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# How Aha! Really Happens

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BY WILLIAM DUGGAN

## THE INNOVATORS



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**H**ow do companies innovate? Look at Google Inc., widely admired as a great innovator. The company offers toys in the lobby, beanbag chairs, game rooms, and time for employees to work on ideas of their own. Isn't that what other companies should do too?

The answer is no. These Google methods are derived from an inaccurate theory of creativity: that people need to turn off their analytical left brain and turn on their creative right brain to produce new ideas. In fact, the Google founders did not come up with the original idea for Google itself by using these methods. Instead, they applied a very different method, one that follows a more plausible theory of how the

brain produces creative ideas. Unfortunately, Google is just one of countless companies whose methods for innovation are woefully out of date.

Over the past decade, neuroscientists have come a long way in figuring out how ideas form in the human mind. As it turns out, their findings contradict how most companies understand and organize innovation. But very few executives know that. They continue applying their conventional wisdom, unaware that science has overturned it.

To understand the new model of the brain, and why it matters so much for business innovation, we must go back to 1981, when Roger Sperry won the Nobel Prize for his work on the two sides of the brain. According to Sperry, the right side

was creative, artistic, and intuitive, whereas the left side of the brain was analytical, logical, and rational. This split-brain model spread quickly throughout the business world, because it seemed to explain why some people came up with new ideas easily and others struggled. One might say, "I'm a right-brained person," or "Could you use your left brain on this?" or "We're a right-brained organization." The most widespread application of Sperry's model was creative brainstorming: People started scheduling meetings where everyone was supposed to turn off their left brains and turn on their right brains, and then let the creative ideas flow.

Today, brainstorming is nearly universal in business practice around the world. If you carefully study the reigning business methods for strategy, decision making, and problem solving, you find brainstorming at the same key step. For example, Michael Porter's famous "competitive strategy" has become nearly universal in business school teaching and in applications in companies. It is found under different names and with slight variations, but all the versions follow the same basic model: They tell you how to analyze your strategic situation, but they do not tell you how to come up with a strategic idea for what to do. After all, the subtitle of Porter's book *Competitive Strategy* (Free Press, 1980) is *Techniques for Analyzing Industries and Competitors*, not *How to Come Up with a Strategic Idea*. Once you come up with your idea, Porter will compare it to his analysis. But the step of coming up with the idea itself is up to you. He gives no guidance on how to do it.

In practice, here's how companies apply the strategy models that

follow from Porter: You conduct your strategic analysis, and then you get in a room and brainstorm. Same with other widespread methods of problem solving and decision making, where you typically (1) define the problem, (2) identify criteria, (3) gather and evaluate data, (4) list and evaluate alternatives, (5) select the best alternative, and (6) implement and follow up. But what exactly do you do in Step 4, to “list” an alternative — that is, to come up with an idea for what to do? The guidance is always the same: Brainstorm.

This reliance on brainstorming for coming up with the actual strategic idea can be found in many guides to business innovation, including *The Innovator’s Solution: Creating and Sustaining Successful Growth*, by Clayton Christensen and Michael E. Raynor (Harvard Business School Press, 2003); *Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant*, by W. Chan Kim and Renée Mauborgne (Harvard Business School Press, 2005); and Edward de Bono’s *Six Thinking Hats* (Little, Brown, 1985). Ultimately, when it comes time to move from analysis to action, these methods all rely on left–right brain division: turning off your logical side and turning on your creative side to generate ideas.

In other words, our most-accepted approach to problem solving is grounded in an incorrect premise about the source of creativity in the brain.

### How Creativity Works

Now let’s turn to the more accurate view of creativity, with its roots in modern science. The watershed year is 1998, when Brenda Milner, Larry

Squire, and Eric Kandel published a breakthrough article in the journal *Neuron*, “Cognitive Neuroscience and the Study of Memory.” Kandel won the Nobel Prize two years later for his contribution to this work. Since then, neuroscientists have ceased to accept Sperry’s two-sided brain. The new model of the brain

kinds of thought. Even a mathematical calculation requires the intuition part, to recall the symbols and formula previously learned in order to apply them to the problem.

When the pieces come off the shelf smoothly, in familiar patterns — such as simple addition you’ve done many times — you don’t even

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is “intelligent memory,” in which analysis and intuition work together in the mind in all modes of thought. There is no left brain; there is no right. There is only learning and recall, in various combinations, throughout the entire brain.

Neuroscientist Barry Gordon gives an overview of this newer model of the brain in his book *Intelligent Memory: Improve the Memory That Makes You Smarter* (Viking, 2003), with coauthor Lisa Berger. He portrays the everyday intelligent memory of human beings as the greatest inventory system on earth. From the moment you’re born, your brain takes things in, breaks them down, and puts them on shelves. As new information comes in, your brain does a search to see how it might fit with other information already stored in your memory. When it finds a match, the previous memories come off the shelf and combine with the new, and the result is a thought. The breaking down and storing process is analysis. The searching and combining is intuition. Both are necessary for all

realize it has happened. When lots of different pieces combine into a new pattern, you feel it as a flash of insight, the famous “aha!” moment. But the mental mechanism works the same way in both cases. Whether it’s working on a familiar formula or a new idea, intelligent memory combines analysis and intuition as learning and recall.

Just as the intelligent memory concept has replaced the old two-sided brain theory in neuroscience, companies need to replace brainstorming with methods that reflect more accurately how creative ideas actually form in the mind. And they don’t need to start from scratch. Once we understand how intelligent memory works, we find several existing techniques that fit. After all, human beings have innovated for eons. If we study how innovation actually happens, we can learn how to do it more reliably.

### Clausewitz and Motwani

Our best starting place is military strategy. Business strategy emerged from the military a century ago,

along with many other aspects of business life — such as the business suit from a military uniform and organization forms such as “divisions” and “war rooms.” The word *strategy* entered the English language from French in 1810 for direct military reasons: That was the height of success of Napoleon Bonaparte, who won more battles than any other general in the Western world in recorded history. His enemies, mostly the English and Germans, started studying how he did it so they could defeat him. There had been previous philosophical essays on strategy — in ancient India, China, and Greece, and in medieval Europe — but this was the first time strategy became an academic discipline in universities. And so was born the formal discipline of strategy that business has inherited today.

The greatest military scholar of that period was Carl von Clausewitz, a Prussian, whose lifetime of work led to the book *On War* in 1832. If we read *On War* with a knowledge of modern neuroscience, we see that Clausewitz offers useful guidance on how to apply intelligent memory to strategy. A great general gets a strategic idea as a *coup d'oeil*, which means “strike of the eye.” It’s a glance that shows you what to do — a flash of insight. Two steps precede the flash: “examples from history,” when you explicitly study what others have done before

you, and “presence of mind,” when you clear your brain of all expectations of solutions. In a clear mind, selected examples from history combine as insight. The last step is resolution, when the flash gives you the will to act on the idea despite the obstacles you face.

Examples from history are a form of intelligent memory. The shelves of the brain are stocked with what you’ve seen or heard or read about what others have done before.

relaxed and wandering, instead of focused on a particular problem. Incidentally, Brian scans of these masters also show this presence of mind and reveal it as a mental discipline you can learn.

You can find the four steps of Clausewitz — examples from history, presence of mind, flash of insight, resolution — in countless cases of genuine innovation in practice. Take Google, for instance. Let’s reconstruct how the original Google

## Were the Google founders working on search? No. At the time, nobody thought companies could make money from search engines alone.

This process takes place naturally in every human brain, but active study can accelerate and improve it, as Napoleon showed. He won his first battle at the siege of Toulon at the age of 24 without any previous military experience. But he was a thorough student of military history, and he combined elements from past battles to make up his winning strategy. The elements were not new, but his combinations were new. His thinking process exemplified the way in which intelligent memory produces creative ideas.

The presence of mind Clausewitz describes is akin to the calm state that precedes a flash of insight, which neuroscientists can now measure. Their subjects include Buddhist monks and other masters of meditation. That explains why you get your best ideas not in formal brainstorming meetings but in the shower, or driving, or falling asleep at night — when your brain is

guys, Larry Page and Sergey Brin, came up with their great idea. My source is *The Google Story*, by David A. Vise and Mark Malseed (Dela-corte, 2005).

The third founder of Google was Rajeev Motwani, a professor in the computer science department at Stanford University. Page and Brin were his graduate students. Were they working on search? Not at all. At the time, nobody thought that companies could make money from search engines alone. The prevailing idea was to create a portal, like Yahoo, where a combination of shopping, e-mail, search, news, and other features would keep people lingering on the same site for as long as possible. The portal owners would make money through banner and pop-up ads that looked like magazine pages and kept people on the site even longer.

Google would turn out to be a highly creative opposite to the

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portal business model. In a second or two, the searcher would get a result and click through to another site. But nobody understood that at the time, not even Motwani, Page, or Brin.

Instead, the trio was working on a more academic subject: applying data mining algorithms from bricks-and-mortar retail to e-commerce companies. They looked on the Internet for companies to study. They used AltaVista to search for them, because AltaVista was the best search engine at the time. It was the first to download an index of every page on the Internet on a huge array of computers and do a full-text search. One day, while Page was using AltaVista, he noticed something. On a search page, he could type in a URL and find other sites that linked to that URL. In a flash

new method. At this point, they thought they had a great topic for a dissertation in e-commerce. But they used up so much Stanford computer space and time that the university made them open their new software to everyone on campus. The users rapidly came back to tell them that this was a great search engine. So Page and Brin stopped working on their dissertation and started a search business.

Already, the founders of Google had had the presence of mind to combine existing elements and change their goal, according to where the combination led them. But that was not enough. Their new search engine still had no way to make money. They did not want to sell advertising, because banner ads and pop-ups would keep the user lingering too long at the search

problem. From there, Google took over the Internet.

The Google story is but one of countless examples of how strategic intuition — an idea for action — appears in practice. Once you understand intelligent memory and the four steps of Clausewitz, you see it time and time again. But how can companies transform this knowledge into innovation methods they can use from day to day? Once again, we don't have to reinvent the wheel. Instead, we find an example from history that we can adapt as needed.

### Harnessing Intelligent Memory

That example comes from General Electric Company. In the late 1990s, CEO Jack Welch and Chief Learning Officer Steve Kerr adopted the concept of making new combinations from existing elements as the basic problem-solving method for the whole company. They used a simple matrix that took the process of intelligent memory — what the brain does in flashes of insight — and turned it into a step-by-step team method.

A similar process step should come between strategic analysis and strategic planning at all levels of your company. In strategic analysis you study your situation, and in strategic planning you lay out how to implement the best course of action in your situation. But between these two steps is the most important, typically overlooked process of developing an idea for the best course of action. Analysis does not produce that, and planning before you have the idea is dangerous and counterproductive. Flashes of insight give you the idea for your strategy, and the GE matrix lets you harness the flashes of the

## Flashes of insight give you the idea for your strategy, and the General Electric matrix lets you harness the flashes of the whole team.

of insight, that realization combined with something else on the shelves of his mind — academic citations.

As an academic, Page knew that academic journals and publishers keep track of how many times other people cite their articles during a year. They rank authors according to the number of citations. Page thought of ranking websites the same way: Many citations would give a site a high rank. He told Brin, who adapted a data mining algorithm to do it. And they both cloned AltaVista on the Stanford computer system to try out their

engine site. The beauty of Google was to get you to the target site as fast as possible.

Then one day, while browsing the Internet again, Page noticed a site called Overture. The site sold advertising and displayed the ads as search results in a nice clean list on the right side of the page. Page experienced presence of mind and another flash of insight. He saw that instead of detracting from search, advertising could add a new dimension to it. He and Brin wrote a version of Overture and folded it into Google. That solved the money

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whole team.

Here's how it works. At the top of the matrix, write down your current understanding of the situation (always as a provisional draft, because your understanding might change). Then comes analysis: List in rows what actions you think you might need to take to succeed in the situation (these too are in draft form, because they also might change). Then ask the most important question you can ever ask to solve any problem of any kind: Has anyone else in the world ever made progress on any piece of this puzzle? List sources to search for an answer to this question, across the top, as columns (in draft again). The team then starts a treasure hunt. They search the sources for elements that might apply to the list of actions, trying to find a good combination.

This matches how your brain works when you have a flash of insight. Your mind wanders from piece to piece of the puzzle, searching its shelves for pieces that go together, and only when it finds them does it know what the full picture looks like. The GE matrix turns that process into a team exercise, and the shelves on which the pieces of the puzzle are located stretch across the whole world. As the team progresses, its members might restate the situation, revise the rows of actions, and change the columns of sources. That's exactly what your brain does before a flash of insight. And when does the team stop? When a combination strikes the members as promising. It usually happens in pieces, as people come in with connections that struck them overnight. Or they might spend weeks and come up with nothing at all. The process can't be forced. But the GE matrix helps

to keep it moving.

Over the years, companies have used many other techniques that parallel how intelligent memory produces creative ideas. For example, instead of brainstorming to generate creative ideas in an hour or two, some companies do "reverse brainstorming." The leaders tell their staff to bring to a meeting ideas they've had over the past week, for everyone to hear and think about. Unfortunately, these good practices are scattered among a much larger number of techniques based on the false notion of the left and right brain.

Eventually, we can expect more techniques based on the new science of intelligent memory to replace methods from the previous paradigm. Companies that get there first will have a distinct advantage. What innovation methods does your company use, and in which paradigm do they fit, the old view of the mind or the new? The race is on, and to the winner go the spoils. +

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