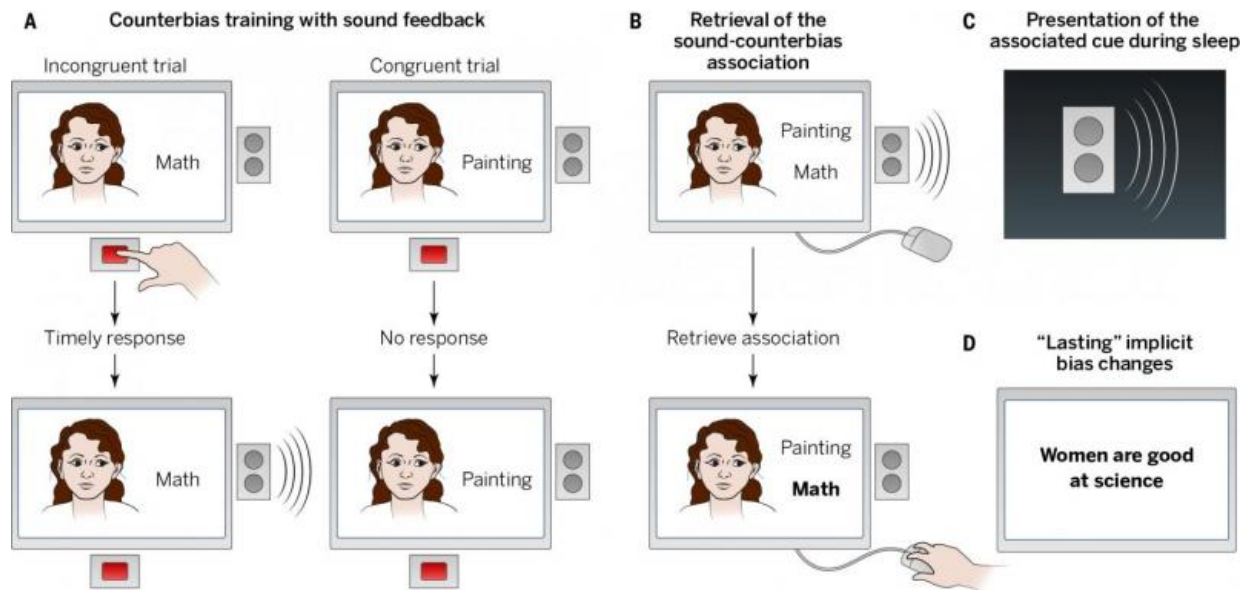


Unlearning implicit social biases during sleep

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Sleeping your way out of a bad attitude. Implicit social bias scores could be improved by applying a counterbias intervention comprising two tasks: counterbias training with sound feedback and retrieval of the sound-counterbias association. This training-induced improvement was then stabilized by re-presenting the sound cue during sleep. (A) On the counterbias training, participants were shown separate pictures of men and women of different racial groups together with words from the opposing categories “science/art” and “good/bad”. When seeing an “incongruous” pair (e.g., face of a woman and the word “math”), participants had to respond by pressing a button. “Correct” and timely responses received a feedback sound. Congruent trials afforded no response. (B) On the sound-counterbias retrieval task, participants were instructed to drag and drop a face (e.g., a female face) onto the incongruous word (e.g., “math”) whenever they heard the sound that was associated with this specific counterbias during the preceding counterbias training. (C) The sound was then used to cue, and thereby reactivate, the memory of the newly learned

counterbias association when the participant entered slow-wave sleep during a subsequent 90-min nap. (D) A stable reduction of implicit social bias, persisting 1 week later, was only achieved if the counterbias intervention was cued during the nap. Credit: P. Huey/Science

Can we learn to rid ourselves of our implicit biases regarding race and gender? A new Northwestern University study indicates that sleep may hold an important key to success in such efforts.

Building on prior research, the Northwestern investigators aimed to find out whether [learning](#) to alter habitual reactions to other people could be enhanced during [sleep](#).

Other researchers have documented many unsavory consequences of common social biases. When playing a videogame with instructions to shoot only people carrying weapons, players were more likely to shoot unarmed targets when they were Black versus White.

Bias also can be demonstrated in hiring decisions. For instance, scientists were more likely to hire male than equally qualified female candidates for research positions.

Even well-meaning people can be influenced by these biases without even realizing it.

Prior research demonstrated temporary reductions in this unconscious or implicit bias produced via a type of training called counter-stereotype training. The new study examined a strategy to bolster the benefits of this kind of training.

Prior studies by the Northwestern researchers have revealed memory

reactivation during sleep. Generally, participants first heard distinctive sounds during a learning session. A short period of sleep came next. After people woke up, what they could remember was changed if learning-related sounds were presented during sleep.

"We call this Targeted Memory Reactivation, because the sounds played during sleep could produce relatively better memory for information cued during sleep compared to information not cued during sleep," said Ken Paller, senior author of the study and professor of psychology at Northwestern's Weinberg College of Arts and Sciences. "For example, we used this procedure to selectively improve spatial memory, such as learning the locations of a set of objects, and skill memory, like learning to play a melody on a keyboard."

The current study was designed to apply the same sort of procedure to counter-stereotype training.

"This type of learning falls into the category of habit learning," said Paller, who is also director of the Cognitive Neuroscience Program at Northwestern. "So in addition to spatial learning and skill learning, we can include habit learning as another type of learning that depends on memory processing during sleep."

Participants in the experiment completed two training regimens, one designed to reduce racial bias and the other gender bias.

In the computerized training tasks, faces were paired with words that ran contrary to a stereotype. For example, female faces appeared with words associated with math or science, and Black faces appeared with pleasant words. There were two distinctive sounds during this training, one that came to be strongly associated with the women+science pairs and the other with the Black+pleasant pairs.

Following the training, participants took a nap. While they were in deep sleep and without their knowledge, one of the sounds was played repeatedly, but with the volume set low enough to avoid disturbing sleep.

The sleep procedure produced the selective benefits that the investigators expected. Bias reduction was stronger for the specific type of training reactivated during sleep. This relative advantage remained one week later.

"It is somewhat surprising that the sleep-based intervention could have an impact that was still apparent one week later," said Xiaoqing Hu, lead author of the study and a Ph.D. student at Northwestern when he began the study. (He is currently a postdoctoral researcher at the University of Texas at Austin.) "The usual expectation is that a brief, one-time intervention is not strong enough to have a lasting influence. It might be better to use repeated sessions and more extensive training. But our results show how learning, even this type of learning, depends on sleep."

"Producing lasting changes in implicit biases is challenging," said Galen V. Bodenhausen, professor of psychology at Northwestern's Weinberg College, who also co-authored the study. "These biases arise from long-term socialization, and they are frequently reinforced by the mass media."

He added that further experiments will need to examine whether these procedures can reduce the impact of implicit biases in important decision-making situations.

One implication of the study, Paller said, is that it can broaden the discussion of what sorts of efforts can be made to combat social bias in society.

"Biases can operate even when we have the conscious intention to avoid

them," said Bodenhausen, who also is a professor of marketing at Northwestern's Kellogg School of Management. "We can try to correct for our biases after the fact, but our results point to a more encouraging possibility—reducing the bias in the first place."

The study also has implications for reducing many other kinds of unwanted social biases and stigmas.

Furthermore, unlearning implicit bias may be a lot like breaking other bad habits. Paller noted that the research also has implications for new techniques to combat habits such as smoking, self-centeredness, phobias or unhealthy eating behaviors.

"Unlearning Implicit Social Biases During Sleep" will be published May 29 in the journal *Science*.

More information: Unlearning implicit social biases during sleep, [www.sciencemag.org/lookup/doi/ ... 1126/science.aaa3841](http://www.sciencemag.org/lookup/doi/.../1126/science.aaa3841)

Provided by Northwestern University

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