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Dartmouth Teacher Makes Health App



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Dartmouth College computer science professor Andrew Campbell speaks with student Chuankai An about Campbell's StudentLife phone app in Hanover, N.H., on Sept. 22, 2014. (Dartmouth College - Eli Burakian)

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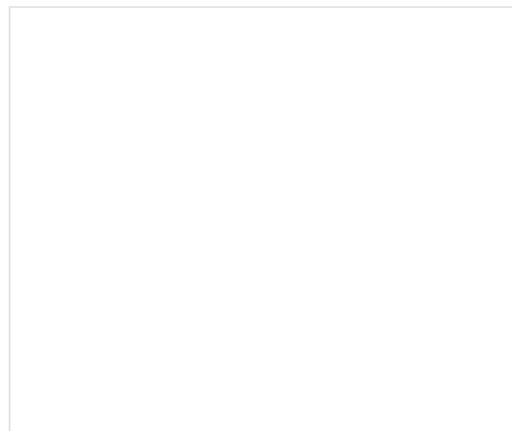
Hanover — “I should have failed those students,” said Andrew Campbell, a Dartmouth College computer science professor whose latest innovation could help people avoid mental health problems.

Fit and bespectacled with a strong British accent, Campbell is a sterling example of an emerging class of computer software developers who are changing the world in ways large and small.

Campbell was talking about a pair of students in one of his spring classes. When they stopped showing up for class and stopped turning in their assignments, Campbell sent them emails asking for an explanation. There was no response.

In most cases, flunking both students would have been an easy decision. Their behavior indicated they were textbook slackers.

But, unlike every other professor who has ever been faced with a perennially absent student, Campbell had access to a stream of private data about the students that cried out for his sympathy.



The two students were part of a 48-student study group that was testing StudentLife, a new software application installed on their smartphones by Campbell and a team of researchers.

“For the first time, a packet of data on your phone can connect to mental health,” Campbell said.

StudentLife turns your smartphone into a continuous monitoring system. It tracks where you go and what your

level of physical activity is. The phone’s microphone becomes a sensor, making note of every conversation. It knows if you’ve gone to the gym.

It knows when you’ve been sleeping, and it knows when you’re awake.

“Some of this stuff — it’s a bit creepy,” Campbell admitted while talking about StudentLife Friday.

But the potential upside is huge. The data, all of which is collected passively, paints a portrait that identifies whether the phone’s user is stressed out, lonely or depressed.

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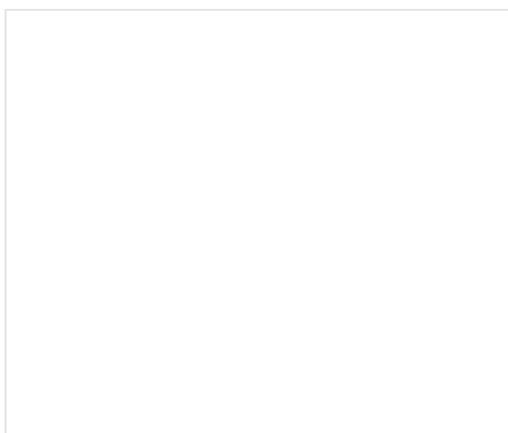
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In order to paint that portrait, the app uses features that are already built into most smartphones. Microphones monitor when the user has a conversation and how long that conversation lasts. The phone's GPS can track whether the student is in a library, or a dining area, or in the gym. The camera can track light levels which, combined with sound and movement, allow it to learn when the person is asleep. By piecing together all of that information and more besides, the study found that early in the term, most students were socializing and hitting the gym regularly but that, as they got more stressed out, the number of conversations held with peers and exercise sessions dwindled, factors that indicate emotional distress.

The app does not, however, track and take into account what specific websites a user is visiting, in part because of privacy concerns, Campbell said.

Still, the amount of data gleaned from continuous monitoring is enormous — over the 10-week period, the 48 students generated 53 gigabytes of data.

When it comes to improving public health, it seems clear that software apps will play a large role, with a Nielsen consumer study report from July showing that smartphone users are spending more than 30 hours per month on apps, a number that has been rising steadily in recent years.



And the number of apps on the market, which topped 1 million in 2011, continues to grow.

Showing Mercy

Once his two students stopped participating in his course, Campbell peeked at their individual data streams to look for clues to their underachieving behavior. What he saw concerned him — they weren't simply blowing off his course to go have fun. Instead, they were showing signs of

being beaten down by Dartmouth's notoriously intense 10-week terms, with a steep dropoff in healthy behaviors and little social interaction with their peers.

At Dartmouth, students who receive three failing grades are automatically suspended. These particular students were given failing grades in two other classes.

Campbell went another route.

"Because I had the data, I decided not to fail those students," Campbell said. "I decided to give them non-failing grades and allow them to complete my class later in the year." Campbell knows that sometimes, people who are overwhelmed by their workload can bounce back if they're given a chance.

For him, it's personal.

"I don't talk about it a lot, but my brother, when he went to university, had a depressive personality," he said. "He dropped out. But then he subsequently went back and completed at another university. I wanted to help students who might be falling off the radar." Campbell's merciful strategy appears to have worked. Both students successfully completed their coursework over the summer and are currently doing well.

When Apple's iPhone hit stores in 2007, it put a powerful computer with a variety of sensor functions into the hands of the average consumer. Ever since that revolution, Campbell and other researchers have been trying to figure out how to take full advantage.



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StudentLife, which is still under development and not yet commercially available, is the pinnacle of a heap of public health-inspired apps that Campbell has had a hand in — an app that alerts pedestrians if they're about to walk into traffic, an app that warns drivers if they're in danger of dozing off, an app that can dissect your speech patterns to determine your mood, and even an app that uses eye-movement tracking to allow you to control your phone just by looking at it.

If used right, StudentLife could tell a student when a lack of sleep is becoming harmful, or when it might be a good idea to seek out some friends for a little social time.

It could also tell an office worker how to avoid unnecessary stressors and have a happier, more productive day. It could also sense when a policeman, air traffic controller or surgeon is at heightened risk of making a potentially fatal mistake.

"If my phone knows that every time I meet my boss I get highly stressed if I meet him or her in my office, then my phone might suggest meeting my boss in a social space, like a cafe," Campbell said. "Or your future Google Calendar could revise your meetings based on your stress level."

He said such nuanced applications could be available within five years.

Privacy Concerns

Denise Anthony, a sociology professor at Dartmouth who focuses on issues of trust and privacy, said she knows Campbell and knows that he is working to ensure that his software is used in the most positive way possible.

But there is still a potential dark side to StudentLife, and to a whole genre of apps that gather health data in order to perform their function.

In order for personal privacy to be maintained, people have to be given control of their own health data and be able to make clear decisions about who, if anyone, to share it with, she said.

"I regularly share quite intimate information with my doctor," she said, "but that doesn't mean I want my neighbor or my sister or maybe even my spouse to know."

StudentLife is designed to make someone's data — and potential reminders about the need for more healthful behavior — accessible only to that person, not other entities. Still, the privacy concerns are complicated, she said, because in some cases, simply using a particular app can be an identifier.

"Just having the app on my phone says something, maybe, about my mental state," she said.

People with a history of anxiety or depression might seek out StudentLife, she said. And interfaces like Facebook regularly push consumers to share a complete inventory of their apps, so that Facebook can fine-tune its services and connect those consumers with specific advertisers.

For health-related apps, that can be dangerous. People who download an app to help quit smoking, for example, might soon see ads related to smoking appear on their screen, Anthony said, letting others in on what might have been a secret habit, or former habit.

While it is difficult to engineer a solution to a privacy concern once the technology has been released, Anthony said it is easier if the developers build safeguards into their platforms from the start, which she said Campbell is doing.

"We took great care securing it," Campbell said. "There are a lot of concerns about big data and Google and Facebook having this data. I'm more concerned about small data, my personal data. I want to give control of small data to the individual and let them decide who they want to share it with."

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Campbell said that online interfaces that ask users to click a button acknowledging they have read and accept a long set of terms isn't good enough.

"It could be saying, 'could I use your credit card,' and I would just click on them all," he said. "Clearly, that's not the right mechanism to get people to consent."

Now, Campbell is busy working on StudentLife 2.0, an extension of the application that he is developing with the help of psychiatrists and wellness experts.

The next step, he said, is to have the application use the data it is collecting by nudging users toward more healthy activities, such as advising them to go to sleep earlier.

Adding a level of feedback, he said, will give students the tools they need to improve their levels of happiness, and their ability to do better in class.

The updated software will be ready for a trial run in spring, he said.

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