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Images available at: <http://senseable.mit.edu/urbanvillages>.

Analysis Of Social Interactions Suggests We All Live In ‘Villages’

Research at MIT and the Santa Fe Institute, analyzing social interactions through cellphone data, suggests we all live in ‘villages’ – even when in large cities.

Cambridge, MA/Santa Fe, NM. Intuitively, the close community spirit of village life and the crowded bustle of the big city suggest very different qualities of social life. A new paper published today in the *Journal of the Royal Society Interface* finds, however, that the social networks of city dwellers are not so different from those of village dwellers.

As part of the study, scientists from the MIT Senseable City Lab and the Santa Fe Institute teamed up with researchers from British Telecommunications and Orange Labs to examine social relationships of people living in towns and cities in Portugal and the UK.

Sociologists have long been interested in the way cities affect social interactions, but previous methods of quantifying these interactions relied on traditional surveys – essentially asking people who they talked to and how often, a time-consuming approach that depends heavily on the accuracy of the respondents' answers.

Today, telecommunications companies keep records of every call made by every customer – information that includes call time, duration, location, and numbers dialed. These data, stripped of all identifying personal information, offer much more extensive records of social interactions than is possible through traditional surveys.

As the basis for their study, the researchers obtained a dataset comprising the majority of landline calls made in the UK during a one-month period in 2005, and another dataset of millions of mobile phone calls in Portugal during a 15-month period in 2006 and 2007. Together, these two datasets represent several billion phone calls.

“This is unprecedented raw material for analysis, poised to change our understanding of society – potentially opening the way to something that some people have started calling ‘computational social sciences’,” said Carlo Ratti, director of the MIT Senseable City Lab, one of the paper’s co-authors.

The researchers then constructed networks of phone interactions for each town in the UK and Portugal, with each individual user represented by a node, and connections between them indicated by a link.

The team’s analyses of the network data revealed that the number of calls made by an individual, as well as his or her total number of connections, depends on the town's size according to a mathematical relation: the larger the town you live in, the more people you call and the more calls you make. Interestingly, this

relation is 'superlinear,' meaning that on average, as the size of a town doubles, the total number of social interactions will more than double in a predictable way.

The team also found, however, that the group clustering of social circles (the odds that your friends mutually know one another) does not change with city size, regardless of whether you live in the five square-mile town of Lixa in northern Portugal or the bustling capital city of Lisbon.

The findings point to the conclusion that human beings living in small towns and large cities alike instinctively form tight social communities. But if you live in a small community, your social circle is more or less determined by those who live around you, whereas in a large city you have more freedom to select which of the thousands of people around you will constitute your social circle.

"It seems that even in large cities we tend to build a tightly-knit community, or 'village,' around ourselves", said Ratti. "In a real village, connections might be defined by proximity, while in a large city we can elect a community based on affinity, interest, or sexual preference, for example."

This points to what is fundamental about a city, said co-author Dr. Luis Bettencourt who, along with co-author Dr. Geoffrey West, leads the cities and urbanization research team at the Santa Fe Institute.

"People tend to think of cities as people, buildings, roads, pipes, and so on," he said. "But at a more fundamental level, cities are really about connections. These connections form networks of people and organizations that enable the production of all products of civilization, from modern economies and fast innovation to complex bureaucracies and political institutions."

"That social interactions per person increase with city size begins to explain how so many socioeconomic quantities, from GDP to violent crime, scale superlinearly," he added. "We had developed theory that predict the superlinear growth of social connections in the way we observe here, but this is the first time that we can observe this phenomenon directly and explore it in detail! It is tremendously exciting."

Dr. Markus Schläpfer of MIT's Senseable City Lab and SFI, the corresponding author on the paper, said the team's findings have important implications for the way information and ideas diffuse throughout a city. Ultimately, this may also help researchers understand phenomena such as the prevalence of certain contagious diseases.

"This was an incredible opportunity, made possible by today's widespread use of mobile communication technologies", he said. "Data of this type keep getting better and better. It will be extraordinary to use them in the future to see how cities around the world reproduce the patterns we observed for Portugal and the UK, and watch fast-growing cities develop as immense social networks. It throws open lots of possibilities to study the organization and dynamics of entire cities."

Co-authors of the paper, titled "The scaling of human interactions with city size," include Schläpfer; Bettencourt; West; Ratti; Mathias Raschke of Raschke Software Engineering, Sébastien Grauwin of the Senseable City Lab, Rob

Claxton of British Telecommunications, and Zbigniew Smoreda of Orange Labs. The project was developed as part of Ericsson's "Signature of Humanity" project.

For more details, visit <http://senseable.mit.edu/urbanvillages>. For additional information please contact senseable-press@mit.edu.

About the MIT Senseable City Lab:

The Senseable City Lab at the Massachusetts Institute of Technology a multidisciplinary research group that studies the interface between cities, people, and technologies. It investigates how the ubiquity of digital devices and the various telecommunication networks that augment our cities are impacting urban living. With an overall goal of anticipating future trends, the Lab bring together researchers from over a dozen academic disciplines to work on groundbreaking ideas and innovative real-world demonstrations. This research is undertaken in partnership with cities, the private sector and other universities; through this collaborative approach we strive to reveal how a new, rapidly expanding network of digital devices is serving to modify the traditional principles of understanding, describing and inhabiting cities. For more information, visit <http://senseable.mit.edu/>.

About the Santa Fe Institute:

The Santa Fe Institute is a private, not-for-profit, independent research and education center, founded in 1984, where leading scientists grapple with some of the most compelling and complex problems of our time. Researchers come to the Santa Fe Institute from universities, government agencies, research institutes, and private industry to collaborate across disciplines, merging ideas and principles of many fields - from physics, mathematics, and biology to the social sciences and the humanities - in pursuit of creative insights that improve our world. The Institute's scientific and educational missions are supported by philanthropic individuals and foundations, forward-thinking partner companies, and government science agencies. For more information, visit www.santafe.edu/about/.