



Can Cognitive Assistants Disappear?

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If the most profound technologies are those that disappear,¹ will a cognitive assistant ever be profound? Cognitive assistants help their human counterpart, implying that the human is actively aware of the assistant and draws on the expertise that the assistant brings to the table. Will cognitive assistants ever disappear? What does that even mean, in this case?

COGNITIVE ASSISTANTS

Various companies have introduced cognitive assistants in recent years, including Aldebaran/Softbank, Amazon, Apple, Google, IBM, and Microsoft (see Table 1). Each cognitive assistant helps its user with various tasks. Personal assistants help their humans with everything from communications to entertainment, while professional assistants can greet customers or help improve patient care, for example. These assistants will likely become more commonplace in the future, but their long-term success will depend on how essential they become to their human counterparts.

Fundamentally, the use case for these technologies involves a human interacting with them directly. These technologies listen and speak to their users. Many can see their humans and some can move and make gestures. Clearly, these technologies are not intended to disappear from view.

They can, however, weave themselves into our everyday lives. They can become essential by performing tasks useful and important to our work and home lives. Such tasks might include

- applying their knowledge of the medical literature to help a doctor make more evidence-based decisions about a patient's care;

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- keeping their elderly charges safe so they can live independently at home, many years beyond the point at which previous generations had to move into nursing homes; and
- helping smoothly run a home with two working parents and school-age children, providing them with more quality family time and less stress and anxiety.

If these assistants can perform these types of tasks, then they will become essential to our lives, possibly weaving their way into our everyday activities.

Although these technologies interact directly with us, they can “disappear” in a sense, if we feel as though we're interacting with another person as opposed to a computer. These assistants will disappear if they can

- interact using natural language,
- read emotions from a tone of voice and facial expressions,
- understand the context of a request, and
- understand gestures and other non-verbal forms of communication.

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Yet, our requests of cognitive assistants are likely to be different in some ways from our requests of human assistants. For example, embarrassment might prevent us from asking questions or making requests of a human assistant in ways that we might not be inhibited when talking with a cognitive assistant. On the other hand, cognitive assistants introduce new privacy concerns. For a cognitive assistant to work, it must be listening to our conversations and watching us at all times, looking for the point at which we want or need its help. If our cognitive assistant is hacked, our personal privacy is compromised.

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TABLE 1
Cognitive assistants in the marketplace.

Company	Product	Quote from company website
Aldebaran/ SoftBank Robotics	Pepper	"Pepper is a human-shaped robot. He is kindly, endearing and surprising. We have designed Pepper to be a genuine day-to-day companion, whose number one quality is his ability to perceive emotions.... Pepper also recently became the first humanoid robot to be adopted in Japanese homes." (www.ald.softbankrobotics.com/en/cool-robots/pepper)
Amazon	Echo with Alexa	"Amazon Echo is a hands-free speaker you control with your voice. Echo connects to the Alexa Voice Service to play music, provide information, news, sports scores, weather, and more—instantly." (www.amazon.com/Amazon-Echo-Bluetooth-Speaker-with-WiFi-Alexa/dp/B00X4WHP5E)
Apple	Siri	"Talk to Siri as you would to a friend and it can help you get things done—like sending messages, placing calls, and making dinner reservations.... Siri works hands-free, so you can ask it to show you the best route home and what your ETA is while driving. It works with HomeKit to let your voice be the remote control for connected products in your home." (www.apple.com/ios/siri)
Google	Home	"Google Home is a voice-activated home product that allows you and your family to get answers from Google, stream music, and manage everyday tasks." (https://home.google.com)
IBM	Watson for Oncology	"Get oncologists the assistance they need to make more informed treatment decisions. Watson for Oncology analyzes a patient's medical information against a vast array of data and expertise to provide evidence-based treatment options." (www.ibm.com/smarterplanet/us/en/ibmwatson/watson-oncology.html)
Microsoft	Cortana	"Cortana will help you find things on your PC, manage your calendar, track packages, find files, chat with you, and tell jokes. The more you use Cortana, the more personalized your experience will be." (http://windows.microsoft.com/en-us/windows-10/getstarted-what-is-cortana)

Cognitive assistants have the potential to become profound technologies that disappear and weave themselves into our everyday lives. They still have quite a way to go, and we face many challenges in achieving their promise, but they are well on the path along this journey.

IN THIS ISSUE

Another new technology that has woven its way into our lives is digital displays. With the proliferation of these displays, pervasive computing researchers are examining new and exciting ways to leverage pervasive displays in unusual ways while also minimizing the associated management costs of this technology. In addition to our collection of articles on pervasive displays this issue, we also have two feature articles.

In our first feature article, Yungeun Kim, Yohan Chon, and Hojung Cha present a "Mobile Crowdsensing Framework for a Large-Scale Wi-Fi Fingerprinting System." In their work, they leverage the sensors on the smartphones of casual users, along with the common behavior of "checking in" at

various locations, to scale Wi-Fi location systems to large areas. At the same time, this approach helps minimize maintenance costs and maintain location accuracy over time. They examine their system in a large shopping mall and an office building.

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Our second feature article, "Psychological Frameworks for Persuasive Information and Communications Technologies," by Joseph J.P. Simons is rather thought-provoking. It examines how insights from social psychology can influence the design of systems intended to foster positive behavior changes in users. Simons presents how three different psychological theories can influence pervasive computing technologies: the theory of planning

behavior, the self-determination theory, and the control theory. He points out that understanding these theories can help pervasive computing practitioners better understand why their interventions ought to be effective or why they might not work. He also helps practitioners identify fertile areas to explore.

In our Notes from the Community department, Justin Manweiler and Mary Baker examine instrumentation. They look at our increasingly instrumented world, with a focus on smarter cities. They also look at instrumenting our bodies, discussing "smart jewelry," a smart postage-stamp-sized health monitor, and wearables for kids. They also discuss drones and robots, including a robot that recycles phone materials and a personal assistant recently introduced by Samsung.

Our Smartphones department focuses on smartdrones. Ross Allen, Marco Pavone, and Mac Schwager argue that smartdrones will serve as the next revolution in personal computing in "Flying Smartphones: When Portable Computing Sprouts Wings." Just as smartphones revolutionized

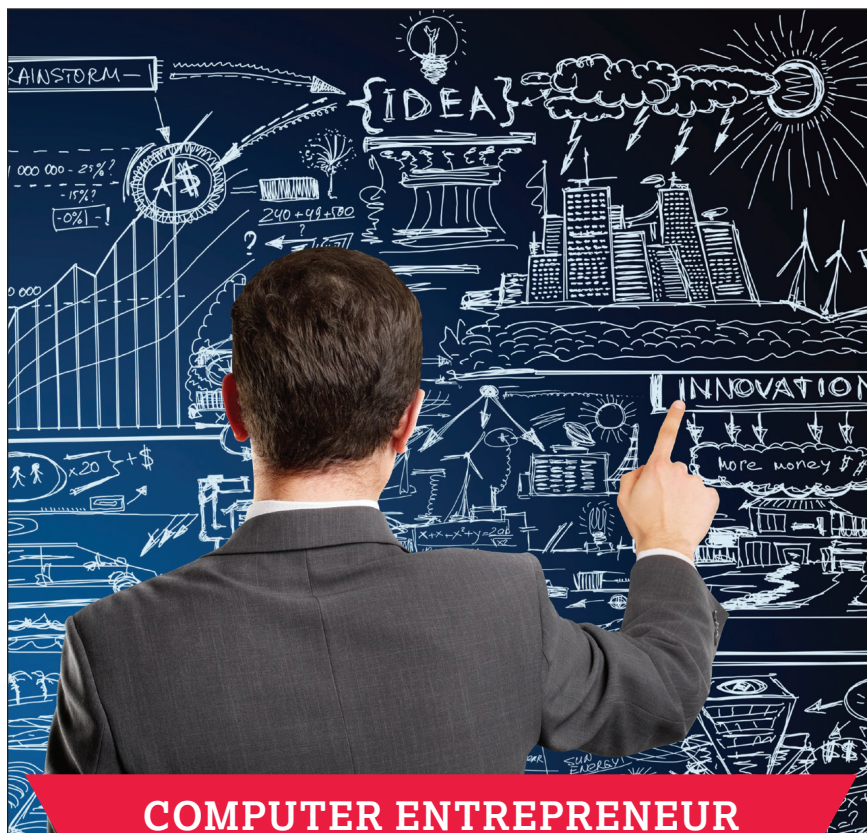
personal computing more than a decade ago, they argue that drone technology will serve as the basis for the next revolution. They provide some very compelling use cases to support this argument as well as a few “further out” ideas such as the concept of an array of drones serving as a mobile, aerial display.

Information is on constant display in the world around us, from posters and billboards to pervasive displays to, perhaps, even aerial displays provided by arrays of smartdrones. Cognitive assistants might one day help us filter this information to highlight the elements that matter most to us. How many times have you missed an important sign because you couldn't see the forest for the trees? Might this someday be a thing of the past, when your cognitive assistant processes that all-important sign and brings its content to your attention just when you need it most? **■**

REFERENCE

1. M. Weiser, “The Computer for the 21st Century,” *Scientific American*, Sept. 1991, pp. 66–75.

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