ANNALS OF IDEAS

GROUPTHINK

The brainstorming myth.

BY JONAH LEHRER

Repeated scientific debunking hasn't dented brainstorming's popularity.

In the late nineteen-forties, Alex Osborn, a partner in the advertising agency B.B.D.O., decided to write a book in which he shared his creative secrets. At the time, B.B.D.O. was widely regarded as the most innovative firm on Madison Avenue. Born in 1888, Osborn had spent much of his career in Buffalo, where he started out working in newspapers, and his life at B.B.D.O. began when he teamed up with another young adman he'd met volunteering for the United War Work Campaign. By the forties, he was one of the industry's grand old men, ready to pass on the lessons he'd learned. His book "Your Creative Power" was published in 1948. An amalgam of pop science and business anecdote, it became a surprise best-seller. Osborn promised that, by following his advice, the typical reader could double his creative output. Such a mental boost would spur career success—"To get your foot in the door, your imagination can be an open-sesame"—and also make the reader a much happier person. "The more you rub your creative lamp, the more alive you feel," he wrote.

"Your Creative Power" was filled with tricks and strategies, such as always carrying a notebook, to be ready when inspiration struck. But Osborn's most celebrated idea was the one discussed in Chapter 33, "How to Organize a Squad to Create Ideas." When a group works together, he wrote, the members should engage in a "brainstorm," which means "using the brain to storm a creative problem—and doing so in commando fashion, with each stormer attacking the same objective." For Osborn, brainstorming was central to B.B.D.O.'s success. Osborn described, for instance, how the technique inspired a group of ten admen to come up with eighty-seven ideas for a new drugstore in ninety minutes, or nearly an idea per minute. The brainstorm had turned his employees into imagination machines.

The book outlined the essential rules of a successful brainstorming session. The most important of these, Osborn said—the thing that distinguishes brainstorming from other types of group activity—was the absence of criticism and negative feedback. If people were worried that their ideas might be ridiculed by the group, the process would fail. "Creativity is so delicate a flower that praise tends to make it bloom while discouragement often nips it in the bud," he wrote. "Forget quality; aim now to get a quantity of answers. When you're through, your sheet of paper may be so full of ridiculous nonsense that you'll be disgusted. Never mind. You're loosening up your unfettered imagination—making your mind deliver." Brainstorming enshrined a no-judgments approach to holding a meeting.

Brainstorming was an immediate hit and Osborn became an influential business guru, writing such best-sellers as "Wake Up Your Mind" and "The Gold Mine Between Your Ears." Brainstorming provided companies with an easy way to structure their group interactions, and it became the most widely used creativity technique in the world. It is still popular in advertising offices and design firms, classrooms and boardrooms. "Your Creative Power" has even inspired academic institutes, such as the International Center for Studies in Creativity, at Buffalo State College, near where Osborn lived. And it has given rise to detailed pedagogical doctrines,

NISHANT CHOKSI

such as the Osborn-Parnes Creative Problem Solving Process, which is frequently employed by business consultants. When people want to extract the best ideas from a group, they still obey Osborn's cardinal rule, censoring criticism and encouraging the most "free-wheeling" associations. At the design firm IDEO, famous for developing the first Apple mouse, brainstorming is "practically a religion," according to the company's general manager. Employees are instructed to "defer judgment" and "go for quantity."

The underlying assumption of brainstorming is that if people are scared of saying the wrong thing, they'll end up saying nothing at all. The appeal of this idea is obvious: it's always nice to be saturated in positive feedback. Typically, participants leave a brainstorming session proud of their contribution. The whiteboard has been filled with free associations. Brainstorming seems like an ideal technique, a feel-good way to boost productivity. But there is a problem with brainstorming. It doesn't work.

The first empirical test of Osborn's brainstorming technique was performed at Yale University, in 1958. Forty-eight male undergraduates were divided into twelve groups and given a series of creative puzzles. The groups were instructed to follow Osborn's guidelines. As a control sample, the scientists gave the same puzzles to forty-eight students working by themselves. The results were a sobering refutation of Osborn. The solo students came up with roughly twice as many solutions as the brainstorming groups, and a panel of judges deemed their solutions more "feasible" and "effective." Brainstorming didn't unleash the potential of the group, but rather made each individual less creative. Although the findings did nothing to hurt brainstorming's popularity, numerous follow-up studies have come to the same conclusion. Keith Sawyer, a psychologist at Washington University, has summarized the science: "Decades of research have consistently shown that brainstorming groups think of far fewer ideas than the same number of people who work alone and later pool their ideas."

And yet Osborn was right about one thing: like it or not, human creativity has increasingly become a group process. "Many of us can work much better creatively when teamed up," he wrote, noting that the trend was particularly apparent in science labs. "In the new B. F. Goodrich Research Center"—Goodrich was an important B.B.D.O. client—"250 workers . . . are hard on the hunt for ideas every hour, every day," he noted. "They are divided into 12 specialized groups—one for each major phase of chemistry, one for each major phase of physics, and so on." Osborn was quick to see that science had ceased to be solitary.

Ben Jones, a professor at the Kellogg School of Management, at Northwestern University, has quantified this trend. By analyzing 19.9 million peer-reviewed academic papers and 2.1 million patents from the past fifty years, he has shown that levels of teamwork have increased in more than ninety-five per cent of scientific subfields; the size of the average team has increased by about twenty per cent each decade. The most frequently cited studies in a field used to be the product of a lone genius, like Einstein or Darwin. Today, regardless of whether researchers are studying particle physics or human genetics, science papers by multiple authors receive more than twice as many citations as those by individuals. This trend was even more apparent when it came to so-called "home-run papers"—publications with at least a hundred citations. These were more than six times as likely to come from a team of scientists.

Jones's explanation is that scientific advances have led to a situation where all the remaining problems are incredibly hard. Researchers are forced to become increasingly specialized, because there's only so much information one mind can handle. And they have to collaborate, because the most interesting mysteries lie at the intersections of disciplines. "A hundred years ago, the Wright brothers could build an airplane all by themselves," Jones says. "Now Boeing needs hundreds of engineers just to design and produce the engines." The larger lesson is that the increasing complexity of human knowledge, coupled with the escalating difficulty of those remaining questions, means that people must either work together or fail alone. But if brain-

storming is useless, the question still remains: What's the best template for group creativity?

In 2003, Charlan Nemeth, a professor of psychology at the University of California at Berkeley, divided two hundred and sixty-five female undergraduates into teams of five. She gave all the teams the same problem—"How can traffic congestion be reduced in the San Francisco Bay Area?"—and assigned each team one of three conditions. The first set of teams got the standard brainstorming spiel, including the no-criticism ground rules. Other teams—assigned what Nemeth called the "debate" condition—were told, "Most research and advice suggest that the best way to come up with good solutions is to come up with many solutions. Freewheeling is welcome; don't be afraid to say anything that comes to mind. However, in addition, most studies suggest that you should debate and even criticize each other's ideas." The rest received no further instructions, leaving them free to collaborate however they wanted. All the teams had twenty minutes to come up with as many good solutions as possible.

The results were telling. The brainstorming groups slightly outperformed the groups given no instructions, but teams given the debate condition were the most creative by far. On average, they generated nearly twenty per cent more ideas. And, after the teams disbanded, another interesting result became apparent. Researchers asked each subject individually if she had any more ideas about traffic. The brainstormers and the people given no guidelines produced an average of three additional ideas; the debaters produced seven.

Nemeth's studies suggest that the ineffectiveness of brainstorming stems from the very thing that Osborn thought was most important. As Nemeth puts it, "While the instruction 'Do not criticize' is often cited as the important instruction in brainstorming, this appears to be a counterproductive strategy. Our findings show that debate and criticism do not inhibit ideas but, rather, stimulate them relative to every other condition." Osborn thought that imagination is inhibited by the merest hint of criticism, but Nemeth's work and a number of other studies have demonstrated that it can thrive on conflict.

According to Nemeth, dissent stimulates new ideas because it encourages us to engage more fully with the work of others and to reassess our viewpoints. "There's this Pollyannaish notion that the most important thing to do when working together is stay positive and get along, to not hurt anyone's feelings," she says. "Well, that's just wrong. Maybe debate is going to be less pleasant, but it will always be more productive. True creativity requires some trade-offs."

Another of her experiments has demonstrated that exposure to unfamiliar perspectives can foster creativity. The experiment focussed on a staple of the brainstorming orthodoxy—free association. A long-standing problem with free association is that people aren't very good at it. In the early nineteen-sixties, two psychologists, David Palermo and James Jenkins, began amassing a huge table of word associations, the first thoughts that come to mind when people are asked to reflect on a particular word. (They interviewed more than forty-five hundred subjects.) Palermo and Jenkins soon discovered that the vast majority of these associations were utterly predictable. For instance, when people are asked to free-associate about the word "blue," the most likely first answer is "green," followed by "sky" and "ocean." When asked to free-associate about "green," nearly everyone says "grass." "Even the most creative people are still going to come up with many mundane associations," Nemeth says. "If you want to be original, then you have to get past this first layer of predictability."

Nemeth's experiment devised a way of escaping this trap. Pairs of subjects were shown a series of color slides in various shades of blue and asked to identify the colors. Sometimes one of the pair was actually a lab assistant instructed by Nemeth to provide a wrong answer. After a few minutes, the pairs were asked to free-associate about the colors they had seen. People who had been exposed to inaccurate descriptions came up with associations that were far more original. Instead of saying that "blue" reminded them of "sky," they came up with "jazz" and "berry pie." The obvious answer had stopped being their only answer. Even when alternative views are clearly wrong, being exposed to them still expands our creative potential. In a way, the power of dissent is the power of surprise. After hearing someone shout out an errant answer, we work to understand it, which causes us to reassess our initial assumptions and try out new perspectives. "Authentic dissent can be difficult, but it's always invigorating," Nemeth says. "It wakes us right up."

Criticism allows people to dig below the surface of the imagination and come up with collective ideas that aren't predictable. And recognizing the importance of conflicting perspectives in a group raises the issue of what kinds of people will work together best. Brian Uzzi, a sociologist at Northwestern, has spent his career trying to find what the ideal composition of a team would look like. Casting around for an industry to study that would most clearly show the effects of interaction, he hit on Broadway musicals. He'd grown up in New York City and attended his first musical at the age of nine. "I went to see 'Hair,' " Uzzi recalls. "I remember absolutely nothing about the music, but I do remember the nude scene. That just about blew my mind. I've been a fan of Broadway ever since."

Uzzi sees musicals as a model of group creativity. "Nobody creates a Broadway musical by themselves," he said. "The production requires too many different kinds of talent." A composer has to write songs with a lyricist and a librettist; a choreographer has to work with a director, who is probably getting notes from the producers.

Uzzi wanted to understand how the relationships of these team members affected the product. Was it better to have a group composed of close friends who had worked together before? Or did strangers make better theatre? He undertook a study of every musical produced on Broadway between 1945 and 1989. To get a full list of collaborators, he sometimes had to track down dusty old *Playbills* in theatre basements. He spent years analyzing the teams behind four hundred and seventy-four productions, and charted the relationships of thousands of artists, from Cole Porter to Andrew Lloyd Webber.

Uzzi found that the people who worked on Broadway were part of a social network with lots of interconnections: it didn't take many links to get from the librettist of "Guys and Dolls" to the choreographer of "Cats." Uzzi devised a way to quantify the density of these connections, a figure he called Q. If musicals were being developed by teams of artists that had worked together several times before—a common practice, because Broadway producers see "incumbent teams" as less risky—those musicals would have an extremely high Q. A musical created by a team of strangers would have a low Q.

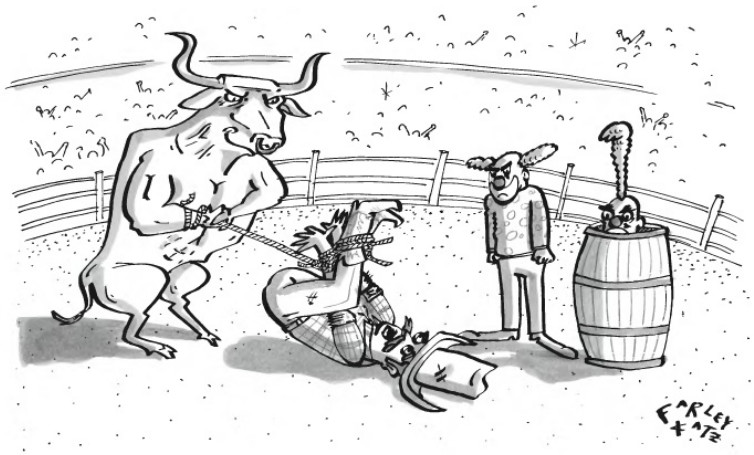
Uzzi then tallied his Q readings with information about how successful the productions had been. "Frankly, I was surprised by how big the effect was," Uzzi told me. "I expected Q to matter, but I had no idea it would matter this much." According to the data, the relationships among collaborators emerged as a reliable predictor of Broadway success. When the Q was low—less than 1.7 on Uzzi's five-point scale—the musicals were likely to fail. Because the artists didn't know one another, they struggled to work together and exchange ideas. "This wasn't so surprising," Uzzi says. "It takes time to develop a successful collaboration." But, when the Q was too high (above 3.2), the work also suffered. The artists all thought in similar ways, which crushed innovation. According to Uzzi, this is what happened on Broadway during the nineteen-twenties, which he made the focus of a separate study. The decade is remembered for its glittering array of talent—Cole Porter, Richard Rodgers, Lorenz Hart, Oscar Hammerstein II, and so on—but Uzzi's data reveals that ninety per cent of musicals produced during the decade were flops, far above the historical norm. "Broadway had some of the biggest names ever," Uzzi explains. "But the shows were too full of repeat relationships, and that stifled creativity."

The best Broadway shows were produced by networks with an intermediate level of social intimacy. The ideal level of Q—which Uzzi and his colleague Jarrett Spiro called the "bliss point"—emerged as being between 2.4 and 2.6. A show produced by a team whose Q was within this range was three times more likely to be a commercial success than a musical produced by a team with a score below 1.4 or above 3.2. It was also three times more likely to be lauded by the critics. "The best Broadway teams, by far, were those with a mix of relationships," Uzzi says. "These teams had some old friends, but they also had newbies. This mixture meant that the artists could interact efficiently—they had a familiar structure to fall back on—but they also managed to incorporate some new ideas. They were comfortable with each other, but they weren't too comfortable."

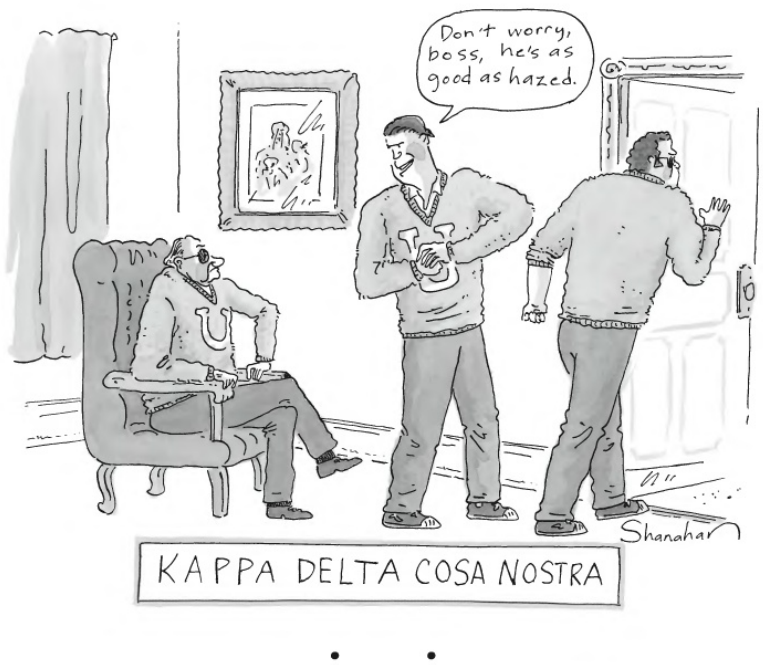
Uzzi's favorite example of "intermediate Q" is "West Side Story," one of the most successful Broadway musicals ever. In 1957, the play was seen as a radical departure from Broadway conventions, both for its focus on social problems and for its extended dance scenes. The concept was dreamed up by Jerome Robbins, Leonard Bernstein, and Arthur Laurents. They were all Broadway legends, which might make "West Side Story" look like a show with high Q. But the project also benefitted from a crucial injection of unknown talent, as the established artists realized that they needed a fresh lyrical voice. After an extensive search, they chose a twenty-five-year-old lyricist who had never worked on a Broadway musical before. His name was Stephen Sondheim.

A few years ago, Isaac Kohane, a researcher at Harvard Medical School, published a study that looked at scientific research conducted by groups in an attempt to determine the effect that physical proximity had on the quality of the research. He analyzed more than thirty-five thousand peer-reviewed papers, mapping the precise location of co-authors. Then he assessed the quality of the research by counting the number of subsequent citations. The task, Kohane says, took a "small army of undergraduates" eighteen months to complete. Once the data was amassed, the correlation became clear: when co-authors were closer together, their papers tended to be of significantly higher quality. The best research was consistently produced when scientists were working within ten metres of each other; the least cited papers tended to emerge from collaborators who were a kilometre or more apart. "If you want people to work together effectively, these findings reinforce the need to create architectures that support frequent, physical, spontaneous interactions," Kohane says. "Even in the era of big science, when researchers spend so much time on the Internet, it's still so important to create intimate spaces."

A new generation of laboratory architecture has tried to make chance encounters more likely to take place, and the trend has spread in the business world, too. One fanatical believer in the power of space to enhance the work of groups was Steve Jobs. Walter Isaacson's recent biography of Jobs records that when Jobs was planning Pixar's headquarters, in 1999, he had the building arranged around a central atrium, so that Pixar's diverse staff of artists, writers, and computer scientists would run into each other more often. "We used to joke that



"I'm sorry—this is literally my first rodeo."



• •

the building was Steve's movie," Ed Catmull, the president of both Disney Animation and Pixar Animation, says. "He really oversaw everything."

Jobs soon realized that it wasn't enough simply to create an airy atrium; he needed to force people to go there. He began with the mailboxes, which he shifted to the lobby. Then he moved the meeting rooms to the center of the building, followed by the cafeteria, the coffee bar, and the gift shop. Finally, he decided that the atrium should contain the only set of bathrooms in the entire building. (He was later forced to compromise and install a second pair of bathrooms.) "At first, I thought this was the most ridiculous idea," Darla Anderson, a producer on several Pixar films, told me. "I didn't want to have to walk all the way to the atrium every time I needed to do something. That's just a waste of time. But Steve said, 'Everybody has to run into each other.' He really believed that the best meetings happened by accident, in the hallway or parking lot. And you know what? He was right. I get more done having a cup of coffee and striking up a conversation or walking to the bathroom and running into unexpected people than I do sitting at my desk." Brad Bird, the director of "The Incredibles" and "Ratatouille," says that Jobs "made it impossible for you not to run into the rest of the company."

In the spring of 1942, it became clear that the Radiation Laboratory at M.I.T.—the main radar research institute for the Allied war effort—needed more space. The Rad Lab had been developing a radar device for fighter aircraft that would allow pilots to identify distant German bombers, and was hiring hundreds of scientists every few months. The proposed new structure, known as Building 20, was going to be the biggest lab yet, comprising two hundred and fifty thousand square feet, on three floors. It was designed in an afternoon by a local architecture firm, and construction was quick and cheap. The design featured a wooden frame on top of a concrete-slab foundation, with an exterior covered in gray asbestos shingles. (Steel was in short supply.) The structure violated the Cambridge fire code, but it was granted an exemption because of its temporary status. M.I.T. promised to demolish Building 20 shortly after the war.

Initially, Building 20 was regarded as a failure. Ventilation was poor and hallways were dim. The walls were thin, the roof leaked, and the building was broiling in the summer and freezing in the winter. Nevertheless, Building 20 quickly became a center of groundbreaking research, the Los Alamos of the East Coast, celebrated for its important work on military radar. Within a few years, the lab developed radar systems used for naval navigation, weather prediction, and the detection of bombers and U-boats. According to a 1945 statement issued by the Defense Department, the Rad Lab "pushed research in this field ahead by at least 25 normal peacetime years." If the atom bomb ended the war, radar is what won it.

Immediately after the surrender of Japan, M.I.T., as it had promised, began making plans for the demolition of Building 20. The Rad Lab offices were dismantled and the radio towers on the roof were taken down. But the influx of students after the G.I. Bill suddenly left M.I.T. desperately short of space. Building 20 was turned into offices for scientists who had nowhere else to go.

The first division to move into Building 20 was the Research Laboratory of Electronics, which grew directly out of the Rad Lab. Because the electrical engineers needed only a fraction of the structure, M.I.T. began shifting a wide variety of academic departments and student clubs to the so-called "plywood palace." By the nineteen-fifties, Building 20 was home to the Laboratory for Nuclear Science, the Linguistics Department, and the machine shop. There was a particle accelerator, the R.O.T.C., a piano repair facility, and a cell-culture lab.

Building 20 became a strange, chaotic domain, full of groups who had been thrown together by chance and who knew little about one another's work. And yet, by the time it was finally demolished, in 1998, Building 20 had become a legend of innovation, widely regarded as one of the most creative spaces in the world. In the postwar decades, scientists working there pioneered a stunning list of breakthroughs, from advances in high-speed photography to the development of the physics behind microwaves. Building 20 served as an incubator for the Bose Corporation. It gave rise to the first video game and to Chomskyan linguistics.

Stewart Brand, in his study "How Buildings Learn," cites Building 20 as an example of a "Low Road" structure, a type of space that is unusually creative because it is so unwanted and underdesigned. (Another example is the Silicon Valley

garage.) As a result, scientists in Building 20 felt free to remake their rooms, customizing the structure to fit their needs. Walls were torn down without permission; equipment was stored in the courtyards and bolted to the roof. When Jerrold Zacharias was developing the first atomic clock, working in Building 20, he removed two floors in his lab to make room for a three-story metal cylinder.

The space also forced solitary scientists to mix and mingle. Although the rushed wartime architects weren't thinking about the sweet spot of Q or the importance of physical proximity when they designed the structure, they conjured up a space that maximized both of these features, allowing researchers to take advantage of Building 20's intellectual diversity.

Room numbers, for instance, followed an inscrutable scheme: rooms on the second floor were given numbers beginning with 1, and third-floor room numbers began with 2. Furthermore, the wings that made up the building were named in an unclear sequence: B wing gave onto A wing, followed by E, D, and C wings. Even longtime residents of Building 20 were constantly getting lost, wandering the corridors in search of rooms. Those looking for the Ice Research Lab had to walk past the military recruiting office; students on their way to play with the toy trains (the Tech Model Railroad Club was on the third floor, in Room No. 20E-214) strolled along hallways filled with the latest computing experiments.

The building's horizontal layout also spurred interaction. Brand quotes Henry Zimmerman, an electrical engineer who worked there for years: "In a vertical layout with small floors, there is less research variety on each floor. Chance meetings in an elevator tend to terminate in the lobby, whereas chance meetings in a corridor tended to lead to technical discussions." The urban theorist Jane Jacobs described such incidental conversations as "knowledge spillovers." Her favorite example was the rise of the automobile industry in Detroit. In the eighteen-twenties, the city was full of small shipyards built for the flour trade. Over time, the shipyards became centers of expertise in the internal-combustion engine. Nearly a century later, those engines proved ideal for powering cars, which is why many pioneers of the automotive industry got their start building ships. Jacobs's point was that the unpredictable nature of innovation meant that it couldn't be prescribed in advance.

Building 20 was full of knowledge spillovers. Take the career of Amar Bose. In the spring of 1956, Bose, a music enthusiast, procrastinating in writing his dissertation, decided to buy a hi-fi. He chose the system with the best technical specs, but found that the speakers sounded terrible. Bose realized that the science of hi-fi needed help and began frequenting the Acoustics Lab, which was just down the hall. Before long, Bose was spending more time playing with tweeters than he was on his dissertation. Nobody minded the interloper in the lab, and, three years later, Bose produced a wedge-shaped contraption outfitted with twenty-two speakers, a synthesis of his time among the engineers and his musical sensibility. The Bose Corporation was founded soon afterward.

A similar lesson emerges from the Linguistics Department at M.I.T., which was founded by Morris Halle, in the early fifties. According to Halle, he was assigned to Building 20 because that was the least valuable real estate on campus, and nobody thought much of linguists. Nevertheless, he soon grew fond of the building, if only because he was able to tear down several room dividers. This allowed Halle to transform a field that was often hermetic, with grad students working alone in the library, into a group exercise, characterized by discussion, Socratic interrogation, and the vigorous exchange of clashing perspectives. "At Building 20, we made a big room, so that all of the students could talk to each other," Halle remembers. "That's how I wanted them to learn."

One of Halle's first recruits was Carol Chomsky, a young scholar who was married to a Harvard grad student named Noam Chomsky, also a linguist. Halle encouraged Chomsky to apply for an open position at M.I.T., and in 1955 he joined the linguistics faculty at Building 20. For the next several decades, Halle and Chomsky worked in adjacent offices, which were recalled by a colleague as "the two most miserable holes in the whole place." Although the men studied different aspects of language—Chomsky focussed on syntax and grammar, and Halle analyzed the sounds of words—the men spent much of their day talking about their work. "We became great friends," Halle says. "And friends shouldn't be shy about telling each other when they are wrong. What am I supposed to do? Not tell him he's got a bad idea?"

After a few years at M.I.T., Chomsky revolutionized the study of linguistics by proposing that every language shares a "deep structure," which reflects the cognitive structures of the mind. Chomsky's work drew from disparate fields—biology, psychology, and computer science. At the time, the fields seemed to have nothing in common—except the hallways of Building 20. "Building 20 was a fantastic environment," Chomsky says. "It looked like it was going to fall apart. But it was extremely interactive." He went on, "There was a mixture of people who later became separate departments interacting informally all the time. You would walk down the corridor and meet people and have a discussion."

Building 20 and brainstorming came into being at almost exactly the same time. In the sixty years since then, if the studies are right, brainstorming has achieved nothing—or, at least, less than would have been achieved by six decades' worth of brainstormers working quietly on their own. Building 20, though, ranks as one of the most creative environments of all time, a space with an almost uncanny ability to extract the best from people. Among M.I.T. people, it was referred to as "the magical incubator."

The fatal misconception behind brainstorming is that there is a particular script we should all follow in group interactions. The lesson of Building 20 is that when the composition of the group is right—enough people with different perspectives running into one another in unpredictable ways—the group dynamic will take care of itself. All these errant discussions add up. In fact, they may even be the most essential part of the creative process. Although such conversations will occasionally be unpleasant—not everyone is always in the mood for small talk or criticism—that doesn't mean that they can be avoided. The most creative spaces are those which hurl us together. It is the human friction that makes the sparks. ♦

NEWYORKER.COM/GO/OUTLOUD
A conversation with Jonah Lehrer.