

The Goldilocks network



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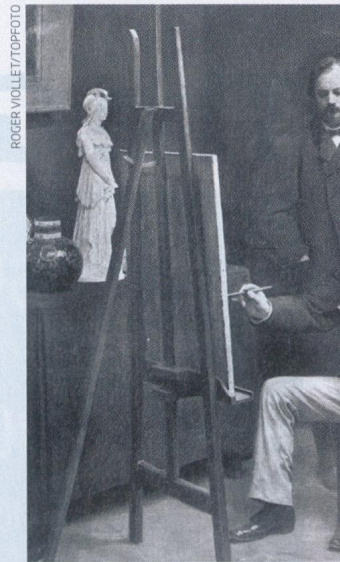
The world's greatest artists and scientists were spurred on by brilliant peers. Now you can cheat and boost your creativity by ensuring that your social circles contain just the right mix of people, finds Zella King

MATHEMATICIANS don't play the Kevin Bacon game; they talk about their Erdős number. To find it, they trace the degrees of separation between their own publications and those of maths legend Paul Erdős, in much the same way you might try to connect any given actor to Kevin Bacon by stringing together a succession of films. Erdős was one of the most prolific scientists who ever lived, publishing in far-flung disciplines ranging from probability to topology.

His status as a hub of scientific ingenuity is turning out to be a key part of what researchers are beginning to discover about the creative process. Of all the ways to boost your creativity – from drinking a glass of red wine to painting your walls blue – perhaps none has been as well studied as the influence of your social circles when it comes to finding solutions to hard problems. Almost all great artists and scientists travelled in rarefied circles of people, who shaped and melded

Picasso's inner circle was comprised of painters, polymaths and a muse called Paquerette

their ideas. William Wordsworth's work was sparked by his association with the other romantic poets; the Impressionist painters worked as a group; Pablo Picasso and Georges Braque formed the Cubists; and Charles Darwin hung out with influential geologist Charles Lyell and Charles Babbage, the father of the computer. The social circles in which >



these artists and scientists moved seemed to foster the free-flowing ideas from which great movements and discoveries sprang.

Could similarly powerful springs of creativity be available to the rest of us? Technology may offer us an opportunity to apply insights from creativity research by tapping into our social networks to mimic the fertile social circles of these artists and scientists. But there is a trick to it.

Creativity has famously resisted attempts to study it, and that is partly because a single definition is so elusive. What do we mean by creativity?

Like it or not, business is responsible for a fair amount of research into creativity. At Henley Business School, where I teach, we use a criterion defined in the 1950s by US psychologist J. P. Guilford: the ability to solve a thorny problem by finding a solution that no one else has thought of before.

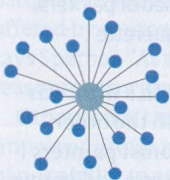
You can't engineer these lightning strikes of inspiration. But you can lay the groundwork, and creativity research has zeroed in on the specific traits of the social groups of great artists, scientists and inventors that made them a fertile environment for new ideas. The constant tension between alien perspectives and familiar faces seems to be key. Take Johannes Gutenberg's invention of the printing press. He was a goldsmith, but his connections to wine-makers enabled him to see the potential of the screw press for printing.

The idea that strangers can be the source of bold flashes of inspiration makes intuitive sense, and science backs it up. In 2004, Ronald Burt, a sociologist at the University of Chicago, showed that if you belong to several unrelated social groups you are in a good position to uproot ideas from one and use them in another (*American Journal of Sociology*, vol 110, p 349).

Where many unrelated groups are

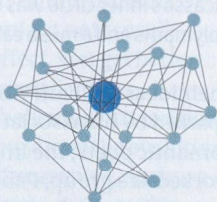
Social structures

OUTSIDER



Having links to many unconnected networks can allow new ideas to flow

INSIDER



When a social network contains too many people who know each other, it can stifle ideas

connected by a few people, a network can begin to develop "small world" properties. This kind of structure is repeated across a surprising range of systems – including scientific collaboration, film-making, power grids, worms' brains, and even memory itself (*Nature*, vol 393, p 440). A small-world network allows information to travel quickly between any two unconnected people by way of a very short chain of intermediaries.

If that sounds like the Kevin Bacon game again, there is good reason. The people who connect far-flung groups to create small-world

"They key seems to be the right mix of insiders and outsiders, and neither too many nor too few of each. But what defines this Goldilocks zone?"

networks are "hubs" or superconnectors. Your Erdős number is the number of "hops" that connects you to Erdős. If you co-authored a paper with him, you are among the 509 people with an Erdős number of 1. If you co-authored a paper with someone with an Erdős number of 1, your Erdős number is 2, an honour you share with 4500 people. Thanks to the exponential increase in connectivity of a small-world network, only a minority of published mathematicians have an Erdős number in the single digits.

As the game shows, a few hubs can profoundly affect how far and fast information can travel in a small-world network. But a small-world network isn't just about strangers. Our friends matter, too.

Would Isaac Newton have conceived his theories without his network of colleagues, associates and rivals? In work published in 1992, Dean Simonton, a psychologist at the University of California, Davis, sifted through the correspondence of more than 2000 eminent scientists and inventors and mapped the links between their relationships. He found that Newton was stimulated and provoked by 25 scientists of his time, including Gottfried Leibniz, Edmond Halley and Jacob Bernoulli. Interactions with these rivals, confidants and correspondents was crucial for shaping the consequent passage of Newton's ideas into history (*Personality and Social Psychology Bulletin*, vol 18, p 452).

Most people's social networks are composed primarily of dense clusters of these close acquaintances. We trust them to act both as fans and critics of our new ideas, reinforcing and developing some aspects and dismantling others. The conformity of a close-knit group

helps batter an idea into coherent shape. But they don't often introduce us to new ideas.

It took an unusual experiment to confirm the existence of a creative "Goldilocks zone" for social networks. Brian Uzzi, a sociologist at Northwestern University in Evanston, Illinois, looked at how the relationships between artists involved in Broadway musicals between 1877 and 1989 affected box office sales (*Science* vol 308 p 697).

Uzzi and Jarrett Spiro, at Stanford University in California, analysed how often everyone involved in each musical had worked together on previous projects. They uncovered an intriguing relationship: too many strangers dampened the free exchange of ideas. But too many close friends created an atmosphere in which ideas were born of inside references and so only appealed to a limited audience.

That had consequences. In the 1920s, for example, Uzzi found that the people working on Broadway came from an unusually small and interconnected pool, so most productions only involved close friends. Musical theatre hit a low point with a "flop" rate of 87 per cent (*Journal of Physics A: Mathematical and Theoretical*, vol 41 p 224023).

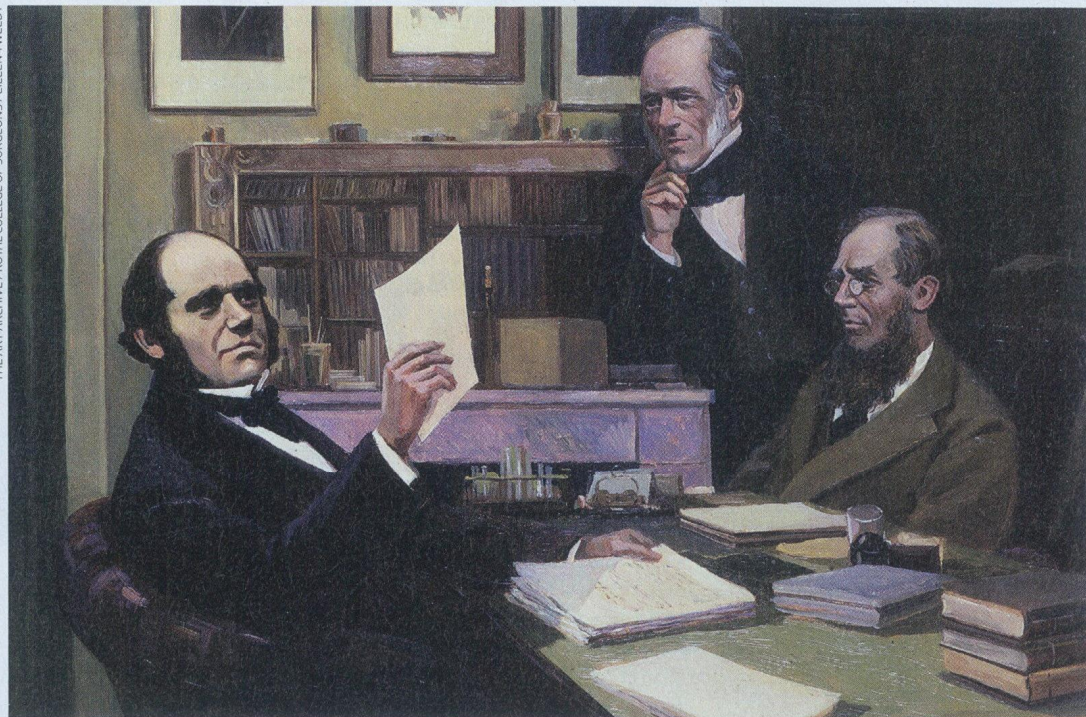
But Uzzi and Spiro showed that when the mix was right, the links between different social clusters served to spark radically new conventions that resonated with audiences. A good ratio resulted in some of the 20th century's most critically successful musicals, such as *West Side Story* (*American Journal of Sociology*, vol 111, p 447).

The ratio was a quantity called Q . Although they called it the "familiarity index", Q isn't just a straightforward percentage of friends and strangers. Instead, it's a measure of just



THE ART ARCHIVE / ROYAL COLLEGE OF SURGEONS / EILEEN TWEDDY

The Impressionists (above) and Darwin changed the world, but they didn't do it alone



how clustered a group is, or the extent to which any two people connected to the same person are also likely to be connected to each other. When the Q score was too high, it meant that people had been working together on one musical after another, cloistered with others who had also worked together before, reducing their openness to fresh ideas. But when the Q was too low, teams weren't sufficiently connected to let ideas flow.

The research showed how small-world networks foster the flow of new ideas and batter them into shape. Now, online social networking raises the possibility of applying some of these insights.

Before everyone had access to the internet and online social networks, a social circle made up of lots of strangers would have been self-contradictory, except if you were part of the scientific or artistic elites. But then came Twitter, Facebook, blogs and social bookmarking websites such as reddit and Pinterest, which let you eavesdrop on the conversations of luminaries and strangers.

By itself, the act of signing up for Facebook, Twitter or a Google+ account does little to improve anyone's creativity. Take a scattergun approach to eavesdropping on strangers, and you might drown in the tide of disorganised information. Most of us react to this information overload by focusing only on what is already familiar. We find it easier to interact with people who are familiar, especially in situations that give us plenty of choices (*Group Processes and Intergroup Relations*, vol 15, p 119). This leads to the clustered shape that characterised so many of our social networks (see diagram, left).

To help you understand whether you're

embedded in an echo chamber of people who all know each other, visualisations can give you a rough sense of your Q score. Apps such as TouchGraph and InMaps provide a "map" of your Facebook or LinkedIn connections.

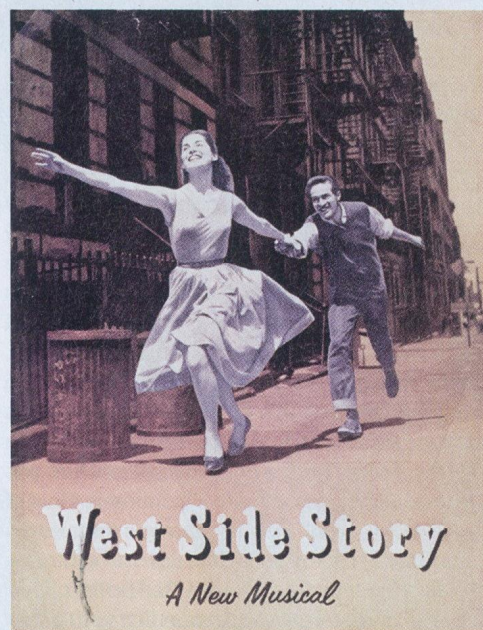
Tune your Q

One way to pepper your social network with the right strangers is by finding the right superconnectors. To find them, you might start by focusing on the problem you're trying to solve, and then seek out the people who share that interest. On Twitter, for example, the hash tag #creativity will turn up other people who are interested in the topic. The links and connections in their tweets will lead you to second-order strangers who might introduce you to magazines, journals and blogs you would never have known about.

Theoretically, the internet can give you access to a limitless number of interesting strangers. But how many should you be listening to? Anthropologist Robin Dunbar of the University of Oxford has placed the upper limit on this number at a puny 150. And in practice, the ones you actually have the time to get ideas from is probably closer to 50.

If you can keep your universe from collapsing to those 50 people, you'll avoid falling into the insider trap that characterises social circles with a high Q. The best way to do this is by periodically replacing 25 per cent of your usual news sites, blogs or Twitter feeds. Replacing is key: our limited attention span requires a revolving-door approach.

After all that, don't forget about your local social network. The internet lets you gather novel snippets in unknown social territory.



West Side Story
A New Musical

But it is the people around you – in your office, lab or school – who will help you translate these snippets into the real world. Their input will develop the strengths and iron out the weaknesses in your ideas.

Of course, there are those who will groan at the prospect of co-opting their social circles in the joyless pursuit of self-improvement.

They can take comfort in the knowledge that creativity research has done nothing to puncture the notion of the role of individual genius. It has simply proposed that, like Kevin Bacon, few who accomplished great things did so entirely alone. ■

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