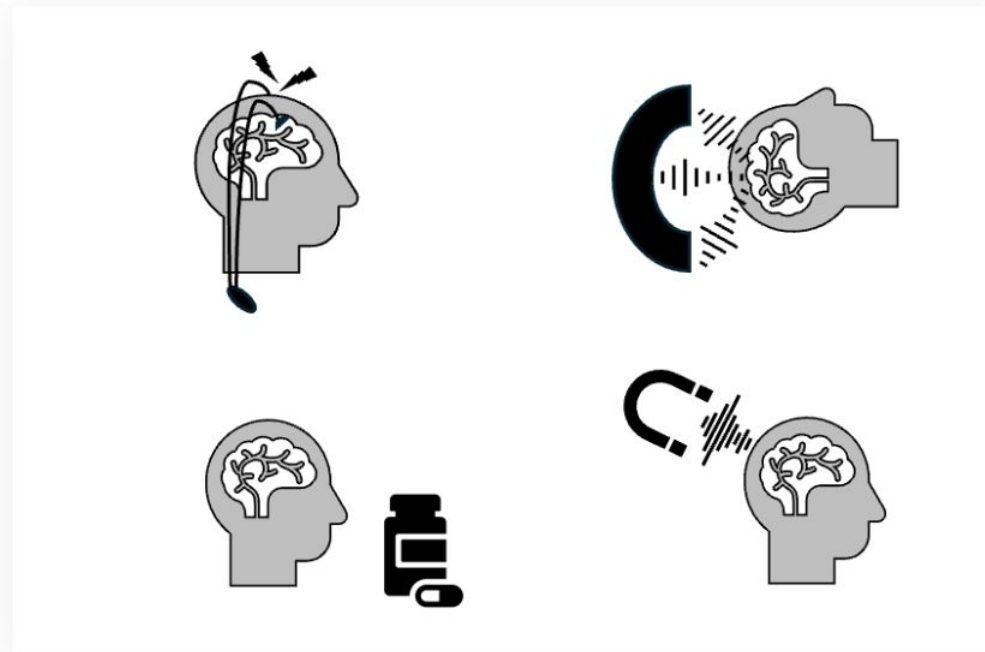


PUBLIC PERCEPTIONS OF EMERGING NEUROTECHNOLOGIES TARGETING MOOD, MEMORY, AND MOTOR SYMPTOMS



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HARVARD MEDICAL SCHOOL

SAMPLE

N=1084

Online Survey distributed by Prolific (sampling firm)
Stratified to be nationally representative on:

- Age Race Gender

EXPERIMENTAL DESIGN

Between Subjects Groups - Symptoms:

- Mood Memory Motor

Within Subjects Groups – Neurotechnologies:

- DBS TMS Pills MRgFUS

Outcome Measures:

- Benefit Acceptability Personal Use
Risk Invasiveness Change to Person

Analyses:

- Repeated Measures ANOVAs

SAMPLE DEMOGRAPHICS

Sample size (N)	1084
Age	
Mean (SD)	45.5 (SD=16.1)
Gender	
Female	514 (49.1%)
Male	507 (48.5%)
Trans female/Trans woman	3 (0.28)
Trans male/Trans man	7 (0.7%)
Genderqueer/Gender non-conforming	12 (1.1%)
*Other	25 (2.4%)
Race	
American Indian, Native American, Alaska Native	11 (1%)
Asian	65 (6%)
Black or African American	135 (12.5%)
Native Hawaiian, Pacific Islander	3 (0.3%)
†Other	8 (0.7%)
White	825 (76.1%)
Ethnicity	
Non-Hispanic	992 (91.5%)
Hispanic or Latino	57 (5.3%)
Education level	
Less than Bachelor's	496 (47.4%)
Bachelor's or higher	551 (52.6%)
Household income	
\$0–\$49,999	444 (42.4%)
≥ \$50,000–109,999	399 (36.8%)
≥ \$110,000	205 (18.9%)

A person has been experiencing the following:

MOOD

Mood symptoms (e.g., feeling sad, irritable, empty), a loss of pleasure or interest in activities, for most of the day, every day. They experience poor concentration, feelings of excessive low self-worth, hopelessness about the future, disrupted sleep, changes in appetite, and feeling tired.

MEMORY

Memory symptoms (e.g., unable to recall memories, difficulty retaining new information), memory loss for most of the day, every day. They experience difficulty learning and recalling new information such as recent events, conversations, or people, and recalling important memories and personal information about themselves.

MOTOR

Motor symptoms (e.g., slowed movement, muscle weakness), a loss of muscle control, for most of the day, every day. They experience tremors while their muscles are at rest, stiffness, trouble swallowing, unstable posture, difficulties with walking, and reduced control over their facial muscles.

Given the severity of their condition, they are presented with the following **neurotechnology** to help reduce symptoms:

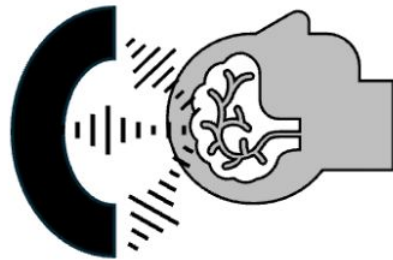
DBS

Deep Brain Stimulation (DBS) involves surgically implanting electrodes into the brain to deliver electrical stimulation to a specific region of the brain.



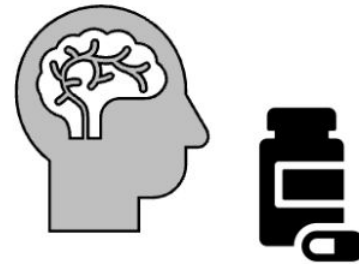
MRgFUS

MRI-guided focused ultrasound (MRgFUS) involves placing a cap on the outside of the head that delivers focused sound waves to create a precise lesion in a specific region of the brain.



Pills

Pills involve ingesting medication (taken by mouth) in the form of a pill to deliver chemicals to the brain.



TMS

Transcranial Magnetic Stimulation (TMS) involves placing a magnet against an area (outside) of the head to deliver magnetic stimulation to a specific region of the brain.



OUTCOME MEASURES

➤ Given this person's (**Mood** / **Memory** / **Motor**) symptoms, to what extent do you think using (**DBS** / **TMS** / **Pills** / **MRgFUS**) would be:

- **Beneficial**
- **Risky**
- **Invasive**
- **Acceptable**

Not at all

Slightly

Moderately

Very

Extremely

➤ Given this person's (**Mood** / **Memory** / **Motor**) symptoms, to what extent do you think using (**DBS** / **TMS** / **Pills** / **MRgFUS**) would:

➤ **change who they are as a person?**

Not at all

A little

A moderate amount

A lot

A great deal

➤ Now, suppose YOU were experiencing these (**Mood** / **Memory** / **Motor**) symptoms, would you consider using (**DBS** / **TMS** / **Pills** / **MRgFUS**)?

I definitely would not

I probably would not

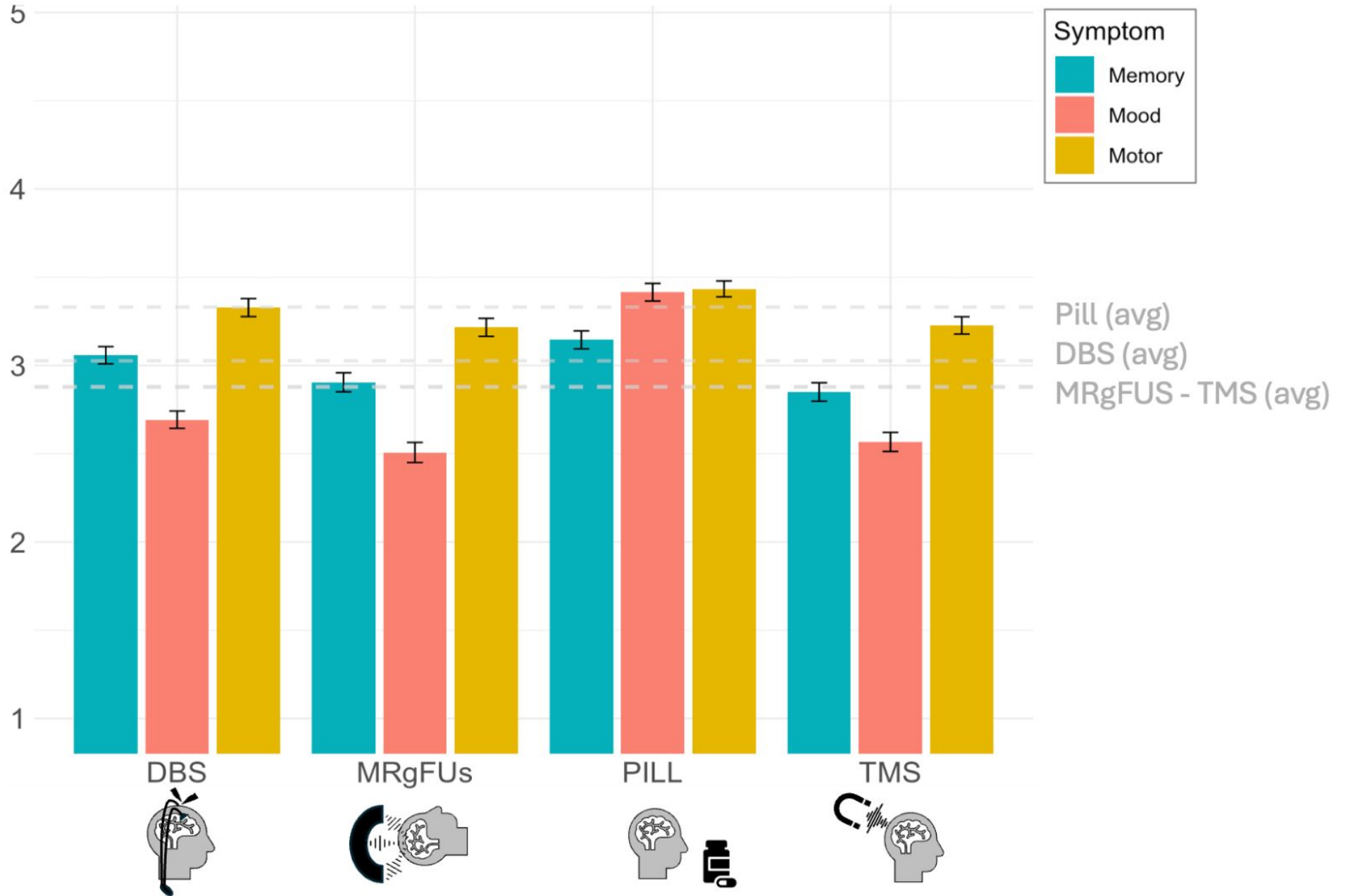
I might or I might not

I probably would

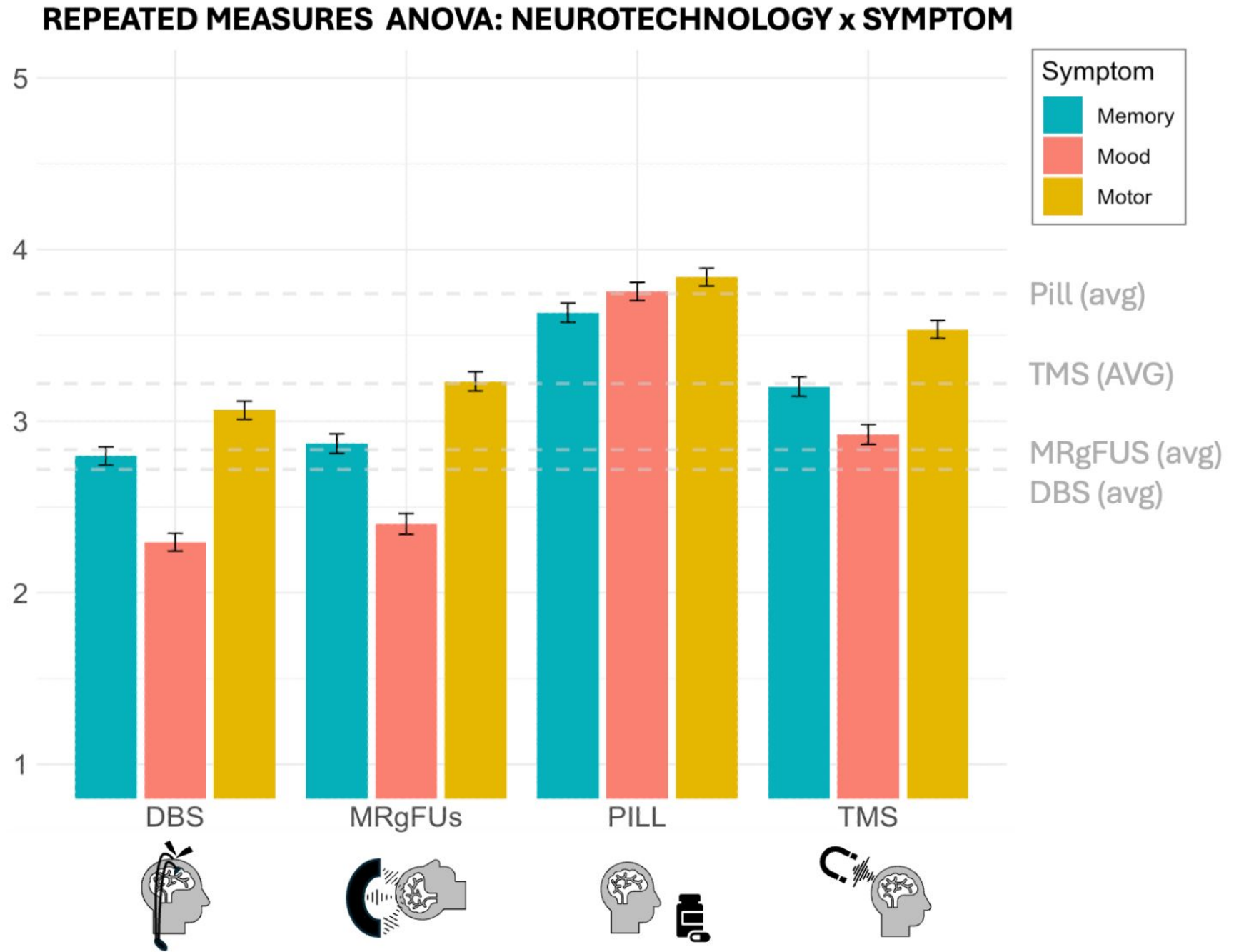
I definitely would

REPEATED MEASURES ANOVA: NEUROTECHNOLOGY x SYMPTOM

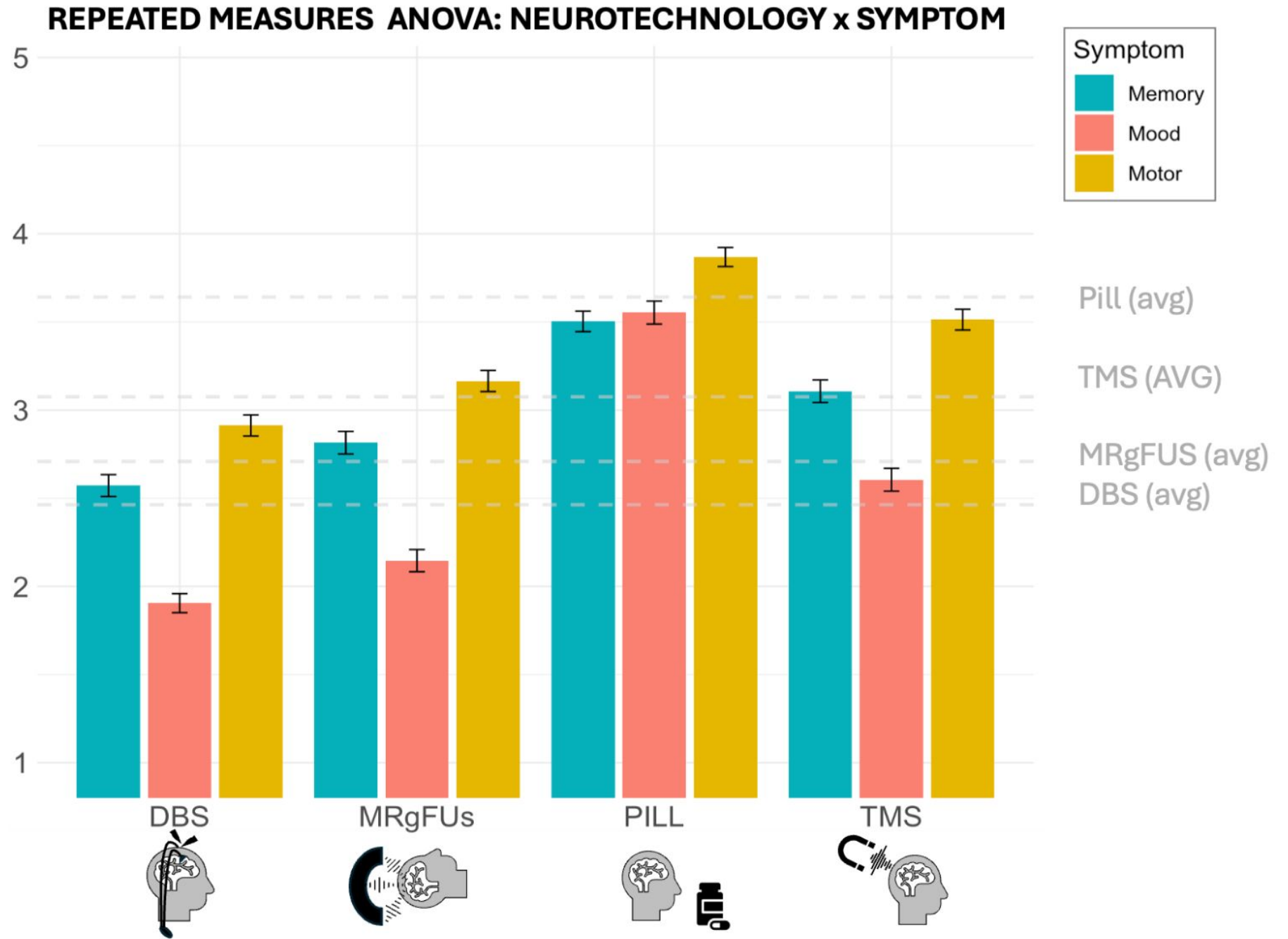
PERCEIVED
BENEFIT



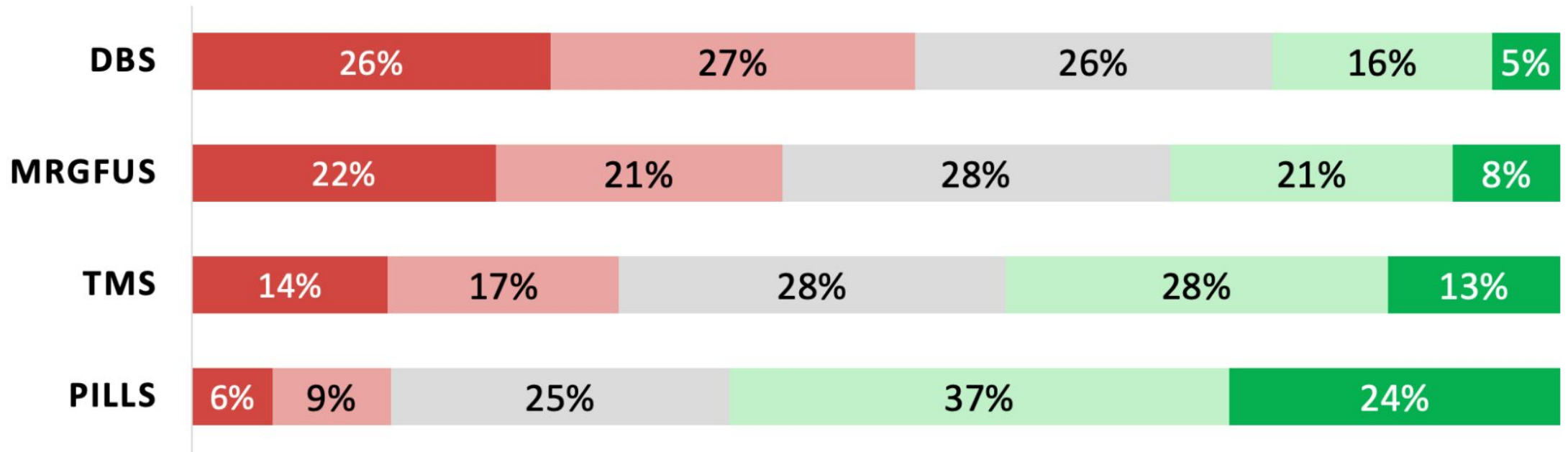
PERCEIVED ACCEPTABILITY



LIKELIHOOD PERSONAL USE



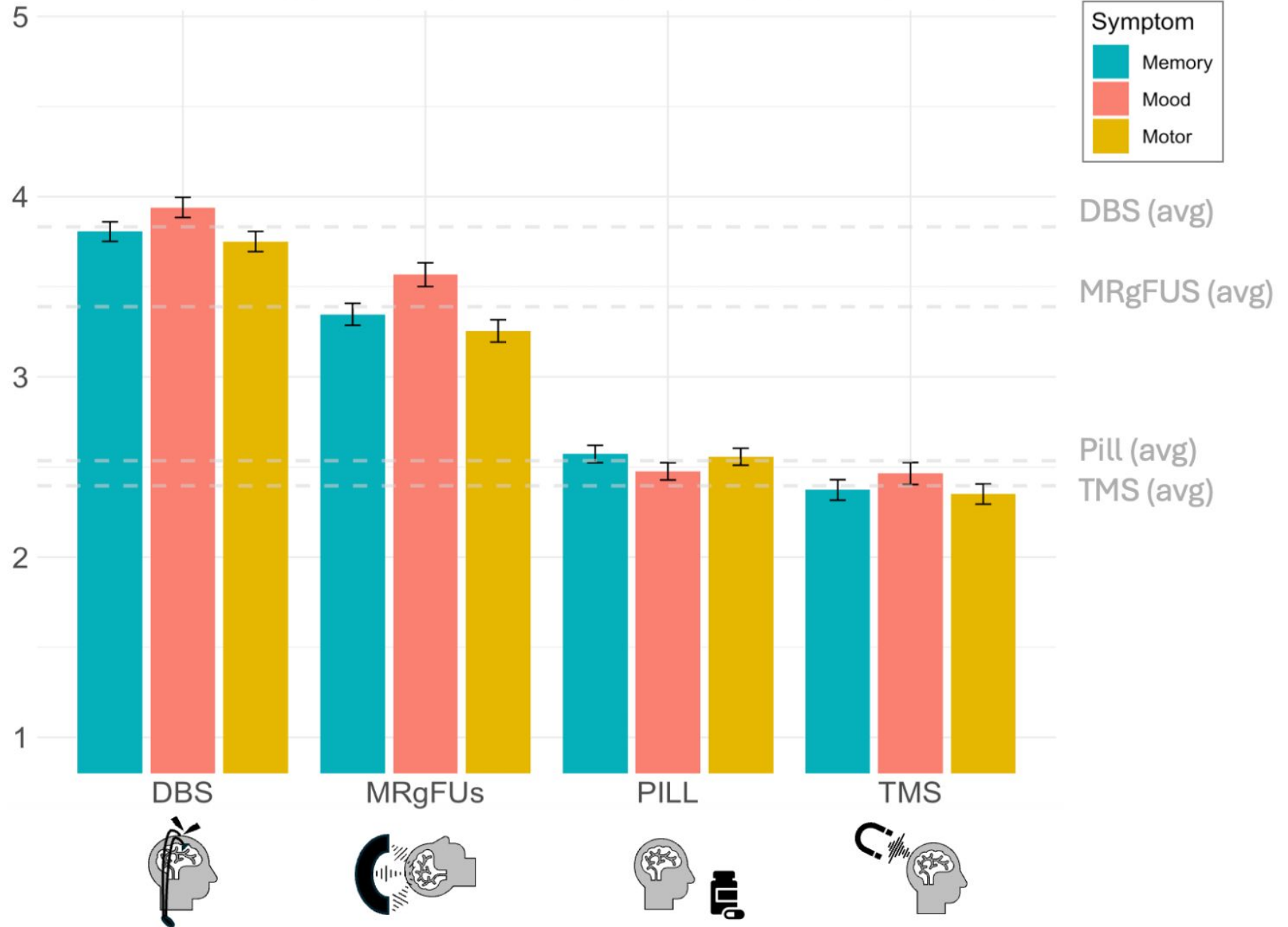
SUPPOSE YOU WERE EXPERIENCING THESE
[SYMPTOMS: MOOD - MEMORY - MOTOR],
WOULD YOU CONSIDER USING:



■ I definitely would not ■ I probably would not ■ I might or I might not ■ I probably would ■ I definitely would

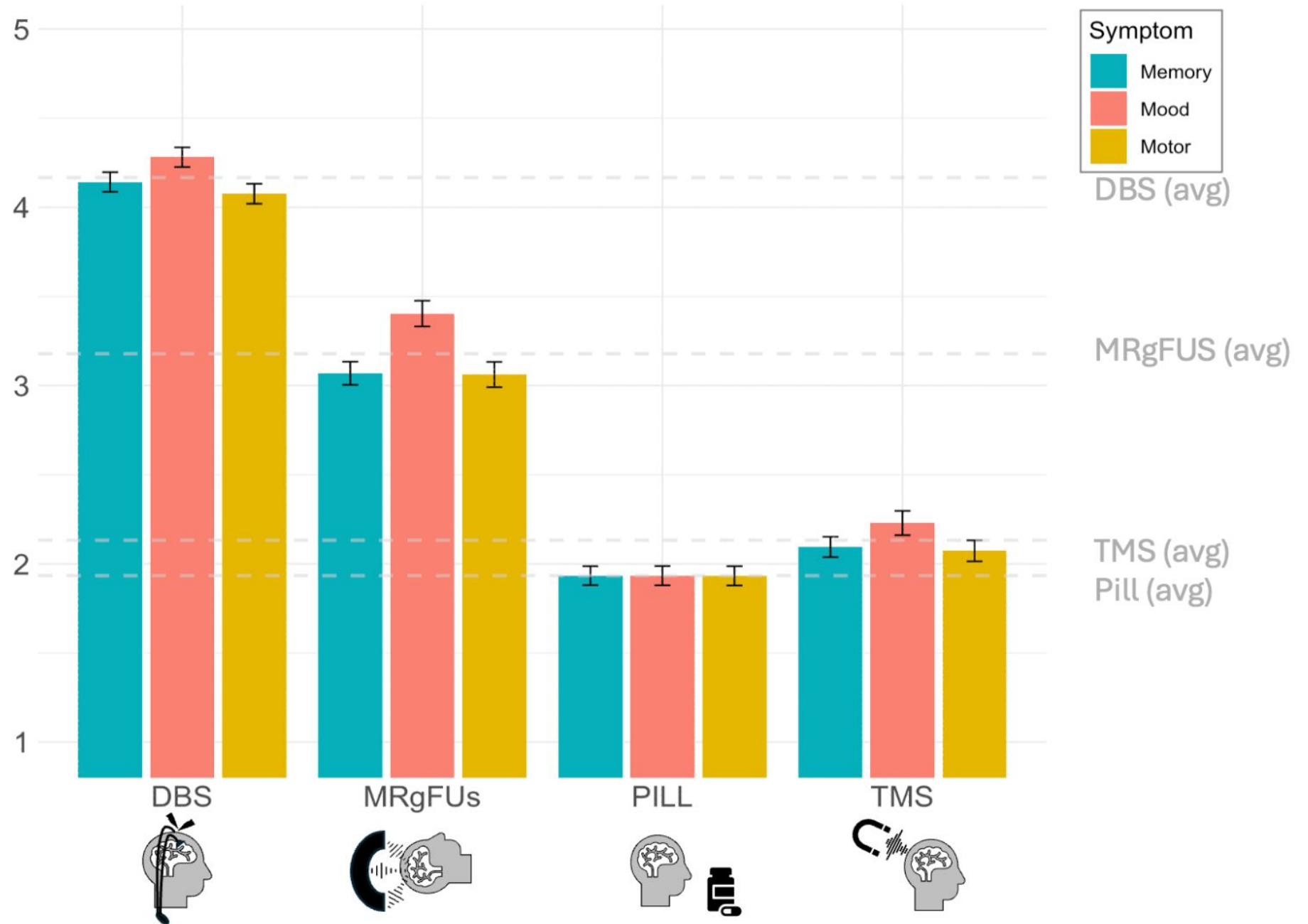
REPEATED MEASURES ANOVA: NEUROTECHNOLOGY x SYMPTOM

**PERCEIVED
RISK**



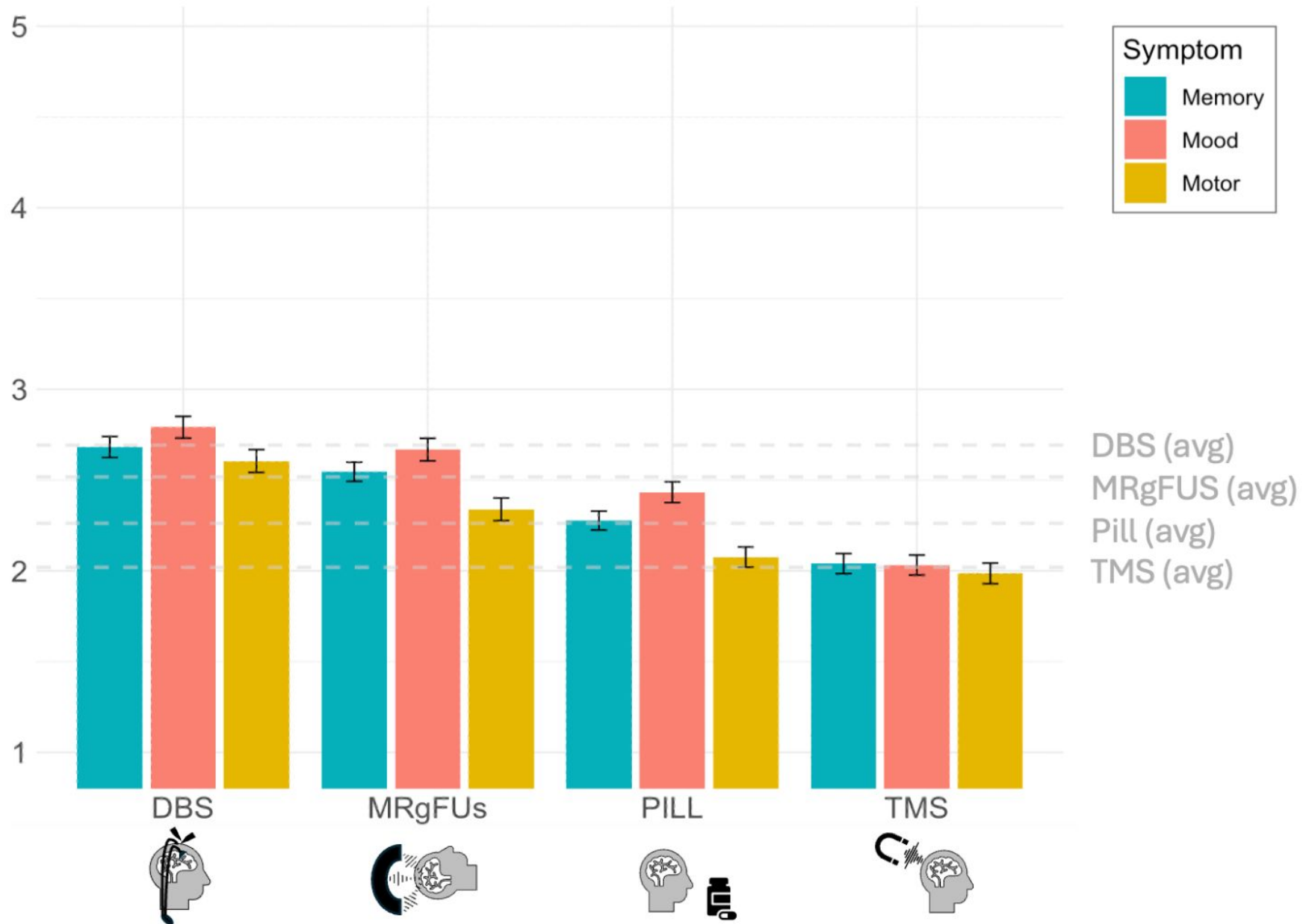
REPEATED MEASURES ANOVA: NEUROTECHNOLOGY x SYMPTOM

**PERCEIVED
INVASIVENESS**



REPEATED MEASURES ANOVA: NEUROTECHNOLOGY x SYMPTOM

**PERCEIVED
CHANGE TO PERSON**



KEY FINDINGS

- **DBS** is perceived as the second most **beneficial** treatment, but as least **acceptable**, least **likely to be used**, **riskiest**, most **invasive**, and most likely to **change the person**.
- Likelihood of **Personal Use** is more strongly associated with perceived **acceptability** than perceived **benefit**
- In contrast to the other neurotechnologies, **pills** are perceived as the least **invasive**.
- **Pills** are perceived as less **invasive**, yet **riskier** than **TMS**.
- **DBS** is perceived as **riskier**, more **invasive**, and more likely to **change a person** compared to **MRgFUS**.
- Neurotechnologies are perceived to be most **beneficial**, **acceptable**, and **likely to be used** by people for **Motor > Memory > Mood** symptoms.

THANK YOU

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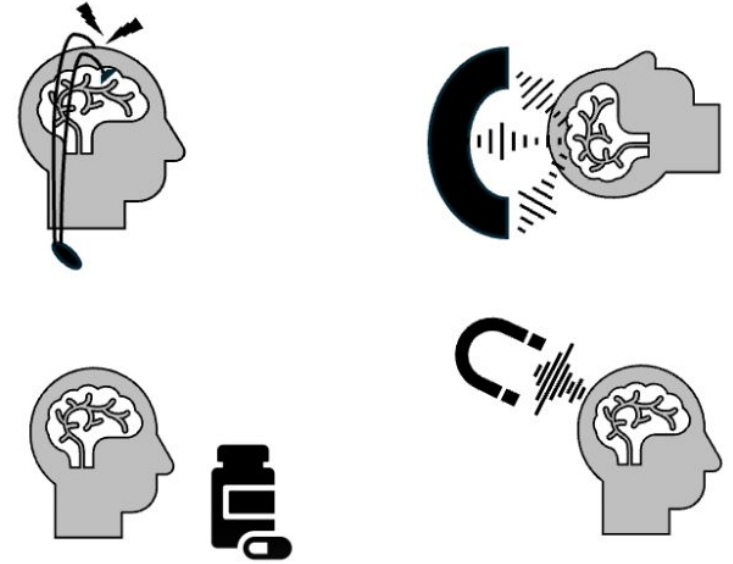
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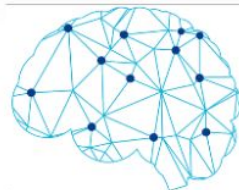
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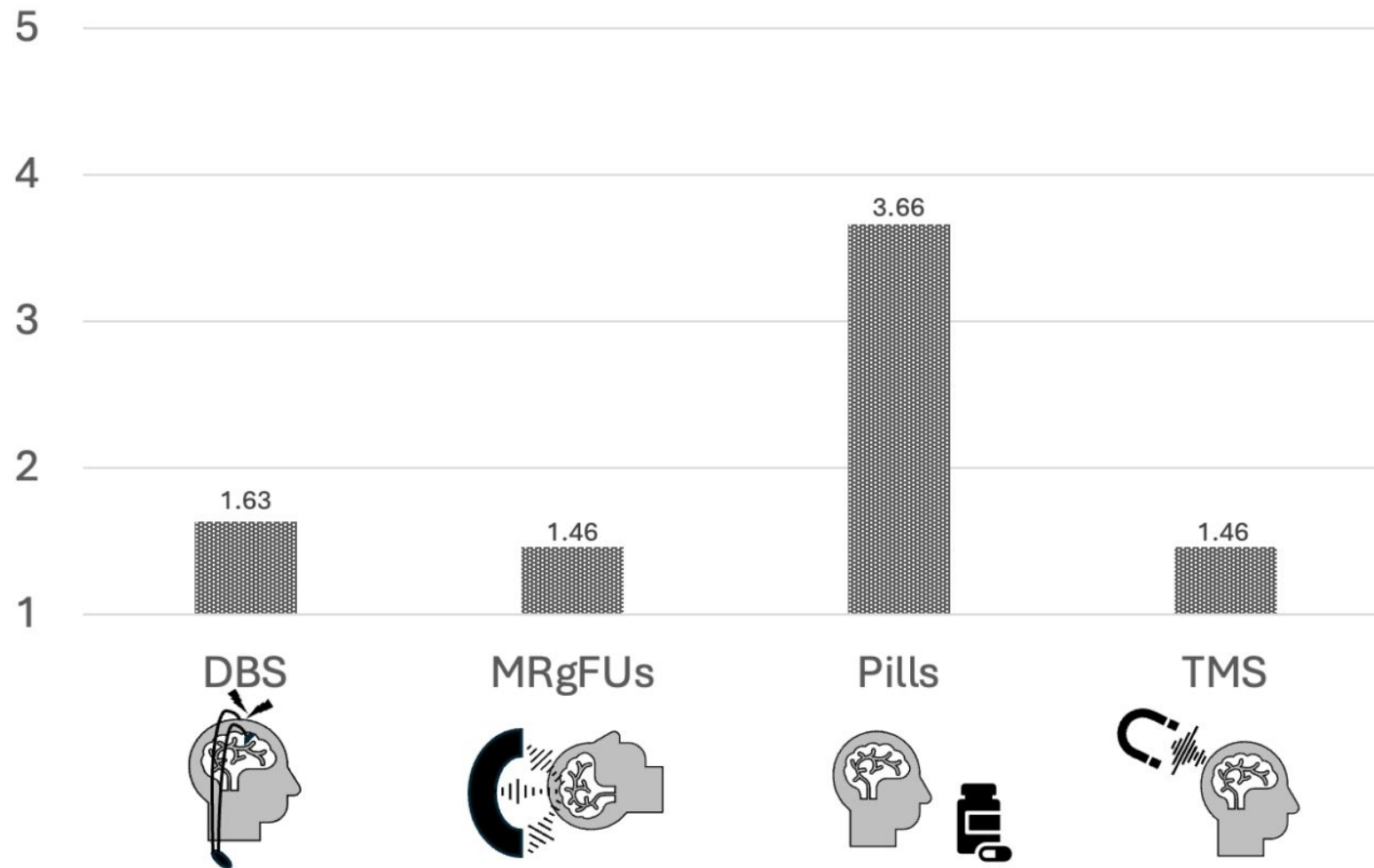


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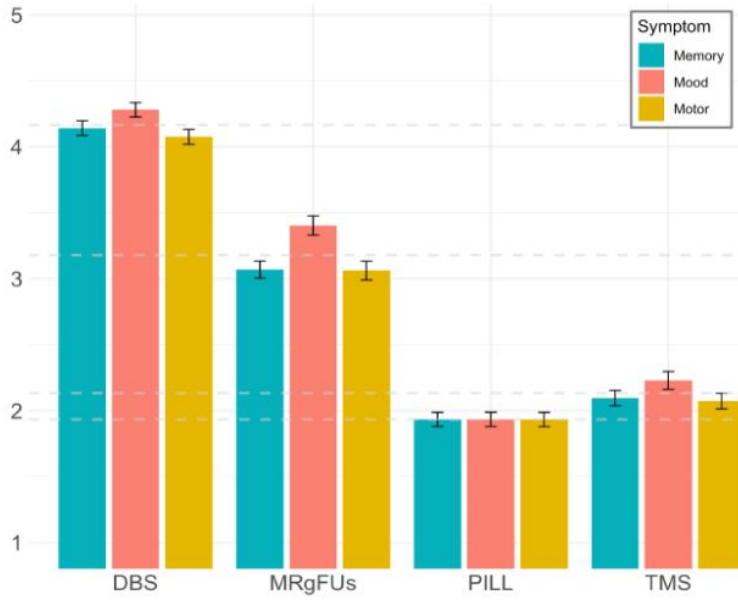


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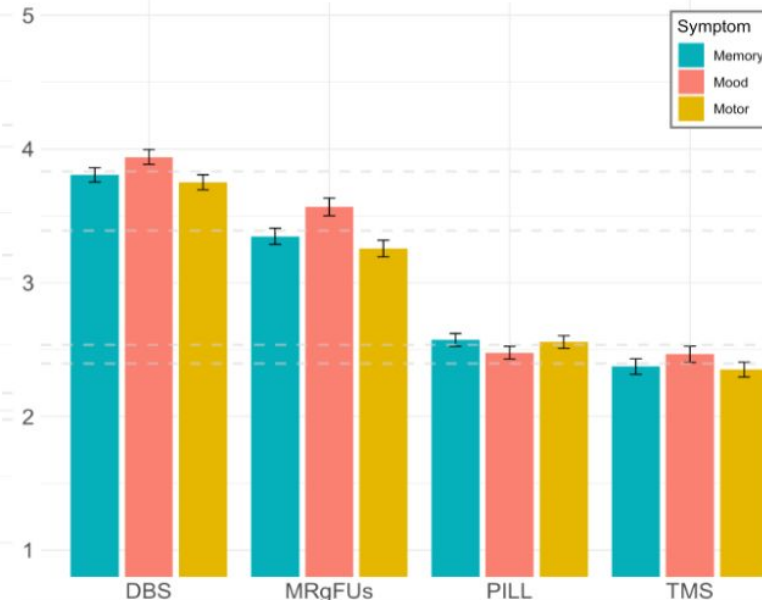
FAMILIARITY



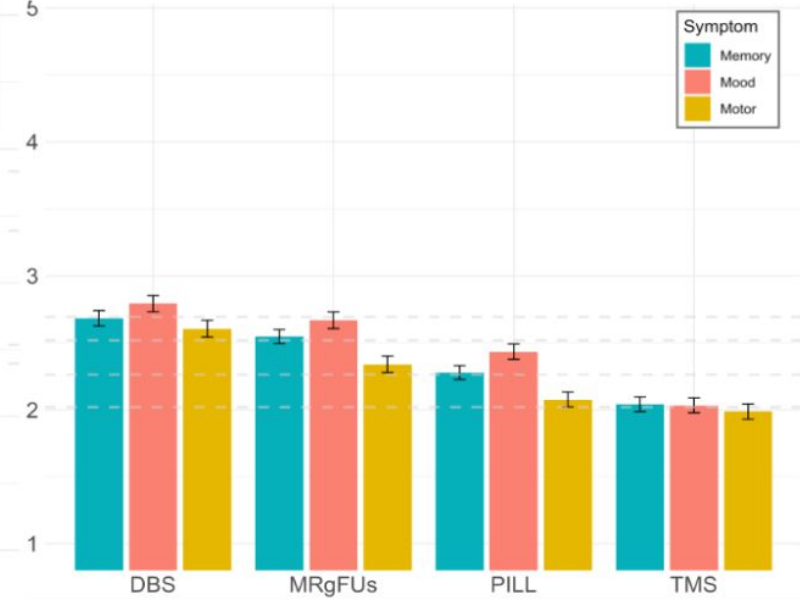
PERCEIVED INVASIVENESS



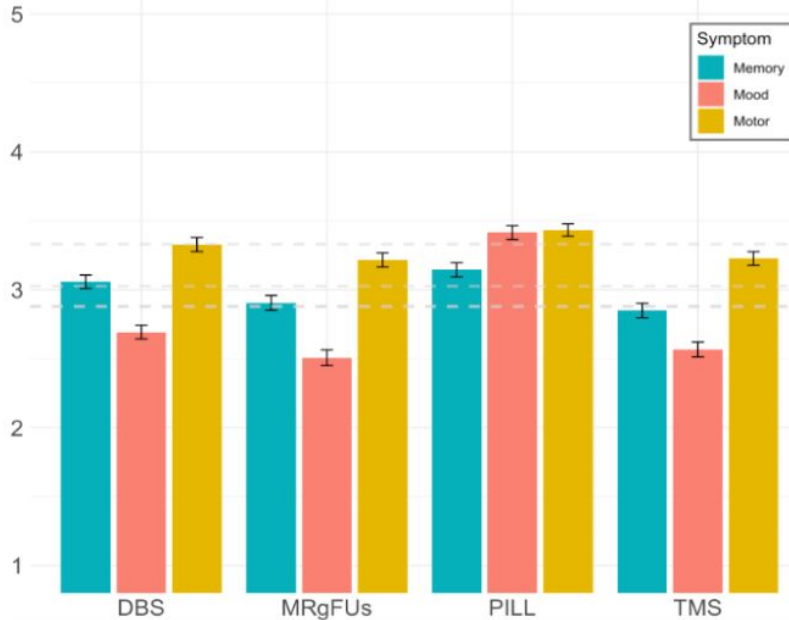
PERCEIVED RISK



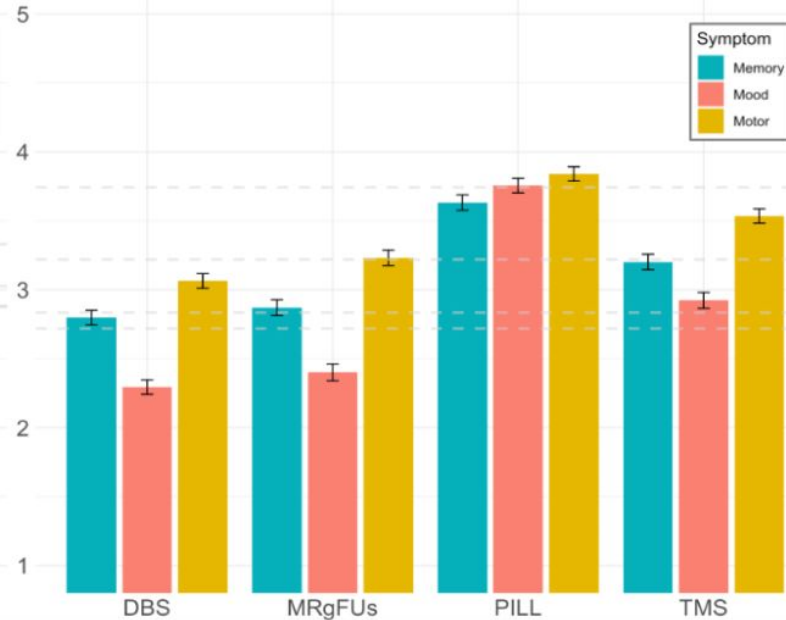
PERCEIVED CHANGE TO PERSON



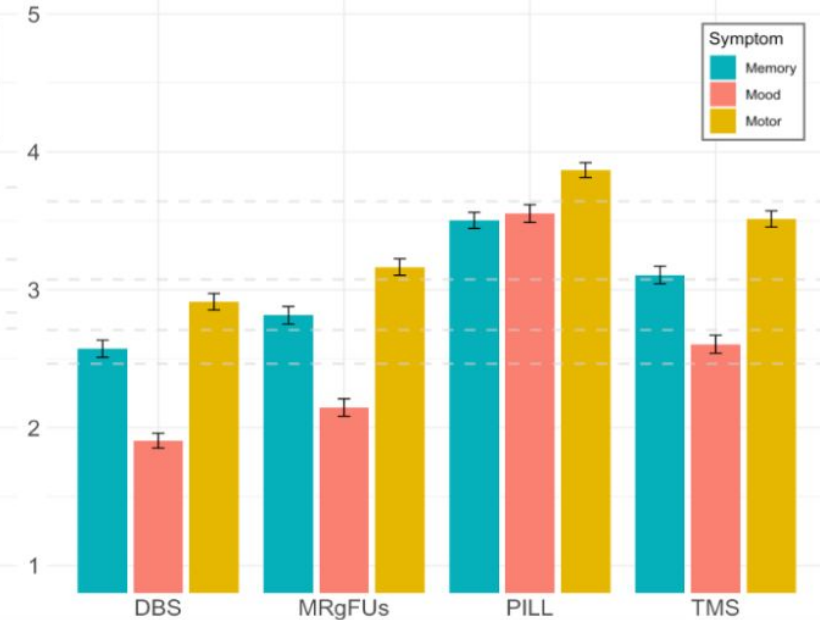
PERCEIVED BENEFIT



PERCEIVED ACCEPTABILITY



LIKELIHOOD PERSONAL USE



Why examine “public” attitudes?

ETHICAL IMPLICATIONS

Understanding how the public perceives these technologies can inform ethical guidelines and policy decisions regarding their development, regulation, and use.

INFORMED CONSENT

Public perception studies can shed light on what information individuals deem important when considering the use of neurotechnologies, aiding in the development of informed consent processes.

AUTONOMY & DECISION MAKING

Understanding how individuals perceive the impact of these technologies on personal identity and autonomy is essential for ethical decision-making.

PUBLIC ENGAGEMENT & TRUST

Engaging the public in discussions about neurotechnologies can build trust and transparency. It allows for meaningful dialogue between researchers, policymakers, and the public, fostering a sense of shared responsibility in shaping the ethical landscape of neurotechnology development and use.