PSYCHOLOGY

Searching for the Google Effect on People's Memory

Four years ago, Betsy Sparrow became exasperated watching an old black-and-white film called *Gaslight*. She recognized the young actress playing the maid but couldn't remember her name. Luckily, she had her smartphone. "I found the answer* online immediately," she says, and the relief was palpable.

That incident sparked a conversation with her husband that continued into the night. "How did we use to remember things like this before the Internet?" wondered Sparrow, who at the time was a psychology graduate student at Harvard University.

In a study (http://scim.ag/B-Sparrow) reported online this week in *Science*, the now assistant professor at Columbia University doesn't directly answer that question. But in four cleverly designed experiments, Sparrow and her colleagues do explore how the Internet may be changing the way people handle such information now. The results, she says, support a growing belief that people are using the Internet as a personal memory bank: the so-called Google effect. What surprised Sparrow most was not people's reliance on nonmemorized information but their ability to find it. "We're remarkably efficient," she says.

Sparrow says her movie trivia failure reminded her of a concept called transactive memory, proposed 30 years ago by her Ph.D. adviser Daniel Wegner. According to the theory, people divide the labor of remembering certain types of shared information. For example, a husband might rely on his wife to remember significant dates, while she relies on him to remember the names of distant friends and family—and this frees both from duplicating the memories in their own brains. Sparrow wondered if the Internet is filling this role for everyone, representing an enormous collective act of transactive memory.

To test this idea, Sparrow devised a series of offline experiments to catch people in the act of relying on future access to information—say, a Google search—rather than memorizing the information themselves. "I didn't want them to actually have access to the information but just think that they would," she says. For the first set of experiments, which involved 106 Harvard undergraduates working on desktop computers, Sparrow tested whether people thought of the Internet as soon as they were posed true-false questions such as, "An ostrich's eye is bigger than its brain." She employed a psy-
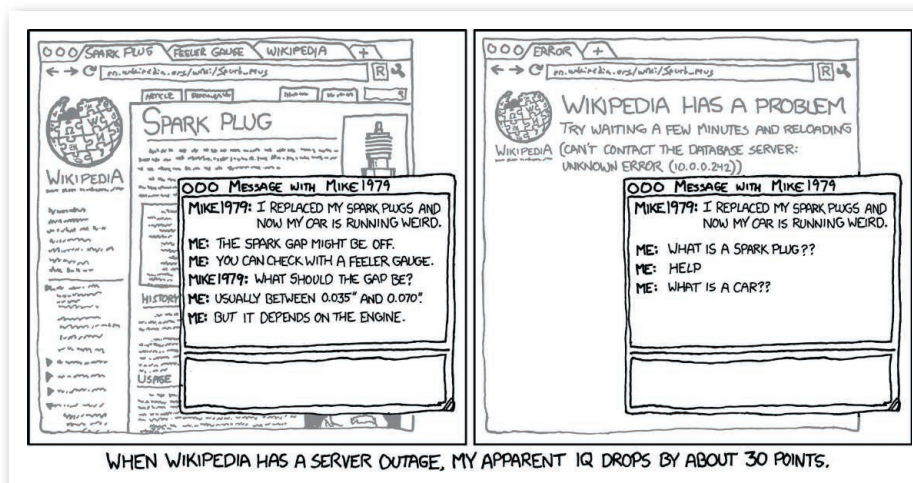
External brain. There's a growing belief, illustrated in this xkcd comic, that people have become more dependent on online information, but few studies have directly examined this.

chological method called a Stroop task. After the trivia questions were posed, various colored words would appear on the screen. When those words matched topics that people were already thinking about, they tended to react more slowly when asked to name the words' colors. And indeed, when the colored words were Internet-related, such as Google or Yahoo, the students answered more slowly, indicating that they were already considering going online for answers.

Then Sparrow played a trick on her subjects. She presented 40 different trivia statements to the students and had them type the factoids on the computer. She told half of the group in advance that the computer would save what they had written so they could see it later; she told the other half that the computer would erase it. Then all of the students were challenged to write down the statements from memory. Those who had been told that the computer would erase their notes had by far the best memory of the statements, as if their brains had made an emergency backup. Those who were expecting to retrieve the information later performed more poorly.

In a further set of experiments with 62 Columbia students, Sparrow tested whether that backup memorization comes at a cost. She again posed trivia questions but allowed the students to type notes. Some were told after each note that it would be saved in one of six computer folders with labels such as "Facts" or "Items," while others were told it would be erased. Then she showed the students a list of the statements, with several of them modified, and asked them to identify if

any had been altered. In a different version of the experiment, subjects were asked to remember where the information had been saved on the computer.

In both cases, the students who had been told that their notes would be erased again had the most accurate memory of the information. But the most strikingly accurate recall was for the location of information on the computer. For example, when posed the question, "What folder was the statement about the ostrich saved in," students easily answered correctly. In short, Sparrow says, they were better at remembering where information was stored than the information itself.

The study is "convincing," and "there is no doubt that our strategies are shifting in learning," says Roddy Roediger, a psychologist at Washington University in St. Louis, Missouri. "Why remember something if I know I can look it up again? In some sense, with Google and other search engines, we can offload some of our memory demands onto machines." But Roediger says this trend started long before the Internet. "When I was a student, many years ago, we consulted books and encyclopedias to write papers. Now students can do it at home on computers. Is that a bad thing? I don't think so."

Our increasingly information-rich environment may, Roediger suggests, even be stimulating minds enough to account for the mysterious Flynn effect, the gradual increase in IQ scores observed over the past century. Never heard of it? Don't worry, Roediger says: "There is a Wikipedia article about it."

–JOHN BOHANNON

*The *Gaslight* actress? An 18-year-old Angela Lansbury. Did you already look online?