

PSYCHOLOGY

How Google Is Changing Your Brain

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For millennia humans have relied on one another to recall the minutiae of our daily goings-on.

Now we rely on “the cloud”—and it is changing how we perceive and remember the world around us

A couple receives an invitation to a birthday party. Through long experience, each intuitively knows what to do next. One partner figures out whether the dress code is formal or casual. The other makes a mental note of the time and place of the gathering so that they don't forget.

To some degree, we all delegate mental tasks to others. When presented with new information, we automatically distribute responsibility for remembering facts and concepts among members of our particular social group, recalling some things on our own and trusting others to remember the rest. When we can't remember the right name or how to fix a broken machine, we simply turn to someone else charged with being in the know. If your car is making a clunking noise, you call Ray, your gearhead friend. Can't remember who starred in *Casablanca*? Marcie, the movie buff, knows. All types of knowledge, from the prosaic to the arcane, get apportioned among members of the group, whether the social unit in question is a married couple or the accounting department of a multinational corporation. In each case, we don't only know the information stored within our own minds; we also “know” what kinds of information other members of our social group are entrusted with remembering.

This divvying up avoids needless duplication of effort and serves to expand the memory capacity of the group as a whole. When we off-load responsibility for specific types of information to others, we free up cognitive resources that otherwise would have been used to remember this information; in exchange, we use some of these resources to increase our depth of knowledge in the areas for which we are responsible. When group members share responsibility for information, each member has access to knowledge both broader and deeper than could be obtained alone. Distributed memory binds the group together—any one individual is incom-

plete without being able to draw on the collective knowledge of the rest of the group. If separated, our birthday couple would be at a loss: one partner might wander the streets in top hat and tails while the other would arrive at the party on time wearing a sweatshirt.

This tendency to distribute information through what we call a “transactive memory system” developed in a world of face-to-face interactions, one in which the human mind represented the pinnacle of information storage. Yet this world no longer exists. With the development of the Internet, the human mind has been reduced from a powerhouse to an also-ran.

Inviting the iPhone’s Siri into one’s social group changes everything. Our work suggests that we treat the Internet much like we would a human transactive memory partner. We off-load memories to “the cloud” just as readily as we would to a family member, friend or lover. The Internet, in another sense, is also unlike a human transactive memory partner; it knows more and can produce this information more quickly. Almost all information today is readily available through a quick Internet search. It may be that the Internet is taking the place not just of other people as external sources of memory but also of our own cognitive faculties. The Internet may not only eliminate the need for a partner with whom to share information—it may also undermine the impulse to ensure that some important, just learned facts get inscribed into our biological memory banks. We call this the Google effect.

A NEW PARTNER

ONE RECENT EXPERIMENT from our group demonstrated the extent to which the Internet is beginning to replace a friend or family member as a companion in sharing the daily tasks of remembering. Betsy Sparrow of Columbia University, Jenny Liu, then at the University of Wisconsin–Madison, and one of us (Wegner) asked participants to copy 40 memorable factoids into a computer (for example: “An ostrich’s eye is bigger than its brain”). Half of the people in the experiment were told that their work would be saved on the computer; the other half were told that it would be erased. Additionally, half of each group was asked to remember the information, whether or not it was being recorded by the computer.

We found that those who believed the computer had saved the list of facts were much worse at remembering. People seemed to treat the computer like the transactive memory partners that we started studying decades ago: off-loading information to this cloud mind rather than storing it internally. Strikingly, this tendency persisted when people were explicitly asked to keep the information in mind. It seems that the propensity for off-loading information to digital sources is so strong that people are often unable to fix details in their own thoughts when in the presence of a cyberbuddy.

Another of our group’s experiments looked at how quickly we turn to the Internet when trying to answer a question. To test this idea, we used what psychologists call a Stroop task,

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Adrian F. Ward received his Ph.D. in psychology at Harvard with Wegner as his adviser. His dissertation focused on ways people blur the boundaries between the Internet and the self. He is now a senior research associate at the University of Colorado at Boulder.



wherein participants examine a series of words in different colors and must identify the color of each word while disregarding the meaning of the word. By measuring how quickly they name each word’s color, we can tell to what extent each word captures their attention. If they are relatively slow to name the color, we assume the meaning of the word is relevant to something they are thinking about. For example, people who have been deprived of food for 24 hours are slower to name the color of a word for a particular food relative to people who are well fed. Because food-related words are relevant to the subjects’ current needs, these words are nearly impossible to ignore and consequently elicit slow reaction times.

In our experiment, participants completed two Stroop tasks: one after responding to easy trivia questions and another after trying to respond to hard ones. The words in these Stroop tasks were related either to the Internet—Google in red letters or Yahoo in blue, for instance—or to general brand names—Nike in yellow or Target in green, among others.

AN ALL-KNOWING FRIEND

WE FOUND a particularly striking effect after asking hard trivia questions—that is, questions participants could not answer on their own (for instance, “Do all countries have at least two colors in their flags?”). People slowed significantly in answering the color of Internet-related words but not general brand-related names, suggesting that the Internet comes to mind quickly when people do not know the answer to a question. Apparently, when we are faced with requests for information we do not know, our first impulse is to think of the Internet—our all-knowing “friend” that can provide this information to us after a simple tap of the finger or effortless voice command. As we off-load responsibility for many types of information to the Internet, we may be replacing other potential transactive memory partners—friends, family members and other human experts—with our ever present connection to a seemingly omniscient digital cloud.

In many ways, this transition from distributing information among members of a transactive social network of friends and

IN BRIEF

Remembering is traditionally a social enterprise. One person knows how to cook a turkey. A partner recalls how to fix the leak in the sink.

The Internet changes everything. With nearly ubiquitous online access, many people may first perform a smartphone search rather than calling a friend.

Being online all the time changes the subjective sense of self as borders between personal memories and information distributed across the Internet start to blur.

acquaintances to the digital cloud makes sense. On the face of it, the petabytes dispersed throughout the Internet bear some resemblance to what is in a friend's head. The Internet stores information, retrieves it in response to questions and even interacts with us in surprisingly human ways, remembering our birthday and even responding to voice commands.

In other ways, the Internet is not like any person we have ever met before—it is always present, is always on and knows virtually everything. The information you can get to with a smartphone is vastly greater in scope than can be stored by any single person—or, many times, entire groups. It is always up-to-date, and, barring a power blackout, it is not subject to the distortion and forgetfulness that afflicts the memories ensconced inside our heads.

The Internet's astounding efficiency contrasts sharply with older search methods. Asking friends for information often requires tracking them down, hoping they know the desired fact, and waiting through hemming, hawing and a throat clearing or two as they search their own memories for an answer. Similarly, finding information in a book may involve driving to a library,

The information retrieved from the Internet now arrives sometimes more quickly than what we pull out of our own memories.

fumbling through a card catalogue and wandering through shelves before the desired material is finally located. The very act of seeking a fact or quotation from an acquaintance or a reference book emphasizes our reliance on external information sources.

Google and Wikipedia have changed all that. The distinction between the internal and the external—what resides in our minds as opposed to what a friend knows—changes radically when the confidant is the Internet. The information retrieved from the Internet now arrives sometimes more quickly than what we can pull out of our own memories. The immediacy with which a search result pops onto the screen of a smartphone may start to blur the boundaries between our personal memories and the vast digital troves distributed across the Internet. We recently performed experiments at Harvard University to test the extent to which people incorporate the Internet into a subjective sense of self. In this study, we again tried to ascertain how our thoughts turn readily to search engines when confronted with a trivia question. Before conducting the research, we devised a scale measuring how people assess the capability of their own memories. Someone who agrees with the statements “I am smart” and “I am good at remembering things” may be said to have high cognitive self-esteem.

Next we asked people to answer trivia questions with or with-

out the assistance of Google and then asked them to rate themselves on this scale. Cognitive self-esteem was significantly higher for those who had just used the Internet to search for answers. Incredibly, even though answers came verbatim from a Web site, people in the study had the illusion that their *own* mental capacities had produced this information, not Google.

To ensure that people had not felt smarter simply because they were able to answer more questions with the assistance of Google, we followed with a similar study in which those who did not use the search engine received false feedback that they had given the right answers to almost all the trivia questions. Even when participants in both groups believed they had performed equally well, those who had used the Internet reported feeling smarter.

These results hint that increases in cognitive self-esteem after using Google are not just from immediate positive feedback that comes from providing the right answers. Rather, using Google gives people the sense that the Internet has become part of their own cognitive tool set. A search result was recalled not as a date or name lifted from a Web page but as a product of what resided inside the study participants' own memories, allowing them to effectively take credit for knowing things that were a product of Google's search algorithms. The psychological impact of splitting our memories equally between the Internet and the brain's gray matter points to a lingering irony. The advent of the “information age” seems to have created a generation of people who feel they know more than ever before—when their reliance on the Internet means that they may know ever less about the world around them.

Yet perhaps as we become parts of the “Intermind,” we will also develop a new intelligence, one that is no longer anchored in the local memories that are housed only in our own brains. As we are freed from the necessity of remembering facts, we may be able as individuals to use our newly available mental resources for ambitious undertakings. And perhaps the evolving Intermind can bring together the creativity of the individual human mind with the Internet's breadth of knowledge to create a better world—and fix some of the set of messes we have made so far.

As advances in computation and data transfer blur the lines between mind and machine, we may transcend some of the limits on memory and thought imposed by the shortcomings of human cognition. But this shift does not mean that we are in danger of losing our own identity. We are simply merging the self with something greater, forming a transactive partnership not just with other humans but with an information source more powerful than any the world has ever seen. ■

MORE TO EXPLORE

Transactive Memory: A Contemporary Analysis of the Group Mind. Daniel M. Wegner in *Theories of Group Behavior*. Edited by Brian Mullen and George R. Goethals. Springer, 1986.
Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips. Betsy Sparrow et al. in *Science*, Vol. 333, pages 776-778; August 5, 2011.

SCIENTIFIC AMERICAN ONLINE

Read a remembrance of the late Daniel M. Wegner from a former graduate student at ScientificAmerican.com/dec2013/wegner