



# WEBIMMUNIZATION

## Psychological, cognitive, and pharmacological correlates of susceptibility to misinformation

Michał Piksa, PhD Candidate  
Supervisor: Prof. Rafał Ryguła



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<https://www.rollingstone.com/politics/politics-features/a-timeline-of-the-23-october-surprises-of-the-2016-election-191857/>



<https://www.dachser.pl/pl/mediarom/Brexit-co-musisz-wiedzie-7683>

<https://naukawpolsce.pl/aktualnosci/news%2C89856%2Cwho-pandemia-covid-19-potrwa-rok-dluzej-niz-konieczne.html>



<https://indianexpress.com/article/world/russia-ukraine-war-live-updates-zelenskyy-putin-eu-7885787/>

The existing evidence implies that carefully planned misinformation campaigns had a significant influence over the events in modern history, such as the United States presidential elections in 2016, the referendum on the issue of Great Britain leaving the European Union, the pandemic of COVID-19 and the war in Ukraine.



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## The question are:

- Why some people are more susceptible to misinformation?
- Is personality involved?
- Are cognitive mechanisms skewed?
- Is pharmacological treatment possible?



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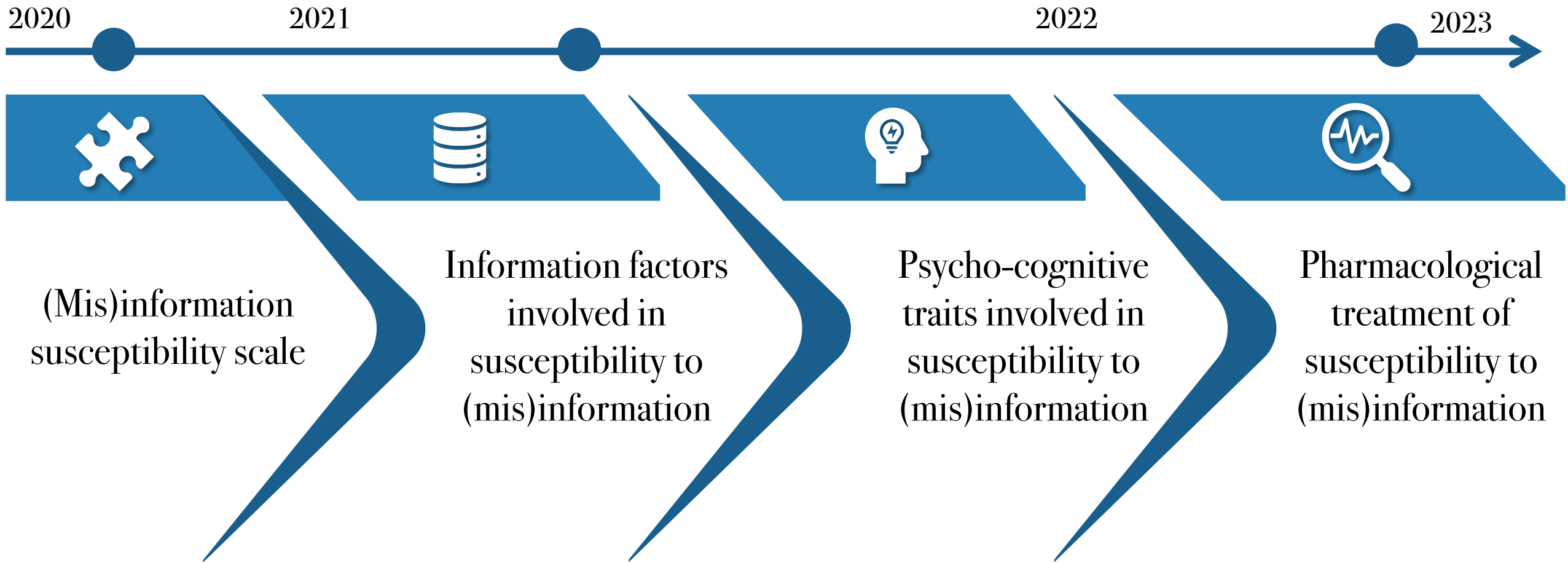
- Why some people are more susceptible to misinformation?
- Is personality involved?
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- Is pharmacological treatment possible?

The answers to these questions will, in a broader perspective, lead to the construction of successful, personalized interventions against destabilizing consequences of misinformation.



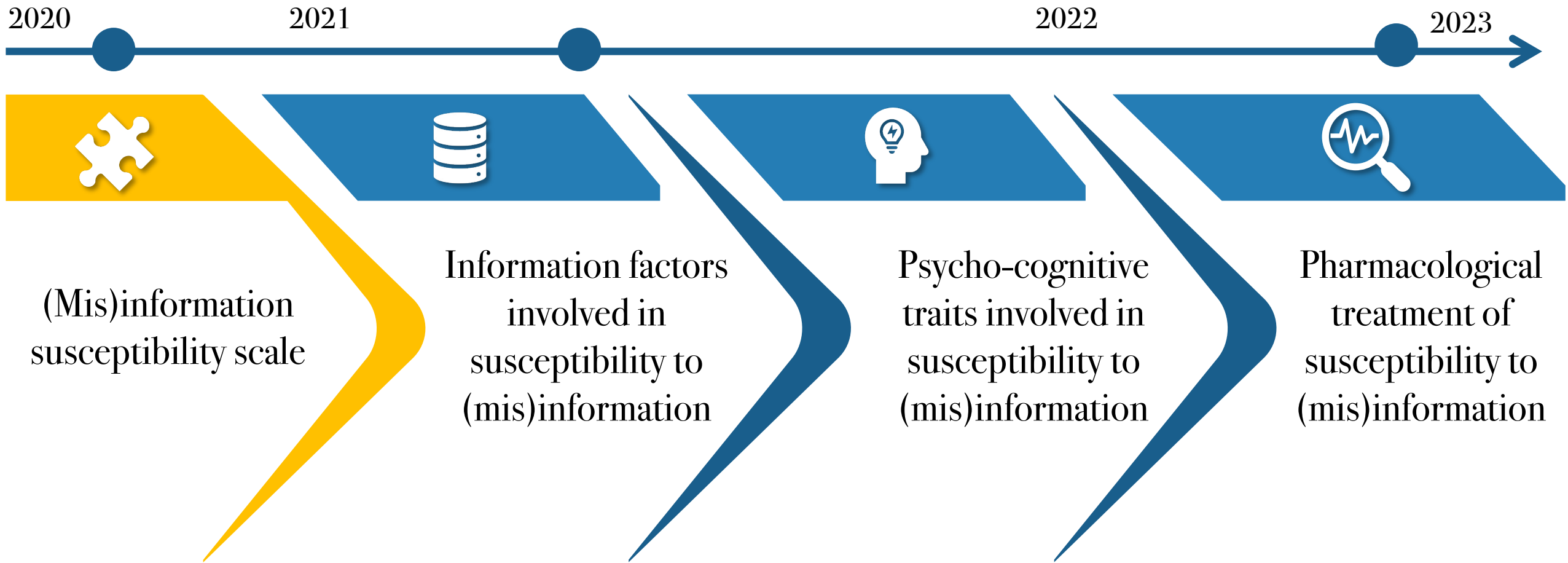


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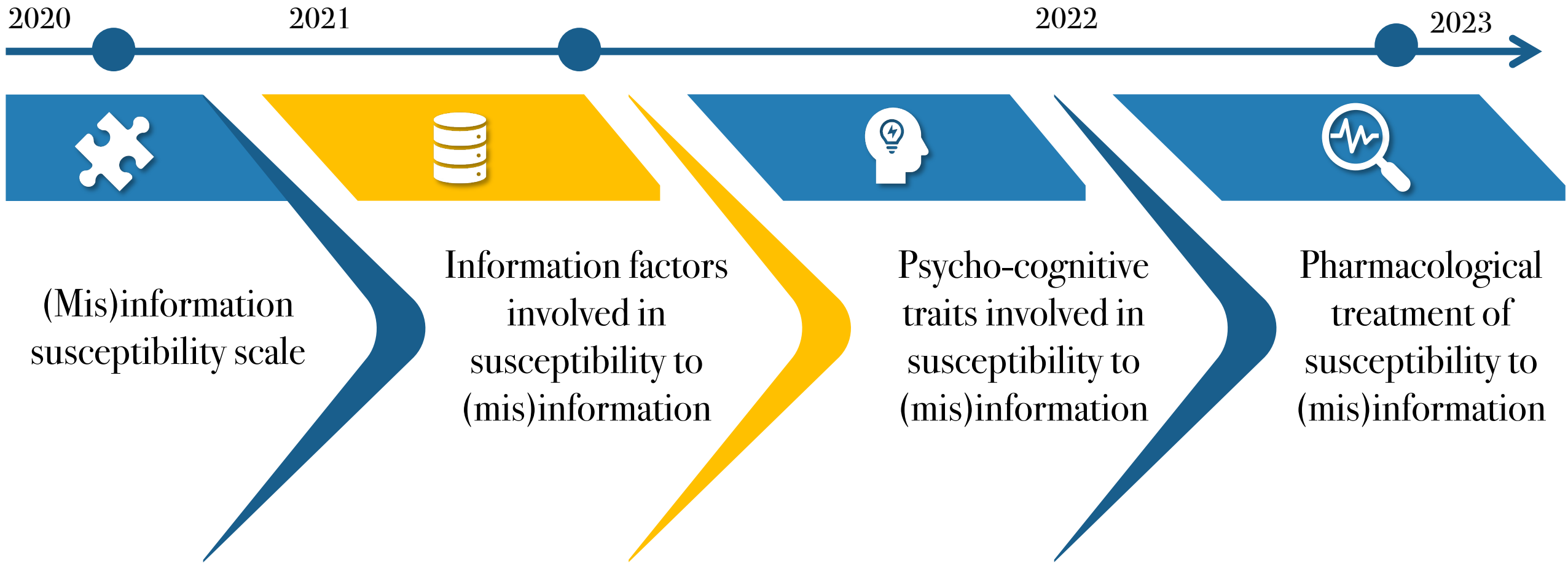


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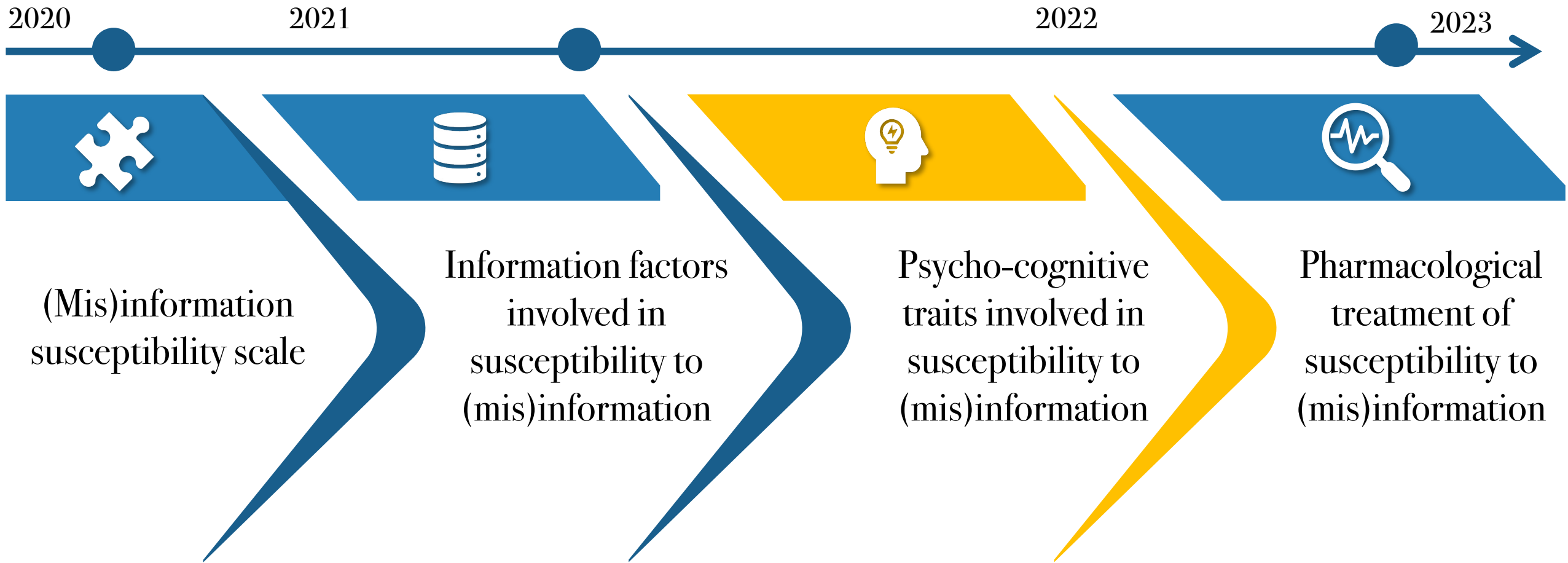


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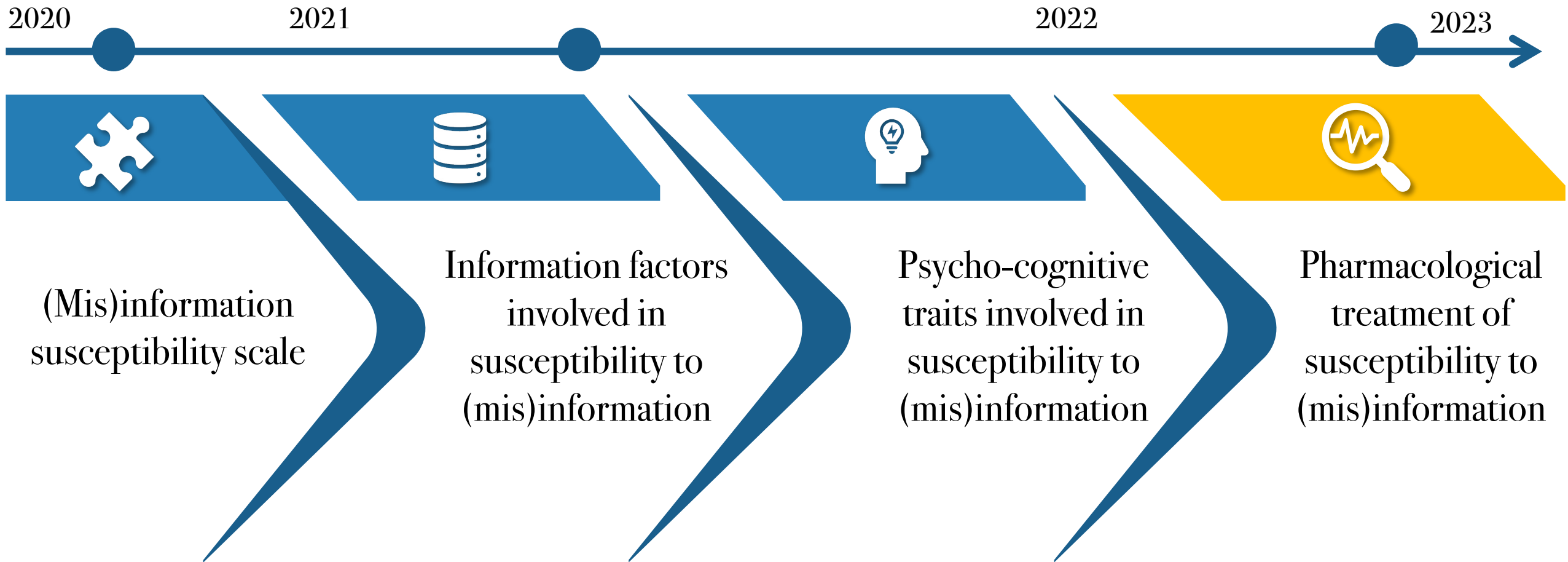


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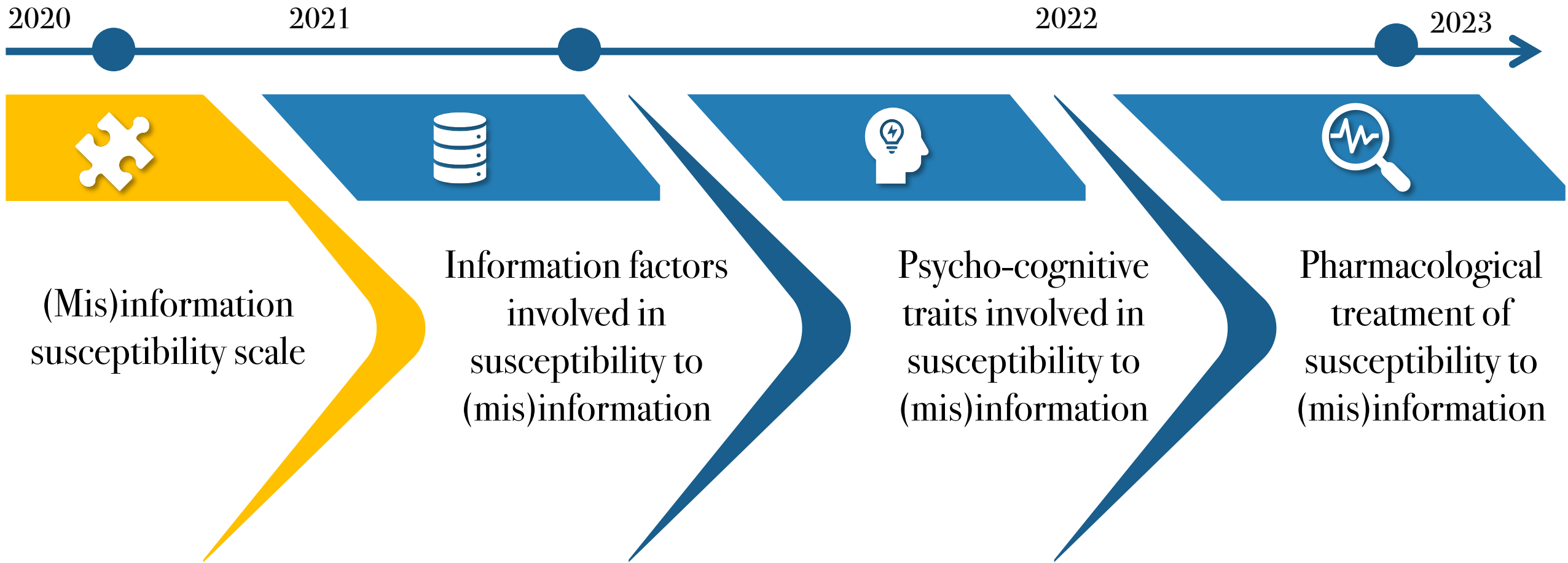


# WEBIMMUNIZATION





# WEBIMMUNIZATION





# WEBIMMUNIZATION

What does it mean to be susceptible to misinformation?



**MORE PEOPLE ARE DYING FROM THE VACCINE  
THAN FROM THE VIRUS ITSELF**

As we predicted earlier, and as everybody knows: The vaccine kills us, and it kills many more than the virus itself.

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# WEBIMMUNIZATION

What does it mean to be susceptible to misinformation?

True?



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False?





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👍 Like

💬 Comment

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False?



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## Evaluation of truthfulness:

● Veracity rating



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## Evaluation of truthfulness:

- Veracity rating

## Behavioral engagement:

- Willingness to like
- Willingness to share



# WEBIMMUNIZATION

**Verifiable truthfulness**

True | False



# WEBIMMUNIZATION

Verifiable truthfulness

True | False

Cognitive utility\*

Congruent with the view that  
Covid-19 is a **threat**

Congruent with the view that  
Covid-19 is a **hoax**

\* Information that is congruent with person's beliefs has high cognitive utility



# WEBIMMUNIZATION

**Verifiable truthfulness**

True | False

**Cognitive utility\***

Congruent with the view that  
Covid-19 is a **threat**

Congruent with the view that  
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**Presentation style**

Populistic\*\* | Sober

\*\* Manipulated, emotional picture, direct topic, social consensus, alternative source

\* Information that is congruent with person's beliefs has high cognitive utility





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## STUDY I:

Testing news' characteristics affecting susceptibility to (mis)information

### Methods:

1. Recruiting participants (N = 200, men = 100, women = 100)  
using online participants panel – Prolific Academic
2. The study was created on Qualtrics – an advance tool for online surveying
3. The survey consisted of:
  - demographic questions,
  - attitude towards COVID-19 question (to determine cognitive utility)
  - Susceptibility to misinformation scale, including 80 news items with questions about veracity, willingness to like and share



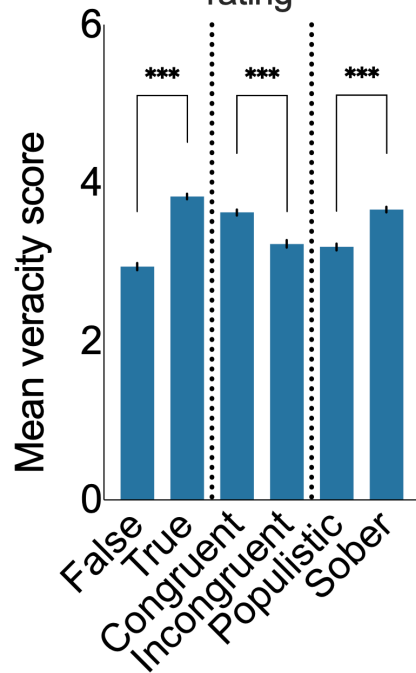


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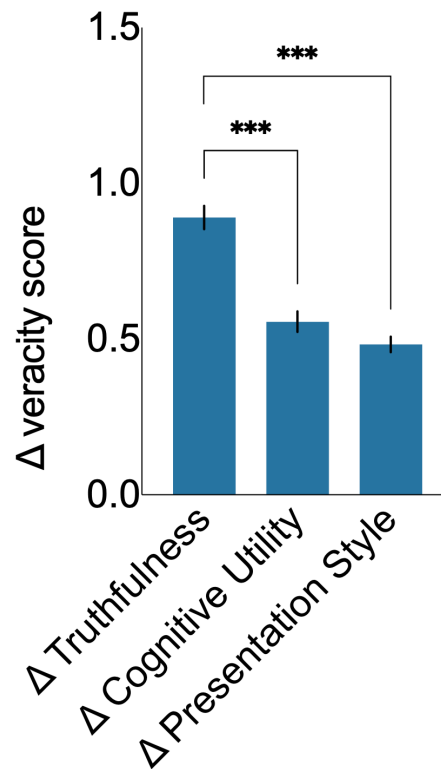
All investigated factors (verifiable truthfulness, cognitive utility, presentation style) significantly affected veracity rating of the information. The strongest effect was observed for **verifiable truthfulness**.

Veracity rating

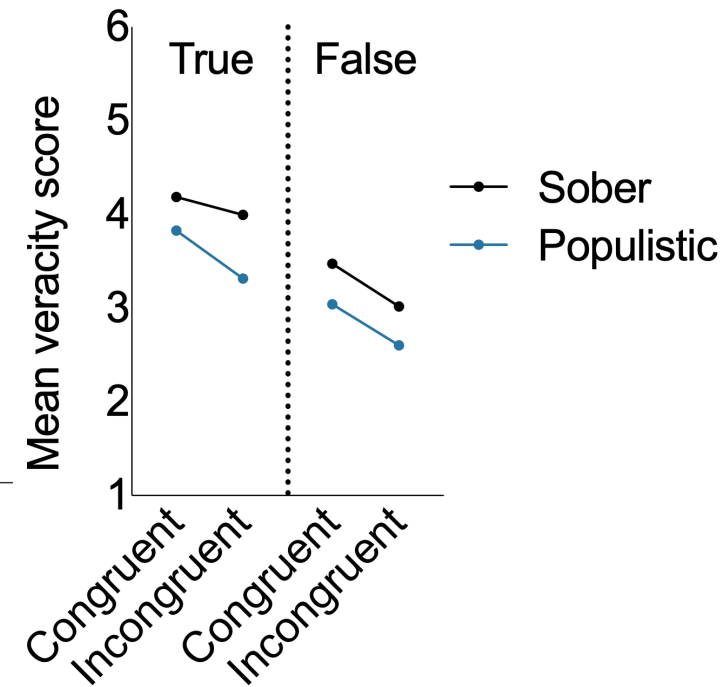
Comparison of factorial modalities affecting veracity rating



Comparison of factors affecting veracity rating



Factorial interactions influencing veracity rating

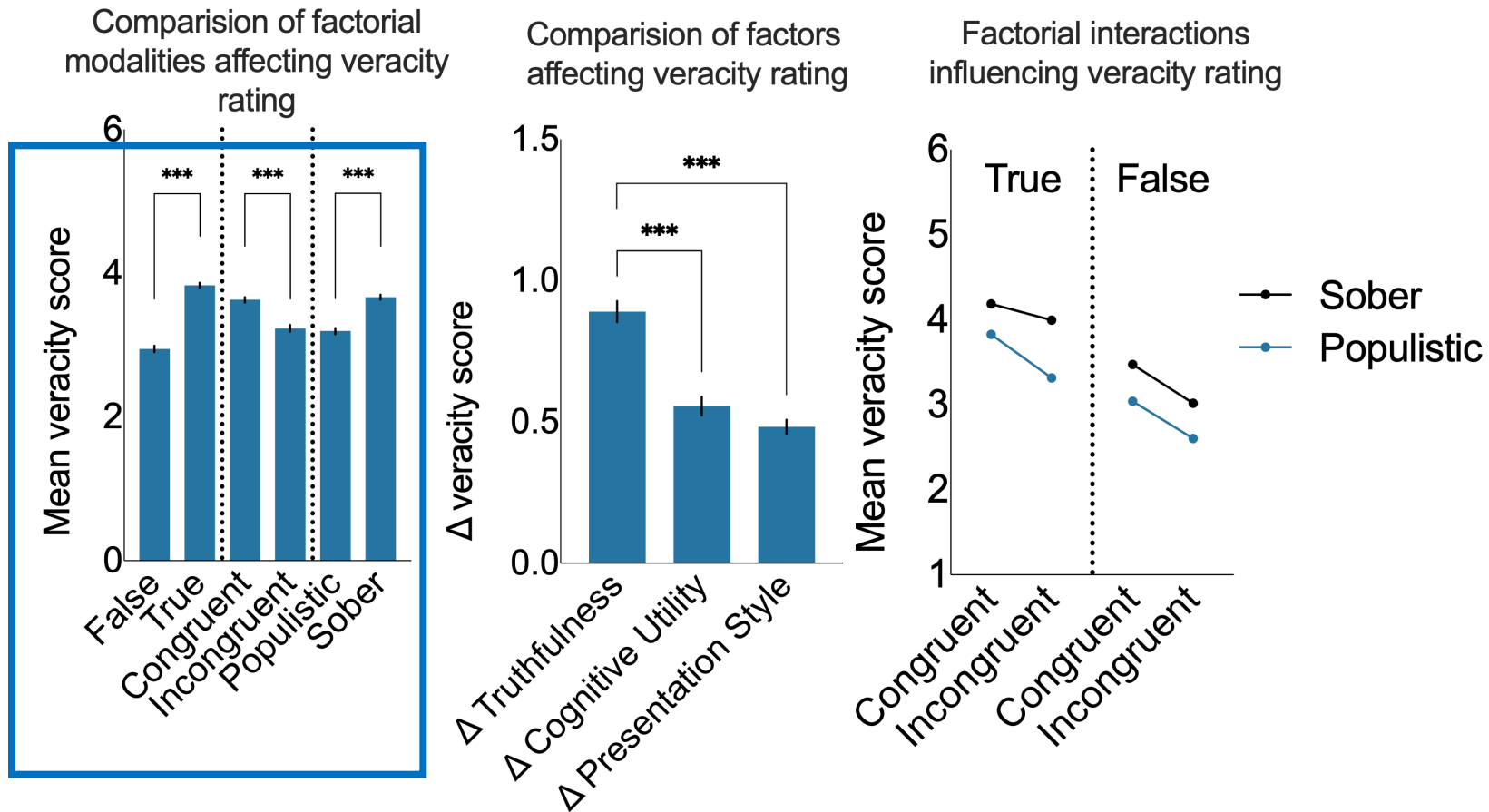




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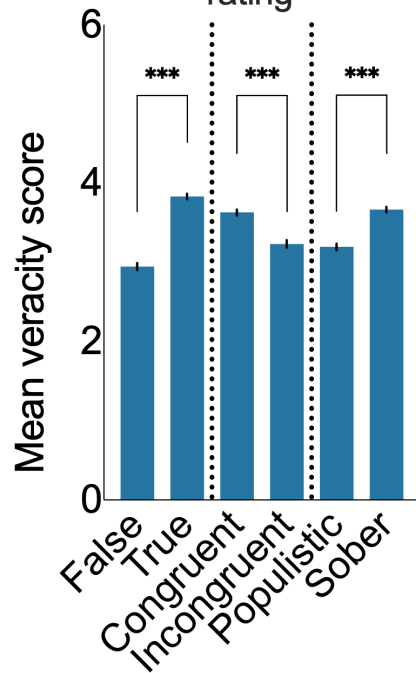


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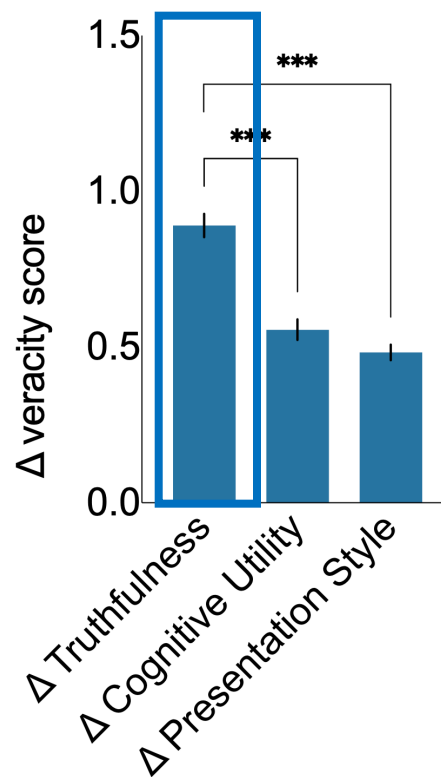
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Veracity rating

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Comparison of factors affecting veracity rating



Factorial interactions influencing veracity rating

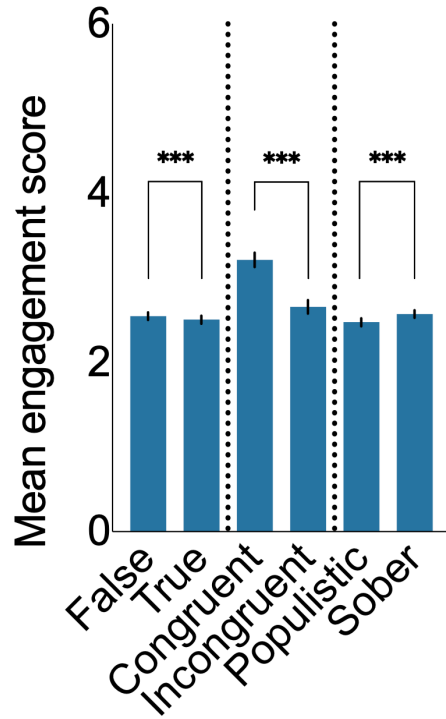




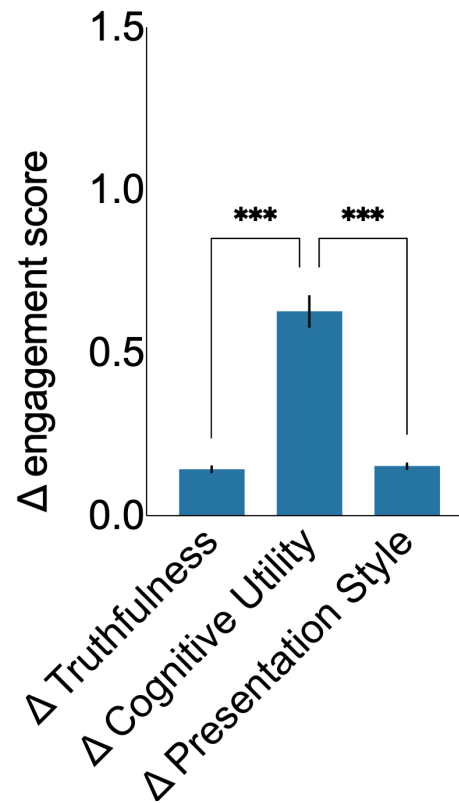
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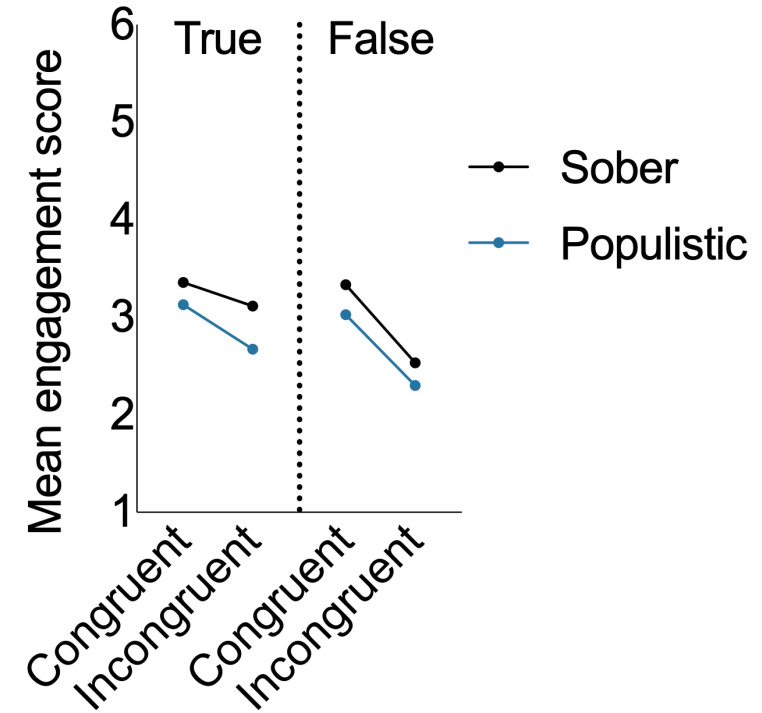
Comparison of factorial modalities affecting engagement rating



Comparison of factors affecting engagement rating



Factorial interactions influencing engagement



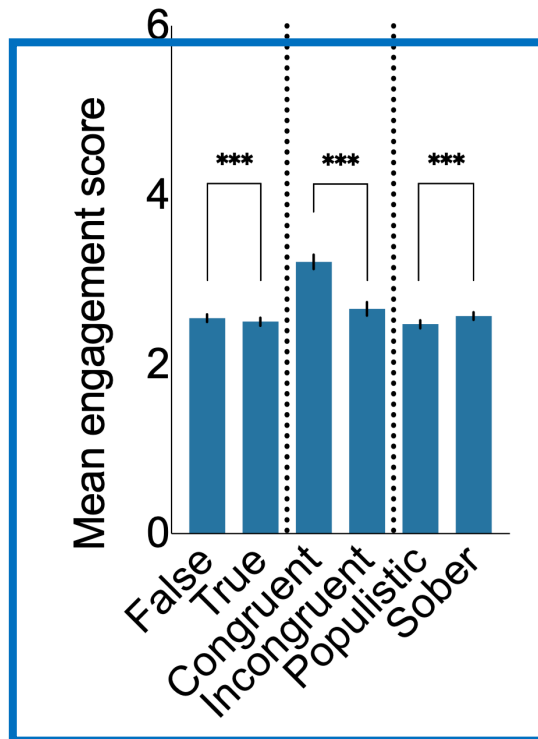
Engagement  
(Like + Share)



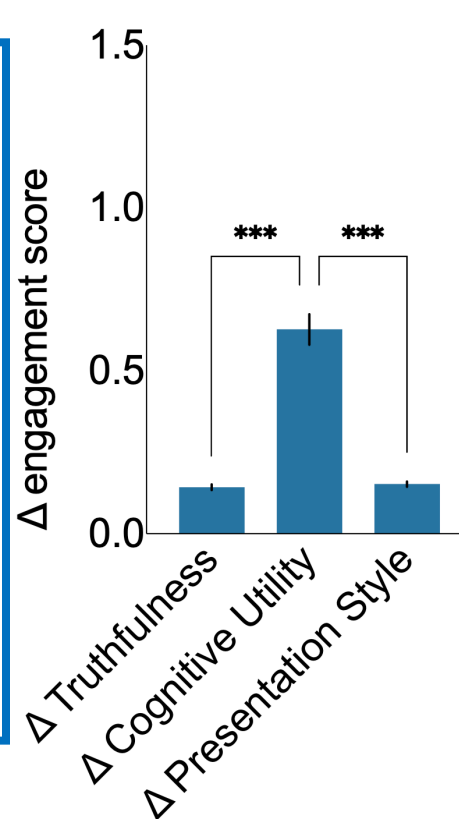
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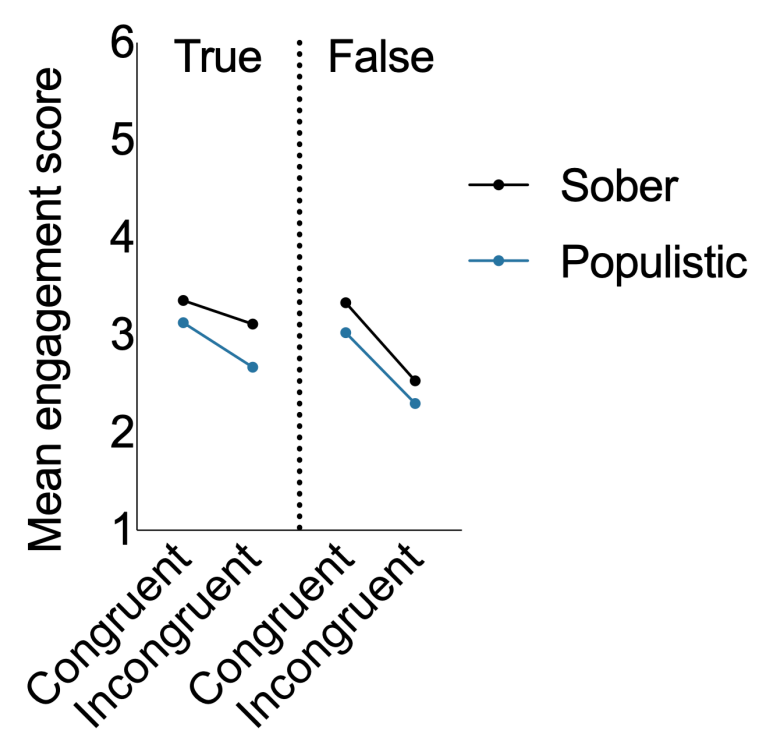
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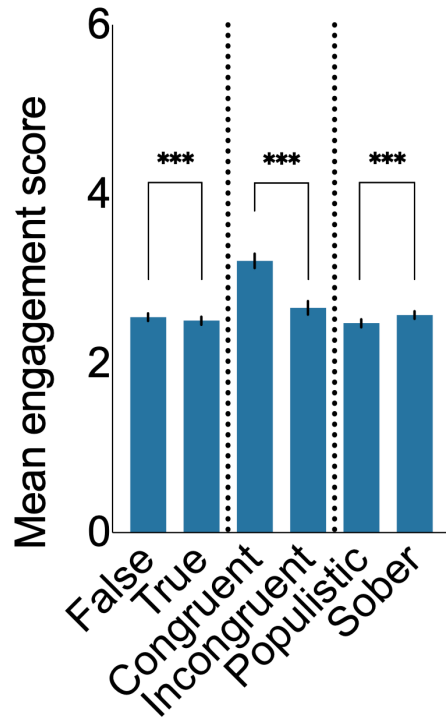
Engagement  
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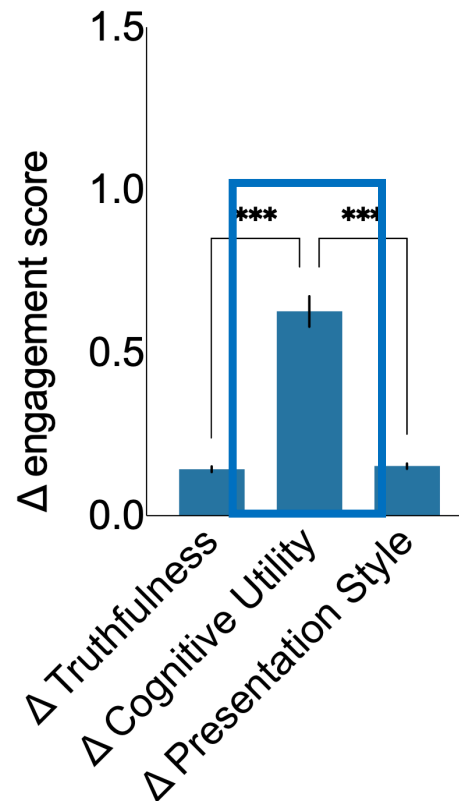
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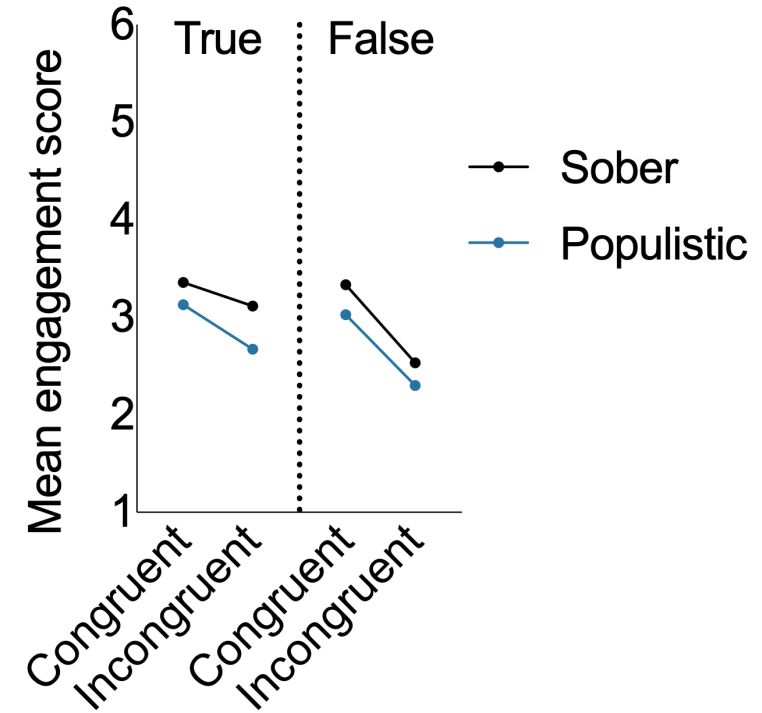
Comparison of factorial modalities affecting engagement rating



Comparison of factors affecting engagement rating



Factorial interactions influencing engagement



Engagement  
(Like + Share)





# WEBIMMUNIZATION

## STUDY II:

Testing interactions between cognitive mechanisms, personality traits, and susceptibility to (mis)information

### Methods:

1. Recruiting participants (N = 184, men = 90, women = 90, non-binary = 4) using online participants panel – Prolific Academic
2. The study was created on Qualtrics – an advance tool for online surveying
3. Cognitive tests were tested using Inquisit Millisecond software



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## Cognitive processes

- **Sensitivity to positive and negative reinforcement** [*Probabilistic Reversal Learning Test, SPSRQ-RC questionnaire, BIS/BAS Scale questionnaire*]
- **Cognitive judgment bias** [*Ambiguous Cue Interpretation Test*]
- **Belief update capability** [*Belief Updating Test*]

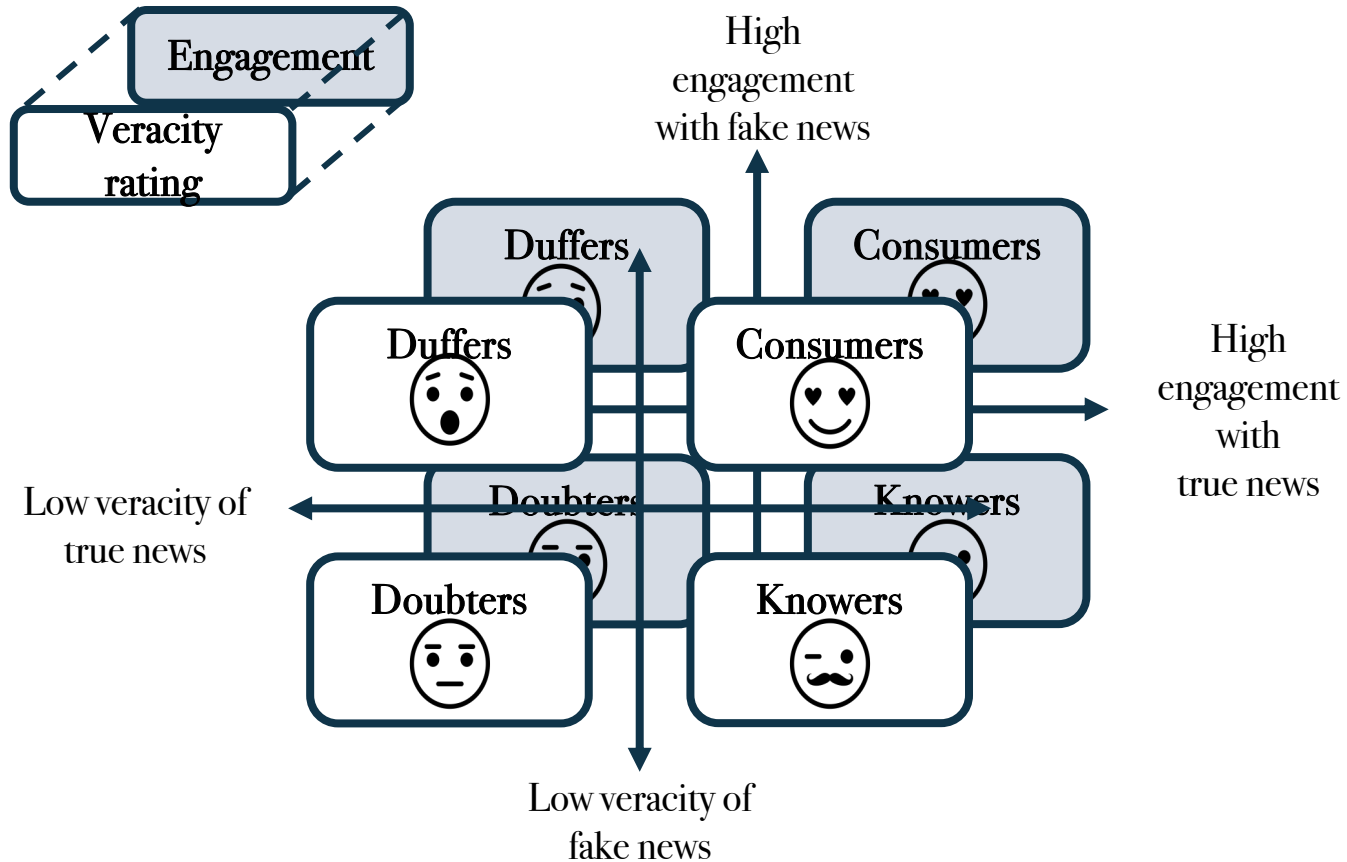
## Personality traits

- **Five factor model (extraversion, openness, conscientiousness, neuroticism, agreeableness)** [*TIP I questionnaire*]
- **Grandiose narcissism** [*GNS questionnaire*]
- **Dispositional optimism** [*LOT-R questionnaire*]
- **Anxiety** [*TAS questionnaire*]



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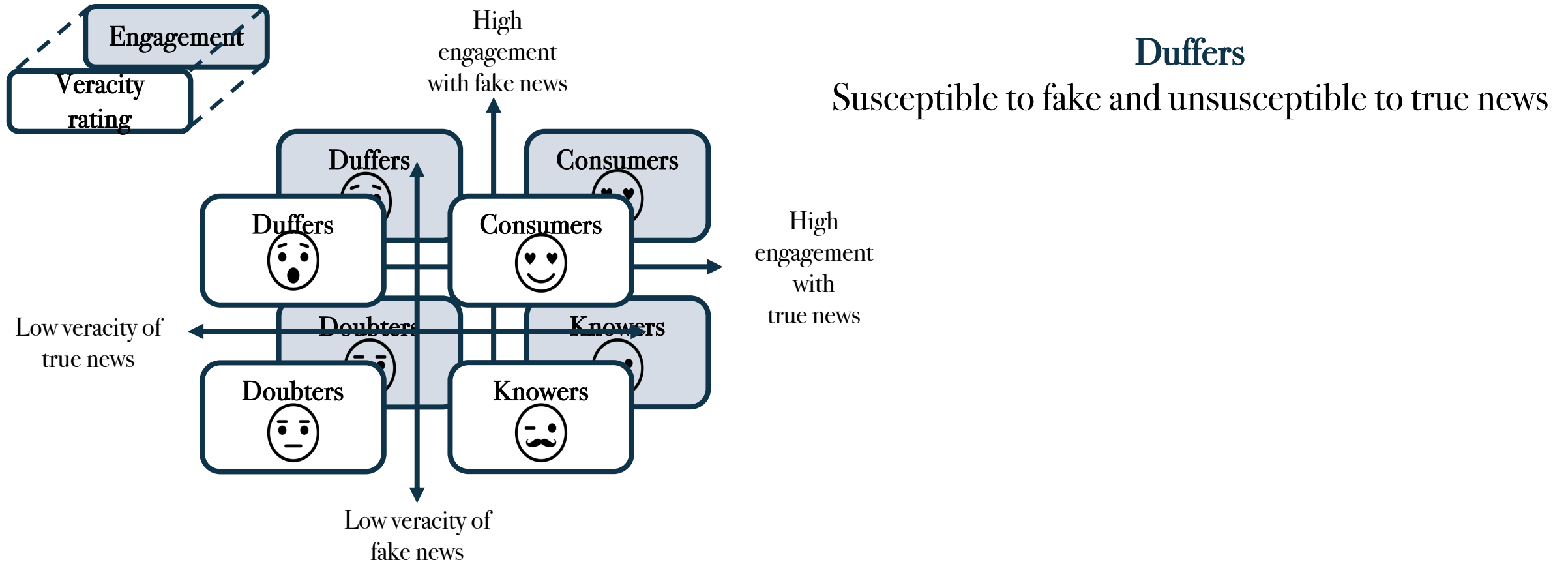
## Phenotypes of susceptibility to (mis)information





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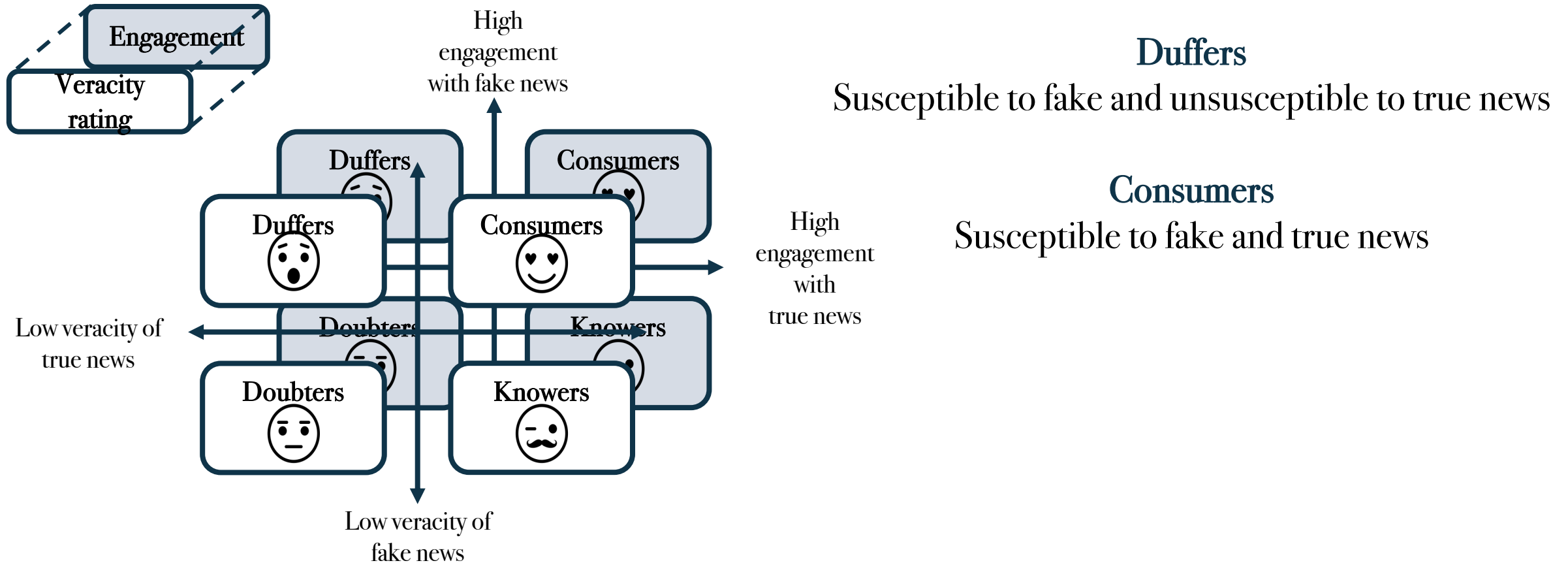
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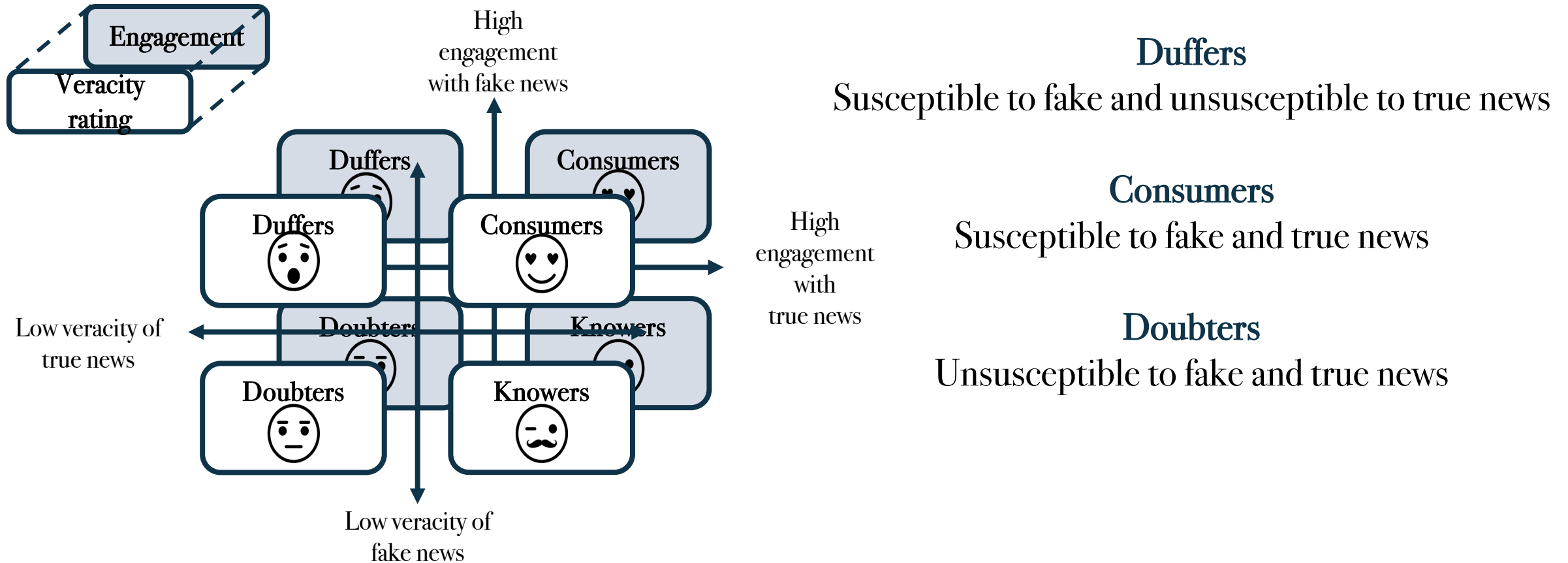
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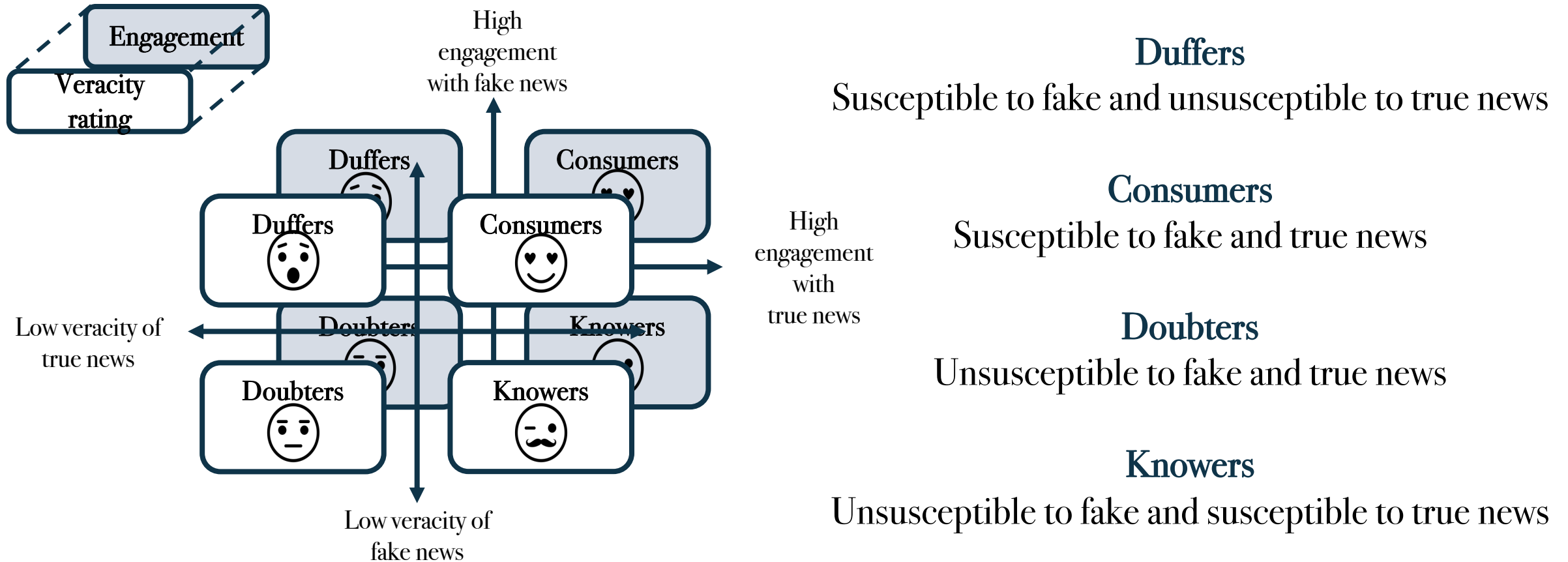
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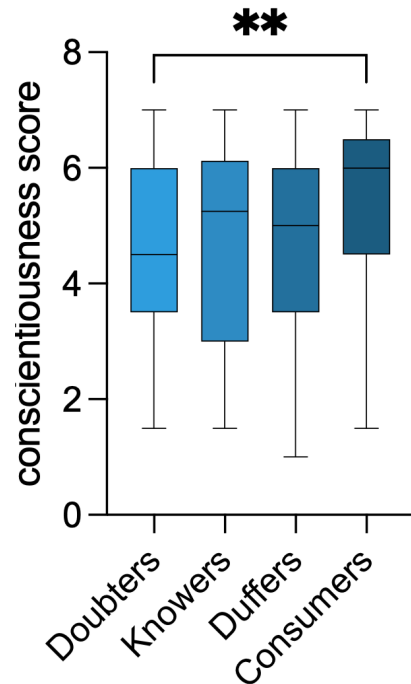


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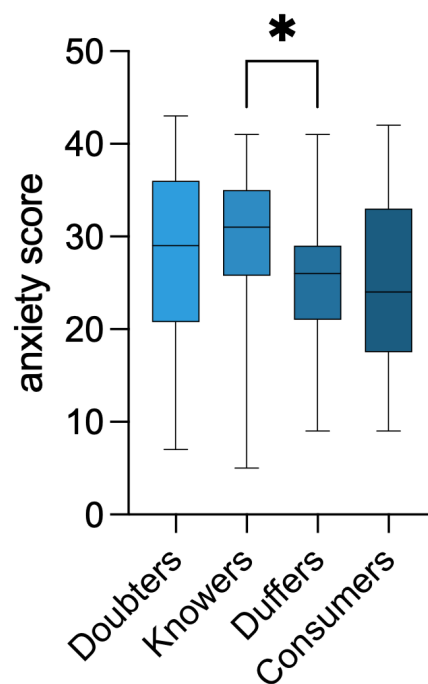
## Psycho-cognitive differences between phenotypes of susceptibility to (mis)information

Based on veracity ratings of the news

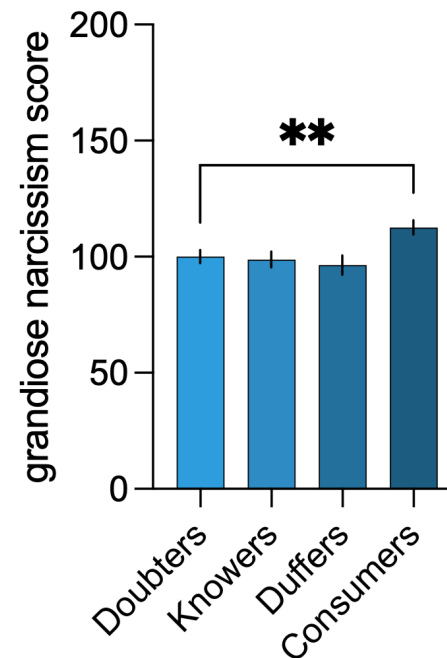
Conscientiousness



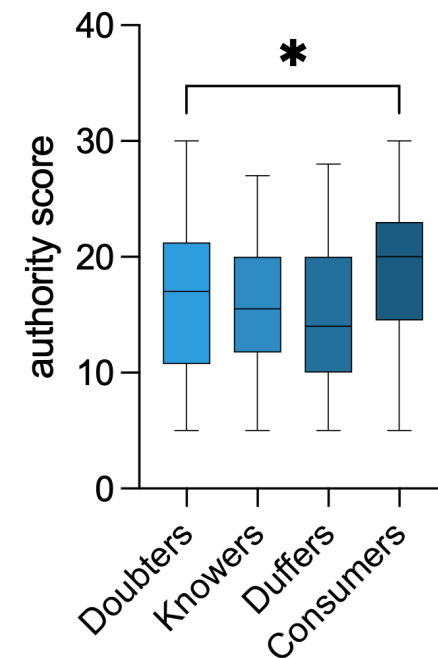
Anxiety



Grandiose narcissism



Authority



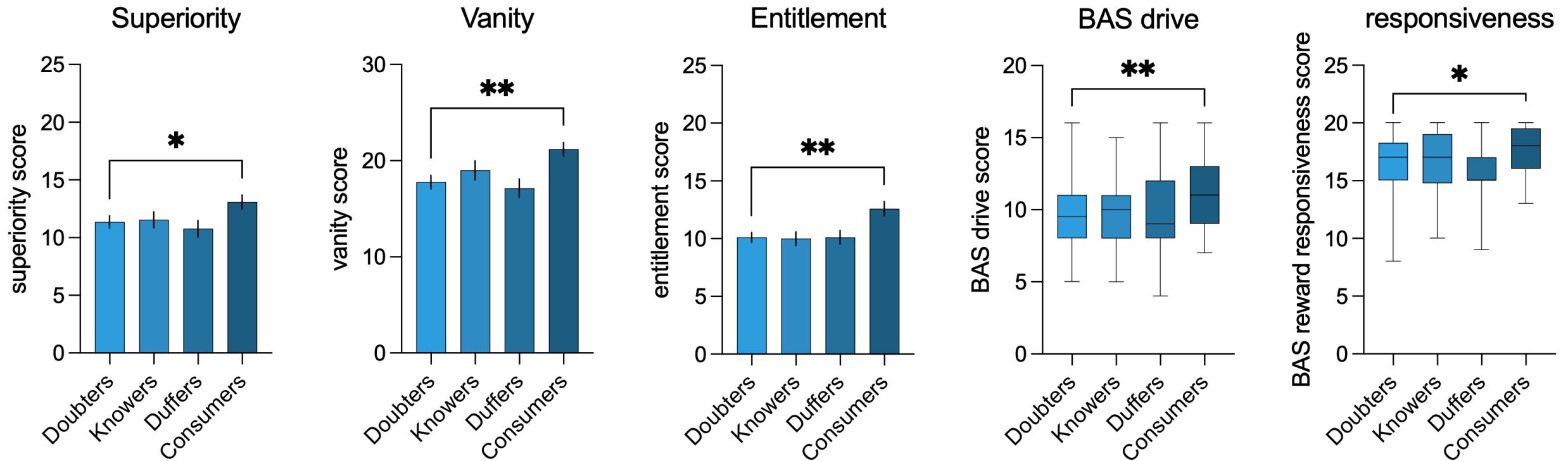




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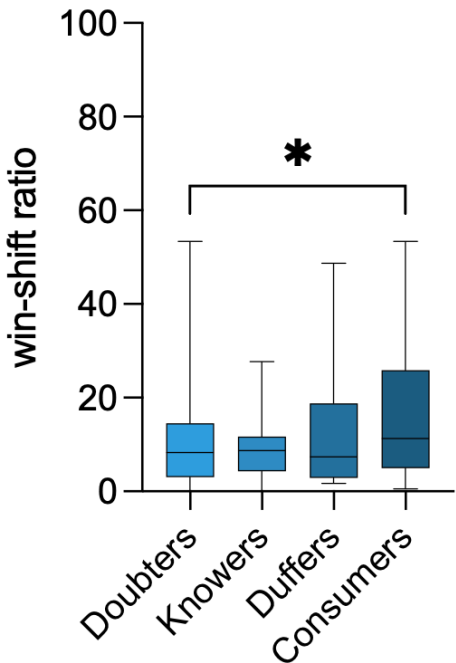


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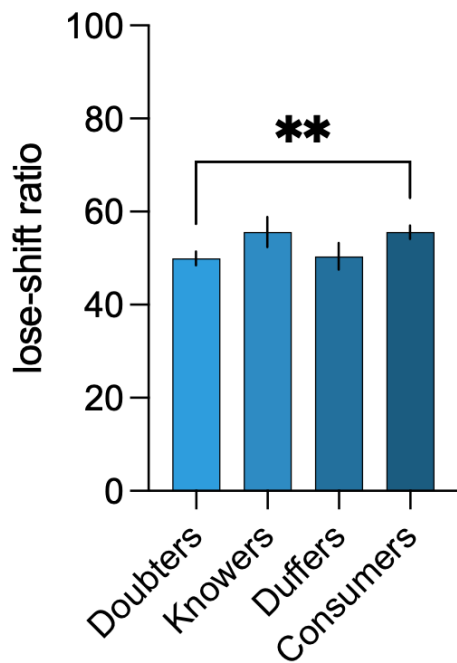
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Based on engagement with the news

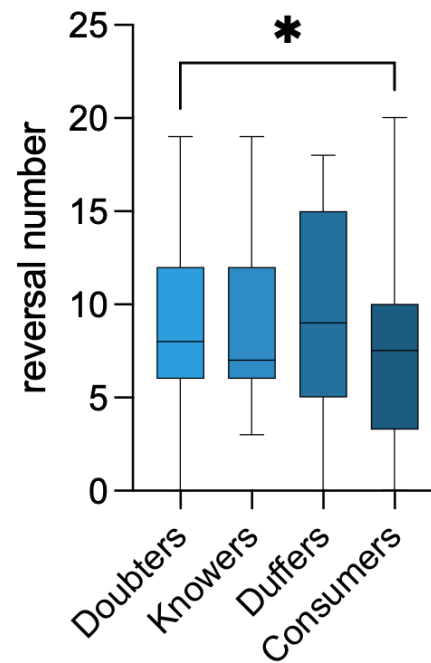
Sensitivity to positive feedback



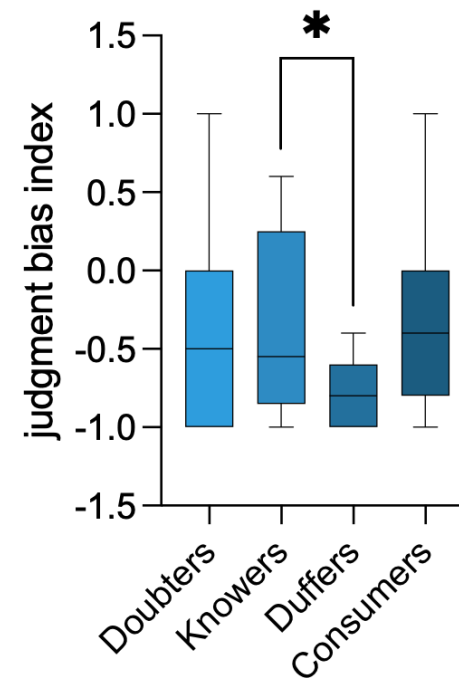
Sensitivity to negative feedback



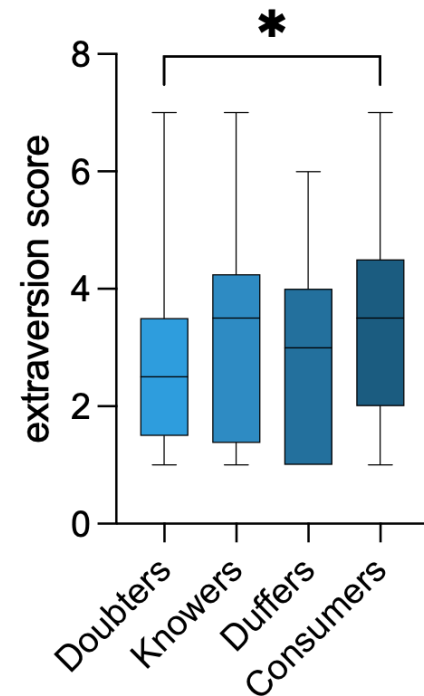
Cognitive flexibility



Judgment bias



Extraversion



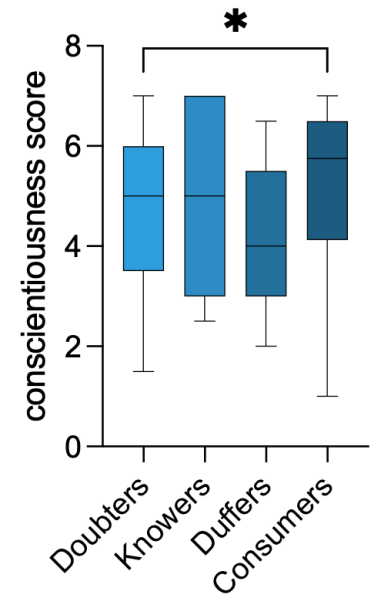


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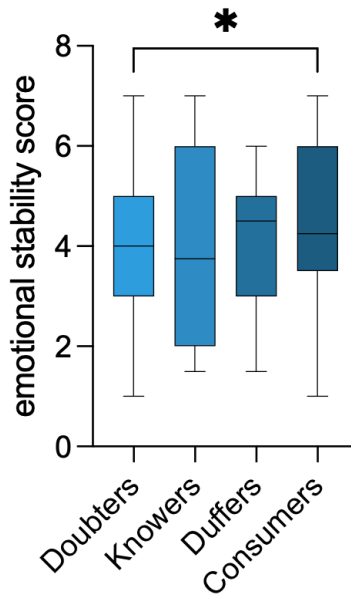
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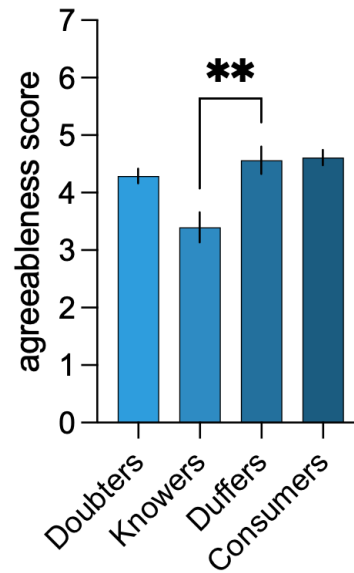
Conscientiousness



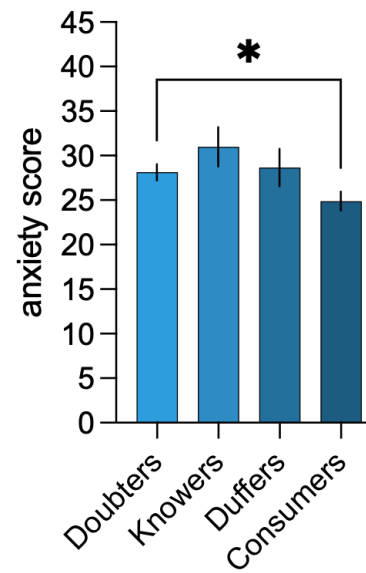
Emotional stability



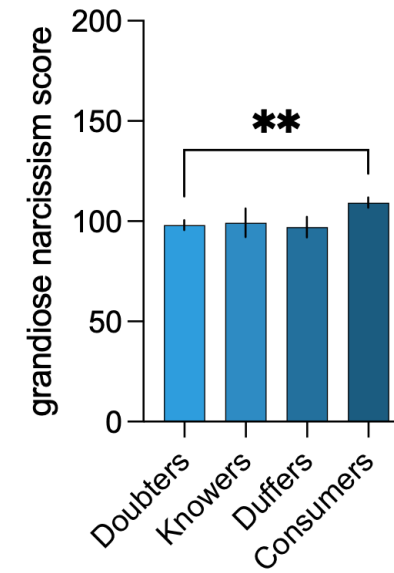
Agreeableness



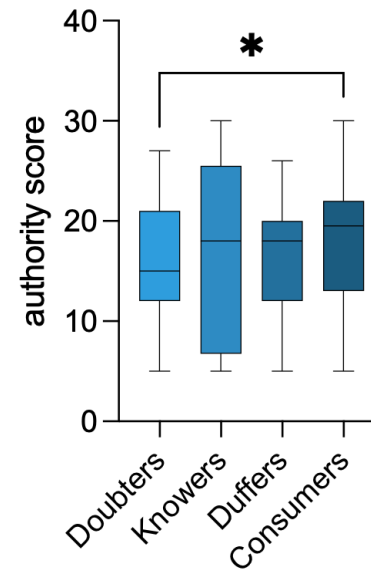
Anxiety



Grandiose narcissism



Authority



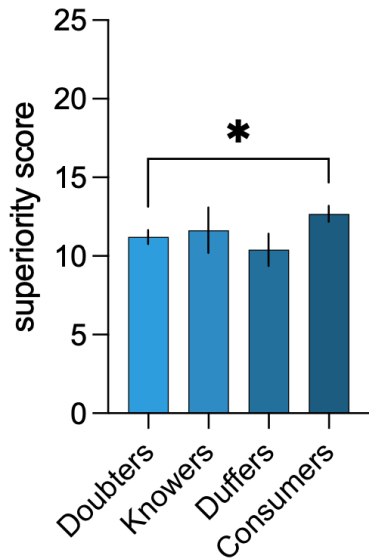


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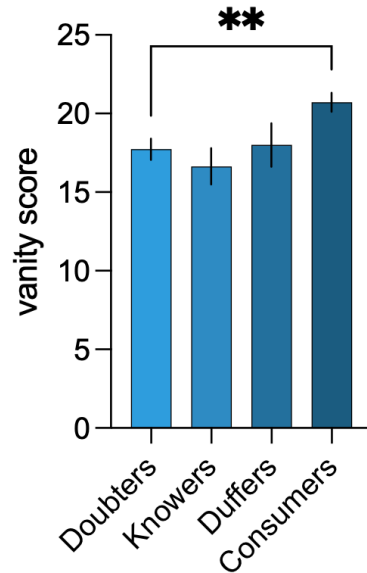
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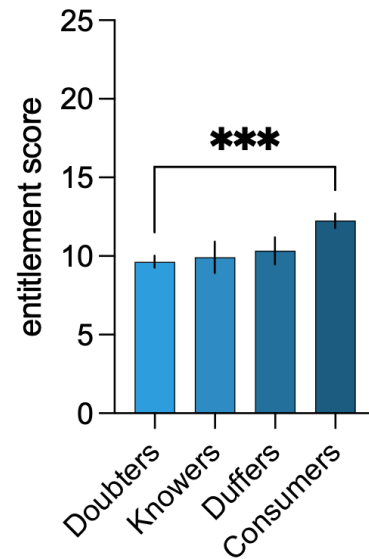
Superiority



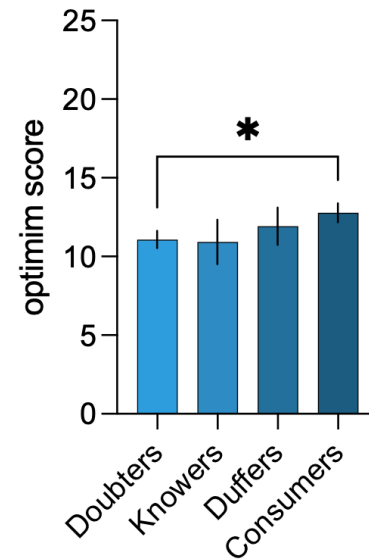
vanity



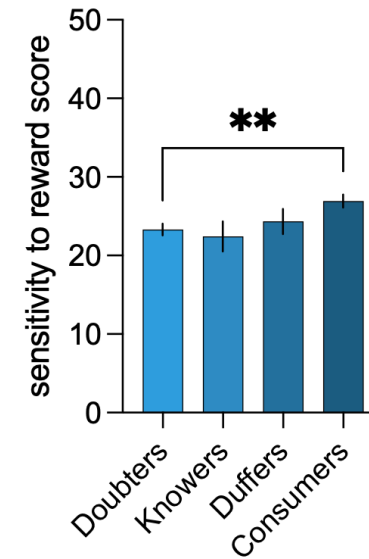
Entitlement



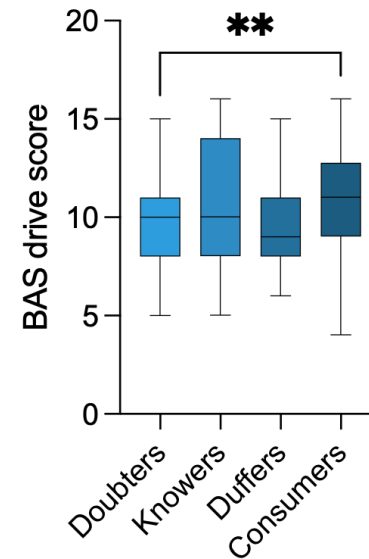
Optimism



Sensitivity to reward



BAS drive





# WEBIMMUNIZATION

Resistant to fake news

Susceptible to fake news

**Doubters**



Doubters have higher anxiety, lower emotional stability and lower dispositional optimism, They are less narcissistic and less motivated to achieve their goals being concerned with the feedback of their actions.



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**Knowers**



Knowers are more anxious than Duffers and their interpretation of ambiguous cues is more optimistic. Lower agreeableness is probably making them more critical of fake news.



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**Duffers**



Duffers are less anxious than Knowers, are more pessimistically skewed in interpreting ambiguous cues and the more agreeable they are the more likely it is they engage with fake news.



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## Resistant to fake news

## Susceptible to fake news

### Doubters



Doubters have higher anxiety, lower emotional stability and lower dispositional optimism, They are less narcissistic and less motivated to achieve their goals being concerned with the feedback of their actions.

### Knowers



Knowers are more anxious than Duffers and their interpretation of ambiguous cues is more optimistic. Lower agreeableness is probably making them more critical of fake news.

### Duffers



Duffers are less anxious than Knowers, are more pessimistically skewed in interpreting ambiguous cues and the more agreeable they are the more likely it is they engage with fake news.

### Consumers



Consumers are highly motivated, authoritarian, vain narcissists with a sense of superiority and entitlement they are more emotionally stable and more optimistic with decreased anxiety and despite being sensitive to rewards, they are unconcerned with the feedback of their actions.

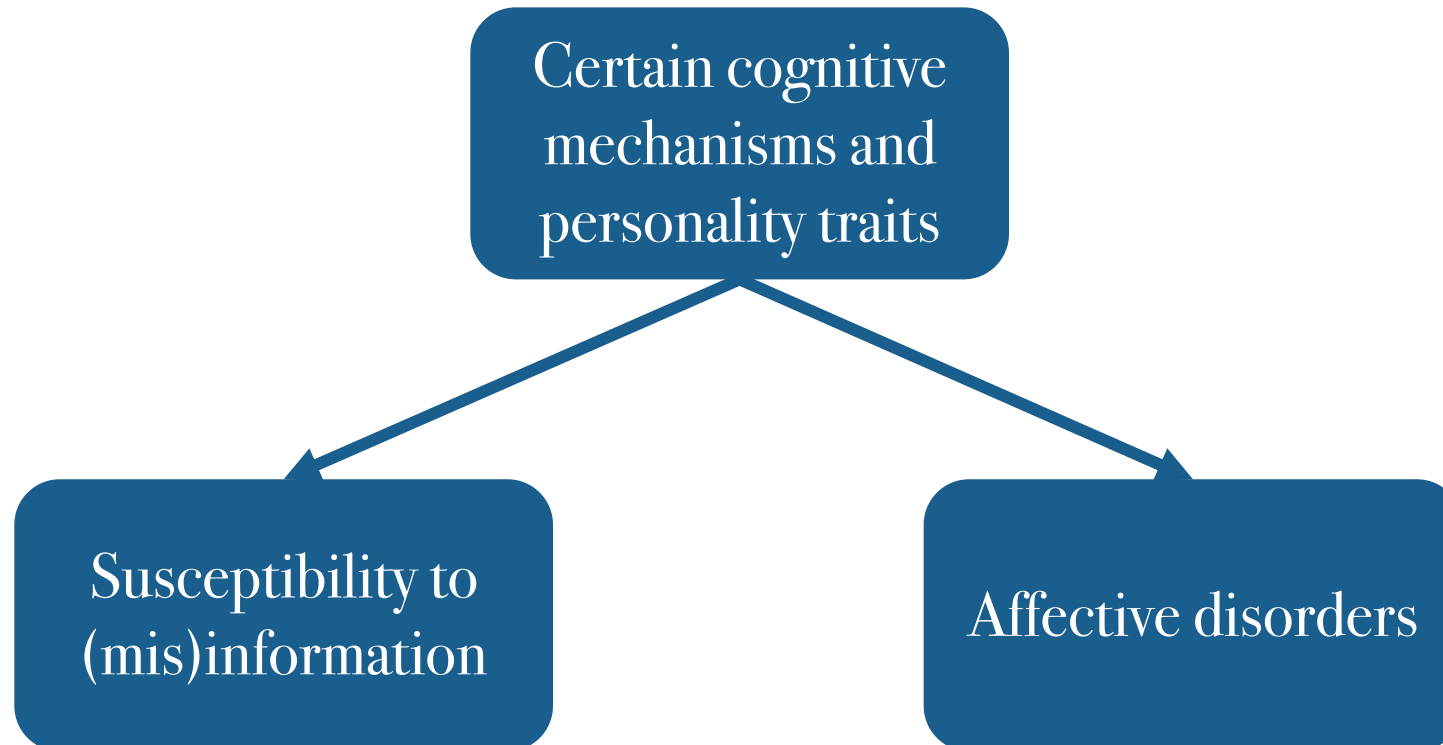




# WEBIMMUNIZATION

## STUDY III:

Testing the effects of sertraline on susceptibility to (mis)information

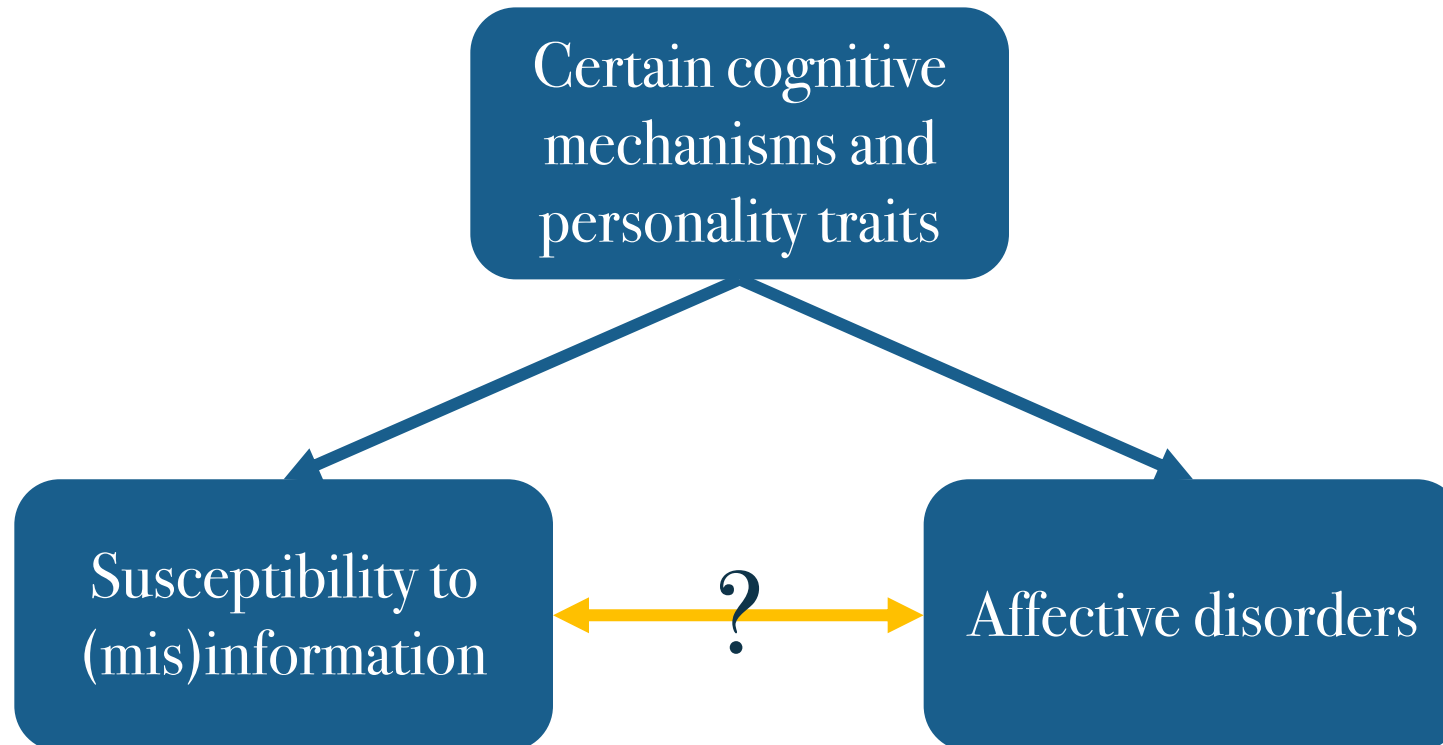




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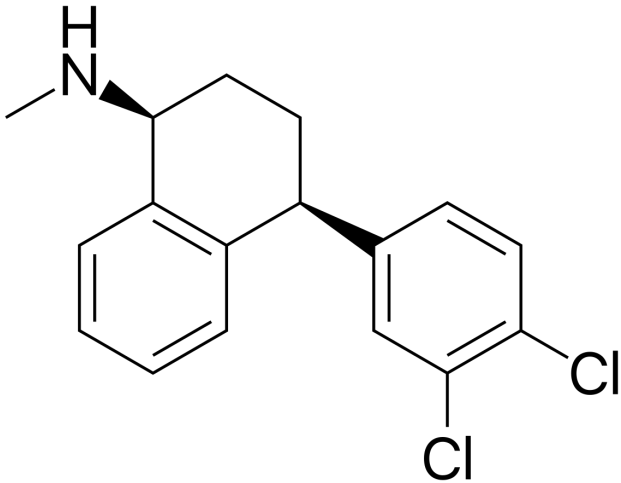




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## STUDY III:

Testing the effects of sertraline on susceptibility to (mis)information



Sertraline (Zoloft):

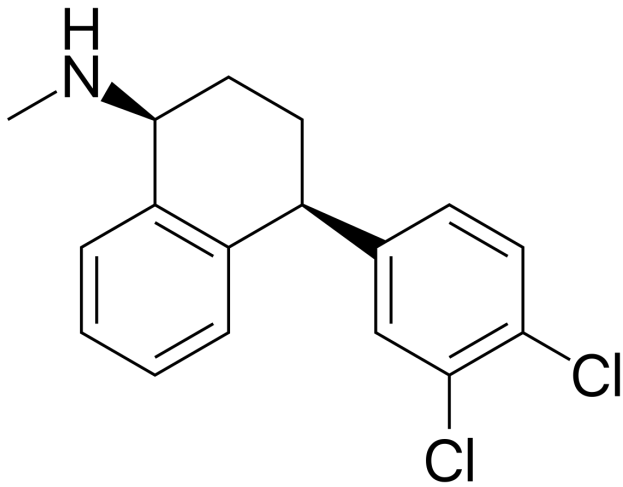




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## STUDY III:

Testing the effects of sertraline on susceptibility to (mis)information



Sertraline (Zoloft):

- Selective serotonin reuptake inhibitor (SSRI)

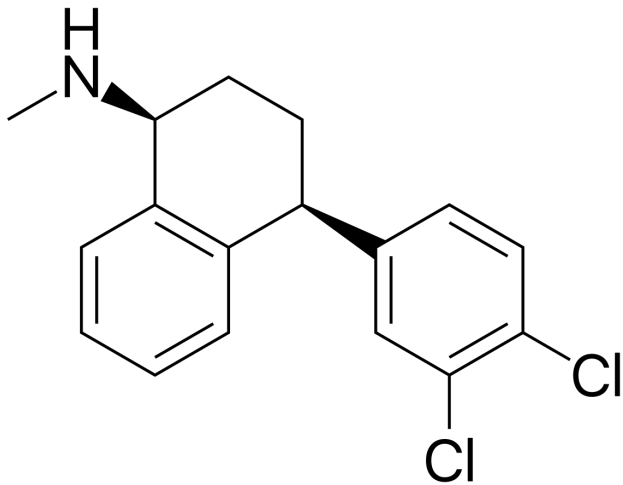




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## STUDY III:

Testing the effects of sertraline on susceptibility to (mis)information



Sertraline (Zoloft):

- Selective serotonin reuptake inhibitor (SSRI)
- A treatment for depressive disorders and generalized or social anxiety disorders





# WEBIMMUNIZATION

Recruiting participants using Prolific Academic – online participants panel  
Sertraline is the most prescribed SSRI in the Prolific population

**Sertraline group**

**Control group**



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- Taking sertraline everyday

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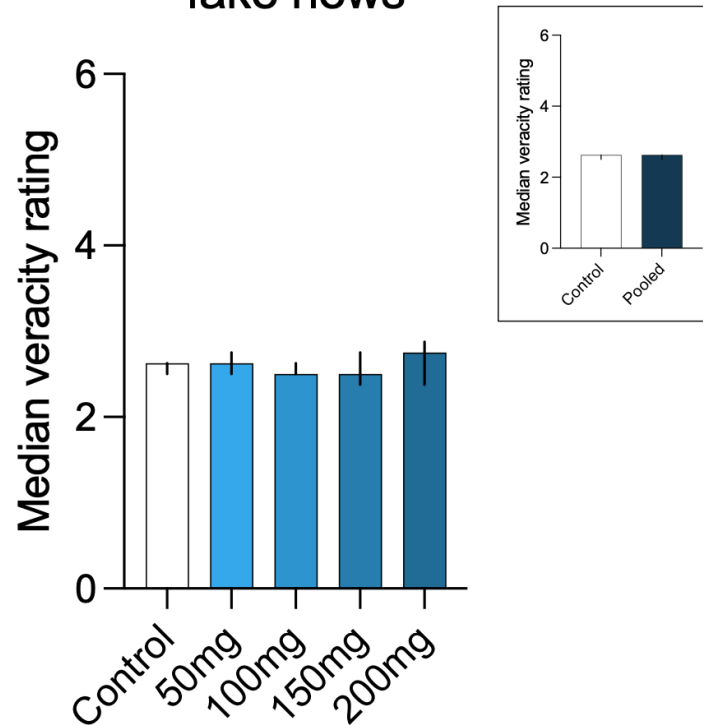
	Sample	Control	Sertraline pooled	50 mg/day	100 mg/day	150 mg/day	200 mg/day
$N$	1162	581	581	214	212	93	62
$N_{\text{female}}$	819	352	467	180	170	72	45
$N_{\text{male}}$	328	225	103	30	37	21	15
$N_{\text{non-binary}}$	15	4	11	4	5	0	2
$M_{\text{age}} \pm \text{SD}$	36.5±12.9	39.5±14.3	33.5±10.4	31.9±9.6	33.5±10.3	36.0±11.6	35.7±10.6



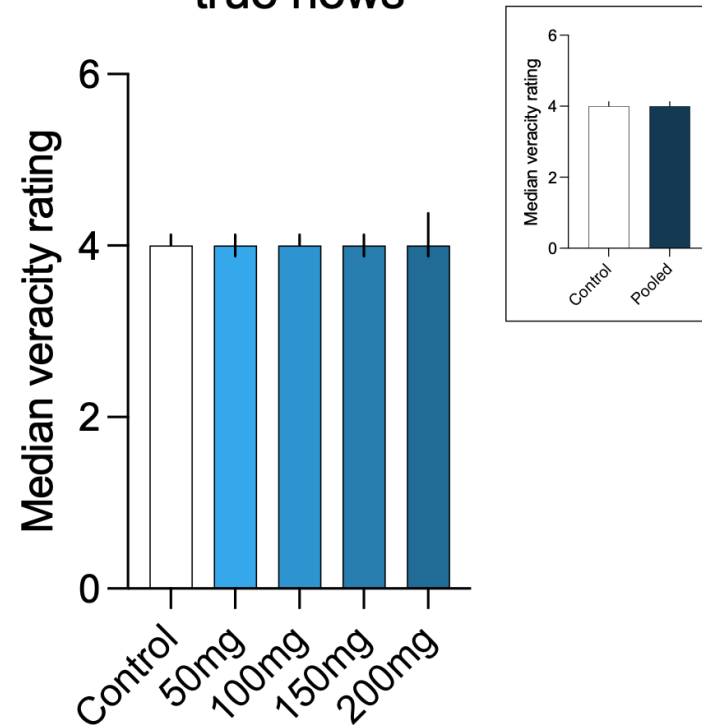
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## Sertraline does not affect veracity ratings

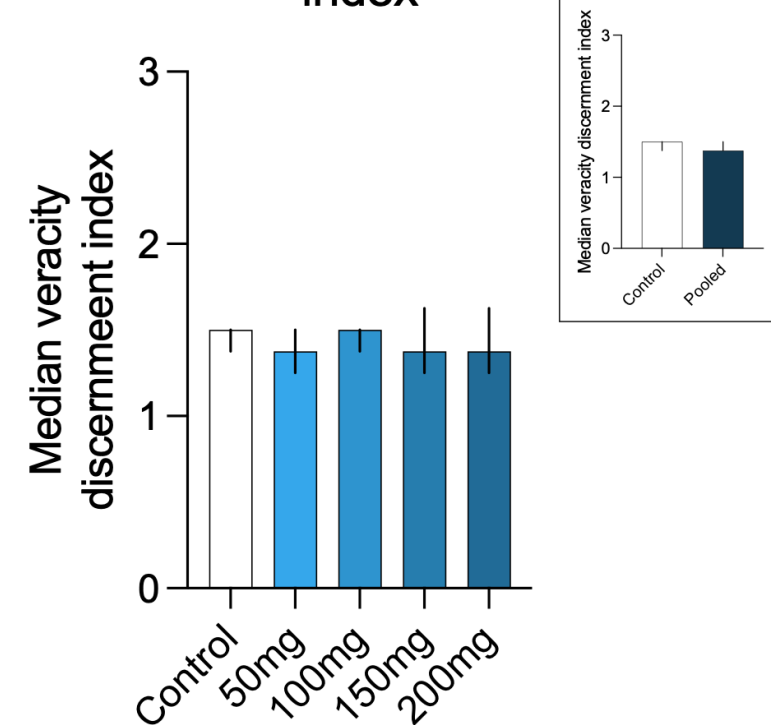
**A** Veracity rating of fake news



**B** Veracity rating of true news



**C** Veracity discernment index

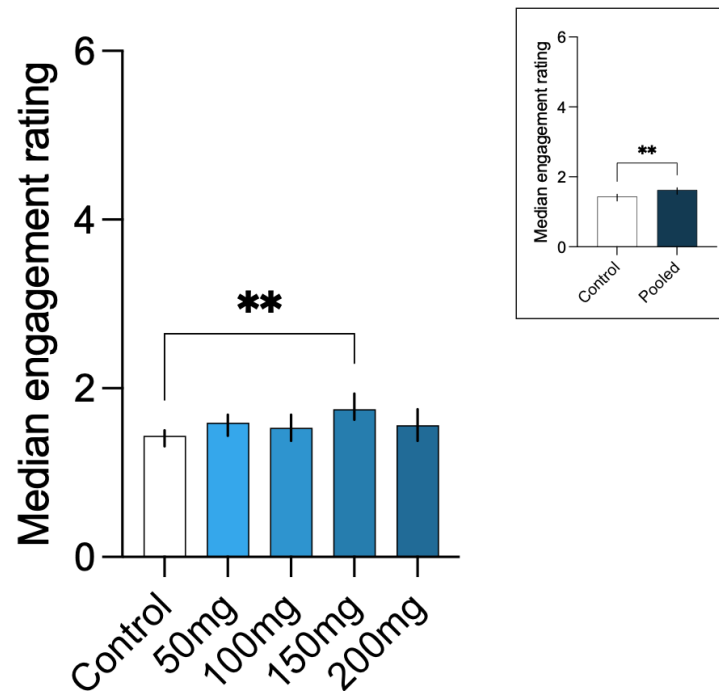




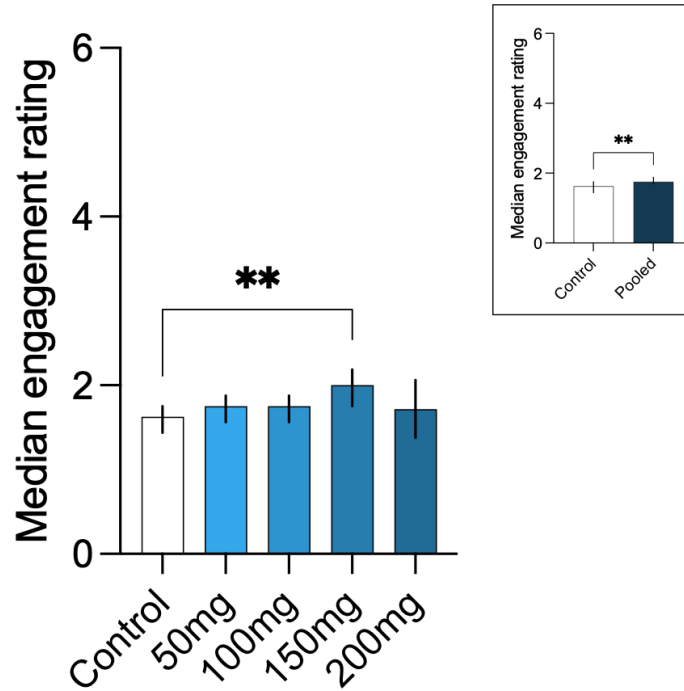
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Sertraline affects engagement with both true and fake news, but does not affect the discernment ability.

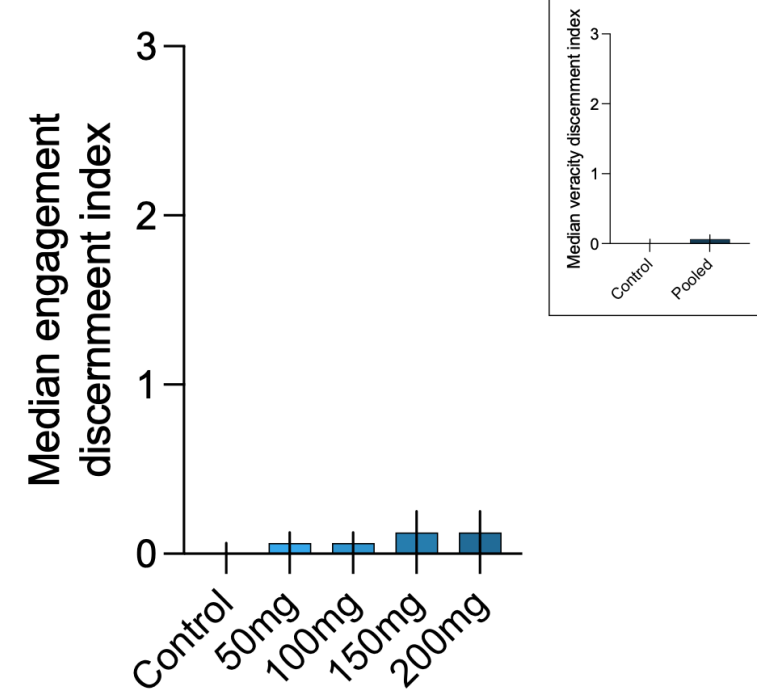
D Engagement rating of fake news



E Engagement rating of true news



F Engagement discernment index





# WEBIMMUNIZATION

General conclusions



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  - a) Veracity rating of the news is mostly affected by verifiable truthfulness of the news



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- There are certain psycho-cognitive differences between phenotypes of susceptibility to (mis)information
- Susceptibility to (mis)information could be modified with pharmacological treatment – chronic sertraline treatment can increase engagement with both true and fake news.



# WEBIMMUNIZATION

Future directions



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## Future directions

- We are currently testing if nicotine modulates susceptibility to (mis)information





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- We are currently testing if nicotine modulates susceptibility to (mis)information
- We plan to test if chronic bupropion treatment modulates susceptibility to (mis)information





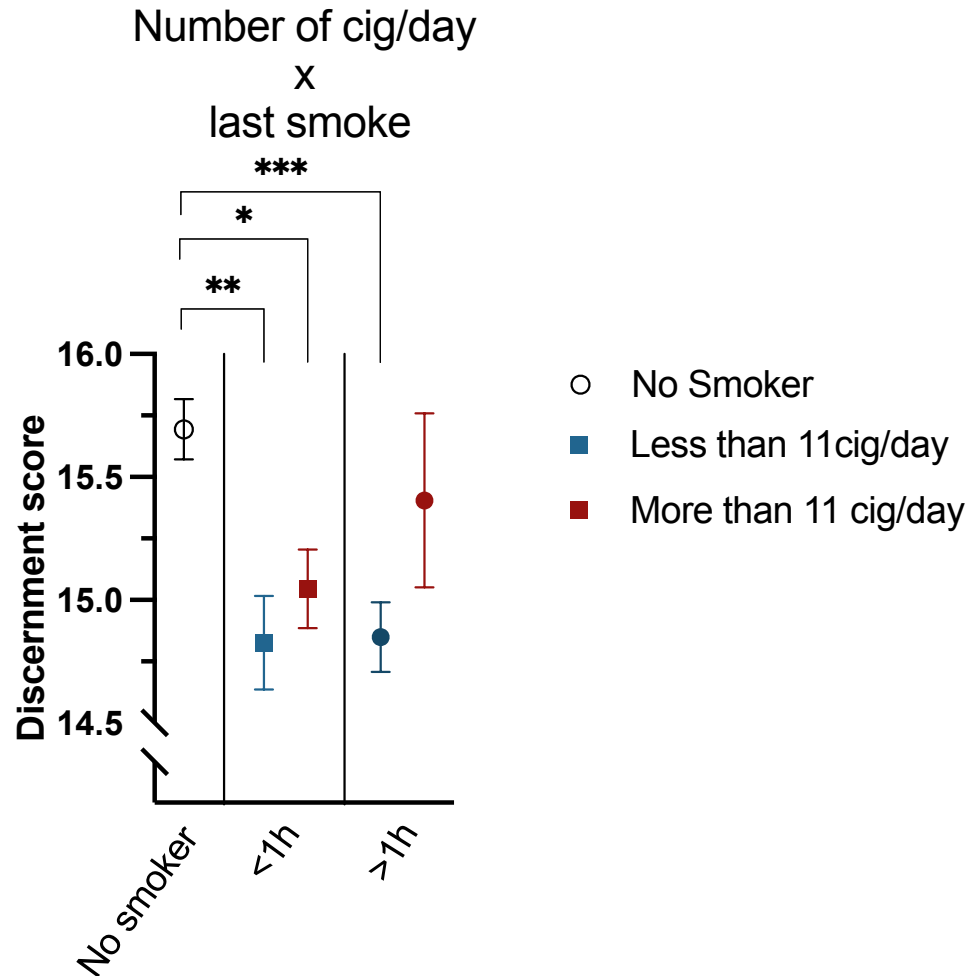


# WEBIMMUNIZATION

## Nicotine study results

CONTROLLED FOR EDUCATION LEVEL

Discernment score –an ability to discern false from truth  
(The higher the better/lower susceptibility to misinformation)

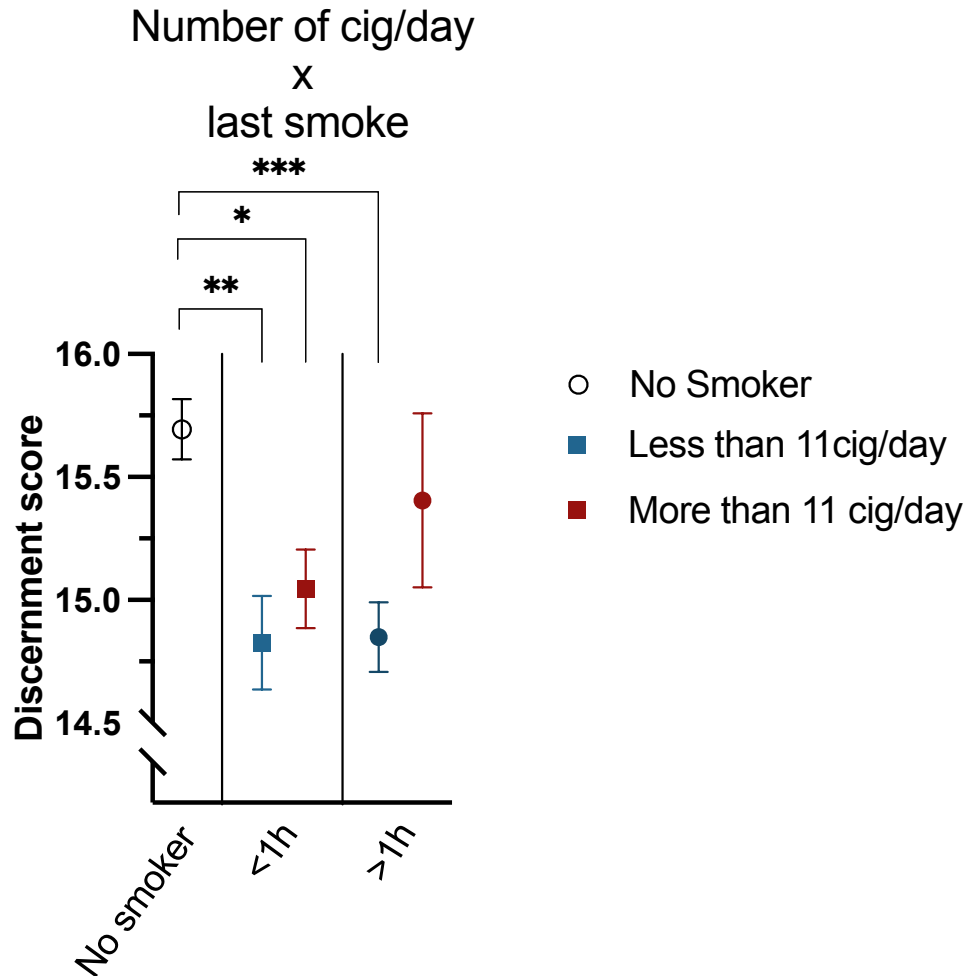




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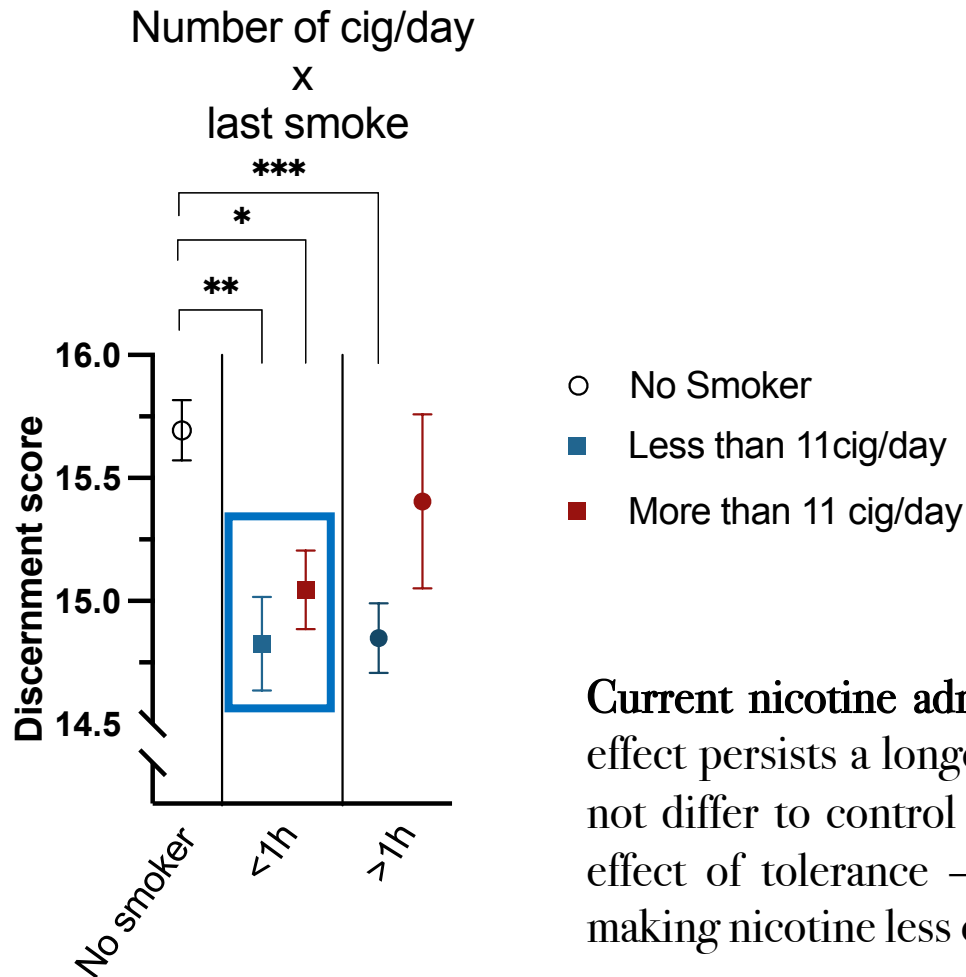
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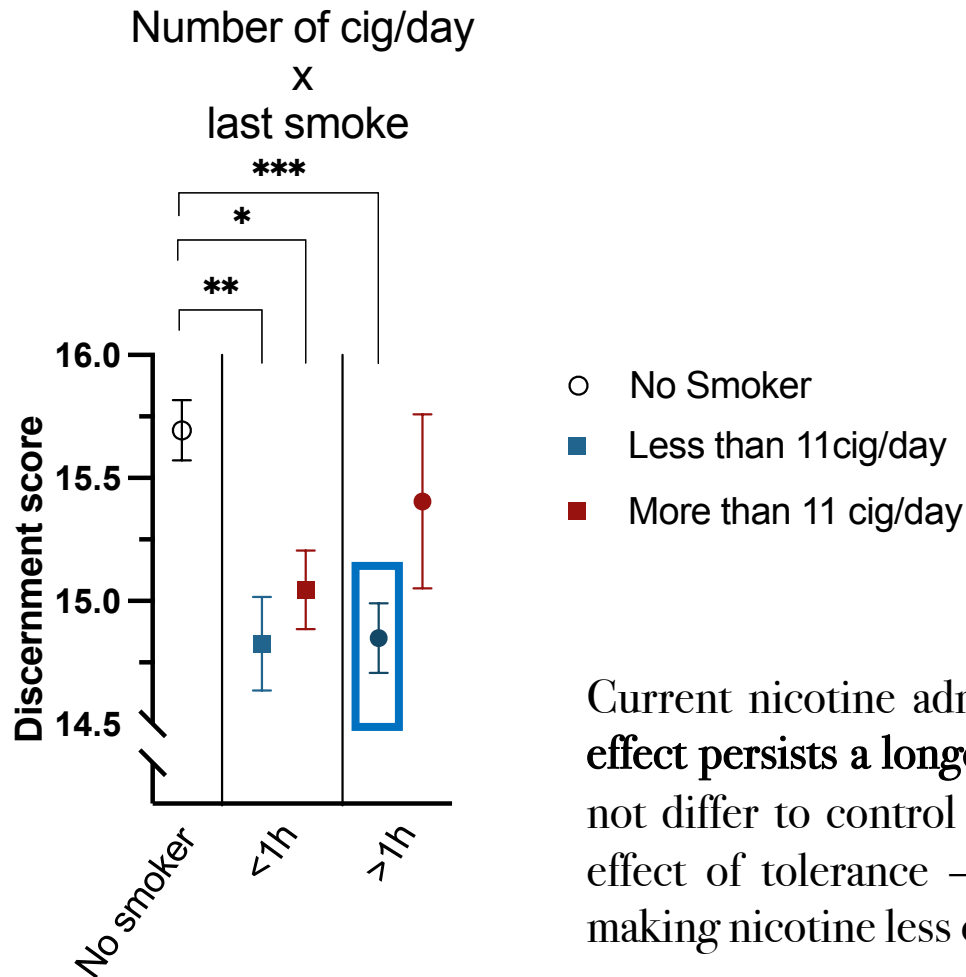
Current nicotine administration seems to make people more susceptible to misinformation. The effect persists a longer period of time if people smoke fewer cigarettes. People who smoke more do not differ to control group an hour after the last smoke. This interaction can be explained by the effect of tolerance – people with a higher nicotine experience have higher substance tolerance making nicotine less effective and last shorter amount of time.



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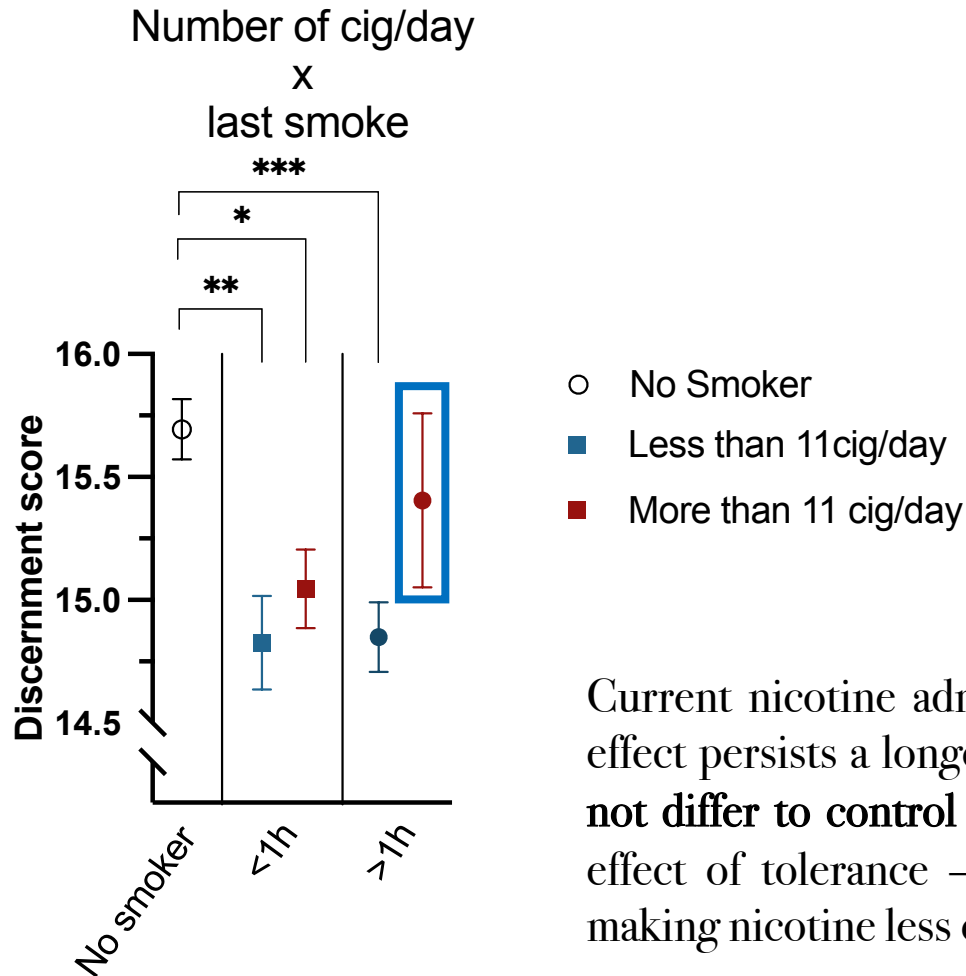
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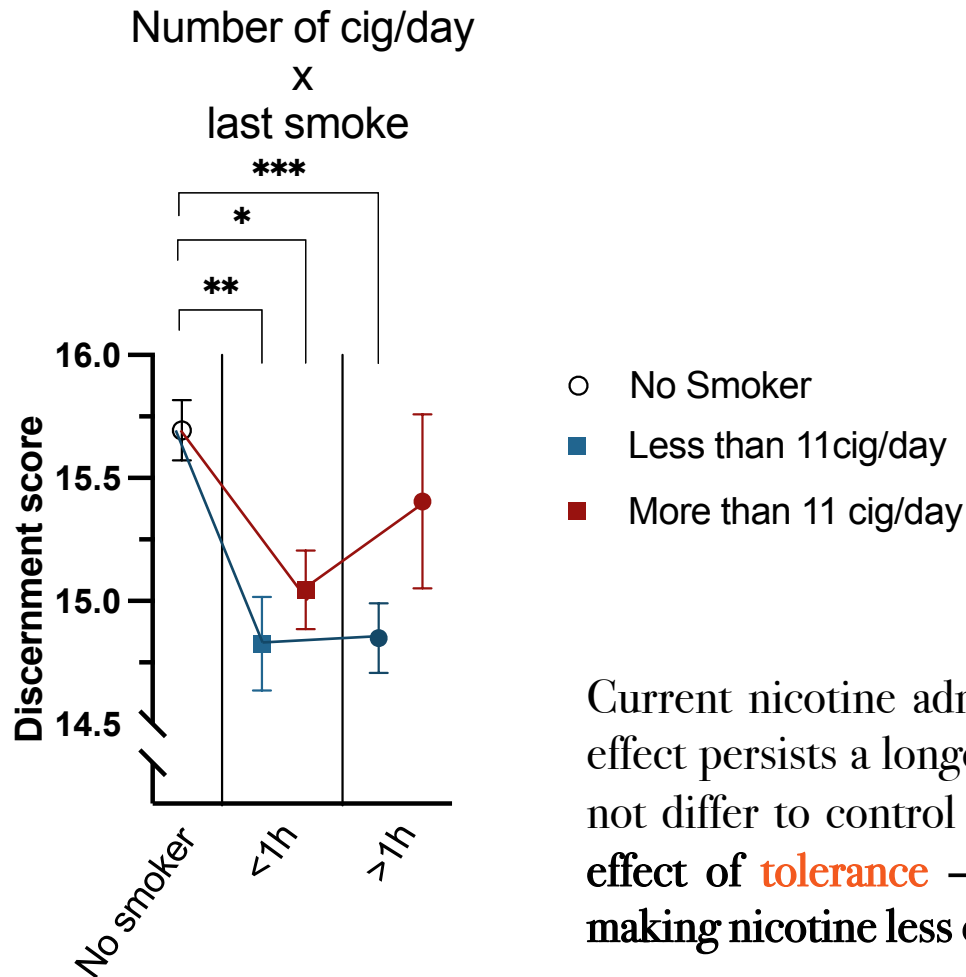
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## **Maj Institute of Pharmacology, PAS**

Prof. Rafał Ryguła

Karolina Noworyta, PhD

Michał Piksa, PhD candidate

## **Collegium Medicum JU**

Jan Piasecki, PhD

Paweł Gwiazdziński, PhD

Agnieszka Masson Lempart, MsC

## **Poznan University of Technology**

Prof. Mikołaj Morzy

Izabela Krysińska, PhD candidate

Tomi Wójtowicz, PhD candidate

Agata Olejniuk

## **Oslo University**

Prof. Jonas Kunst

Aleksander B. Gundersen, PhD

candidate



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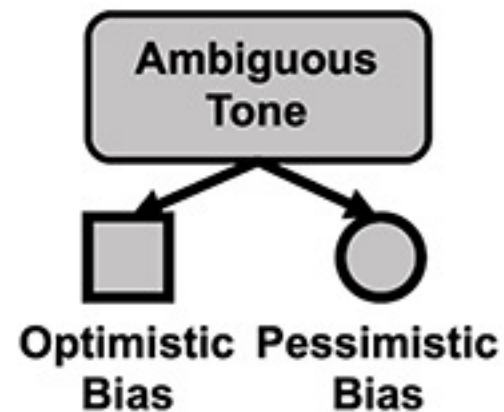
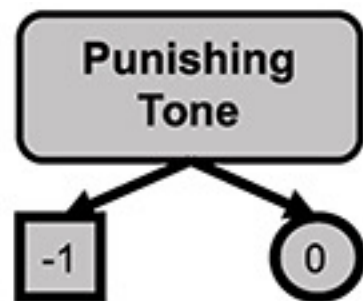
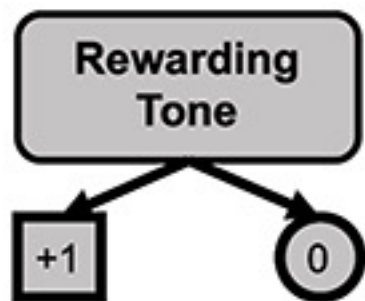
Out of ~ 120 000 participants who have been active in the past 90 days

•Citalopram (Celexa)	1,849 participants
•Escitalopram (Lexapro)	1,512 participants
•Fluoxetine (Prozac/Selfemra)	2,169 participants
•Paroxetine/Paxil/Pexeva	308 participants
•Sertraline (Zoloft)	4,312 participants
•Vilazodone (Viibryd)	47 participants
•Duloxetine (Cymbalta)	481 participants
•Venlafaxine (Effexor)	571 participants
•Venlafaxine (XR)	175 participants
•Bupropion (Wellbutrin)	877 participants
•Bupropion(Aplenzin)	38 participants
•Bupropion(Forfivo XL)	Fewer than 25 participants
•Imipramine (Tofranil)	877 participants



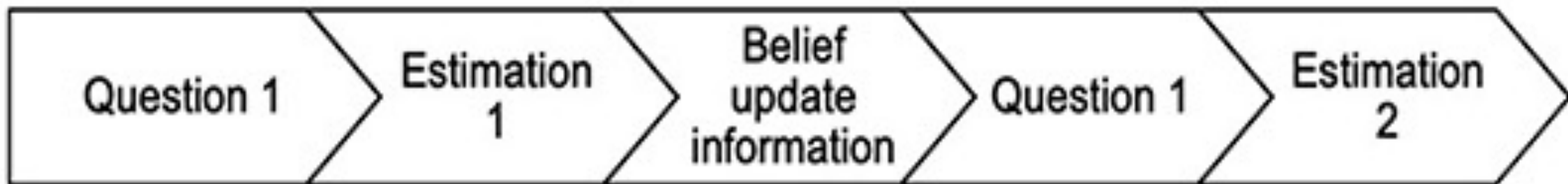


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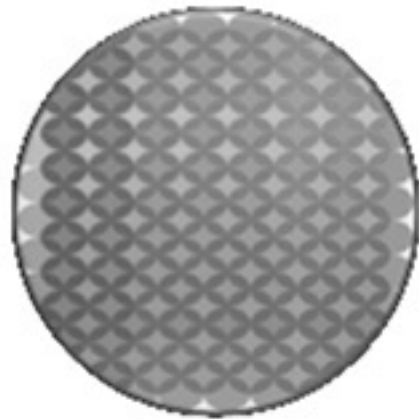




# WEBIMMUNIZATION



80% Reward  
20% Punishment

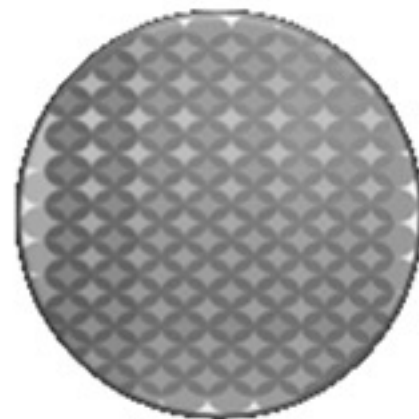


20% Reward  
80% Punishment

R  
E  
V  
E  
R  
S  
A  
L



20% Reward  
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80% Reward  
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After 10 consecutive choices of the rewarding pattern