Twitter tweets our emotional states

By David Brown, Published: September 29

@dbtwp: Sci mag shows morning happy, afternoon less, Monday a drag, Saturday nite depends, but at least the sun's out. Who knew!

That’s what life’s like according to Twitter.

A new study in the journal Science examined the contents of more than 500 million tweets sent in 84 countries over two years, looking for signs of good moods and bad. It found what a lot of us could tell by looking at our own lives.

Optimism is reborn with each new day and slowly erodes as we work, study and go about our quotidian affairs. Our mood lifts as we head home to friends, family, entertainment and beer. Our outlook tends to be sunnier on weekends. And speaking of sun, when it starts to pile up in the spring or disappear in the fall, that affects our mood, too.

The fact that two researchers at Cornell University confirmed such obvious truths across cultures using Twitter as their source is the other — and possibly more important — finding of the study.

“This is a stone in the foundation of a new social science that is being built,” said Nicholas A. Christakis, a sociologist at Harvard University who was not involved in the research. “We’re in a similar place that we were in in the 17th century with the discovery of the telescope and microscope.”

‘Massive passive’ data

The study isn’t the first to use data mining of social media for scholarly (as opposed to commercial) purposes. A study presented at a conference in Hyderabad, India, last spring analyzed how information flows through the Twitter networks of celebrities, bloggers, organizations and media outlets. The Cornell study goes beyond that to examine the emotional state of millions of users.

The research community has not yet judged whether such a sample — non-random, English-speaking, heavily tipped toward the young, well-educated and talkative — is a reasonable surrogate for humanity as a whole. But the fact that it gives predictable answers suggests that it might be.

“This should reassure people the method is not crazy. You want to sort of calibrate the instrument, and I think
these results are a good indication that the instrument is telling you reasonable things,” said Duncan J. Watts, a sociologist and researcher at Yahoo Labs.

Other experts, however, wonder whether just knowing a person’s or a population’s emotional state tells you much.

“The real problem with this method is that you don’t know what the people are doing,” said Jonathan Gershuny, a sociologist who directs the Center for Time Use Research at the University of Oxford. “All you know is they’re on their social-network sites. The real job is to find out what has got them steamed up.”

Traditionally, researchers have used surveys, records of daily activity that a sample of people are asked to keep, and diaries to get an idea of how people’s moods change with activity and time.

If it turns out that tweets and other forms of “massive passive” data are a way of tracking the emotional state of individuals and populations, it might be possible to answer more detailed questions. How do news events, changes in government policies or economic conditions affect mood? When do people think about violence? Are there “emotional bubbles” similar to “market bubbles”?

The questions don’t have to be about emotion; they can involve attitude and behavior. Does the frequency and timing of religious expression differ by religion or region? Does the prevalence of eating disorders, as indicated by certain words in messages, differ by country or locality?

The Cornell researchers have analyzed tweets and found an interesting connection: Peak usage of the word “beer” and “drunk” occur seven hours apart.

510 million tweets

In the study, Scott A. Golder, a 30-year-old doctoral candidate in sociology, and his faculty adviser, Michael W. Macy, used an archive of tweets sent from February 2008 through January 2010. Designed for use by third-party software developers, the archive is increasingly being used by scholars.

Golder and Macy examined 510 million tweets written by 2.4 million users, collecting as many as 400 a person and ignoring people who tweeted only occasionally. Only messages from Twitter users who made their tweets public when they signed up for the service were used.

Age, sex and other demographic information wasn’t available, but most Twitter accounts include time-zone information, and often the user’s country, so some information could be inferred.

Using software the research team wrote, more than 50 computers working for six weeks analyzed the millions of messages, looking for presence of words known to signal “positive affect” — which consisted of enthusiasm, delight, alertness and determination — and “negative affect” — indicating distress, fear, anger, guilt and disgust. The program measured the absolute amounts of “positive affect” and “negative affect” in tweets and how the emotional content varied by hour of the day, day of the week and season.

The two measures, however, aren’t mirror images of each other. When one is high, the other isn’t necessarily low.

The researchers’ findings were remarkably consistent across time zone and, by inference, across nationality and culture.

Positive feelings peaked between about 7 and 9 a.m., then descended to a trough between 3 and 6 p.m.
before rising again and peaking about midnight. Negative feelings were less commonly expressed and showed much less variability. They were lowest early in the morning, rising slightly throughout the day. Like good feelings, bad ones rose at night, peaking about 10.

The fact that both positive and negative tweets are common in the evening hours suggests that’s the most emotional time of the day. The weekly peak for both types of tweets is Saturday night. One explanation is that on some Saturday nights, a person feels good and expresses that; on other Saturday nights, things are not so good, and that’s telegraphed in the message.

It’s even possible both emotional states — and messages reflecting them — occur on the same evening.

Wrinkles in the cycles

The cycles Golder and Macy found were consistent day to day, except for a few wrinkles.

People’s base-line negativity is higher on Monday, and their morning bump of positivity lower. There are more good feelings on Saturday and Sunday mornings than on weekdays, but they came on two hours later — evidence, the researchers speculate, of people sleeping in.

(Negative feelings are also less prevalent on weekend mornings.)

Interestingly, this pattern was seen on Fridays and Saturdays in places such as the United Arab Emirates, where those days are the weekend. The researchers found that base-line positivity grew as the day length grew, most dramatically around the summer solstice.

The consistency suggests that something powerful is driving emotional rhythm — something that isn’t directly linked to work or school.

“People do seem to be refreshed by sleep,” Golder said, pointing to one obvious possibility. “Perhaps underlying we are all the same, responding to the same biological rhythms.”

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