1 Mobile Phones, Sensors, and Lifelogging: Collecting Data from Individuals While Considering Privacy

Never before has it been easier to collect so much daily data about ourselves. Technologies that track our habits, our location, our purchases, our routines, our social interactions, and our sentiments abound, from mobile phones and downloadable software to galvanic skin monitors and wearable cameras. Indeed, the ease with which the "data exhaust" is emitted and can be captured in the wake of our daily behaviors presents researchers with new opportunities not only to gain insight into those behaviors, but also to use these insights to better design systems to reflect how people actually behave.

Sensors, software, and their prevalence in our lives are important factors driving this trend. One significant set of sensors is embedded within today's mobile phone. With its rise in popularity and near necessity in daily life for people all over the world, the mobile phone is an undeniably essential tool for gathering data about the individual. By the end of 2012, there were nearly 6 billion mobile phone subscriptions currently worldwide.[1] And even the simplest phone leaves evidence of its owner's location with its service provider every time it pings a communication tower. Mobile phones, at first merely communication devices, have become constant computational companions that are increasingly being equipped with additional sensors. These accessories include accelerometers that are able to monitor our body movement, global positioning system (GPS) chipsets that measure our location, short-range radio protocols such as Bluetooth that can sense whom we are near, microphones that can infer what is happening around us, and even simple communication logs that are a measure of the evolution of our social networks.

A phone that is aware of a person's habits can make inferences about schedules, suggest activities, or provide reminders without any manual prompting. It can change its mode to accommodate various situations—for example, automatically turning off its ringer when in a movie theater and turning it back on after the film. A phone that knows more about your habits can recommend that you visit a bar where people with interests similar to yours gather or introduce you to a new restaurant just before you knew you wanted to try a new place for dinner.

Data from mobile phones can also provide insight into when and where people move from one location to another—information that can be critical when developing models of the spread of diseases such as malaria and flu. In addition, researchers are showing that changes in movement and conversation patterns captured by a phone with the appropriate sensors and software can indicate the onset of illnesses such as depression[2] or Parkinson's disease[3] earlier than other medical tests. These are just a few early-stage examples of the potential of Reality Mining, the idea of using personal data to make people's lives easier and healthier.

But it's not just mobile phones that keep track of us: a growing number of software applications monitor personal computer usage. Researchers hypothesize that the more a person knows about how long they spend on certain websites or reading and answering email, the more she can fine-tune her daily productivity. And, of course, as mobile phones become ever powerful computers, software that tracks the way people use phone applications has been built as well. Combining this watchful software with data from phone sensors and other applications, such as a calendar or contact list, is a powerful way to extrapolate behavioral information.

In addition to mobile phones and personal computers, people are increasingly signing up to wear specialized sensors throughout the day or during exercise or sleep, with the goal of providing insight into their physical habits and health. Google Glass is a head-mounted system that sports a small display, camera, microphone, processor, and wireless radio. It's gotten a great deal of attention as a way to stay constantly connected and to chronicle your life more easily by snapping pictures and recording video. More prosaically, unobtrusive pedometers and sleep monitors are gaining commercial traction. Data from these devices and applications on mobile phones that mimic many of these devices' functions can show a person precisely how physically active they are. Seeing such data can motivate people to live healthier lives. Another recent trend that has produced an enormous repository of personal data is the popularity of social-networking sites such as Facebook and Twitter, which allow people to post "status updates." With a short message, a user provides a snapshot into her life, answering questions such as "What are you doing?" "How do you feel?" "What's going on around you?" "What interests you right now?" Thus, status updates are akin, in some ways, to a user's answers to a sociologist's survey questions.

Once posted, these status updates are projected directly to people within a social network and, in some cases, to anyone who wants to look at these publicly available profiles online.

Some researchers are exploring ways to automate status updates based on information such as calendar events and location. Others are trying to make sense of these sentiments in aggregate; software developers have written simple programs to analyze the statements. Such programs often visualize the frequency of certain words used by increasing the font size for words that are used more often. In this way, people are able to see a snapshot of their activities and feelings over time.

A growing number of people have become fascinated with their personal data and combine all of the information about themselves they can acquire, be it from mobile phone communication, computer activity, biometric sensors, video recordings, or data recorded manually. This extreme sort of cataloging and quantifying is known as "lifelogging," and although it is not yet widespread, it has appealed to some people as a way to better understand all of their habits.

Lifelogging has gained traction mostly with engineers and designers who build web applications and other technology tools to make lifelogging easier. But as systems such as Google Glass and other lifelogging tools become available, and, importantly, as these tools become more integrated into people's daily lives, the activity of capturing moments will become less of a burden on the average person. It may even overcome the social stigma and be adopted by increasing numbers of less technologically savvy people.

In this chapter, we explore the ways in which an individual's data can be collected and logged, from a tacit, everyday interaction with a mobile phone to more purposeful digital announcements such as a status update. In addition, we discuss the privacy considerations that individuals, entrepreneurs, and big businesses need to keep in mind when collecting and analyzing the data as well as the privacy approaches currently in practice.

I What Your Phone Knows

In the fall of 2004, 100 incoming and current MIT students were provided Nokia 6600 mobile phones that were loaded with a custom version of ContextPhones[4] that tracked cell tower IDs, application usage, and phone status such as whether the phone was idle or charging. Over the course of nine months, 300,000 hours of user data were logged for the MIT project.[5]

All participants were informed of the capabilities of the phones' logging software and were asked to sign a consent form[6] verifying that they understood what data their phones were collecting. Participants were able to erase the collected data at any time and turn off the logging function. As an additional privacy measure, the phone numbers of people outside the study were turned into a unique ID by a one-way (MD5) hash, making it impossible to retrieve the original number.

The Nokia 6600 was essentially a pack of sensors that the participants almost constantly wore. For years, researchers at universities and companies had been using sensors strategically placed in a room or office or sensor pack to collect data about a person's location, proximity to other people, and physical motion as well as even snippets of ambient sounds in that location.[7] Smart badges, with infrared or radio frequency identification (RFID) emitters and sensors designed to "see" other badges, had also been employed in projects to study workplace collaboration and social networking at conferences.[8] The sensors and smart badges were improvements from the days of wearing a backpack full of sensors and circuit boards, but still somewhat cumbersome.

Although there are as many different ways to affix sensors to people as there are computer science dissertations, the Nokia 6600 Reality-Mining project was unique in that it showed for the first time that researchers could track people's location, social interactions, and habits in a scalable way. At the time of the project, tens of millions of phones were capable of running the uberspyware loaded on the Nokia 6600s. This project proved that mobile phones could be a viable, scalable tool for ubiquitous computing and a way to gather more behavioral data than ever before. The information in the surveys that most sociologists use to learn about study participants' behaviors can't compare to the density and accuracy of data collected by the mobile phone.

Nokia 6600 phones were selected because they used the Symbian Series 60 software platform and could run a custom version of the Context software, developed at the University of Helsinki, which logged the individual phone's status: anything from making a call to charging to sitting idle. The phone came with 6 megabytes of internal memory and could accommodate a 32-megabyte MultiMediaCard flash memory card. The phones were unlocked and could be used with any local Global System for Mobile Communications mobile phone operator, including T-Mobile, AT&T, and Cingular (which since the time of the study has been acquired by AT&T). Custom applications could be added to the phone via the General Packet Radio Service data network, Bluetooth, memory card, or infrared port.

The phone continuously scanned and recorded Bluetooth devices within its vicinity. Bluetooth is a wireless protocol in the 2.4 to 2.48 gigahertz range, developed by Ericsson in 1994 and released in 1998 as a serial-cable replacement to connect different devices. Each Bluetooth-enabled device is capable of "device discovery," which allows the devices to seek out and find the Media Access Control address of other Bluetooth devices (BTID) within 5 to 10 meters.

The project used a modified version of the BlueAware application (MIDP2–Java for mobile devices) to record and time stamp the found BTIDs in a proximity log located on a server. However, using BlueAware to continually scan and log BTIDs depleted the phone battery within 18 hours, so the standard application was modified to scan the environment only once every five minutes, extending phone standby time to 36 hours. When dealing with mobile phones or other battery-powered devices, it's crucial to consider resource requirements of the sensors and consider workable alternatives to constant scanning.

A variation on BlueAware is called Bluedar, developed to work on a device that was fixed in locations where study participants gathered socially. Bluedar continuously scanned for visible devices and wirelessly transmitted detectable BTIDs to a server over an 802.11b wireless network. At the heart of the devices is a Bluetooth beacon that incorporates a class 2 Bluetooth chipset that can be controlled by an XPort web server, effectively able to detect any Bluetooth device within a range of 25 meters.

In addition to Bluetooth scans, the Nokia 6600 continuously logged cell tower IDs. There has been a significant amount of research that correlates cell tower ID with a user's location.[9] But obtaining accurate location information from cell towers is complicated by the fact that phones can detect cell towers that are several miles away, and in urban areas it's not uncommon to be within range of dozens of different towers.

For the study, relatively high location accuracy was achieved when a user spent enough time in one place to provide an estimate of the cell tower probability density function: phones in the same location can be connected to different cell towers at different times depending on a variety of variables, including signal strength and network traffic. Thus, over time, each phone "sees" a number of different cell towers, and the distribution of detected towers can vary substantially with even small changes in location. Cell tower ID can also be cross-referenced with static Bluetooth devices, such as a desktop computer, to narrow down a location.

Of course, today a mobile phone can log its user's location in a number of other, straightforward ways. Many smart phones are equipped with GPS chips, and companies such as Google and Skyhook use a combination of location-triangulation means to eke out a phone's location from Wi-Fi base-station signals, cell towers, and GPS (which is less accurate when used indoors). However, for simple phones, using a cell tower ID is still the cheapest, easiest, and least obtrusive way to log location.

In the early part of the MIT Nokia 6600 experiment, the data collected were stored on the phone's limited internal memory, making it necessary to frequently dump the data to the researchers. The process took about five minutes and allowed the researchers to install upgrades to the application. However, as one month of data amounted to approximately 5 to 10 megabytes, it made sense to store some of it on the phone's removable flash memory card. With modifications to the program to write more efficiently to the flashcard, data collection was eventually postponed for months. In addition, some participants later used T-Mobile's limited Internet service to email the data to a proxy server.

Finally, study participants completed surveys asking them about their mobile phone usage, their daily behavior patterns, their satisfaction with MIT, their social circle, and their work group. In addition, the last question included a list of every study participant and asked the subject to rate his or her frequency of interaction with any of the others on the list and whether any of them was in the subject's circle of friends. These surveys complemented the primary data sets from the phone and helped to put analysis of the data in perspective.

The findings of the 100-person study were encouraging. With the use of computational tools called "eigenbehaviors," the results indicated that a person's location, proximity to other people, call logs, and phone activity at the beginning of the day often indicate only a small possibility of behaviors later in the evening.[10] For instance, if a person woke up at 10:00 a.m. on a Saturday, it was possible to predict, with surprisingly high accuracy, that he would be with certain people at a certain place later in the evening. In addition, analysis of communication and proximity data revealed relationships and positions within social networks such as whether a subject was an MIT freshman, a graduate student, or a professor. Potential applications that can make use of these results are discussed in the next chapter.

Since the time of this study, projects that use mobile phone sensors have cropped up at universities and in company labs, and there are a number of variations on the data-collection themes outlined by the MIT/Nokia project in 2003. For example, in a 2009 project called SoundSense, from Hong Lu and other researchers at Dartmouth University, software was loaded onto an iPhone to capture ambient sound to give contextual awareness in an energy-efficient and privacy-sensitive way.[11] The hypothesis was that a phone can know when a person is in an important meeting from certain audio cues and might direct calls from certain people directly to voicemail while letting others through.

One notable example and publicly accessible way to track phone activity is called Funf, an open-sensing framework spun out of MIT's Media Lab. The Funf framework allows data collection from various "probes" on the phone: GPS, location, accelerometer, call log, running apps, screen state, and battery status, for example, all stored and encrypted locally on the phone. Whereas Funf is a framework that allows any programmer to build software to suit his or her needs, Funf Journal is a ready-made app for Android phones that stores data from various probes on the phone in an encrypted state, which is key to protecting user data. It also provides a way for people to download their data to a computer or upload those data to a remote server for analysis.[12]

In addition to Funf, numerous commercial spyware applications are available for both the phone and personal computers that can be an important part of the data-collection toolkit for someone who might not have the means to develop his or her own personal software. In particular, software for monitoring productivity on computers—how much time is spent on certain websites and using certain applications—has become a cottage industry in itself.

II Software That Watches Your Habits

The MIT Reality-Mining project provides a specific example of setting up a mobile phone–based study to collect personal data. One of the tools used in the project was specialized software from the University of Helsinki that tracked the state of the phone: when it was in use for a call, when it was charging, when it was turned off, for example. Although this software may not be available to the average person, other software options can provide a log of the way a phone is used. And in some cases, software can log GPS data, obviating the need to go through a mobile operator or triangulating a Wi-Fi signal to get location data.

A quick web search turns up a number of sites that sell software to be installed on iPhones, BlackBerrys, Android phones, and Windows Mobile and Symbian operating system phones.[13] The software is targeted at parents worried about their teens' phone activity and whereabouts, at employers who want to monitor employees' use of company-supplied phones, and at people who want to catch spouses they suspect of cheating. It's important to note that different regions have different laws for collecting data from people's mobile phones, and to do so legally, permission from the person who owns the phone or ownership of the device and/or contract is required.[14]

The tracking software is loaded onto the phone and runs in the background, logging activity by those on the phone. These logs are then sent to a server and are accessible through a website. Call logs can be collected, including incoming and outgoing number, duration, and time stamp. Entire text messages can be stored on remote servers even after the phone's logs are deleted. GPS location can be logged when a signal is available. Depending on the phone, website uniform resource locators (URLs) can be recorded as well.

Comparable commercial spyware for personal computers is also available. Such spyware is marketed mostly to people who are interested in self-monitoring their computer activities to help them increase their own productivity. Throughout the world, millions of people spend their work hours using computers and applications such as email, chats, web browsers (and web pages), as well as word-, image-, and video-processing software—essentially any software that runs on a computer. Software applications such as Slife, RescueTime, Klok, SlimTimer, and WorkTime from Nestersoft Inc., to name a few, are designed to track the time spent running different applications in the foreground of the system and then to provide feedback to the user.

The software can be installed on a computer or run from a website. In some cases, a person can share information collected from these watchful services by tagging certain activities, such as reading news stories, as "public" information. She can also set goals for the amount of time spent in certain applications—for instance, 30 minutes answering emails in the morning. She can see progress toward her goals in visualization and can set up reminders to change tasks if she's spent too long using one application.

In addition to automatically logging information about the person using a device, there is a growing trend toward survey-based software specifically for mobile phones. In the fall of 2009, the company Techneos launched SODA, a system that lets people, researchers, and companies create surveys for mobile phones. Because mobile phones are, for many people, always nearby, a mobile phone survey, unlike an online survey, can target a person at a specific time of day or at a specific location, and it can be less obtrusive than a phone call.

SODA can be an interesting tool for people looking to collect data for Reality Mining because people can provide much more information than usually available in simple answers to survey questions. Location data can be included if the participants agree to it, and participants can also include pictures that are relevant to questions. The platform is flexible in terms of the type of questions that can be asked—multiple choice, sliding scale, open numeric, open text, audio file, image file, and even barcode input. In addition, it can be targeted to a range of languages, including Chinese, English, French, Portuguese, Spanish, German, Hindi, Japanese, and Thai.[15]

III Biosensors on the Body

Productivity, communication logs, and surveys, as recorded by a computer or a phone, supply only part of the picture of a person's day and life, however. Biometric sensors can fill in the gaps, giving precise information about physiological changes that occur during various times of day and during various activities. To get this information, researchers and individuals—often those with chronic illnesses—have turned to specialized hardware systems that track pulse, blood pressure, skin conductivity, and other metrics and in some cases that allow them to manually record symptoms, diet, and exercise.

BodyMedia is a large, established company that offers devices and a web service for tracking activity and providing reminders about health goals. CardioNet offers a portable electrocardiogram (ECG) system. Products such as the FitBit pedometer, the Nike+ exercise-tracking system, Polar and Garmin GPS watches, and the Withing's Wi-Fi-connected scale have also gained traction in the marketplace. (The Zeo Personal Sleep Coach also found market success as a sleep tracker using a wireless headband that transmitted data to a bedside alarm clock or a mobile phone, but unfortunately the company dissolved in early 2013.) In addition, mobile phone applications that make use of the gadget's accelerometers and GPS sensors, for instance, are also starting to play a growing role in collecting biometric information. Table 1.1 is a list of some commercial technologies that log biological data.

Software developers have also made phone applications that can provide some of the same functionality of dedicated sleep trackers, albeit with variable accuracy. iSleepTracker and Sleep Cycle are examples of apps that use the iPhone's accelerometers

Table 1.1
Various Commercially Available Sensor Products: Purpose, Features, and Interfaces

Product	Purpose	Features	Interface
Body Media FIT by Body Media	Tracks sleep quality and calories expended and consumed, mainly for weight-loss purposes.	Armband that contains a three-axis accelerometer that tracks motion, a thermometer that measures skin temperature, a galvanic skin-response sensor that tracks water content, and a heat flux sensor that measures heat dissipated from the body.	Simple LED indicator on armband; more detailed data are available on the website, to which users regularly upload data from the device.
Mobile Cardiac Outpatient Telemetry by CardioNet	Tracks heartbeats for irregularities and other problems.	A small, wearable ECG system that tracks all heartbeats 24 hours a day for up to 21 days.	Electrical leads attached to a person's chest transmit electrical signals to a small portable monitor worn around a patient's neck. When an abnormality occurs, the monitor wirelessly sends data to a center, where they are further analyzed and reported to doctors.
FitBit Tracker by FitBit, Inc.	Tracks certain types of low-impact physical activity and sleep quality.	A small, unobtrusive pedometer clips to pants or a bra (and in a wristband at night). It lasts 10 days before it needs to be recharged.	An in-home base station wirelessly transmits data from the pedometer to the company's server, where it is uploaded to a website that summarizes the data.

Table 1.1 (cont.)

Product	Purpose	Features	Interface
Zeo Personal Sleep Coach by Zeo, Inc. (company dissolved in 2013)	Tracks brain and face muscle activity during sleep.	Consists of a headband that measures electrical activity that corresponds to sleep stage and quality. The data are wirelessly sent to a specialized alarm clock that gently awakes a person in his or her lightest stage of sleep.	A specialized alarm clock displays sleep information and a web service that analyzes it and tries to correlate sleep quality to various lifestyle factors.
iSleepTracker by Innovative Sleep Solutions	Tracks sleep activity and quality.	A wristwatchlike device tracks sleep activity.	A website provides analysis and visualization.
HRS-I by WIN Human Recorder	Tracks heartbeats for irregularities and other problems as well as body temperature and movements.	A small sensor pack that attaches to a person's chest that can last for three to four days on a charge.	Data are transmitted to a mobile phone or computer and can be viewed online.
Garmin Forerunner 910XT GPS device	Records time, distance, elevation, and heart rate on land and swim distance, efficiency, stroke count, and pool lengths in water.	A wristwatchlike device that tracks various modes of physical exertion and geographic movement.	Wirelessly transfers data to Garmin Connect, an online site for analysis and sharing.

to measure movement on a bed. Similarly, Smart Alarm, an Android application, estimates a sleeper's sleep stage. Because these applications indirectly measure a person's movement (and results vary based on number of people and animals in the bed as well as firmness of mattress), the main purpose seems to be to wake up a sleeper when she is in the lightest sleep stage, staving off grogginess that can come from waking up during deep sleep.

Nike+ makes use of devices such as iPhones, Android phones, and iPods that people already use to listen to music while running. It tracks steps using a pedometer that can be clipped onto shoes or inserted in specialized Nike footwear, and wirelessly transmits the data to the phone or music player. When the gadgets are synced to the Internet for updates via a user's computer, the Nike+ data are uploaded to Nike's site, where a user can see his or her progress and virtually compete with other runners. The system is focused mainly on helping people who are actively running or walking to keep track of their workouts.

Similarly, RunKeeper, Runtastic, and Runmeter are mobile phone applications that use GPS to track people's outdoor activity where GPS signal strength is contingent upon direct line-of-site to GPS satellites. A person may manually enter activities that aren't outdoors, such as swimming at a pool, and allow their iPhone to sync with gym equipment, such as a treadmill, that provides workout outputs. As with all of the other systems, an online dashboard is used to see progress and keep track of goals.

RunKeeper has collaborated with Withings, a company that makes Wi-Fi-enabled scales so that when a person weighs herself on a Withings scale, the data is automatically logged on RunKeeper's site. This information is used when RunKeeper roughly calculates the number of calories burned based on the speed with which a person travels over a certain distance.

Each of these apps and devices provides various levels of user control over the way the data it collected are exported by the user. In some cases, in-app analysis is provided for free or with a fee for more advanced options. In the case of Body Media, a researcher must purchase a special license for access to all the data the armband collects. In order for individual Body Media customers who are not participating in a research study to access the data the armband collects, they must purchase a subscription to the company's online services and provide a significant amount of personal information to use the analysis tools. Although these products are providing more insights into the body than ever before, customers should read the fine print in product agreements to know exactly how the data are collected and used and whether the company or the customer retains ownership of it. Chapter 2 discusses more concerns over data ownership.

IV What Are You Doing?

Many biometric sensors and mobile phone applications are capable of sending out a message to a third party, be it a doctor or a public website where fitness data are publicly available. In essence, people are providing "status updates" about their physical condition. But status updates of all sorts have lately gained traction with the general public, providing a wealth of information about people's habits and activities.

A number of activity-tracking apps can now automatically update Twitter or Facebook statuses when an activity such as running or biking is complete. The Dartmouth project SoundSense, mentioned previously, uses the microphone of a mobile phone to infer a person's location and activity, information that could be used to provide simple status updates, such as whether a person is in a coffee shop, walking outside, or brushing his or her teeth, for example. The software captures bits of sound and, using machine learning techniques, guesses general sounds such as music or a human voice and discovers new sounds unique to a user, while keeping privacy in mind. In all cases, the raw audio is preprocessed so that features are extracted. The original audio is not saved, and the features alone don't provide enough information to re-create it.

V Lifelogging: Capturing the Flow of Data

Clearly, there are myriad ways to collect data about the individual. It's also clear that there currently is no unified method for collecting different types of data, which may be captured automatically, inferred by software, or produced and logged manually. But a growing subset of people are trying to create such a method for logging part or all of their lives: anything about themselves that can be quantified.

Lifelogging as a trend is somewhat more popular in communities of technically oriented people. Some of these people have created Internet and mobile phone applications for logging data, specialized hardware such as wearable cameras for capturing video and images, and spreadsheet templates for recording a range of daily behaviors such as types of food consumed and emotions felt. Lifelogging fills in the gaps left by other data-collection methods and attempts to combine all the data in a cohesive framework that explains the individual quantitatively.

Ultimately, this type of work has a boundless potential. One obvious application is that lifelogging allows people to see their habits and how small changes in behaviors affect the rest of their lives, but there are more far-reaching possibilities as well. Today, no one really knows what the longitudinal indicators of, say, a heart attack are. But with more people self-surveilling so many aspects of their lives—and making it public, as is the trend—it might be possible for researchers to look back over a person's months or years of data and determine correlations, possible causes, and potential indicators of a severe medical event.

Some of the most compelling lifelogging projects involve automatically capturing images and video. In late 2009, Vicon, a company that makes motion-capture systems, licensed technology developed at Microsoft to manufacture and sell a wearable camera that automatically takes a series of pictures throughout the day.[16] Microsoft's SenseCam hardware consists of a wide-angle lens and a number of different electronic sensors, including light-intensity and light-color sensors, a passive infrared (body heat) detector, a temperature sensor, and a multiple-axis accelerometer. SenseCam can be programmed to take a picture at a regular interval or when changes in the wearer or environment, recorded by the sensors, trigger a photograph to be taken.[17]

Today, Google is promoting its lifelogging device, Glass, which sports a heads-up display, camera, microphone, processor, and wireless functions—all inside the frame of a pair of lens-free glasses.[18] With a voice prompt, the camera can take pictures or video. Because the display is networked, it can show text messages and provide navigational directions. Google allows programmers to build their own apps for the device, from games to news alerts. It's still early days for this product, which has received quite a bit of hype. No one knows how popular it will eventually be outside tech circles, but it's likely just the first iteration of this sort of wearable technology.

Other small, wearable cameras are the GoPro and Contour wearable video cameras, designed for extreme athletes. Both come with a number of different types of mounts so the cameras can be affixed to a helmet or worn on a chest harness, for instance. Another wearable video camera, called Loocxie, is small and light enough that it can be mounted around the ear.

A number of online blogs aggregate information about various lifelogging devices, systems, and software, some of them mentioned earlier in this chapter. *Total Recall* by Gordon Bell and Jim Gemmell and *The Quantified Self* by Kevin Kelly are popular blogs that cover lifelogging. Gordon Bell of Microsoft is known as one of the most prolific lifeloggers and has been collecting personal data for years in a project called MyLifeBits.[19] The project is accessible online, where pictures, videos, phone call recordings, personal letters, and greeting cards are sorted and searchable.

To log your life, it's helpful to begin with a guide,[20] and people sometimes start by focusing on one aspect of their lives—such as when they go to sleep and wake up—and expand to other areas where recording data isn't as daunting. One system that focuses on a single metric is called Track Your Happiness.[21] It's a project out of Harvard in which automated text messages are sent to a participant's mobile phone. The messages contain a link that opens a short survey about what the person is doing and how they feel about it. After weeks of answering questions multiple times a day, a person is provided a "happiness report" that visualizes the participant's responses.

Another system, called your.flowing.data,[22] allows people to send to an online database a direct message via Twitter about what they are doing. For the most accurate log, it helps to follow a proscribed template in the messages, such as "reading X" or "watching X." The your.flowing.data system automatically logs the time the message is sent, thereby providing a time stamp, and the site provides visualization of the frequency of activities.

DailyDiary[23] is a site that sends out email prompts asking people specific, preselected questions such as “How was your day?” and “What did you eat today?” Members of the site answer questions, get ratings, and are able to participate in an online community, seeing how others are progressing toward goals.

Although these tools allow people to log and organize more information about their lives in a digital way, they lack a crucial characteristic: they are not easy to use and to remember to use. As long as lifelogging relies heavily on manual data entry, with an objective to collect as much as possible, it will remain a fringe activity because most people only selectively and sparsely record their life events.

VI Conclusion

A person can self-track parts of his or her life and habits in a growing number of ways, and there is more and more software that does much of this tracking passively, behind the scenes, without input from a person using the tracking software. Some people would argue that personalized data collection won’t take off until it can happen without a person constantly tending to a device, entering data, and fiddling with settings. Others believe that people should always be in the loop of personal data collection so they can choose exactly what they want saved and how and where they want it stored.

It’s likely that a combination of the two approaches will persist in personal-data-collection techniques for a while. Each person has his or her own tolerance for making information about himself or herself publicly available, so the best approach that self-tracking services can take is to offer a range of privacy settings that are easily readable and understandable by their