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***The Sharpest Edge*: Digital Assistants**

Many scientists, politicians, philosophers, and ordinary citizens worry about the impact that powerful artificial intelligences will have on our society. Meanwhile, AI's slower cousins, digital assistants, are already having meteor-strike impact on industries as varied as media, entertainment, retail, ecommerce, payments, transportation, health, communications and more.

But this transformation can be hard to see because – thanks to science fiction – chatting with computers has been a familiar idea for more than half a century. The original *Star Trek* series (starting in 1966) featured talking computers. The 1968 movie *2001: A Space Odyssey* starred the sinister HAL 9000. More recently, Jarvis in the *Avengers* movies (starting in 2008) runs an entire corporation, and Samantha in the movie *Her* (2013) is so lifelike that her user falls in love with her disembodied voice.

This familiarity makes the arrival of real-life digital assistants – like Apple's Siri, Google Assistant, Amazon's Alexa, and Microsoft's Cortana – different than earlier new technologies for creating and manipulating information. When the first Mac was unveiled in 1984, users had to learn how mouse movements correlated to onscreen cursor movements. A few years later, tablets and smartphones required users to learn how to use touch-screens to swipe, pinch-and-zoom, etc.

In contrast, we talk with digital assistants the same way we talk with our fellow humans, even though today's assistants often fail to understand the most basic queries.

At the Center, we believe that new interfaces can lead to big changes in behavior, which is why we included several exploratory questions about digital assistants in our most recent annual survey on the impact of technology on Americans. The results were intriguing.

In light of these results, our aim is to launch a bigger survey to explore in detail how Americans view their digital assistants. We also want to delve into how Americans' activities are changing as we all get comfy asking our new digital friends to help us with everyday tasks. And, we'll explore the implications these developments have for organizations and businesses of all types.

In the pages that follow, you'll see both the conclusions that our current results suggest and also some of the burning questions we will explore.

We invite you to partner with us as we pursue this important new project.

Brad Berens, Ph.D.
Chief Strategy Officer

Beyond smartphones and smart speakers

What is a digital assistant? Here is how we posed the question to our respondents:

A "digital assistant" is a voice-activated program in your smartphone or in a device in your home: Apple's Siri, Amazon's Alexa, Google's Assistant, and Microsoft's Cortana are all examples. Do you use a digital assistant?

Neither the question nor the responses distinguish between the two general containers for digital assistants: smartphones like Apple's iPhone and smart speakers like Amazon's Echo devices.* A great deal of recent thinking about digital assistants splits the analysis by kind of device, so one research company might narrowly focus on how many more Echo smart speakers Amazon has sold compared to equivalent devices at Google or Apple.

One thing this narrow focus misses is that Amazon *had* to apply its considerable marketing muscle to selling smart speakers because its Fire Phone alternative to iPhone and Android was a rare failure for the company.

More importantly, focusing on sales numbers for smart speakers distorts the larger strategic picture because it ignores the huge existing "install bases" of both Siri in iOS devices (iPhones and iPads) and the Google Assistant in many different sorts of Android devices.

Amazon may be leading the market in smart speaker sales, but many more people are likely to interact with the Google Assistant because there are more Android devices sold than either Echo smart speakers or iOS devices. For both Apple and Google, buyers of their smart speaker products represent extra users for already pervasive digital assistants.

Moreover, unlike Amazon and Apple, you don't have to buy an Android device to use the Google Assistant: a limited version of the Assistant comes with the Google App that anybody can use, for free, on an iPhone or iPad. The main difference between the Google Assistant on an iPhone and on an Android phone is that on Android the Assistant is the *default* always-listening digital assistant. If you say, "OK Google" to an iPhone the result will be silence ... unless you've already opened the Google App.

At the Center, our focus is on how digital assistants change behavior, rather than which company is winning the race to sell a particular device and create an ecosystem of services around it. Whichever company wins, digital assistants are here to stay.

* Microsoft's Cortana also exists within its Xbox game platform, and Siri comes with the most recent Macintosh computers and laptops.

1. Who uses digital assistants?

44% Percentage of Americans who use digital assistants, either on smartphones or devices at home

62% Percentage of Americans under 16 who use Digital assistants

Almost half of Americans use a digital assistant. However, use varies dramatically depending on age; more than half of respondents under 16, age 16-18, age 25-34, and age 35-49 use digital assistants, while 34 percent or less of users age 50 or older use them.

< 16	16-18	19-24	25-34	35-49	50-64	65-74	75+
62%	51%	46%	51%	51%	34%	31%	27%

Analysis

Some of our youngest respondents will never remember a time when they *didn't* talk with computers, which is an important mindset shift. For these youngest respondents, digital assistants are a *native interface*: part of their earliest computing experiences, akin to how babies and toddlers today effortlessly navigate tablets apps.

Despite the cliché that older people are technophobic Luddites, the percentage of Americans aged 75 and older who use digital assistants is high for a relatively new technology. With decreased vision and mobility that can come with age, digital assistants are likely to become increasingly important ways for the elderly to stay connected and remain independent.

We can see a time of high level partnerships between digital assistant creators and health insurance companies, hospitals, and retirement communities as digital assistants evolve from novel gadgets into key lifestyle interfaces for older Americans, with attendant privacy concerns (see the final section for more on privacy).

Burning questions to explore:

- Which digital assistants do different age groups prefer?
- Do different age groups lean towards smartphone assistants or smart speaker assistants?
- How do different age groups use digital assistants?
- Why do people use digital assistants? If they don't, why not?
- Do people tend to use only one digital assistant or more than one? If more than one, then do they use their different digital assistants in different ways?
- What would make people use digital assistants more or less often?

2. What do users do with their digital assistants?

> **60%** Information searches; check weather and traffic; set alarms

7% Chat with their assistant when they are alone

Respondents use digital assistants for a broad range of functions: secretarial functions like information retrieval, setting alarms, and checking weather or traffic; as well as more sophisticated interactive processes such as home energy management or asking the digital assistant to read emails aloud while driving.

A small but notable percentage use their digital assistant to socialize: seven percent of users said they chat with their digital assistant when they are alone.

To check the weather or traffic	64%
To search for information online	64%
To set alarms, reminders, and timers	62%
To text or call people when I'm driving	45%
To listen to music, podcasts, and other entertainment	43%
To ask the time	39%
I ask it weird questions to entertain myself	35%
To perform various functions like add things to my calendar, to-do lists, or shopping lists	29%
To tell me jokes	26%
To settle bets or win arguments	24%
To listen to the news	19%
To control devices in my home: lights, air conditioning, entertainment system or heat	13%
To buy things online	11%
To read my email to me when I'm driving	10%
I chat with it when I'm alone	7%

Analysis

The three most common ways that people use their digital assistants – setting alarms, timers and reminders; checking the weather and traffic; searching for information – are all things that people already do with other devices. Digital assistants just make the process easier and enable users to do other things at the same time.

Lower percentages either reflect newer activities (having a computer read email aloud) or activities that require additional investment (like having to purchase smart light bulbs and sensors needed to create a "smart home").

Shopping and buying

Let's zoom in on the 53-percentage point difference between how many people use digital assistants to search for information online (64 percent) and how many people buy things online (11 percent). Despite a lot of ink spilled in the press about the rise of "conversational commerce," at the moment 89 percent of American users of digital assistants do *not* complete transactions through their digital assistants alone.

Although direct buying via voice is still in its infancy, we expect both that it will grow quickly and also that interactions with digital assistants are already affecting other forms of shopping and transaction. If a shopper asks Alexa for, say, AAA battery options, then the different brand options that Alexa shares can have an impact on what the user buys even if the user ultimately buys via a phone, computer, digital assistant, or at a store. (See additional voice commerce discussion in the final section.)

Entertainment

More than a quarter of Americans who have digital assistants ask it to tell jokes, and 35 percent entertain themselves by asking it weird questions. This suggests that while at the moment digital assistants are primarily functional, in the not-too-distant future the digital assistant may become a go-to entertainment medium, not only to control an entertainment center or pipe in music and podcasts but also as a set of interactive experiences that can only happen among users and digital assistants.

It may not be long before we can say, "Hey Siri, let's play 20 questions" or "OK Google, harmonize with me as I sing 'This is America.'"

This likely arc from-utility-to-entertainment would echo how the web developed in the early years of the internet. While at first users went online in order to get specific information or do predetermined things, over time they increasingly went online with no specific destination in mind: 85 percent of Americans did this sometimes or often in our 2017 study.

Loneliness

Although at seven percent, "I chat with it when I'm alone" is the least selected answer, it's still surprising that the number is even that high.

For the 25 to 34 year old group, the number is nearly doubled at 13 percent. It's unlikely that these digital assistant users *really* think that there are conversation-worthy intelligences hiding inside smartphones or smart speakers, so why are these users chatting with Siri, Alexa, et cetera? And what are they talking about?

Famously, computer scientists have the "Turing Test" as a benchmark for artificial intelligence: an AI passes the test when it can engage a human in conversation without the human realizing that she or he is talking with a machine.

What the seven percent of cyber-chatting Americans suggests is that there's another question lurking behind the Turing Test: while it's important to determine whether or not humans can *tell* if they're talking with machines, it's also important to find out if they *care* that they're talking with machines instead of other people, particularly when lonely.

Work-based uses

The options we provided to respondents were mostly private or home-based activities people might engage in with digital assistants. The exceptions were asking the assistant to make calls, send texts, or read email messages out loud.

A new frontier of activities for digital assistants involves taking on human secretarial duties such as scheduling meetings, fielding phone calls, and taking notes in meetings. Some pioneering companies are already exploring this: X.ai has its email-based Amy and Andrew virtual meeting schedulers. Voicera has Eva, a virtual assistant that rides along with its users during the parts of the business day that involve other people.

In May, Google announced "Google Duplex," an extension to the Google Assistant that will do things like using the phone to schedule haircuts for Assistant users. The Duplex persona was so convincing that, after protests, Google reprogrammed Duplex to let the people it was calling know that it was a virtual assistant rather than a flesh-and-blood person.

Our next steps will explore how people are using digital assistants to help them in their workdays, what they use them for, and how they feel about the interactions.

Burning questions to explore:

- What different sorts of information do people want from their digital assistant compared to other forms of searching?
- When people shop with digital assistants, how is that shopping different than other sorts of ecommerce or from going to a physical store? Do they shop for different things by voice?
- Do people engage differently with brand-name products versus generics or house brands when they shop with digital assistants?
- Do different groups buy different things with digital assistants?
- Do people use different digital assistants to buy different things?
- How do buying patterns vary across age, income, education, and geography?
- When people chat with their digital assistants, what do they talk about?
- How does at-home or personal use of a digital assistant compare to at-work or professional use?
- Do users prefer one digital assistant for both home and work or to have different assistants for different realms?
- Do people feel differently about interacting with somebody else's digital assistant – say, when setting up a meeting – than they feel about interacting with their own?

2a. What do users do with their digital assistant? (By gender)

45% Men who use digital assistants

44% Women who use digital assistants

Nearly equal percentages of men and women use digital assistants. However, men and women report many differences in how they use them.

In general, larger percentages of men report using most of the functions of digital assistants, such as checking the weather or traffic, listening to news or entertainment, or setting alarms; more women report using digital assistants to buy online, read email to them while driving, and chat while they are alone. Men seem to be adopting digital assistants as all-purpose utilities slightly faster than women.

Overall		Male	Female	Difference
64.4%	To search for information online	65%	65%	–
63.9%	To check the weather or traffic	69%	59%	+10 men
61.7%	To set alarms, reminders and timers	65%	59%	+ 6 men
44.9%	To text or call people when I'm driving	44%	45%	+ 1 men
43.1%	To listen to music, podcasts and other entertainment	46%	40%	+ 6 men
38.5%	To ask the time	41%	36%	+ 5 men
35.2%	I ask it weird questions to entertain myself	36%	35%	+ 1 men
29.0%	To perform various functions like add things to my calendar, to-do lists or shopping lists	33%	25%	+ 8 men
25.6%	To tell me jokes	27%	24%	+ 3 men
23.8%	To settle bets or win arguments	25%	23%	+ 2 men
19.2%	To listen to the news	22%	16%	+ 6 men
12.9%	To control devices in my home: lights, air conditioning, entertainment system or heat	15%	10%	+ 5 men
11.0%	To buy things online	9%	12%	+ 3 women
9.9%	To read my email to me when I'm driving	8%	12%	+ 4 women
6.8%	I chat with it when I'm alone	5%	9%	+ 4 women

3. What do users think about digital assistants?

22% Use it a lot or couldn't live without it

39% Don't use it often or wouldn't miss it

Even though more than forty percent of Americans use digital assistants, their enthusiasm for the devices is relatively low.

Of digital assistant users, 18 percent said they use the devices a lot, while four percent said they "couldn't live without it." However, at the other extreme, 26 percent said they don't use their digital assistants often, and 13 percent said they wouldn't miss their digital assistants if they were gone.

I use it because it's there	38%
I don't use it very often	26%
I use it a lot	18%
I wouldn't miss it if it were gone	13%
I couldn't live without it	4%
Other	1%

Analysis

People generally adopt a new technology for a handful of reasons:

- 1) it's exciting and new, so a slim percentage of early adopters who like to explore new things jump at the chance (CompuServe and AOL in the first days of the internet, the earliest automobiles);
- 2) the new technology does something that people are already doing, but better faster or cheaper (email instead of paper mail or fax, streaming music instead of buying CDs or mp3s); or
- 3) different technologies or activities combine to create something new (blogging and digital photography become Instagram; the mp3 format plus digital distribution result in podcasts; GPS, Google Maps, a smartphone, and a credit card make possible ride-hailing services like Lyft or Uber).

All these reasons for adoption hold for digital assistants: 1) although there are plenty of early adopters, use of digital assistants is far less than, say, email or smartphones; 2) digital assistants let users set timers, listen to music and podcasts and get the time without picking up a device, and 3) users can chat with digital assistants the way they can't with, say, a conventional search engine. As time goes by more new activities will come into focus.

At first glance, it might seem disheartening that only four percent of Americans couldn't live without their digital assistants. However, the reality – that at 38 percent the most-selected answer was, "I use it because it's there" – is good news for the creators of the various digital assistants. Siri first became available in 2011, Alexa in 2014, and the Google Assistant in 2016, so it's a triumph for a tool to become naturalized as a go-to resource for users in just a handful of years.

Enthusiasm vs. adoption

While enthusiasm and adoption rates overlap, they are not the same thing. Many people complain about an unrelenting Niagara of email hitting their inboxes every day, but email is still one of the dominant ways we communicate. Digital assistants may find a similar place in the lives of users: occasionally interruptive but always around, always useful, and eventually indispensable.

Moreover, "I use it because it's there" as the most-popular answer illuminates the strategy that all three major creators of digital assistants are using: *be there as much as possible*.

The key metric

The race to watch isn't which company sells the greatest number of smartphones or smart speakers. Instead, the key metric to track is which digital assistant eventually enjoys the widest distribution across the world's population and the deepest penetration into the greatest number of actions and activities that individuals perform on a daily basis.

By this metric, Google has an advantage at the present time.

Without a smartphone (as discussed earlier), Amazon has had to focus its Alexa-shaped energies on selling as many Echo devices as possible and also on integrating Alexa into as many other technologies as it can, including cars, new home developments, smart home technology, and many digital services.

Amazon is also rumored to be developing prototype "Alexa Glasses" that put a small microphone into the nosepiece of glasses frames and use the earpieces to create a mastoid bone conducting "speaker." Wearers of these frames would have Alexa mounted on their faces, always listening... it's an attempted end-run around Siri and the Google Assistant to put a different default listening digital assistant between the smartphone and the user.

Apple had a head start with Siri that it squandered by not investing heavily in upgrading the technology, but the number of iPhones with Siri still eclipses the number of Amazon Echo devices. More recently, Apple has poured Siri into its new wireless earbuds, Macs, and the just-released HomePod speaker.

Is computing hardware losing importance?

Apple's successful strategy of positioning itself as a luxury brand in consumer electronics has made it the most valuable company in the world, but when it comes to digital assistants the thin-upper-slice niche strategy will be a limitation. As more and more computing becomes auditory (rather than touch and vision based), hardware will become less important, which may become another threat to Apple.

The Google Assistant is pervasive across every Android phone or tablet, Chromebook, Google search, and speaker; a hardware purchase isn't required to use it, and – perhaps most important and least remarked upon – some aspects of the Google Assistant follow users from device to device.

If you Google something on your smartphone, that search informs what Google shows you on your laptop. If you search a location on Google Maps on your computer, then when you hop in the car and whip out your smartphone, the address is already there.

In contrast, although different versions of Siri and Alexa share information (so long as each device links to the same Apple ID or Amazon account), at present Alexa isn't there outside of Echo devices and partner devices; Alexa also won't help you when you're shopping at Amazon.com. Similarly, there is no free version of Siri, and Siri doesn't help when you're using iTunes on your laptop... at least for now.

Next Steps

Voice commerce

Earlier, we noted that despite a great deal of industry press about voice-enabled shopping and buying the vast majority of Americans digital assistant users (89 percent) do *not* make purchases via their digital assistants... at least not yet.

A recent report by eMarketer, "Conversational Commerce: the Rise of Voice Assistants" (May, 2018), reported that 22 percent of Americans who own smart speakers make purchases via those devices. Not too many Americans own smart speakers, and digital assistants represent a broader category than smart speakers (see "Beyond Smartphones and Smart Speakers," above). Nevertheless, we can expect increased voice commerce as digital assistants of all sorts become more pervasive.

We can also expect that voice-based searching for products will change the nature of purchases. Unlike conventional search, which is visual and where an entire "search engine results page" (SERP) displays after we hit "Enter," digital assistants can only recite one result at a time. Being first in search results will therefore become even more important with voice than with visual search.

It's also possible that voice shoppers will tend to buy more generic goods rather than name brands given the more conversational nature of voice shopping. Unless the shopper is already committed to a specific brand, then how likely is it that the shopper will say, "Alexa, I need Charmin" rather than, "Alexa, I need toilet paper"?

Amazon's tendency to favor its house brands in voice search results (according to research by Bain & Company performed in October of 2017) might also add to this possible rise of generics and decline of brand names.

Privacy

In May, a woman named Danielle who lives in Portland, Oregon discovered that her Amazon Echo device had recorded some of the conversations happening in her home and then emailed the recordings to one of her contacts without her realizing any of this had happened.

As the story quickly gained traction in the news media, Amazon claimed the incident was because of a series of mishaps (the device thought it heard the wake word "Alexa," and then it misheard other things), rather than planned surveillance.

Users expect discretion from their digital assistants. On one hand, the assistant should always be listening, ready to obey any commands the user issues. On the other hand, the assistant should only pay attention when the user wants it to do so, otherwise sitting deaf.

Views about digital assistants

We expect user attitudes towards digital assistants to evolve quickly, both as more people start using digital assistants and also in the face of increased awareness of issues concerning digital privacy on a global scale.

Recent news stories about digital privacy include the European Union's newly-launched General Data Protection Regulation (GDPR), Facebook's series of negative revelations about how it and its associates misuse people's information (the most prominent was the Cambridge Analytica scandal), and the FCC's rollback of Obama-era internet neutrality regulations.

Digital assistant privacy issues are complex. Do users feel differently about their smartphones always listening versus dedicated smart speaker devices? And how do possible concerns about digital assistants compare to other always-listening devices (for example, some Samsung televisions are always listening)? Likewise, how do concerns about digital assistants compare to other forms of digital surveillance, like how tech companies track people's overall online activities and use that information to build sometimes spookily accurate profiles?

Burning questions to explore:

- Are users concerned about their digital assistants storing their credit card numbers?
- If this concern exists, then how does it compare to similar concerns about sharing credit card numbers with websites and ecommerce companies?
- Do users notice – and do they care about – the reduced number of options presented by digital assistants compared to visual ecommerce?
- Do users worry about their digital assistants spying on them?
- Do concerns about digital assistants and privacy differ between home use and work use?

Conclusion

These and other issues are new, like the digital assistants themselves. However, there are now enough people using digital assistants that it's both urgent and compelling to investigate how this use changes attitudes and behaviors.

About the Center for the Digital Future

The Center for the Digital Future at USC Annenberg is a think tank that explores current issues and coming trends in the digital realm. The Center was created in 1993, and tracks the global evolution of digital technology and platforms, studying their impact on users and non-users.

The Center is best known for the Digital Future Project, the first and longest-running longitudinal research study that explores the views and behavior of American users and non-users of digital technology. First published in 2000, each year the project explores more than 100 major issues in five general subject areas. The Digital Future Study is the most comprehensive study of its kind. The "Sharpest Edge" short reports present focused samples of the larger study's highlights.

The Center for the Digital Future created and manages the World Internet Project, which coordinates similar research on digital technology conducted in 32 partner countries. The Center also conducts customized and propriety studies, consulting, and marketing research to support global companies, government leadership, NGOs, and policymakers.

The Center is based in the USC Annenberg School for Communication and Journalism. Until July 2004, it was housed at the UCLA Anderson Graduate School of Management.

Director Jeffrey I. Cole, Ph.D.

The Center for the Digital Future is directed by Jeffrey I. Cole, Ph.D., a scholar on communication issues who has taught and conducted research on the faculties at USC and UCLA since 1978.

New Projects

In 2016, the Center launched a new series of topical surveys on Americans' behavior and views about specific industries, including transportation, digital money and banking, sports, and health.

Emerging Issues

The Digital Future Study is not restricted to investigating a particular method of accessing the internet. The project also explores many aspects of change on the internet and its evolving applications; such as social networking, unwanted attention online, bullying, the cloud, and online dating.

Visit www.digitalcenter.org for more about the Center, or contact us either via email at info@digitalcenter.org or by phone at 310.235.4444.