
# SIRI RISING

## Is She the Voice of Our Digital Future?

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ILLUSTRATION BY MARTIN GEE; PC PLUS MAGAZINE/FUTURE PUBLISHING/GETTY IMAGES (IPHONE)

# >> The world got its first inkling

of the quick wit that would make Apple's Siri an icon during a packed press conference held before an auditorium of tech elite. ❡ "Who are you?" an Apple executive asked the assistant. ❡ "I am a humble personal assistant," Siri answered to appreciative laughter. ❡ More like humbled personal assistant. That press conference was actually Siri's second coming-out party. When the virtual assistant first launched in early 2010, it was a standalone iPhone app called Siri created by a 24-person startup with the same name, a company Apple would later acquire.

A customer tries the Siri voice assistant function on an Apple iPhone 5 in Australia during its debut on Sept. 21, 2012.

IAN WALDIE/BLOOMBERG VIA GETTY IMAGES

Back then, Siri boasted an even more irreverent tone — and a more robust set of skills. Like fiction writers dreaming up a character, Dag Kittlaus, Siri's co-founder and chief executive, and Harry Saddler, a design expert, had carefully crafted the assistant's attitude and backstory. It was to be "otherworldly," "vaguely aware of popular culture" and armed with a "dry wit," Kittlaus says.

Ask it about gyms, and Siri sent back a mocking, "Yeah, your grip feels weak." Ask, "What happened to HAL?" — the brainy (and murderous) talking computer that starred in Stanley Kubrick's 1968 thriller *2001: A Space Odyssey* — and it delivered a sullen, "I don't want to talk about it." In those days, Siri still had "fuck" in its lexicon.

That was before Apple washed Siri's mouth out with soap and curbed many of its talents, even as it endowed the assistant with new gifts. The Siri that Apple introduced in October 2011, 16 months after acquiring the technology for a reported $150 to $250 million, had expanded its linguistic range from one to multiple languages. It was scaled to serve millions of people and programmed to operate internationally. It had acquired a voice with which to speak its answers, where before it had offered only written responses. And it was deeply integrated into the iPhone, so that it could tap into about a dozen of Apple's own tools to handle simple tasks like scheduling a meeting, replying to emails or checking the weather.

> "A KINDER, GENTLER HAL IS ON WAY ITS WAY TO THE MAINSTREAM FOR SURE."

As impressive as those talents were, most failed to realize that Apple's version of Siri lacked many of the features once built into the program. This, after all, was no ordinary iPhone app, but the progeny of the largest artificial intelligence project in U.S. histo-

ry: a Defense Department-funded undertaking that sought to build a virtual assistant that could reason and learn.

At its original debut, in 2010, Siri had been able to connect with 42 different web services — from Yelp and StubHub to Rotten Tomatoes and Wolfram Alpha — then return a single answer that integrated the best details culled from those diverse sources. It had been able to buy tickets, reserve a table and summon a taxi, all without a user having to open another app, register for a separate service or place a call. It was already on the verge of "intuiting" a user's pet peeves and preferences to the point that it would have been able to seamlessly match its suggestions to his or her personality.

At a 2010 tech conference, Siri co-founder Tom Gruber demonstrated the app's reach: Telling the assistant, "I'd like a romantic place for Italian food near my office," yielded an answer that seamlessly combined facts from Citysearch, Gayot, Yelp, Yahoo! Local, AllMenus.com, Google Maps, BooRah and OpenTable.

As conceived by its creators, Siri was supposed to be a "do engine," something that would allow people to hold conversations with the Internet. While a search engine used stilted keywords to create lists of links, a do engine could carry a conversation, then decide and act. Had one too many drinks? The ability to coordinate a Google search for a ride home might elude you, but a do engine could translate a muttered, "I'm drunk take me home," into a command to send a car service to your location. The startup's goal was not to build a better search engine, but to pioneer an entirely new paradigm for accessing the , one that would let artificially intelligent agents summon the answers people needed, rather than


A demo version of the early Siri from 2010.

YOUTUBE/SIRIVID

pull relevant resources for humans to consult on their own. If the search engine defined the second generation of the web, Siri's co-founders were confident the do engine would define the third.

The do engine was designed to be a participant in the life at hand — one that could anticipate what you wanted before you wanted it, and make it yours before you could ask. Siri's creators planned, though never implemented, a way for Siri to assist waylaid travelers: The assistant could preempt the frustration caused by a delayed plane by suggesting alternate flights, trains departing shortly, or car rental companies with vehicles available.

This Siri — the Siri of the past — offers a glimpse at what the Siri of the future may provide, and a blueprint for how a growing wave of artificially intelligent assistants will slot into our lives. The goal is a human-enhancing and potentially indispensable assistant that could supplement the limitations of our minds and free us from mundane and tedious tasks.

Siri's backers know Apple's version of the assistant has not yet lived up to its potential. "The Siri team saw the future, defined the future and built the first working version of the future," says Gary Morgenthaler, a partner at Morgenthaler Ventures, one of the two first venture capital firms to invest in Siri. "So it's disappointing to those of us that were part of the original team to see how slowly that's progressed out of the acquired company into the marketplace."

Siri's co-founders from left to right: Adam Cheyer, Dag Kittlaus and Tom Gruber.

COURTESY OF DAG KITTLAUS

But as a new wave of virtual assistants compete to take on our to-do lists, Apple is under growing pressure to use the technology it already has and turn Siri into the multitasking, proactive helper it once was. Siri's history suggests a fantastical future of virtual assistants is coming; where we now see Siri as a footnote to the iPhone's legacy, some day soon the iPhone may be remembered as a footnote to Siri.

"A kinder, gentler HAL is on way its way to the mainstream for

sure," says Kittlaus. "Siri is just a poster child, but it goes way, way beyond that."

## REPORTING FOR DUTY AT 'NERD CITY'

Thirty-five years after HAL's big screen debut, turning the stuff of science fiction into fact fell to perhaps the only organization with a more outlandish imagination than a Lucas or Spielberg: the Defense Department.

In 2003, the agency's investment arm, DARPA, tapped the non-profit research institute SRI International to lead a five-year, 500-person effort to build a virtual assistant, one the government hoped might yield software to help military commanders with both information overload and office chores. Although it wasn't the project's mission, this helper, the Cognitive Assistant that Learns and Organizes, or CALO, would ultimately provide the inspiration and model for Siri.

The Defense Department's financial backing, $150 million in all, united hundreds of top-tier artificial intelligence experts for an ambitious and uncertain endeavor that most corporate R&D labs could only dream of tackling:

ASA MATHAT/COURTESY OF MORGENTHALER VENTURES

Gary Morgenthaler, a partner at Morgenthaler Ventures, one of the two first venture capital firms to invest in Siri.

teaching computers to learn in the wild. The army of engineers at "nerd city" — one SRI researcher's nickname for the lab — were tasked with creating a PC-based helper smart enough to learn by observing a user's behavior, and all the people, projects and topics relevant to her work. The undertaking was "by any measure, the largest AI program in history," says David Israel, one of the lead researchers on CALO.

The CALO project was part of the PAL (Personal Assistant that

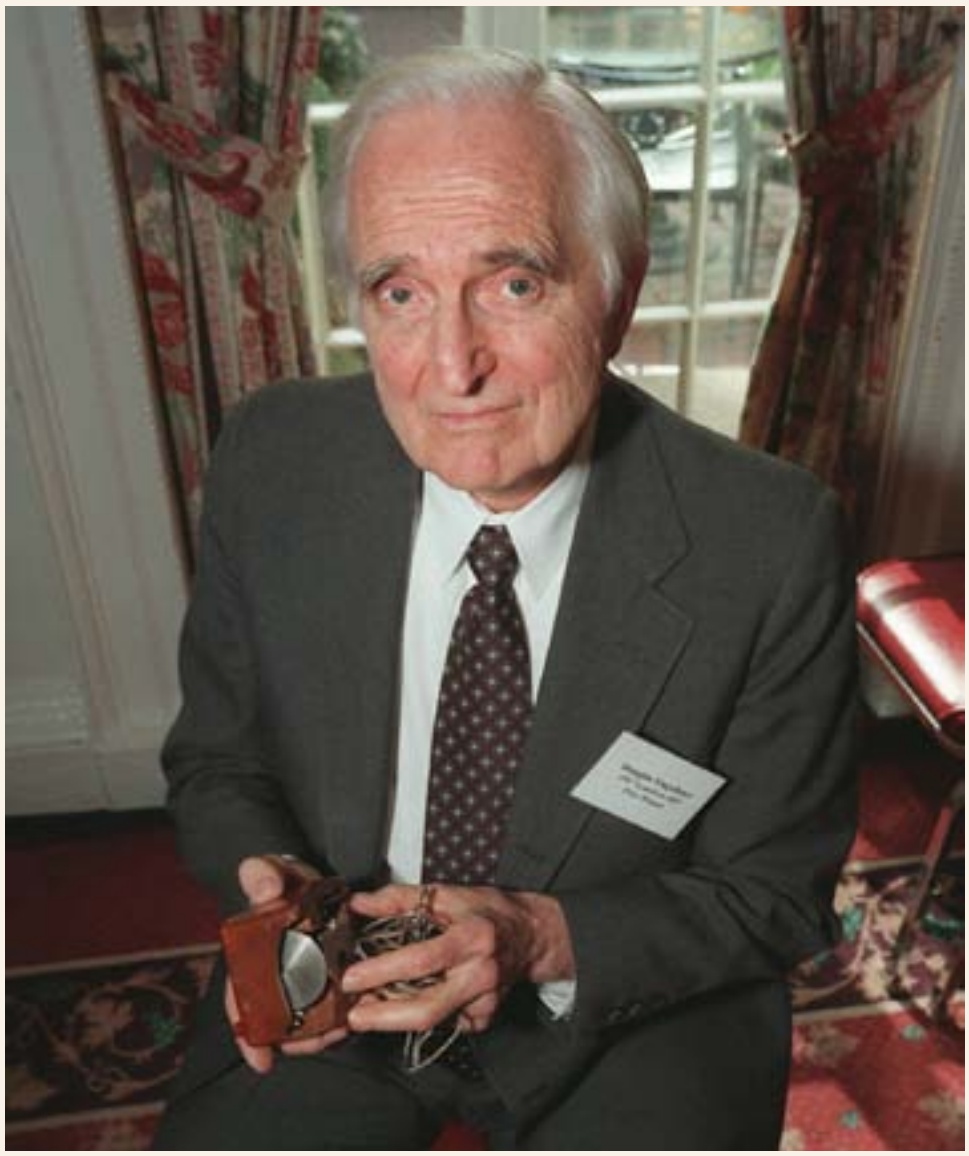
Learns) program, funded by the Defense Department's investment arm, DARPA.

At least to some people, it seemed as if the serious-minded federal government was taking a flier on the stuff of 9-year-old boys' sci-fi fantasies.

"CALO was put together at a time when many people said AI was a waste of time," explains Paul Saffo, a technology forecaster and associate professor at Stanford University. "It had failed multiple times, skepticism was high and a lot of people thought it was a dumb idea."

Despite its naysayers, CALO proved a scientific triumph. The project reunited, for the first time in decades, independent disciplines of artificial intelligence that had been deemed too complex to cooperate.

It also demonstrated that a machine could learn in real time through its lived experience, as a human being does. Previously, artificial intelligence software had been coached "in vitro," meaning a machine-learning algorithm would be applied to a fixed set of data, then judged on how it handled that information. Every part of CALO instead had to learn "in vivo," training itself as it performed tasks using an uncontrolled diet of information.



Doug Engelbart, inventor of the computer mouse and winner of the Lemelson-MIT prize, in 1997, with the mouse he designed.

AP PHOTO/MICHAEL SCHMELLING

The SRI lab had a history of bringing the future to the present. Founded in 1946 by Stanford University trustees seeking research for "the good of society," SRI formally split from the university in 1970 and has operated independently ever since. The institute leads research projects funded by government agencies and corporations, then spins out its most promising technologies into standalone startups. The inkjet printer, LCD screen and Disney-

land are all among the institute's brainchildren.

The Menlo Park lab also gained renown for counting, among its researchers, Silicon Valley legend Doug Engelbart, who in the 1960s pioneered the computer mouse and foresaw many of the basic computing tools we now take for granted.

Adam Cheyer, an engineer at the institute, was already drawing comparisons to Engelbart, well before he launched what would eventually become Siri. The dark-haired, soft-spoken engineer — a one-time Rubik's Cube champion who could solve the puzzle in just 26 seconds — shared not only Engelbart's ingenuity, but also his "people first" approach to technology.

Engelbart maintained that machines should be used to augment human intellect and capabilities. The objective was "not trying to replace humans in any respect, but trying to have devices, hardware and software that make humans more effective at what they already do," explains Israel, who remembers Cheyer and Engelbart having lengthy discussions in the research institute's cafeteria.

Where other people saw chores on a to-do list, Cheyer saw learning opportunities for virtual assistants. During an earlier stint at SRI in the 1990s, Cheyer, then straight out of a master's program in computer science, built a small army of prototype assistants. Cheyer's kitchen helper, for example, could track the contents of his fridge and place grocery orders online when milk ran low.

At SRI, Cheyer worked on assembling all the pieces produced by the CALO project's 27 teams into a single assistant, which was required to take an annual exam testing what it had learned over the course of the year. The "research-grade" virtual assistant Cheyer helped build — also called CALO — was still too rough


Siri co-founder Adam Cheyer arrives at the 5th Annual Crunchies Awards in 2012.

ARAYA DIAZ/GETTY IMAGES FOR TECHCRUNCH

around the edges to be installed in white-collar workers' office PCs. But CALO was capable of performing an impressive variety of tasks that once seemed exclusive to human assistants.

Say your colleague canceled shortly before a meeting. CALO, knowledgeable about each person's role on a project, could discern whether to cancel the meeting, and if needed, reschedule, issue new invitations and pin down a conference room. If the meeting went ahead as planned, CALO could assemble (and rank) all the documents and emails you'd need to be up to speed on the topic at hand. The assistant would listen in on the meeting, and, afterward, deliver a typed transcript of who said what and outline any specific tasks laid out during the conversation. CALO was also able to help put together presentations, organize files into folders, sort incoming messages and automate expense reports, among a host of other tasks.

Cheyer split his time between training CALO and assisting SRI's Vanguard program, a parallel effort launched in 2003 to help companies such as Deustche Telekom and Motorola probe the future of a promising new gadget called the smartphone. The Vanguard program developed its own prototype assistant, more limited than CALO, but more feasible.

The prototype dazzled a general manager at Motorola by the name of Dag Kittlaus.

A native mid-Westerner once likened to a "baby-faced Nordic Brad Pitt," Kittlaus supplemented his office routine with a daredevil's diet of activities — chasing tornadoes, jumping from planes and earning a black belt in Hapkido. He was a sci-fi buff partial to authors like Arthur C. Clarke (who helped pen the screenplay for *2001: A Space Odyssey*) and would later set out to write his own novel set in the distant future.

**"SOME DAY SOON THE IPHONE MAY BE REMEMBERED AS A FOOTNOTE TO SIRI."**

When Kittlaus failed to persuade Motorola to adopt Vanguard's technology, he quit the company in 2007 for a position as entrepreneur-in-residence at SRI. Soon after, he found himself on a plane to California for a retreat with Cheyer and several SRI colleagues. Their mission for the

weekend: figure out how to harness the best ideas from CALO and Vanguard to seed a startup.

It was at the Cypress Inn at Half Moon Bay, a quiet, coastal town just south of San Francisco, that the vision for Siri was born. This mobile virtual assistant — like CALO, and in tune with Engelbart's thesis — would be put to work relieving humanity of low-grade mental busywork.

The working nickname for this assistant was HAL. The proposed tagline: "HAL's back — but this time he's good."

## THE UNFINISHED REVOLUTION

Virtual assistants had long proved a kind of siren song to an entire crew of Silicon Valley dreamers that wound up shipwrecked in pursuit of a more human, intelligent and helpful HAL.

Over a decade earlier, in 1994, Wildfire Communications debuted a new telephone-based assistant, "Wildfire," that could handle messages, place calls and retrieve voicemail in response to a prompt. Wildfire earned good reviews, but saw little pickup, despite the fact that "she" charmed users with sassy responses. A few years later, Microsoft Office's assistant Clippy, an over-eager bouncing paperclip volunteering tips and shortcuts, launched to the chagrin of office workers everywhere. Eventually, Clippy made *TIME's* list of 50 worst inventions. In

**"OUR WHOLE TREND IS TOWARD EVER MORE INTIMATE INTERACTIONS WITH MACHINES."**

1998, General Magic's Portico promised to connect the  and cell phones with a voice-controlled aide that could read emails and take messages, among other tasks. Within four years, the company shut down the assistant and filed for Chapter 11 bankruptcy.

Yet if ever there were a right place and a right time for virtual assistants, the fall of 2007 appeared to be it. Faster wireless speeds, better speech recognition, the rise of cloud computing, the debut of Apple's iPhone and a flood of new web services made virtual helpers seem attainable at last.

The SRI crew could see that the iPhone, which had launched just before their excursion to Half Moon Bay, would yield a population of networked, always-on-the-

Siri co-founder Tom Gruber.

FLICKR/TOM GRUBER

go consumers who would increasingly rely on tiny touch-screens to tell them what to do. An assistant, in the form of a voice-controlled iPhone app, seemed the ideal way to help mobile users complete all kinds of tasks, without having to poke at small screens with fat fingers or wait for web pages to load.

The aspiring entrepreneurs also had the advantage of being able to tap CALO's technology. Under a law passed by Congress in 1980, nonprofits, like SRI, were given the right to keep the profits flowing from software developed via government-funded research. The law would allow a startup to license key software from the CALO project in exchange for giving SRI a stake in the company.

Though Cheyer had doubts CALO research could be used to create a profitable business and was reluctant to leave his post at the lab, Kittlaus prevailed on his "innovation soulmate." The result was a new company named Siri, with Kittlaus, as CEO, taking on

co-founders Gruber, as chief technology officer, and Cheyer, as vice-president of engineering.

Siri's founding trio required prospective hires to read MIT professor Michael Dertouzos's *The Unfinished Revolution*, a treatise arguing for "human-centric computing" and devices that "truly serve us, instead of the other way around." If an applicant didn't agree with Dertouzos' thesis, he or she wasn't a match for Siri.

Once hired, new Siri employees were handed an empty frame and instructed to keep a photo on their desks of the person whose vision most inspired their work. Cheyer framed a picture of another tech visionary who preached the "people first" mentality: Doug Engelbart.

Siri secured $8.5 million from investors in early 2008 and its progress over the following months was "absolutely breathtaking," says Morgenthaler, the early Siri investor. Shawn Carolan, a partner at Menlo Ventures and another Siri backer, recalls, "Every board meeting was a breakthrough."

The founders enlisted their Siri prototype in a rigorous artificial-intelligence boot camp of their own design, one meant to train the assistant to understand, interpret and answer queries. When asked a question, Siri, which processed information in a remote data center, would send the audio of the speaker's question to a server, where speech recognition software would "transcribe" the spoken words.

Siri then had to figure out the words' meaning — what computer scientists call natural language processing. People have dozens of ways of asking the same thing, and while humans can deduce that the phrases, "I'm in the mood for a croissant," "Is there a bakery nearby?" and "Some French pastries would be nice," all arrive at the same point, it takes a highly sophisticated algorithm to reach that same conclusion.

The more traditional, error-prone approach to natural language processing interpreted meaning by identifying the parts

**"THEIR SHARED OBJECTIVE: IMPROVE TECHNOLOGY IN ORDER TO MAKE PEOPLE BETTER AT WHAT THEY DO, NOT TO REPLACE HUMANS WITH MACHINES."**

of speech in a sentence. But Siri abandoned that method in favor of a breakthrough approach devised by Cheyer and his colleagues. Instead of modeling linguistic concepts, their system could model real-world objects. Told, "I want to see a thriller," Siri would immediately identify "thriller" as a film genre — and summon up movies — rather than analyze how the subject connected to an object and a verb.

Siri was able to map the contents of a question onto a domain of potential actions, then pick the action that seemed most probable, based on its understanding of the relationships between real-world concepts. (For example, Siri knew a given restaurant should have a rating, an address, a type of cuisine and a price range associated with it.) Siri could also apply details about the time of day and a user's preferences and location to inform its response, or to ask for more information.

Picture Siri as a concierge in a noisy lobby. A request for the "closest coffee shop" might sound like "closest call Felicia" over the din. But knowing that "closest" is more likely to characterize a place than a person, and that a guest is more likely ask a concierge for dining tips, a human hotelier would infer the asker was probably hankering for a cappuccino. Same with Siri, which was tuned to listen for the kinds of phrases an employer might use with a personal assistant and could get the gist of a question without understanding every word. To avoid miscommunication, Siri also allowed users to type, rather than speak, their questions into its interface.

**"SIRI COULD DO FOR 'THOUSANDS OF ACTIVITIES WHAT AMAZON HAS DONE FOR SHOPPING.'"**

To pull a list of cafés, Siri would tap into data it had organized from over 40 web services that operated like remote, diffuse lobes of its brain. While previous virtual assistants functioned through deep training in a single specialty, Siri had been built as a cross-industry savant with expertise in anything from books to bagels; it just needed access to the application programming interfaces, or APIs, many web companies offer to third parties.

Early on, the Siri developers

saw virtually no limit to the routine transactions the assistant could automate. They envisioned Siri's architecture allowing for any web service with an API — potentially hundreds of thousands of them — to add its database to the do engine.

But Siri's creators also knew their virtual assistant would only succeed if it was both smart and a smartass, both artificially intelligent and artificially amusing.

Kittlaus and Saddler brainstormed snappy comebacks for all the offbeat questions people were likely to ask the assistant. The co-founders also dreamed of offering users a choice of different personality "packs" that could be installed to make Siri's answers sweeter or sassier. And because Siri could recognize nuances in users' speech mannerisms, its creators hoped one day they might even build a Siri that could mimic people's personalities. "Yo, yo what kind of flicks are playing, dude?" might get Siri to answer, "Hey man, check out the new Eastwood flick. Word," according to Kittlaus.

In February 2010, three weeks after Siri debuted as an independently developed iPhone app, Kittlaus received a call from a mystery number — one he nearly missed thanks to a glitchy, unresponsive iPhone screen.

It was Steve Jobs and he wanted to meet. The next day.

Siri's co-founders spent three hours with Jobs at his Palo Alto home discussing the future of do engines and how people could converse with machines (Jobs loved Siri's snark). Apple quickly followed up with an interest in acquiring the young company.

"The way that Steve described it, speech recognition — and how to use it to create a speech interface for something like the iPhone — was an area of interest to him and Scott Forstall [then head of Apple's mobile software] for some time," recalls Kittlaus. "The story that I'm told is that he thought we'd cracked that paradigm with our simple, conversational interface."

Verizon thought so, too. In the fall of 2009, several months before Apple approached Siri, Verizon had signed a deal with the startup to make Siri a default app on all Android phones set to launch in the new year. When Apple swooped in to buy Siri, it insisted on making the assistant exclusive to Apple devices, and nixed the Verizon deal. In the process, it narrowly avoided seeing Siri become a selling point for smartphones powered by its biggest

rival, Google. (Somewhere in the vaults of the wireless giant, there are unreleased commercials touting Siri as an Android add-on.)

Its first and only app had barely been available for two full months. And now Siri — and its future — belonged to Apple.

"It was a storybook ending — or beginning, you can call it," Kittlaus says.

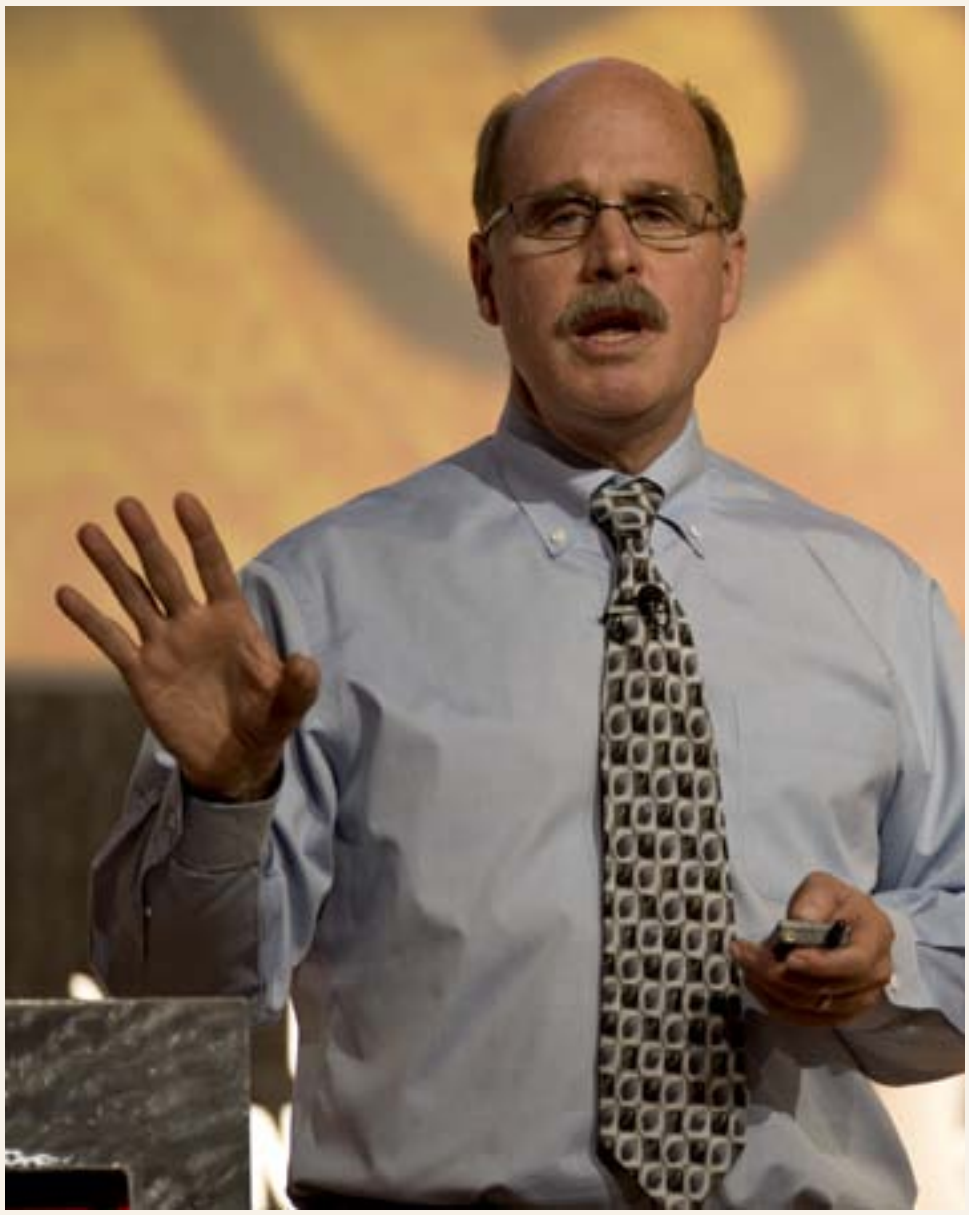
## 'AN ARTIFICIALLY-INTELLIGENT ORPHAN'

With Siri and its entire 24-person team installed at Apple's Cupertino headquarters, the tech giant at once got down to tinkering with its new acquisition.

Even as Apple amped up some features, it removed many of Siri's powers by disconnecting the assistant from most of the outside services that had powered its digital brain. The restaurant reservation function, one of the key features of the original Siri app in 2010, would be denied to iPhone users until 2012.

Industry insiders say Apple's size has hindered its ability to forge deals with the dozens of services that once synced with Siri. Whereas partnering with a startup in its embryonic stages was a simpler affair, brokering a deal with the world's most influential tech company, a high-stakes undertaking by any measure, required many lawyers, meetings and spreadsheets of cost-benefit analyses. Though Apple has the technology to pair Siri with a multitude of sites and services — and could use it soon — it may not yet have persuaded those potential partners to embrace a bigger Siri.

Apple also seems keen to ensure Siri will be decent for many users, rather than genius for a few. Progress has been slowed by Apple's



RONALDO SCHEMIDT/AFP/GETTY IMAGES

Paul Saffo, a technology forecaster and associate professor at Stanford University. "We moving more and more towards an interface like the interface we have with each other," Saffo said.

need to localize the assistant in the nearly 100 countries that offer the iPhone. Sending Siri abroad requires training the assistant in dozens of different languages, a time-intensive affair given the technical challenges of teaching the algorithm to understand human speech.

People familiar with the early version of Siri gripe that Apple, usually so meticulous about its products' look and feel, has hidden Siri's capabilities with a design that over-promises on what Siri can deliver. To avoid disappointing its users, the original Siri app tried to teach people what they could ask by showing a screen of sample questions each time they queried the assistant. Siri's current layout largely leaves the assistant's abilities to the user's imagination, even though it excels at only a very specific subset of tasks. Apple's slogan for Siri — "Your wish is its command" — creates even more frustration by suggesting people should let their dreams run wild and expect Siri, the genie in the iPhone, will fulfill any desire.

Apple also must wrestle with the fact that Siri isn't always a great listener, especially in the places it's likely to be used most.

Speech recognition software, is still iffy in noisy settings, and especially has trouble decoding the low-quality audio that Bluetooth headsets send to Siri — so good luck chatting with Siri while you're driving a car. That problem is likely temporary, however, as better data and more sophisticated models help machines become ever-more in tune with human speech.

Already, Apple's assistant does seem to be getting sharper: Investment bank Piper Jaffray raised Siri's grade from a "D" to a "C" after a test of its skills last December found Siri could understand 91 percent of queries and correctly answer 77 percent of them.

**"SIRI HAS BECOME 'AN ARTIFICIALLY INTELLIGENT ORPHAN' WITHIN APPLE."**

But corporate politics have been unkind to Siri, and the endeavor's prospects may be jeopardized by its loss of many powerful advocates within Apple. Though Saffo, the Stanford professor and futurist, cautions deciphering Apple's inner workings is like "trying to understand North Korea," he ventures that Siri has become "an artificially-intelligent orphan"

within the company.

Only one of Siri's three co-founders, Tom Gruber, remains at the company. Kittlaus left three weeks after Apple re-launched Siri in 2011, and Cheyer quit a year later. Apple's Forstall, who introduced Siri at its first keynote and oversaw the company's iOS software, was fired last year. Steve Jobs died the day after Siri debuted. And Luc Julia, who replaced Kittlaus as head of Siri, lasted just 10 months at Apple before leaving in 2012.

## A HIGHER STATE OF BEING

Siri offered the first mass-market assistant capable of understanding humans' natural speech patterns and assembling information from disparate parts of the  into a single, correct response. That model, one Siri pioneered, has been embraced by a growing wave of artificial intelligence engineers and entrepreneurs keen to pioneer their own version of HAL.

The virtual assistants now coming to market are trying to provide many of the same capabilities offered in the early version of Siri, and CALO before it. Even Apple has been slowly reinstating some of the capabilities Siri once offered, such as movie reviews and restaurant bookings.

Having seen Siri's success, Silicon Valley startups are now mining the CALO project to build a race of assistants tailored to work in specialized fields. Desti is an artificially intelligent assistant specializing in travel; Lola is a "Siri for banking;" and Kuato is leveraging CALO research to build a learning assistant.

More than half a dozen Siri-like services launched in 2012 alone. Samsung debuted S-Voice, a voice-controlled assistant. Nuance, a provider of speech recognition software, released a "Siri for apps" called Nina. Startups Evi and Maluuba each released virtual assistant apps. IBM is working on adapting its supercomputer Watson into a turbo-charged Siri that can help physicians, farmers, Wall Street traders and high-schoolers. And Google has followed Siri with its own conversational assistant, Google Now.

"The idea is not to ask one question and get an answer, but to have the assistant proceed with me in a conversation and go and do things for me," says Scott Huffman, an engineering director who oversees Google's mobile search efforts. It's a vision that sounds remarkably like the one Siri's founders first embraced.


AP PHOTO/PAUL SAKUMA

Phil Schiller, Apple's senior vice president of worldwide marketing, talks about Siri on the iPhone 4S at the Apple Headquarters in Cupertino, Calif.

Futurists and researchers predict such voice-controlled software, like Siri and Google Now, will take us from understanding how to use technology to technology that understands us.

"We're moving more and more towards an interface like the interface we have with each other," says Saffo. "Our whole trend is toward ever more intimate interactions with machines [...] and with each phase, machines are doing something ever more central to our lives."

These ever more central tasks include everything from taking care of life's little hassles to actually shaping what we do. Siri's founders had planned to make the assistant a source of personalized advice and wisdom by implanting Siri with CALO's cutting-edge learning skills. Siri would have taken it upon itself to summon information that hadn't specifically been requested.

Google's assistant is going a step further, volunteering information before it's even been asked. Google Now masters its users' routines so it can proactively fetch game updates for sports fans or advise users to leave early for a meeting due to traffic. (As Google chairman Eric Schmidt, "[People] want Google to tell them what they should be doing next.")

A few years from now, as you walk through the mall, your virtual assistant will tell you where to shop for shoes by factoring in your wardrobe, time frame and cash flow. When you step into a store, you consult the options the assistant has lined up for you. The calfskin loafers are a must, it whispers, at the same time cautioning that the purchase would put you over your monthly budget. If you do splurge, it suggests you request a cash advance, and the assistant offers to contact your bank. While you're paying, the assistant, knowing that you've been going to a lot of museums lately, offers updates on current exhibits. Or, thanks to emotion-recognition technology that infers your mood from your facial expressions, it senses you're feeling down and cracks some jokes. At the office, another assistant might take over. Before your date, yet another could counsel you on your love life.

Where does that leave humans?

Siri investor Shawn Carolan, like many others, imagines we'll be more productive. "Take everything you do in a day and just condense it down from 15 minutes down to 30 seconds. You can just express your intent, and it gets done," explains Carolan. "You just became a 30 times more powerful human."

> "IT WAS A STORYBOOK ENDING — OR BEGINNING, YOU CAN CALL IT."

With its own reach and Siri's software, Apple could still fulfill the do engine dream. If it took advantage of Siri's early architecture that used web services' APIs to feed the assistant's ever-expandable brain, Siri would have the potential to automate a multitude of tasks.

Morgenthaler argues that with this technology, Siri could do for "thousands of activities what Amazon has done for shopping." Under Apple, Siri could one day book flights, order flowers and offer fashion advice, becoming what

former CALO program director James Arnold calls an "iTunes for everything else in the world." Siri, the startup, took a commission anytime someone made a purchase via the app. Were Apple ever to do the same, it could tap into an entirely new source of cash.

Arnold also sees virtual assistants as intellectual equalizers. A superb memory might cease to be an advantage as intelligent assistants are tasked with remembering names, dates and other details. Everyone will have the ability to see unusual but important connections between legal cases or patients' symptoms, thanks to assistants that can identify relevant precedents or files.

"The future of virtual personal assistants is to make it so we don't have to think so much and work so hard to do things that are possible," says Kittlaus. "It's less about survival and more about exploring the world."

Yet for all the efficiencies these do engines may provide, they may also carry a significant risk. Evan Selinger, a fellow at the Institute for Ethics and Emerging Technologies, argues that less friction in our lives may "render us more vulnerable to being automatic," and eliminate crucial opportunities for moral deliberation. "The digital servant becomes the digital overlord, and we don't even recognize it."

They might also make us an easy target for an algorithm that knows more about our bad habits and indulgences than we do, and isn't above exploiting them. The stream of suggestions from virtual assistants, especially if advertisers have a say, could make us more susceptible to overeating and over-spending. A spouse knows not to encourage you to stop by the steakhouse given your heart condition. But would Siri? Or Google Now if Google got a big ad buy from the steakhouse? Would Siri nag you into becoming your best self or would it coddle and humor you into a state of blissful complacency?

By freeing us of the irritants and drudgeries of life that keep us from pursuing our more serious interests, the promise of virtual assistants offers a release into an inconceivably higher state of being. As the mathematician and philosopher Alfred North Whitehead observed, "Progress is measured by what you no longer have to think about."

But progress toward what? That may be one of the few questions our assistants won't be able to answer.