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COULD IT BE A BIG WORLD?

COULD IT BE A BIG WORLD AFTER ALL?
THE "SIX DEGREES OF SEPARATION" MYTH

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Abstract

The idea that people are connected through just "six degrees of separation," based on Stanley Milgram's "small world study," has become part of the intellectual furniture of educated people. New evidence discovered in the Milgram papers in the Yale archives, together with a review of the literature on the "small world problem," reveals that this widely-accepted idea rests on scanty evidence. Indeed, the empirical evidence suggests that we actually live in a world deeply divided by social barriers such as race and class. An explosion of interest is occurring in the small world problem because mathematicians have developed computer models of how the small world phenomenon could logically work. But mathematical modeling is not a substitute for empirical evidence. At the core of the small world problem are fascinating psychological mysteries.

The "small world problem" takes its name from an experience familiar to us all. As Milgram (1967) describes 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..."
>
> "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"
>
> "No kidding!" Jones exclaims in amazement.
>
> "Good lord, it's a small world, isn't it?" (p. 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? (Kochen, 1989; Garfield, 1979). 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Pool at MIT and Manfred Kochen of IBM collaborated on mathematical models of the small world problem and circulated unpublished papers within an invisible college of colleagues for two decades.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 (1989) explains, because "we never felt we had 'broken the back of the problem.'" (p.viii)

But Stanley Milgram believed he had solved the problem, or at least made substantial empirical progress, through an ingenious experiment. Milgram (1967) 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 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 even closer. Returned tracer postcards tracked the progress of each chain.

Would any folders reach the target person? Milgram was delighted at how fast the answer came. His first target person was the wife of a divinity student living in Cambridge:

> 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 home town, 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*! [emphasis in original] (pp. 64-65)

In a second study, using Nebraska starters and a target who lived in Sharon, Massachusetts and worked in Boston, Milgram (1967) reported that "chains varied from two to 10 intermediate acquaintances, with the median at five" (p. 65). Any person appeared to be able to reach another person with an average of 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 entered the world of imagination. The notion that we live in a "small world" where people are connected by only "six degrees of separation" has become part of the intellectual furniture of educated people. "Six Degrees of Separation" is the name of an acclaimed play by John Guare. "Six Degrees of Lois Weisberg" is the title of a famous article by Malcolm Gladwell (1999) explaining how people who span subcultures have enormous social power. "Six Degrees of Kevin Bacon" is a parlor game for movie buffs. "Six Degrees of Separation" is a popular 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 Disneyland in a heart-warming exhibition celebrating the connectedness of people all over the world.

In the digital age, many of us believe, the world has shrunk even more, turning us into a "global village." But is this really the case? Tom Wolfe (2000) argues that the conventional wisdom--that "no person on earth (is) more than six mouse clicks away from any other"--is nothing but "digibabble" (p. 67). People in the western world have been told for over a hundred years, he points out, that technology is making the world smaller and what we have witnessed instead is people banding together along ethnic bloodlines with bloody consequences as in the Middle East and the Balkans. Could our coming together through technology have had the unintended consequence of driving us apart? Cultural groups may set up psychological boundaries when geographic boundaries slip away.

In this paper, I argue that the pleasing idea 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. I make three points:

1. Milgram's published findings on the small world problem, the lack of replication by other researchers, and an unpublished "first Milgram small world study" I discovered in the Milgram papers in the Yale archives do not justify the famous interpretation of his research--that people are connected "by six degrees of separation." In a nutshell, the vast majority of chains in small world studies spanning more than one city were never completed.

2. The astonishing degree of acceptance of the notion that people are connected by only six degrees of separation is in itself a fascinating phenomenon important for psychologists to investigate. Why is this seemingly counter-intuitive finding so easy to believe and what does it tell us about how the human mind works?

3. A renaissance 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 *Nature*, proposing a mathematical basis for the notion that we live in a small world (Watts & Strogatz, 1998). Despite the explosion of scholarly and media interest, the small world problem has dropped out of the discipline of psychology, a discipline especially suited to examining the cognitive and emotional questions that the mathematicians are identifying.

What the Yale Archives Revealed

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 mail version and an e-mail version of his famous 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 Boston stockbroker or even his children--- 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 but not a document that looked like a passport.

What I found in the Milgram papers in the Yale archives was disconcerting and cast doubt on the validity of his findings:

1. 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. This popular publication is the commonly cited source for the idea of "six degrees of separation." But Milgram did not publish in *Psychology Today* or in any other source the statistical results of what he calls this "first" study, where starters in Wichita, Kansas tried to reach an obscure target, the wife of a divinity student in Cambridge. An undated paper, "Results of Communication Project," in the Stanley Milgram papers in the Yale archives reveals that 60 people had been recruited as starters from a newspaper advertisement in Wichita, and 50 chains had been started. Just 3

of the 60 documents (5%) reached the wife of the divinity student, and they passed through an average of 8 people (9 degrees of separation). The memorable anecdote in *Psychology Today* was at great variance from the actual, unreported results of the first study.

2. Subtle features of Milgram's second, published Nebraska study strongly favored chain completion. The document sent through the mail turned out to be impressive indeed: a passport of thick royal blue cardboard with the name "Harvard University" embossed in gold letters on the cover and a stylish gold logo. The roster of signatures was visually impressive--each person's name written with a fountain pen in different colors of ink. An impressive passport is not a biasing factor. But it did support the idea that people would have tried to send on the document rather than not bother with it---the explanation usually offered for the low chain completion rates (Milgram, 1967; Travers & Milgram, 1969; Guiot, 1976).

But other features of Milgram's small world studies might well have biased the results in favor of his theory that people live in a small world. Take the selection of the sample. I found in the archives the original advertisement recruiting subjects for the Wichita, Kansas study. This advertisement was worded so as to attract not *representative* people but particularly sociable people proud of their social skills and confident of their powers to reach someone across class barriers. A second biasing factor was that Milgram recruited subjects for the Nebraska and Los Angeles studies by buying mailing lists, an item which appears in his proposal budget available in the Milgram papers. People with names worth selling are more likely to be high-income people, who are more connected and thus more apt to be able to get documents through (Beck & Cadamagnani, 1968).

3. I found in the archives a variation of the small world study, probably sent to Milgram for review but to my knowledge unpublished. This study not only showed extremely low chain completion rates (below 18%) but also suggested that people are actually separated quite dramatically by social class (Beck & Cadamagnani, 1968). This study recruited 151 volunteers from Crestline, Ohio, divided into low-income, middle-income, and high-income groups. The starters were to try to reach a low-income, middle-income, or high-income person in Los Angeles. While the chain completion rate was too low to permit statistical comparisons of subgroups, the researchers observe that "No low-income senders were able to complete chains to target Ss other than the low-income target" (p.5). The middle-income and high-income people, on the other hand, did get messages through to some people in every other income group. These patterns suggest a world divided by social class, with low-income people disconnected.

Published Research on the Small World Problem

I realized that Milgram's original experiment--sending a document from people in Nebraska to a stockbroker in Boston--did not in a scientific sense support the popular, media interpretation that people in the United States, or indeed the world over, were connected by six degrees of separation. After all, this study was based on efforts to reach only one particular person and a socially prominent person at that. But surely there had been numerous replications of the small world problem all over the world, just as there had been of Milgram's famous study of obedience to authority (Blass, 1992). The small world study was easy to replicate and inexpensive. The Nebraska study, I learned in the Yale archives, had a budget of only $680.

I was in for a surprise. I did an exhaustive search of the published literature, not only using computerized databases but also following up bibliographical leads which I found in the unpublished papers on the small world problem I located in the Milgram archives. Some of this research could not be found in today's computerized literature searches. I spent months tracking down obscure journals, sometimes published abroad. I triumphantly located the author [Eugene Garfield] of a research review of the small world problem which had been sent to Milgram for his comments but which had no author listed.

Using as my criterion for a "replication" of the small world study, that the study had to span at least two

disconnected cities, I could find only ***two*** published replications and one was conducted by Milgram himself (Korte & Milgram, 1970). A lot of research had been done on the small world phenomenon, but this industry of studies consisted mostly of adaptations of the method to such limited settings as a college campus (Shotland,1976), businesses (Lundberg, 1975) a high-rise apartment (Bochner, Duncan, Kennedy, & Orr, 1976), or a single urban area (Lin, Dayton, & Greenwald, 1978). None of these studies asked whether people could connect with people they didn't know in different regions of the United States, let alone in different regions of the world.

Perhaps Milgram was right that we live in a world with six degrees of separation. Perhaps he had discovered a fundamental and universal truth about the human world. But the evidence was simply not there. The inescapable fact is that the great majority of chains were never completed. To put it another way, the vast majority of people could **not** reach the target person. Of the 296 possible chains in the technical research report , 217 chains were started, and 64 were completed--a success rate of only 29% (Travers & Milgram, 1969). Again, a careful reading of the technical report also shows that the starters had social advantages; they were far from a random or representative group. The three starter groups were: (a) 100 blue chip stock owners from Nebraska recruited from a mailing list, (b) 96 people from Nebraska designated as the "Nebraska random" group [quotations in the original] but actually recruited from a mailing list, and (c) 100 people from Boston designated as the "Boston random" group [quotations in the original] but actually recruited from a newspaper advertisement. All would have had a leg up in making social connections to a Boston stockbroker. The Bostonians lived in the same city. The blue chip stock owners were apt to have business connections to a stockbroker. The Nebraska starters were recruited from mailing lists apt to contain names of higher income people.

Milgram's subsequent study of acquaintance networks between racial groups also reveals not only a low rate of chain completion but also the importance of social divides (Korte & Milgram, 1970). White starters in Los Angeles, solicited through mailing lists, tried to reach both white and "Negro" targets in New York. Of the 270 chains started and directed toward "Negro" targets, only 13% got through compared to 33% of the 270 chains directed toward white targets. The results suggest again that, far from living in a small, inter-connected world, we live in a world with racial barriers.

I could find only one other replication of the small world study in the published literature, which came close to meeting the criterion that a replication had to span at least two disconnected cities--Lin, Dayton, and Greenwald's (1978) investigation of a single urbanized area in the Northeast. The research purpose was to examine social stratification, particularly barriers between whites and blacks. Of 596 packets sent to 298 volunteers, 375 packets were forwarded and 112 eventually reached the target--a success rate of 30%. This study, too, underscored the importance of a racial divide. "Communication flows mainly within racial groups," the authors conclude. "Crossing the racial boundary is less likely to be attempted and less likely to be effective" (p.118).

The One Exception

I located one study inconsistent with the pattern of low chain completion rates in small world studies over a large geographic area. This research did not meet my criterion for a replication: that a replication had to span at least two disconnected areas. Guiot's (1976) study of ethnic gate-keeping focuses on only one city, Montreal. Nonetheless, his completion rate of 85% is so startling that this study warranted special attention.

Guiot had developed an interesting adaptation of the small world method. Instead of using the mail, he used the telephone. Each potential starter was called on the telephone and asked to participate, using telephone messages to move closer toward the target. If a person dropped out, the chain was reactivated by calling back the previous person and asking that person to select a new contact to restart the chain. Whether this novel procedure is consistent with the theoretical nature of the small world problem is questionable since

people who did not telephone another contact, despite prodding from the researcher, may have been socially isolated individuals.

The starters were 52 French Canadian volunteers in Montreal who were instructed to reach a prominent Jewish target. The 85% chain completion rate may only demonstrate that Jews in Montreal live in a small social world: Once you find a Jew, you can get your message through. Still, future research on the small world problem should consider a telephone method, where researchers can monitor the reasoning, networks, and progress of people trying to make connections.

In short, he small world problem remains eternally fascinating. Did Milgram's low success rates result from people not bothering to send on his blue and gold embossed passports, as he would have us believe? Or do his low success rates reveal that his theory, no matter how emotionally inviting, is incorrect. Or maybe some of us live in a small, small world where we can easily reach people across boundaries but others do not?

In my view, the research on the small world problem suggests not a counter-intuitive triumph of social research but an all-too-familiar pattern: We live in a world where social capital, the ability to make personal connections, is not wide-spread and more apt to be a possession of high-income, white people or people with exceptional social intelligence. Certainly some people operate in small worlds, such as scientists with worldwide connections or university administrators (Garfield, 1979; Shotland, 1976). But many low-income people or minority people do not seem to. What the empirical evidence suggests is that l some people are well-connected and others are not, a world not of elegant mathematical patterns where a random connector can zap us together but a more prosaic world, a lot like a bowl of lumpy oatmeal.

Our Desire To Believe We Live in a "Small, Small World"

The speed with which both researchers and the general public accepted Milgram's results, despite so little supporting evidence, raises an intriguing question: Why do we find it so easy to believe what appears to be a counter-intuitive notion, that we live in a small, small world?

Psychological research on information processing provides cogent explanations of why people may fall prey to the six degrees of separation illusion. When people experience an unexpected social connection, the event is likely to be vivid and salient in a person's memory. {I WILL ADD A REVIEW OF THIS LITERATURE.}

As I questioned people about whether they believed in a "small world" and why, I was astonished to find how strong this belief was and how resistant it was to any empirical disconfirmation. Three major reasons recurred:

1. Belief in a small world gave people a sense of security. "It's a scary world out there," one federal judge told me. "It's good to believe that we are all somehow holding hands."

2. Small world experienced were interpreted in terms of religious faith. When you met someone from your past or someone who knew someone from your past, this was evidence of God's designs.

3. People had little intuitive understanding of coincidence. One person, for example, told me of meeting his third grade classmate on a Belgium train, and his delight when she recognized him. He was less impressed, he confessed, when he saw her again at the American Express office in Rome and then again in Paris.

As I listened to these descriptions of cherished small world experiences, I realized that these experiences had a different mathematical structure from the classic small world problem that Milgram and the

mathematicians were investigating. The classic "small world problem" is expressed in such forms as: What are the chances that two people chosen at random from the population will have a friend in common? But the small world experiences I was hearing about would be expressed mathematically in a very different form: What is the probability that you will meet a friend from your past or a stranger who knows a friend from your past over the course of your lifetime?

How likely would it be, particularly for educated people who travel in similar social networks, *never* to meet *anyone anywhere anytime* who knew someone from their past? We have a poor mathematical, as well as a poor intuitive, understanding of the nature of coincidence (Watts, personal communication, October 5, 2000). Odd coincidences do occur. Here is one: The two great investigators of the small world problem, Stanley Milgram and Ithiel de Sola Pool, both died in the same year,1984, Milgram of a heart attack and de Sola Pool of cancer (Kochen, 1989).

Need for Psychological Research on the "Small World Problem"

While the small world problem is rarely covered in introductory psychology textbooks and has been the topic of little recent psychological research, an explosion of interest in this fascinating issue is occurring in mathematics and other fields. What triggered this interest was the invention of a mathematical model explaining how the small world phenomenon might operate (Watts & Strogatz, 1998). Random connectors in a network (such as especially sociable people, the "Lois Weisbergs" who span subcultures), it turns out, can vastly decrease the distance between points. This mathematical invention has produced a renaissance of interest in the small world problem in many scholarly fields and a flurry of articles in the media. This explosion of interest, oddly enough, that has escaped the field that first made empirical inroads into the problem--social psychology.

Psychologists are especially well-equipped to investigate the problems that the mathematicians are identifying. Kleinberg (2000), for example, has investigated a network where everyone is connected to four points on each side but also has some long range, oddball connection. Short connections do exist, but the maze would seem too bewildering, Kleinberg theorizes, for people at any point on the grid to find their way through. Such important work in mathematics begs for psychological research: What do people actually believe about the navigability of their social worlds and how do such beliefs influence their search attempts and their search success?

Empirical research is also important to investigate questions such as these: What does it actually mean in practical terms to be linked to others on a first-name basis? A welfare mother in New York might be connected to the president of the United States by a chain of fewer than six degrees: Her caseworker might be on first-name terms with her department head who may know the mayor of Chicago who may know the president of the United States. But does this mean anything from the perspective of the welfare mother? As mathematicians put it, is "six degrees of separation" a large or a small number? We are used to thinking of "six" as a small number, but in terms of spinning social worlds, in a practical sense, "six" may be a large number indeed.

Nothing is so useful as a good problem. The "small world problem" remains eternally fascinating and even more so in the digital age. Milgram has not shown that we live in a world of "six degrees of separation." How we are connected to each other remains an important mystery....and a researchable one.

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