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Letters from the Past Shed Light on Human Activity Patterns

Charles Darwin couldn't flick on the computer when he needed to send a note—correspondence in his time demanded a different approach than it does today. Yet a new study examining the nearly life-long letter collections of 16 well known writers, performers, politicians, and scientists—including Darwin—shows that the factors that determined their correspondence patterns are the same factors that shape emailing patterns today.

In an article published in the September 25, 2009, issue of the journal *Science*, Howard Hughes Medical Institute early career scientist Luis Amaral and collaborators make the case that letter-writing activity is dictated by circadian rhythm and a preference for task repetition, and that shifts in correspondence patterns that occur throughout a lifetime can be attributed to an individual's changing communication needs. These are the same factors that Amaral found, in a previous study, determine when people send emails.

A driving force behind these analyses is to determine how people structure their activities. "Modeling human activity patterns can have important ramifications, from predicting disease spread and optimizing resource allocations, to predicting demand for certain services and patient compliance with their doctors' orders," explained Amaral, who is at Northwestern University. "This kind of model can have implications in designing better systems that will save us from ourselves, or prevent us from being in situations where we are more likely to make mistakes."

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As an example, Amaral noted a recent study that quantified how many deaths of hospitalized patients might have been prevented if there had been better mechanisms in place to guard against physician error. One such safeguard might have been the development of a more efficient schedule for hospital procedures that is based on the optimal times of day to perform specific tasks. Similarly, Amaral says that patient compliance in taking prescribed medications or monitoring blood sugar might be improved by paying attention to the kinds of activity patterns identified in the letter-writing study.

Correspondence records, which track date, sender, and recipient of each letter or email, sometimes over many decades, offer a powerful opportunity to study human activity patterns. Prior to the new study, many researchers suspected that patterns of human correspondence reflected a rational, prioritized approach: People write their most urgent communications first. But Amaral and his colleagues had previously shown that people's emailing patterns seemed to be guided more by circadian rhythm and task repetition – and he suspected the same held true for letter-writing.

Amaral and his colleagues used the Internet to access the nearly life-long letter collections of Ernest Hemingway, Albert Einstein, Robert E. Lee, Anna Jameson, H.G. Wells, Karl Marx, Carl Sandburg, and eight others. They were careful to choose subjects from different professions and different eras so that their model would show patterns that were universal. The subjects' letter collections spanned from 28 to 70 years, and included 119 to 10,319 letters.

To begin their analysis, the researchers divided each individual's collection of letters into segments, each spanning about a year. They could then evaluate patterns of letter-writing within each segment, since life events might alter the patterns when viewed over a longer time scale. "There are some people whose letters we analyzed who didn't become famous during their lifetime, so we don't see a dramatic change in correspondence," Amaral says. "Einstein and Darwin, of course, became famous scientists during their lifetimes. When they did, their letter-writing frequency increased by a factor of 100." The team designed their computer model so that it would be relevant for both situations.

Approaching the data in this way indicated that indeed, letter-writing patterns were shaped by the same forces that influence email correspondence. The subjects of the study tended to send multiple letters on a given day, and to send more letters later in life, after they had achieved renown. "We found out that you need to integrate all three of these factors to understand the data. And when you think of them, they are the ones that fit into many facets of our lives – when we go shopping, make doctor's appointments, go to the gym, etc.," says Amaral.

As an example, Amaral described Einstein's correspondence, which included 10,319 letters and fit the model perfectly. As a young man, Einstein had only

a sparse communication record. When his famous theory of relativity was confirmed in 1919, Einstein's correspondence needs shot up considerably. Between 1928-33, more than 50 percent of his letters were sent in cascades of multiple letters, illustrating the powerful influence of task repetition on human correspondence.

"I think our study is revealing that there are certain universal mechanisms to how people do things, when they do them, and when they are better able to do them," Amaral says. "These insights can extend to other areas of human life."