

# Separating You and Me? 4.74 Degrees

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The world is even smaller than you thought.



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Cornell News Service  
Jon Kleinberg of Cornell said weak ties could be important.

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Adding a new chapter to the research that cemented the phrase “six degrees of separation” into the language, scientists at [Facebook](#) and the University of Milan reported on Monday that the average number of acquaintances separating any two people in the world was not six but 4.74.

The original “six degrees” finding, published in 1967 by the psychologist Stanley Milgram, was drawn from 296 volunteers who were asked to send a message by postcard, through friends and then friends of friends, to a specific person in a Boston suburb.

The new research used a slightly bigger cohort: 721 million Facebook users, more than one-tenth of the world’s population. [The findings](#) were posted on Facebook’s site Monday night.

The experiment took one month. The researchers used a set of algorithms developed at the University of Milan to calculate the average distance between any two people by computing a vast number of sample paths among Facebook users. They found that the average number of links from one arbitrarily selected person to

another was 4.74. In the United States, where more than half of people over 13 are on Facebook, it was just 4.37.

“When considering even the most distant Facebook user in the Siberian tundra or the Peruvian [rain forest](#),” the company wrote on its blog, “a friend of your friend probably knows a friend of their friend.” The caveat there is “Facebook user” — like the Milgram study, the cohort was a self-selected group, in this case people with online access who use a particular Web site.

Though the study was by far the largest of its kind, it raised questions about definitions of terms like “friend” on Facebook.

A Microsoft study in 2008, using a more conservative definition of friend, found an average chain of 6.6 people in a group of 240 million who exchanged chat messages. Eric Horvitz, a Microsoft researcher who led the study in 2008, said that network was based on people who exchanged messages, rather than those who identified as “buddies.”

“There is an issue of how many friends you actually have,” he said. But, he said, the Internet might have altered the definition.

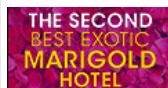
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“My own notion of what a friend is has evolved,” he said.

Jon Kleinberg, a computer science professor at Cornell and a faculty adviser to an author of the new study, said some links might be more meaningful than others.

He offered the example of a man wanted for a crime. A random Facebook user might discover that she took a class with someone who rented an apartment from someone who grew up with the suspect. They may all be connected as Facebook “friends.”

“We are close, in a sense, to people who don’t necessarily like us, sympathize with us or have anything in common with us,” Dr. Kleinberg said. “It’s the weak ties that make the world small.”

Still, he noted that such ties were hardly meaningless. “We should ask what things spread well on weak ties,” he said. “News spreads well on weak ties. Those people I met on vacation, if they send me some cool news, I might send that to my friends. If they send me something about a protest movement, I might not.”

Matthew O. Jackson, an economist at Stanford who studies social networks, raised questions about the bias built into a study based on random samples. He said the study confirmed Facebook’s success in being where millions of people communicate. “It’s more evidence that they’ve been enormously successful at connecting a large number of people very well,” he said.

The research underscores the growing power of the emerging science of social networks, in which scientists study the ways people interact by crunching gigantic sets of Internet data.

“These social network tools provide individuals with tremendous reach,” said Dr. Horvitz, the Microsoft researcher. “People can share ideas with only a few jumps to a large portion of the world’s population and with even fewer steps to the entire population of a nation.”

In addition to social scientists, a new generation of Internet commerce is using social network research to market products, and Pentagon sleuths are using similar techniques to identify networks of insurgents.

The “six degrees” concept dates to a 1929 short story, “Chains,” in which Frigyes Karinthy, the Hungarian author, suggested that no one is more than a string of six friends away from any other person.

After Milgram published his famous paper “[The Small World Problem](#),” in 1967, the playwright John Guare made “Six Degrees of Separation,” the title of a 1990 play that explored Milgram’s premise. And that gave rise to the parlor game Six Degrees of Kevin Bacon, in which disparate Hollywood personalities are linked to one another. (Elvis Presley was in “Change of Habit” with Edward Asner; Mr. Asner was in “J.F.K.” with Kevin Bacon.)

The Facebook paper, titled “Four Degrees of Separation,” notes that Milgram posed both an optimistic interpretation of his findings and a pessimistic one.

On one hand, it is a startling notion that reaching someone on the other side of the world takes only a small group of social connections. On the other hand, Milgram said, the result could also be evidence of psychological distance: that we were actually, on average, five “worlds apart.”

“From this gloomier perspective,” the new paper says, “it is reassuring to see that our findings show that people are in fact only four worlds apart, and not five.”

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