THE SMALL WORLD PROBLEM

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The pleasing notion that we live in a "small world" where people are connected by "six degrees of separation" may be the academic equivalent of an urban myth. New evidence discovered in the Milgram papers in the Yale archives, together with a review of the research on the small world problem, reveals that this widely accepted idea rests on scanty empirical evidence.

The "small world problem" takes its name from an experience familiar to us all. As Stanley Milgram described it:

> Fred Jones of Peoria, sitting in a sidewalk cafe in Tunis, and needing a light for his cigarette, asks the man at the next table for a match. They fall into conversation; the stranger is an Englishman who, it turns out, spent several months in Detroit studying the operation of an interchangeable-bottlecap-factory. "I know it's a foolish question," says Jones, "but did you ever by any chance run into a fellow named Ben Arkadian? He's an old friend of mine, manages a chain of supermarkets in Detroit..."
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> "Arkadian, Arkadian," the Englishman mutters. "Why, upon my soul, I believe I do! Small chap, very energetic, raised merry hell with the factory over a shipment of defective bottlecaps"
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> "No kidding!" Jones exclaims in amazement.
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> *"Good lord, it's a small world, isn't it?"* (1967:61)

The question of how people are hooked up had long been an entertaining parlor game among mathematicians where it took such forms as: If you choose any two people in the world at random, how many acquaintances are needed to create a chain between them? Ithiel de Sola Pool at MIT and Manfred Kochen of IBM collaborated on mathematical models of the small world problem and circulated unpublished papers within an invisible college of colleagues for two decades. They were reluctant to publish, Kochen explains, because "we never felt we had 'broken the back of the problem'" (1989, viii).

The brilliant social psychologist Stanley Milgram believed he had solved the problem, or at least made substantial empirical progress, through an ingenious experiment. Milgram asked "starters," supposedly "randomly" chosen people from psychologically distant locations like Kansas or Nebraska, to send a folder through the mail to a target person in places like Cambridge, Massachusetts or Boston. The starters were given basic information about the target person and written instructions to send the folder through the mail to someone they knew on a first-name basis who would be more likely to know the target. That person was to send the folder on to someone closer to the target whom he or she knew on a first name basis. Returned tracer postcards tracked the progress of each chain. The idea was to see how many jumps were needed to reach someone, when the connections could only be through friends, relatives, or close personal acquaintances.

Would any folders reach the target person? Milgram's first target was the wife of a divinity student living in Cambridge. He was astonished at how fast she got the folder from Kansas. In a memorable example in his famous article in the first issue of *Psychology Today* in 1967, Milgram wrote: "Four days after the folders were sent to a group of starting persons in Kansas, an instructor at the Episcopal Theological Seminary approached our target person on the street. 'Alice,' he said, thrusting a brown folder toward her, 'this is for you.' At first she thought he was simply returning

a folder that had gone astray and had never gotten out of Cambridge, but when we looked at the roster, we found to our pleased surprise that the document had started with a wheat farmer in Kansas. He had passed it on to an Episcopalian minister in his hometown, who sent it to the minister who taught in Cambridge, who gave it to the target person. Altogether, the number of intermediate links between starting person and target amounted to *two*!" (pp. 64-65).

In a second study, using Nebraska starters and a target who lived in Sharon, Massachusetts and worked in Boston, Milgram reported that "chains varied from two to 10 intermediate acquaintances, with the median at five" (p. 65). Thus, any person appeared to be able to reach another person in just six jumps—the empirical basis for the famous phrase "six degrees of separation."

Milgram's fascinating findings have slipped away from their scientific moorings and sailed into the world of imagination. "Six Degrees of Separation" became the name of an acclaimed play by John Guare. "Six Degrees of Lois Weisberg" became the title of a famous article by Malcolm Gladwell (*The New Yorker*, January 11, 1999:52-63) explaining the value of social connectors, people who know people from different subcultures. "Six Degrees of Kevin Bacon" became the name of a parlor game for movie buffs. "Six Degrees of Separation" became the name of a web site, which explains that it was inspired by the idea of six degrees of separation to create a place which would connect millions of people from around the world. "It's a Small, Small World" sing dolls in their national costume at a heart-warming Disneyland exhibit.

The vast majority of chains in any small world study spanning more than one city were never completed. The memorable example of the Kansas wheat farmers who reached the wife of the divinity student in two jumps comes from an unpublished study I found in the Milgram archives. Only 5 percent of the letters actually reached their target. Milgram's other studies show completion rates of roughly 30 percent. Further, the astonishing degree of acceptance of the notion that people are connected by only six degrees of separation is in itself a phenomenon that needs to be explained.

An explosion of interest in the "small world problem" is occurring in mathematics and other fields ranging from disease transmission to neuroscience. What triggered this interest was an important article in 1998 in *Nature* by D.J. Watts and S.H. Strogatz, entitled "Collective Dynamics of 'Small-World' Networks" (393: 440-442). In it the authors propose a mathematical foundation for the notion that we live in a small world. Mathematical models, however, rely on non-empirical assumptions. Whether anyone has yet "broken the back" of the small world problem is still open to question.

Information in the Milgram Papers

I had always regarded Milgram's work on the small world problem as one of the great, counter-intuitive studies in the social sciences. My interest in pursuing its details arose from a teaching problem. Social science research, some of my graduate students insisted, was nothing more than the systematic study of what you already know.

Thinking about how to show my skeptical students that social research could produce surprising results, I hit upon the idea of replicating Milgram's small world study in the Internet Age. We would run a postal version and an e-mail version of his great study. Surely those of us on the right side of the digital divide were far more connected to each other than Milgram had ever imagined. I fantasized about finding the original target people in Milgram's small world studies, such as the wife of the divinity student or the Boston stockbroker, and asking them to be the targets for this replication more than a quarter of a century later, a bit of showmanship worthy of Stanley Milgram himself.

To prepare for this research project, I needed to find Milgram's original research materials, available for public review in Boxes 48 and 49, Stanley Milgram Papers, Manuscripts and Archives, Yale Library (Kaplan, 1996). Key details of Milgram's study were unclear. What exactly had Milgram sent through the mail? Sometimes it was called a "chain-letter," sometimes a "passport," sometimes a "document in a folder." What this item actually looked like could make a big difference in whether people sent on the letters or tossed them out. People would find a chain-letter easy to throw out, I reasoned, but not a document that looked like a passport.

What I found in the Milgram papers in the Yale archives was disconcerting. Milgram published the arresting anecdote of the divinity student's wife who had gotten a letter in four days (quoted above) in the *Psychology Today* article without giving the statistical results of this study. An un-