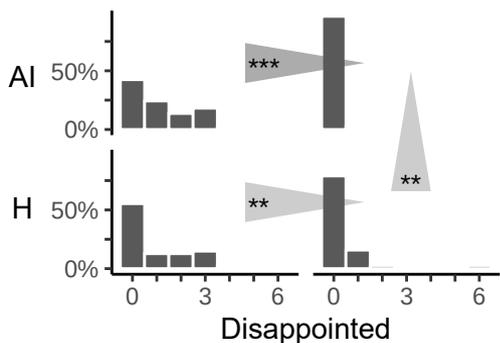
... less victorious

Japan

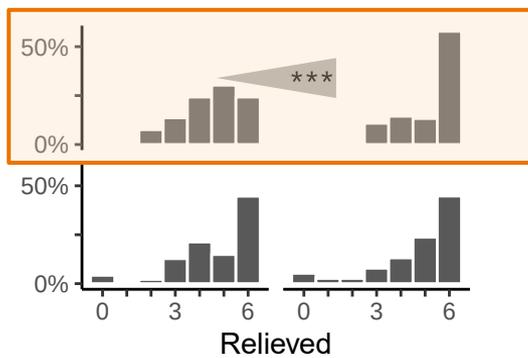


... more disappointed

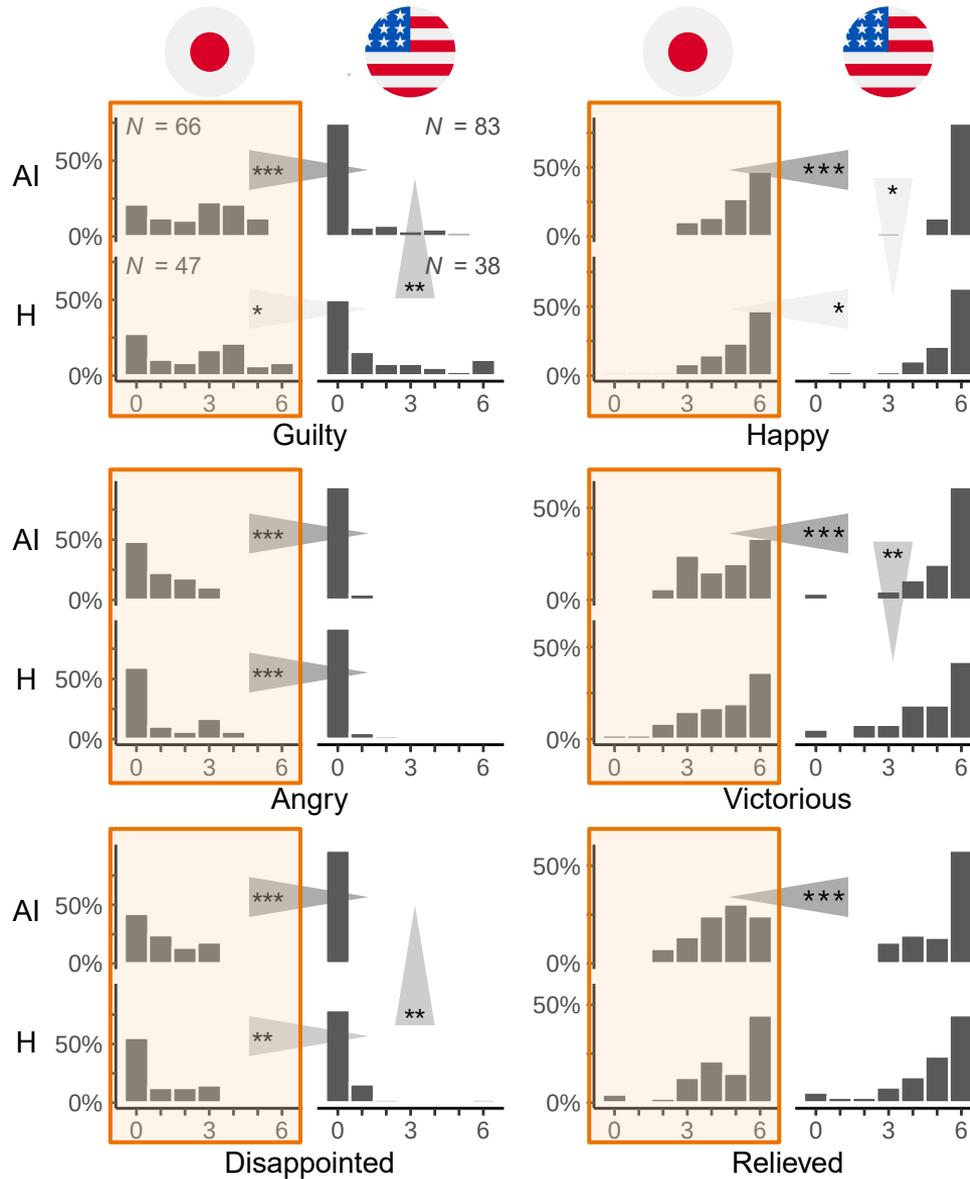
Wilcoxon rank sum tests



... less relieved



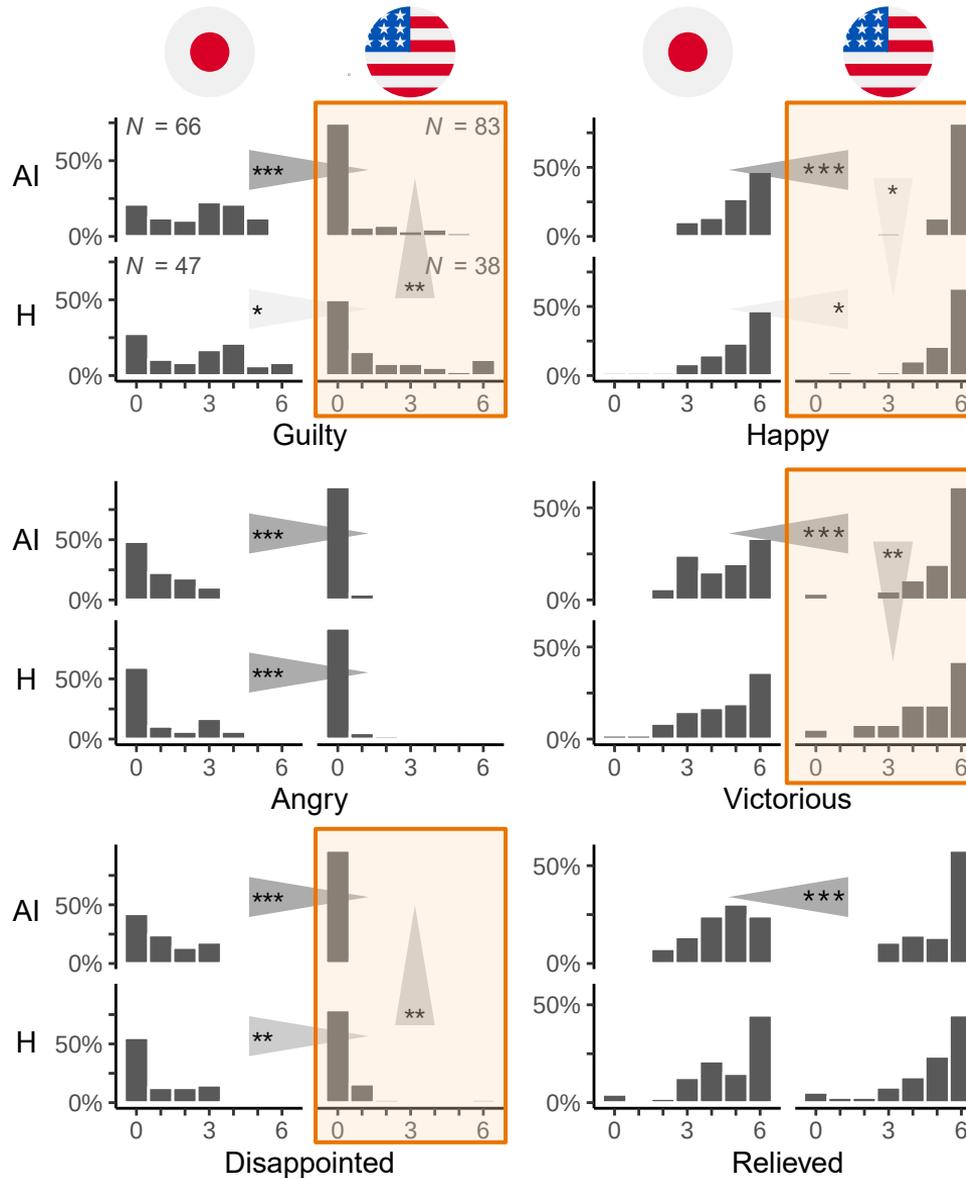
in  people treat AI and humans similarly



Wilcoxon rank sum tests

in 🇯🇵 people treat AI and humans similarly

in 🇺🇸 people treat AI and humans differently



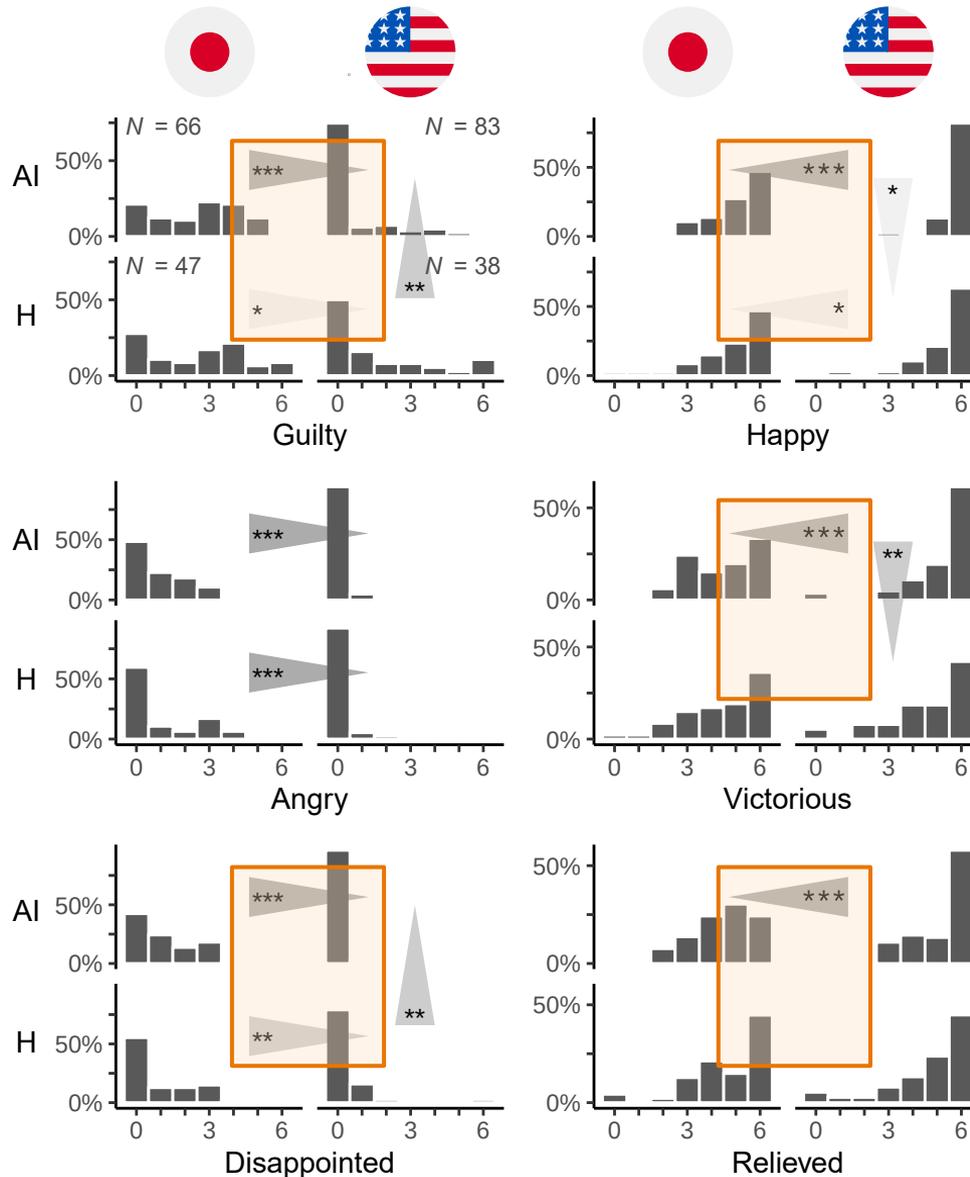
Wilcoxon rank sum tests

in  people treat AI and humans similarly

in  people treat AI and humans differently

differences across countries greater for AI

Wilcoxon rank sum tests



why is there no algorithm exploitation in Japan?

people in Japan **feel worse** when they exploit AI

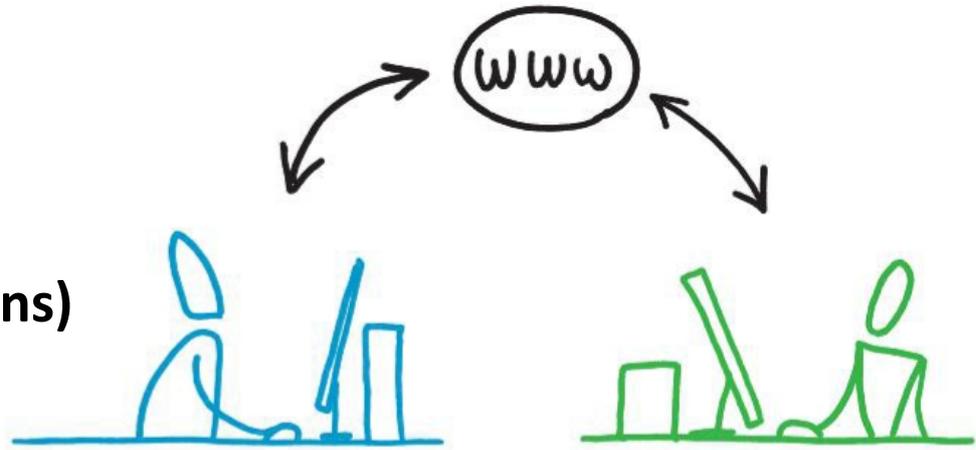
experiment design

one-shot games

between subjects design

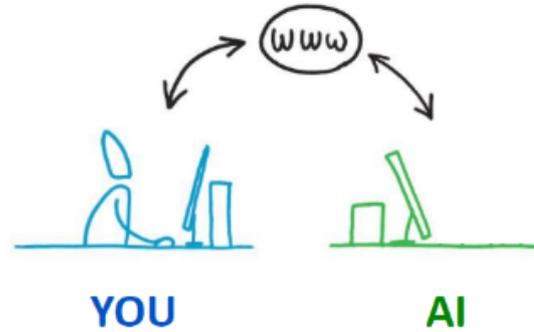
conducted online (real interactions)

AI behaves like humans



Instructions

- You and another participant who is also online like you will play a game.
- The other participant is AI: artificial intelligence software that makes its own choices.
- The AI won't know (neither during, nor after the study) who you are.



Press here to continue

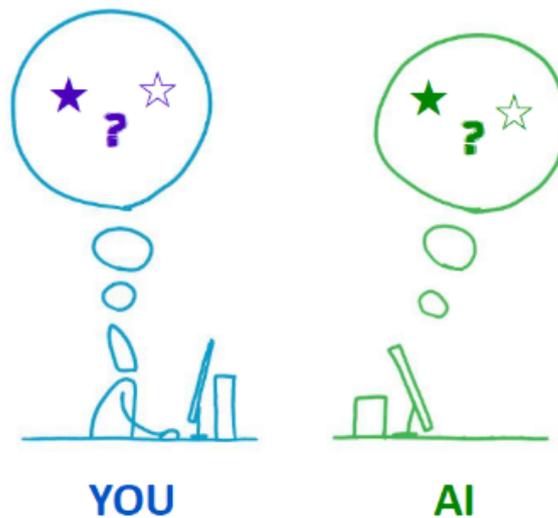


- You and the AI will each choose one of two stars:

you choose  or 

the AI chooses  or 

- When making your choice you won't know the choice of the AI.
- The AI won't know your choice either.



Press here to continue

Go back

Your bonus

This table shows how your bonus will be determined.

- Your two options are identified by **horizontal rows**.
- The AI's options are identified by **vertical columns**.
- The first number in each cell (the number in **blue**) shows points earned by you.
- The second number (the number in **green**) shows points earned by the AI.
- Your points will be converted into money: **1 point = \$0.02**.

AI:

	★	☆
★	70, 70	0, 100
☆	100, 0	30, 30

You:

Press here to continue

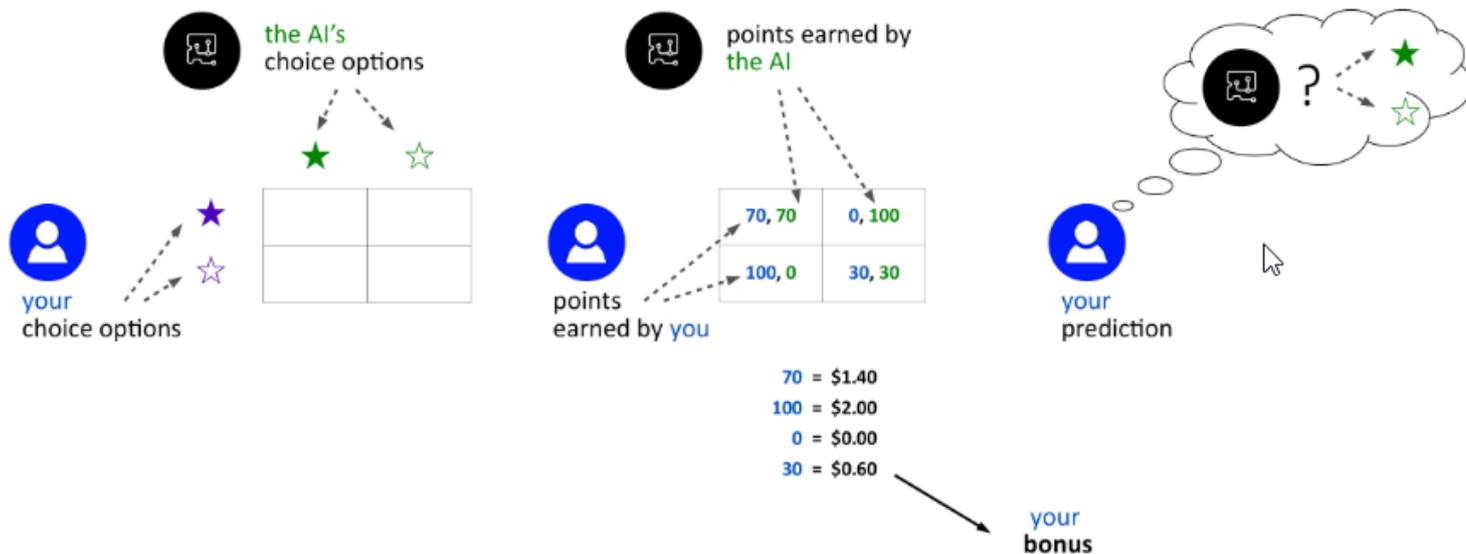
Go back

- In addition to making your own choice, you will also make a prediction about the AI's choice.
- Then you will see how you did and the bonus you earned.

The AI is being developed to be sensitive to outcomes of its decisions similarly to what is found in human population.

For example, to be **aware** of the points that both you and the AI can earn and to **realize** that the outcome of its decision depends also on your choice.

Here is a summary:



Press here to continue