Scott Barry Kaufman
Beautiful Minds

Brain Stimulation Makes the 'Impossible Problem' Solvable

'Thinking cap' makes a virtually impossible problem — possible.

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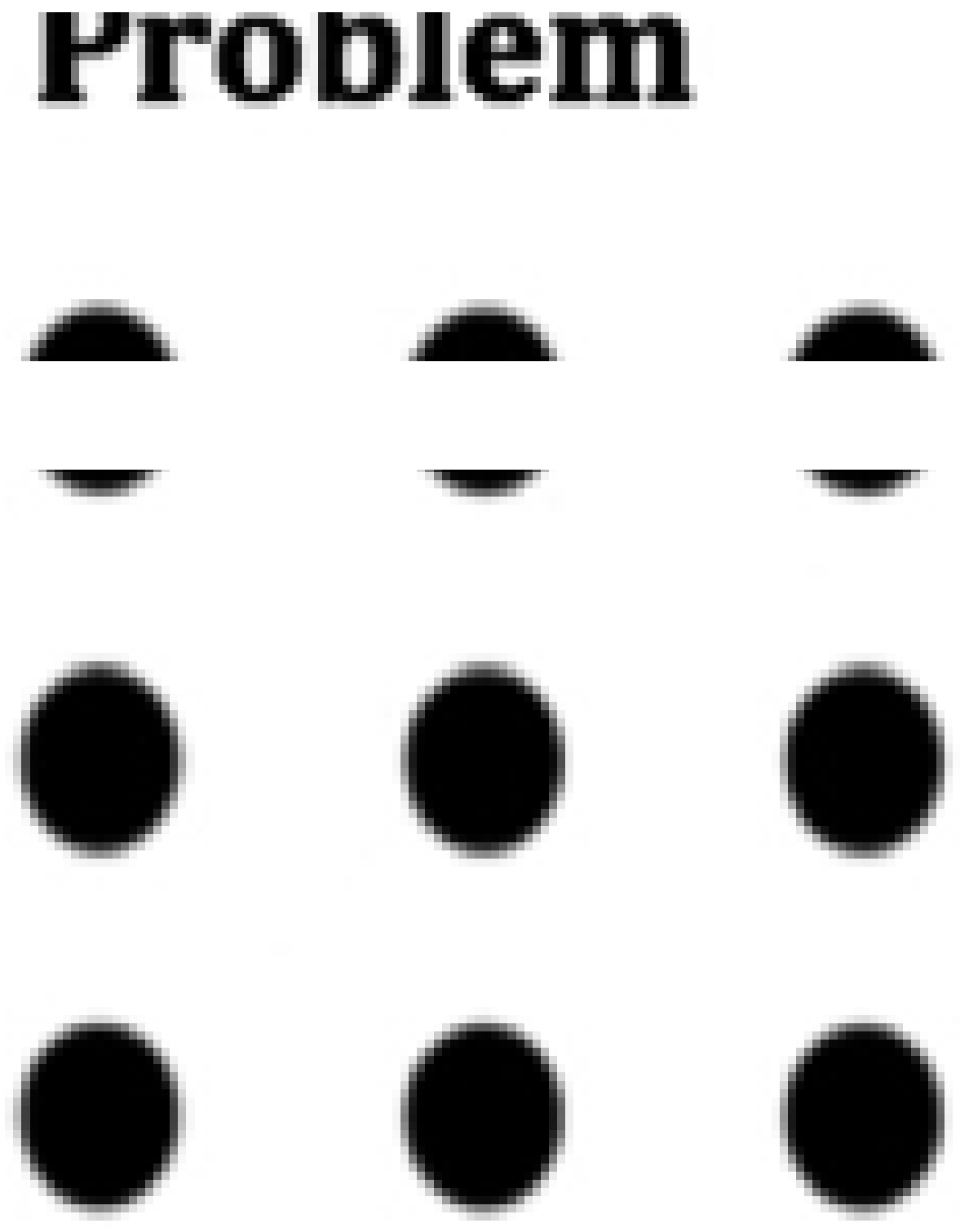
> "The difficulty lies, not in the new ideas, but in escaping from the old ones, which ramify...into every corner of our mind." - John Maynard Keynes

Try connecting all nine of these dots with just four straight lines without lifting your finger or retracing a line:



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Have difficulty? You're not alone. A century of psychological research shows that under laboratory conditions, the expected solution rate for this 'nine-dot' problem is 0 percent. Most people continue having difficulty solving the problem after given hints, extended time, and even 100 chances!

In their prior research, Allan Snyder and his colleagues have found that zapping the brain leads to increased insight. Enter a recent study. Richard Chi and Allan Snyder wondered: would their electric 'thinking cap' make performance on a virtually unsolvable problem-- the nine-dot problem-- solvable?

They gave 28 healthy right-handed participants (aged 19-63) the nine-dot problem to solve. Before brain stimulation, 0 out of 22 participants solved the problem. Then they used transcranial direct current stimulation (tDCS), which is a safe, non-invasive technique that can increase or decrease cortical excitability and spontaneous neuronal firing in targeted regions. Specifically, they simultaneously *decreased* excitability of the left anterior temporal lobe (ATL) while they *increased* the excitability of the right anterior temporal lobe (ATL).

After 10 minutes of right lateralizing tDCS, more than 40 percent of the participants got the problem correct. For contrast, they placed sponge electrodes in the same positions of 11 other participants but they turned off the electrical current after 30 seconds. Therefore, these 'control' participants received the exact same experience as those in the active condition but didn't actually have their brain zapped. None (0/11) of the folks in this placebo condition solved the problem at any point during the experiment.

brains were zapped solved the problem. They estimate the probability of this happening by chance is less than *1 in a billion*.

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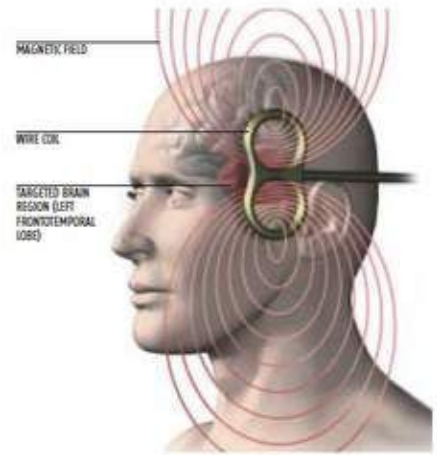

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Why did stimulating these brain areas have such an effect? The *left* ATL is associated with a hypothesis driven cognitive style and the *right* ATL is associated with insight and novelty (see References). One possibility is that by reducing left hemisphere dominance, the thinking cap reduced the tendency to see the nine-dot as just a square with imposed rigid boundaires. In other words, the brain stimulation made it easier for the participants to literally 'think outside the box'.

Of course, there are other interpretations of their findings (as the researchers recognize), but their effects are consistent with a number of different studies conducted by various researchers. **Bruce Miller and his colleagues** found that people with anterior temporal lobe dementia spontaneously showed creative and artistic talents they never displayed before. Perhaps the dementia got rid of some of the typical inhibitory mechanisms and allowed insight mechanisms in the right part of the brain to bubble to the surface (which had previously been blocked by the other side). In other lines of research with prodigious savants, **Darold Treffert** has found exceptional skills are frequently associated with dysfunction of the left ATL, and **Snyder and his colleagues** have found that they can induce savant-like skills using tDCS. (See **here** for a critical interview I conducted with Snyder a few years back on that topic).

Roi Cohen Kadosh and his colleagues at the University of Oxford used transcranial magnetic stimulation (tMS) to disable bits of the brain involved in mathematical reasoning (the right parietal lobe, to be exact). When they did this, participants could barely comprehend mathematics! Excitingly, they were also able to do the reverse. When they applied tDCS to the same part of the brain while simulataneously using the opposite current to lower excitation of the left parietal cortex, participants performed math calculations faster than those given sham stimulation (read about the study **here**). When tested 6 months later, those who were stimulated still did better than those who weren't zapped!

Chi and Snyder report on a case study that is particularly telling. One participant in their study was excluded from the experiment because of a head injury that occured when he was about 10 years old. He didn't tell the experimenters about his head injury until he got to the laboratory. While he was there, he expressed interest in attempting to solve the nine-dot problem. He was the only participant excluded from their study who attempted to solve the problem.

Turns out, he solved the problem, along with another difficult insight problem! During an interview with the experimenters he explained how he sees the world:

> "I only focus on a particular thing, so if I walk into a room, I'd just take things methodically, each thing at the time, I don't look at the whole picture. . .I notice everything by itself, as singular objects instead of the whole scene. . .even my writing. . .I'm only focused on one part. . .My long term memory is very very good. . .I can recall everything that happened in year 6 (12 years old)."

temporal bone"!

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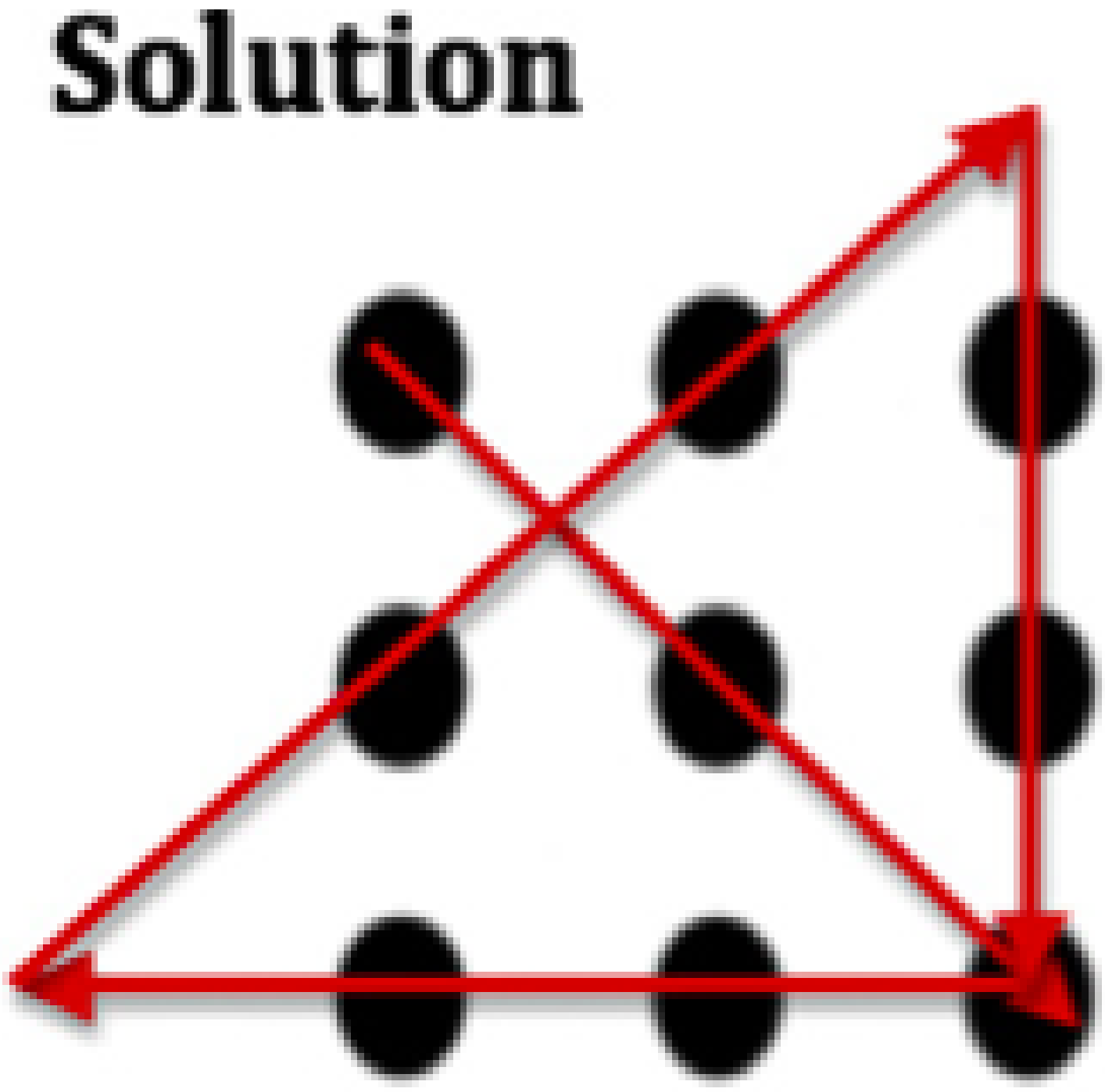
Like many of you, these results had me thinking: *where can I get a thinking cap!?* The researchers argue it's possible to benefit from brief non-invase stimulation with minimal and temporary costs. They argue that brain stimulation has greater potential for tasks, like the nine-dot problem, that our brains are not well adapted for, compared to tasks in which our minds find more familiar.

Do I think scientists are ready to sell mini-transcranial direct current stimulation devices to **Walgreens**? Probably not. tDCS is still **controversial** and a lot more research is needed. Still, I think there is a lot of potential here and one day in the not too distant future I believe it *will* be possible. You really can mess with your brain to great effect.

I'll be keeping a close eye on this research. Not only for the practical benefits, but also in its potential to increase our understanding of the human mind and its seemingly unlimited potential.

In case you were wondering, here's the answer to the nine-dot problem:



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About the Author

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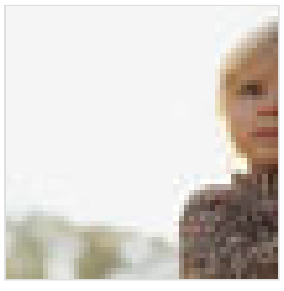

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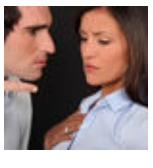

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