Exploring the science of inspiration

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We knew that stimuli can inspire problem solving. Now we know why. Credit: CC0 Creative Commons

Have you ever struggled with a problem that appeared to have no solution, and after turning your attention elsewhere, suddenly received a spark of inspiration?

This nearly universal experience caught the attention of Carnegie Mellon University's Kosa Goucher-Lambert and Jonathan Cagan. The idea that outside stimuli can provide problem solvers with the inspiration necessary for creating new solutions has been around for decades, but the researchers are specifically interested in investigating the creative potential inspirational stimuli have on assisting designers in developing novel solutions to challenging design problems.

Postdoctoral researcher Goucher-Lambert and Cagan, a professor of mechanical engineering, collaborated with Jarrod Moss, an associate professor of psychology at Mississippi State University. The team used functional magnetic resonance imaging (fMRI) to explore brain activation while designers developed solutions with and without inspirational stimuli.

In doing so, they could actively map out which areas of the brain were engaged during design ideation, and thereby demonstrate exactly why stimuli can be a powerful tool for inspiring design. Their findings were published in the journal *Design Studies*.

For their investigation, the researchers placed participants in an fMRI and asked them to develop solutions to 12 different open-ended design problems. In order to indicate that they had created a new solution, participants would press a button, thereby allowing the researchers to later associate the fMRI images with periods of successful idea generation. For example, a participant might be asked to develop a measuring cup for the blind. At the same time, participants were provided with varying types of inspirational stimuli meant to facilitate retrieval of useful concepts from memory that might help to generate new design solutions.

Three types of inspirational stimuli were used: those similar to more expected problem solutions (near stimuli), those that seemed totally

foreign from the problem (far stimuli), and control stimuli which added no new information to the problem and simply recycled from the problem prompt. All three types were presented textually, with a collection of words displayed on a screen in front of the participant along with the design problem prompt.

After receiving the prompt, participants were presented with one collection of words, dependent on the stimuli type assigned to them. For the measuring cup example, the words presented were: braille, touch, beep, sound, sensor (near); preprogram, recognize, pressure, holes, cover (far); and measuring, cup, for, the, blind (control). In this way, Goucher-Lambert and Cagan could begin to observe the impact that these varying types of inspirational stimuli had on problem-solving.

Overall, Goucher-Lambert and Cagan found that inspirational stimuli allowed participants to maintain a productive level of idea generation for a longer period of time, thereby helping them to generate more solutions to the design problems. Both near and far stimuli allowed participants to formulate more solutions than when no stimuli were provided, likely because these words helped direct the designer's internal attention to their memory. These stimuli encouraged semantic processing and analogical reasoning, a type of logic in which individuals apply concepts from the stimuli to a problem, through a series of associations between the two.

Perhaps most interestingly, neurological evaluation of the results revealed the activation of different brain networks depending on whether or not inspirational stimuli were given, suggesting a fundamental difference between how we think with and without outside inspiration. What's more, near stimuli activated different neurological processes than far stimuli, thereby providing additional insight into what defines a stimulus as near or far to a problem statement.

When provided with near inspirational stimuli, fMRI images showed a form of reasoning termed by Goucher-Lambert and Cagan as 'inspired internal search,' during which significant areas of activation were observed in regions of the brain associated with insight and directing attention internally towards concepts retrieved from memory. In contrast, fMRI images associated with control stimuli demonstrated 'unsuccessful external search,' during which there was increased activation in brain regions associated with visual processing and directing attention outward. Rather than finding solutions through insight, participants were more likely to look actively for another solution by analyzing their external environment.

Curiously, far inspirational stimuli showed results of both near and control stimuli. While they shared the positive characteristics of near stimuli in that they allowed participants to produce more solutions through inspired internal search, far stimuli also activated regions associated with the unsuccessful external search similar to the control stimuli. This is likely because the far stimuli, being less associated with the problem statement, required the participants to create more connections before arriving at another solution.

Ultimately, this work has numerous applications in design research. In addition to aiding in the development of a design tool which might provide the right stimuli at the right time, allowing the designer to come up with the most novel and productive solutions, this research also reveals how we can better teach design and problem-solving. With this work accomplished, we are one step closer to creating approaches that empower designers to develop better solutions.

More information: Goucher-Lambert, K., Moss, J., & Cagan, J. (2018). A neuroimaging investigation of design ideation with and without inspirational stimuli—understanding the meaning of near and far stimuli. Design Studies. doi.org/10.1016/j.destud.2018.07.001

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