Cracking the Creativity Code

Chapter 10

ZiZoZi

for Creativity, Fun, and Success

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Chapter 10 The New Neuroscience of Zi/Zo/Zi

It all started with questions – by a Jewish mother, an American Nobel laureate physicist Isador Rabi, and an American physician, Dr. Raymond V. Damadian.

<u>Question One:</u> The late Nobel Laureate in Physics, Isador Rabi, ascribed his success to his mother. Most moms ask you, what did you learn in school today? he recounted. Rabi's mom asked him, Izzie, *what good questions did you ask in school today?*

> **A study by three Technion researchers led by Prof. Yoed Kenett formally explored the link between framing questions and creativity. They note: "Question asking has been a critical tool for teaching and learning since the time of Socrates and is important in the creative problem-solving process. Yet, its role in creativity has insofar not been thoroughly explored. The current study assessed the role of question asking in the creative process."[1] They find what startup entrepreneurs know well: Those who ask creative, unusual, complex questions tend to be more creative than others. Complex questions are a predictor of high creativity. Creative ideas often are born out of creative questions.**

<u>Question Two.</u> Rabi, who asked great questions, was part of a team at MIT that helped to develop a key component of radar, in WWII – a crucial breakthrough. His research on magnetic resonance (excitation of particles like atomic nuclei or electrons in a magnetic field) led to development of MRI, which uses a magnetic field and computer-generated radio waves that excite atoms in the body, to create detailed images of the organs and tissues of the body. *Rabi asked, what happens when molecules are 'excited' by a strong magnetic field, and then, allowed to 'relax' when the field is removed? How do the molecules resonate?*

Note that 'complex' does not necessarily mean complicated or long. A complex question can be one nobody else asks.

Question Three: Here is the question Dr. Damadian asked, that ultimately led to the MRI: "Can the magnetic properties of the body's atomic nuclei [pioneered by Rabi] be used to create a

[1] Tuval Raz, Roni Reiter-Palmon, Yoed N. Kenett, "The Role of Asking More Complex Questions in Creative Thinking." Psychology of Aesthetics, Creativity and the Arts, 2021.

diagnostic tool for medical imaging?" Nobody else dreamed of linking magnetic resonance with medical imaging.

Damadian's researched sodium and potassium in living cells. It led him to his first experiments with nuclear magnetic resonance (NMR), which caused him to first propose the magnetic resonance imaging (MRI) body scanner in 1969. Damadian discovered that tumors and normal tissue can be distinguished inside living human bodies, by nuclear magnetic resonance (NMR) because of their prolonged relaxation times. (Relaxation time is the time between the excitation of molecules by a strong magnetic field, and then the absence of such a field, causing the molecules to 'relax'.)

Damadian was the first to do a full-body scan of a human being in 1977 to diagnose cancer. Damadian invented the apparatus and method to use NMR safely and accurately to scan the human body, a method now known as magnetic resonance imaging (MRI)

And, perhaps, there is a fourth question. Can we use MRI to better understand how the brain works?

- **Functional magnetic resonance imaging or functional MRI (fMRI) measures brain activity by detecting changes associated with blood flow. This technique relies on the fact that cerebral blood flow and neuronal activation are closely related. When an area of the brain is in use, when we use it to think, recall or imagine -- blood flow to that region also increases. Parts of the brain that are highly active, e.g. in creative thinking, demand and receive a larger flow of blood. This 'extra' flow of blood can be seen on fMRI and shown in colors in photographs.**

This form of fMRI was discovered by Seiji Ogawa in 1990.[2] It is now widely used to map neural activity in the brain or spinal cord of humans or other animals by imaging the change in blood flow related to energy use by brain cells. Since the early 1990s, fMRI has come to dominate brain mapping research because it does not involve

[2] Seiji Ogawa is a Japanese biophysicist. He trained as an applied physicist in the University of Tokyo and got a Ph.D. in chemistry from Stanford. He worked for 33 years in biophysics research at AT&T Bell Laboratories in Murray Hill, New Jersey, a source of numerous creative breakthroughs.

the use of injections, surgery, the ingestion of substances, or exposure to ionizing radiation.[3]

Among other uses, fMRI has now been used widely to explore the inner working of the brain with respect to creative thinking. It confirms our Zi/ZoZi method and reveals that it is employed by our brains themselves.

> **Long before the invention of fMRI, the metaphor of the "zoom lens", it emerges, has been employed by neuroscientists more than 35 years ago. Erikson and St. James (1986) liken the distribution of attention [i.e., thinking about new ideas] to a "zoom lens that can narrow or widen the focus of attention….attention can be distributed both over a large area of the visual field and also function in a focused mode."**

Scott Barry Kaufman [2013] has written a clear summary of fMRI research on creative thinking. To our surprise and delight, it confirms the ZiZoZi Zoom In/Zoom Out approach. It emerges that not only is this a strong, effective, proven method for creative thinking – it is one that the brain itself employs!

Different brain regions engage in different tasks related to creativity, Kaufman explains. There are three key networks that are involved.

<u>Zoom In:</u> The "Executive Attention Network is recruited when a task requires that the spotlight of attention is focused like a laser beam. This network is active when you're concentrating on a challenging lecture, or engaging in complex problem solving and reasoning that puts heavy demands on working memory."

<u>Zoom Out:</u> "The Imagination Network is involved in 'constructing dynamic mental simulations based on personal past experiences such as used during remembering, thinking about the future, and generally *when imagining alternative perspectives and scenarios to the present'*.[4]

<u>Integrating Zoom In/Zoom Out:</u> "The Salience Network monitors both external events [Zoom Out] and the internal stream of

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[3] Source: Wikipedia, Functional Magnetic Resonance Imaging.

[4] See Buckner et al., 2019.

consciousness [Zoom In] and flexibly passes the baton to whatever information is most salient to solving the task at hand."

"The key to understanding the neuroscience of creativity", Kaufman explains, "lies not only in knowledge of large-scale networks, but in recognizing that different patterns of neural activation and deactivation are important *at different stages of the creative process.*"

Kaufman cites Jung et al. [2013]. They suggest that "when you want to loosen our associations, allow your mind to roam free, imagine new possibilities, and silence the inner critic, it's good to reduce activation of the Executive Attention Network (a bit, but not completely) [i.e., Zoom In] and increase activation of the Imagination and Salience Networks [i.e. Zoom Out]." Jung et al. suggest that research on jazz musicians and rappers engaging in creative improvisation "suggests that's precisely what is happening in the brain *while in a flow state*." However, Kaufman adds, sometimes "it's important to bring the Executive Attention Network back online, and critically evaluate and implement your creative ideas."

<u>Flow State</u>: Creativity is, especially for those really good at it, highly enjoyable. The brain rewards ideation with pleasure hormones. Psychologist Mihaly Csikszentmihalyi (2008, 2014) interviewed a very large number of creative people, in all realms of creativity (music, arts, literature, engineering), and describes the state in which creative ideas "flow" – bringing 'deep enjoyment'. Csikszentmihalyi asserts that 'flow' can be fostered and enhanced. "By ordering the information that enters our consciousness, we can discover true happiness and greatly improve the quality of our lives."

Perhaps, then, ZiZoZi is not just a method for enhancing creativity. Perhaps it is also a recipe for a more fulfilling way to live.

In this book, we describe this recipe as 'head in the clouds/feet on the ground'. Head in the clouds – wild ideas, brought by the brain's Imagination Network. Feet on the ground – pragmatic thinking about what is feasible and can be implemented, brought by the Executive Attention Network – and, as our integrator of Zoom in/Zoom out – the Salience Network, integrating the Imagination Network's wild ideas with the experience and wisdom of the Executive Attention Network.

Both Zoom Out and Zoom In are crucial. There are creative people who flash creative imaginative thinking (Zoom Out) but their ideas are never implanted. There are capable people who are practical implementers (Zoom In) – but their intense focus on practicality and feasibility kills wild ideas or even the possibility of having them. It is the integration of Zoom In/Zoom Out that brings both novel and useful ideas to the world.

Hellman's (2016) research supports this contention. "Innovation," he writes, "requires disengagement and divergent thinking *primarily mediated by frontal networks."* (Zoom Out). But "innovation also requires associative and convergent thinking" (Zoom In). Creative thinking requires "integration of highly distributed networks". Hellman notes that "people are often most creative when they are in mental states associated with reduced levels of brain norepinephrine, which may enhance the communication between distributed networks."

We are encouraged, and perhaps a bit surprised, to find how neuroscience and the fMRI mapping of brain activity support an innovation process we have used, taught and described in the previous eight chapters.

It turns out that the brain itself employs Zoom In/Zoom Out. This is of course not to say that there are are not a huge number of ways creative people find and implement novel ideas. But it does suggest that it is useful to consciously, purposefully employ a process that the brain itself employs, to change the world.

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