Chapter 4

Future Actions

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Search is moving from a place of answers to a state of action.

—Microsoft Voice Report[1]

The AI-driven voice technology is described as a major disruptive technology trend.[2] In this chapter, we first review the future trends of voice technology and conversation AI. We then offer guidance and suggestions for preparing such changes at the organizational and leadership level.

Looking Forward

After a decade of development, conversational AI and voice technology have progressed beyond the early infancy stage and moved into a phase of mass adoption. According to Gartner's Hype Cycle, which charts the maturity, adoption, and business applications and values of emerging technologies and innovations, voice assistant technology has now surpassed the initial proof-of-concept and marketing hype stages and entered into a zone that demands further realization of its value and fulfillment of expectations. Gartner has also upgraded voice assistant technology's maturity level from emerging to adolescent and predicted that it will reach the mainstream adoption stage in a two-to-five-year time scale.[3] In another analysis, both Microsoft and Voicebot.ai reported that voice assistant technology and conversational AI have crossed the chasm of the early adopters phase and entered the early majority of users stage in E. M. Rogers's Diffusion of Innovation theory.[4] We anticipate that AI-powered voice technology will gain more traction and move closer to a central and powerful position in our evolving digital transformation. Meanwhile, end users will accelerate the adjustment to a lifestyle—as well as the formation of an even-closer personal partnership—with voice assistants. It is imperative for organizations to shift their worldview of working and serving their customers in this transformation, identifying a new service model centered on these new technologies.

Platform Shift

Our relationship with computers and technology has been evolving over time. Based on the way we interact with technology, Kinsella identified three technology platform and user interface shifts since the advent of the World Wide Web more than twenty-five years ago (see table 4.1).[5] Websites and hyperlinks are the first generation of technology platforms and user interfaces that we use to interact with digital content and services. The introduction of mobile devices and apps in the late 2000s expanded the apparatus for us to engage with the digital world. Conversational AI and voice technology elevate us to a new experiential level of human-computer interaction. Although we are still in the midst of voice-based platforms, Deloitte Consulting has already predicted that intelligent interfaces will be the next breakthrough of human experience platforms. Integrating a class of AI-powered solutions, such as affective computing, computer vision, sentiment analysis, and voice stress analysis, the intelligent interface interacts with humans through gestures, gazes, head movements, and voices; detects their physical states, emotional conditions, and moods through sensors; and responds to their needs in the appropriate context.[6] Deloitte expects that we will see more progress in and growing application of affective computing in the next eighteen to twenty-four months.

Throughout the process, each platform shift introduces advanced technologies that enhance the old methods, create innovative ways of conducting business, and generate values and efficiencies. Throughout the transition, it is common to see established companies dislodged by start-ups, traditional business

Table 4.1
Platform and UI shifts

Platform & UI	Time	Technologies	Devices	Open Standards	Key Market Players
Web & links	Mid-1990s	Internet, web browser	PC	HTML, HTTP	AOL, Microsoft, Netscape, Yahoo
Mobile apps & touch/swipe/pinch	2008	Wi-Fi, iOS/Android, cloud computing	Mobile devices	Wi-Fi, Android	Facebook, Instagram, LINE, Twitter, WhatsApp, YouTube, Uber, Lyft, Yelp
Voice assistants & conversational UI	2011	AI, natural language processing	Mobile devices, smart speakers	Standardizing natural language process and AI technologies	Amazon, Apple, Google, Microsoft
Intelligent interfaces/ affective computing	Near future	Auditory analytics, augmented/virtual reality, cloud and edge computing, computer vision, Internet of Things, 5G network	Wearable devices, gesture control devices, smart headsets, AR goggles, sensors	N/A	Up for grabs

models displaced by new paradigms, and consumer behavior transformed. The platform shift from web to mobile apps created new entrants and a new segment of business. Lyft and Uber (ride hailing), Facebook and Instagram (social networking), and Yelp (local business reviews) are prominent examples.

At this early stage of the voice platform shift, the business model is still hazy and the technology standards have yet to be settled. For major tech companies that dominate the web and mobile app platforms, the stakes are high and the competition is fierce. Top players have invested billions of dollars in voice assistants and smart speakers to ensure they continue to dominate their existing market position and maintain competitive advantages with the new voice technology. Amazon and Google are reported to sell their devices below the cost of producing them in order to gain market share.[7] Amazon reported having a team of 10,000 employees working on Alexa alone.[8] At Amazon's job site, there are currently over 2,700 Alexa-related open positions, ranging from software development (1,304 vacant positions) to marketing and PR (77 positions).[9] In 2017, Microsoft's AI division had 8,000 employees before its reorganization.[10] Google draws employees from related departments to support Google Assistant instead of concentrating positions in one department or product team.[11]

Which Voice Technology?

In the current conversational AI landscape, voice assistant applications are not compatible. You cannot summon Alexa on a Google Home device or Google Assistant on an Amazon device. With limited resources, organizations can afford to commit to only one proprietary technology. Selecting the appropriate voice platform that fits the organization's unique business situation and customer needs is a strategic decision. Although all the core players in voice assistant technology overlap in providing basic functionalities, each individual option has its own strengths and specializations. For example, Amazon dominates in the areas of online shopping and control of smart home devices while Google has a stronghold in the content and search arena. To differentiate, Microsoft devises a two-dimensional matrix that maps four key players based on two criteria:

1. Ability to access and control IoT and home management devices (vertical axis)
2. Ability of fulfilling purchasing request (horizontal axis)[12]

The four quadrants generated within this two-dimensional grid represent key mastery of voice assistant performance. These four areas are

1. **Knowledge:** the ability to answer questions
2. **Utility:** the ability to access and control IoT devices
3. **Commerce:** the ability to make purchases with voice commands
4. **Productivity:** the ability to integrate into work solutions

Figure 4.1 provides a visualization of how the four voice assistants fit across this functional spectrum based on these two factors. Amazon Alexa is strong in both the utility and commerce masteries. Google

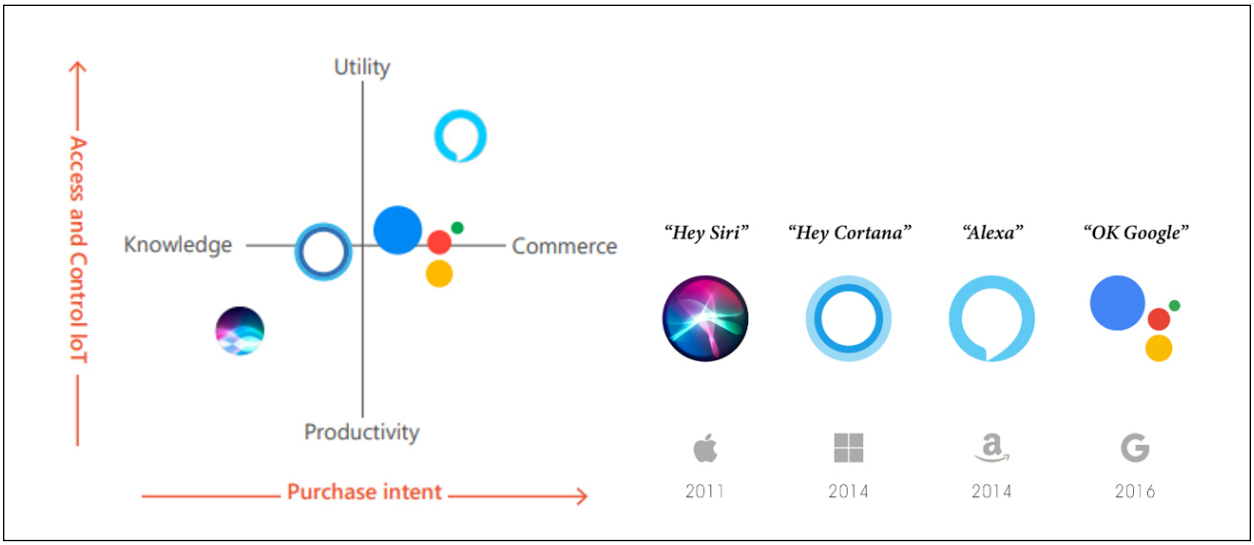

Figure 4.1
Functional spectrum (Source: Christi Olson and Kelli Kemery, *Voice Report: From Answers to Actions: Customer Adoption of Voice Technology and Digital Assistants* [Redmond, WA: Microsoft, 2019), 28, https://about.ads.microsoft.com/en-us/insights/2019-voice-report.)

Assistant and Microsoft Cortana are positioned close to the center of the grid, an indication that they are both doing equally well in these four areas. Apple's Siri plays well in both knowledge and productivity masteries.

According to Microsoft, an ideal voice assistant should perform equally well in all four areas and land itself close to the center of this diagram.[13] This framework provides a tool for us to see the relative positions of key market players within the four functional areas. The visual snapshot further allows us to assess how these competing technology providers are executing their stated visions and how well their product performs against the two key factors.

Evolving Voice Assistants

As AI-powered voice technologies advance and use cases expand, we are likely to see the following developments in the next few years:

- **Ubiquitous:** Voice assistants will be omnipresent as they continue to proliferate and penetrate our daily life. As one example, Amazon has been embedding Alexa into more appliances, such as the Ring Video Doorbell Elite that allows visitors to chat with Alexa. Amazon also introduced several wearable Alexa gadgets, including glasses (Echo Frame), wireless earbuds (Echo Buds), and black ring (Echo Loop) that allow users to interact with Alexa around the clock.[14]
- **Available across devices:** Voice assistants will not be affixed to one specific device or platform as they rapidly expand to other appliances, IoTs, and voice access points such as in-car voice assistants, smart watches, and smart home devices. Devices will eventually assume a secondary role.[15] In another effort to make voice assistants less dependent on devices, Amazon and more than thirty companies signed the Voice Interoperability Initiative in September 2019 to make voice assistants available on voice-activated devices from different vendors. However, Apple and Google are still yet to sign onto this agreement.[16]
- **Multisensory:** With new technologies, such as affective computing, voice assistants will be able to facilitate our engagement with the digital world through a broad range of human senses: visual, aural, kinesthetic, and tactile. According to Garner, in the future, digital assistants will sense users' intent from voice, gesture, and touch and thus provide a richer experience for conveying nuanced contextual information.[17] Voice technology will further combine with other technologies, such as virtual reality, augmented reality, and mixed reality, to provide an immersive user experience.
- **Comprehensive:** Voice assistants will offer "universal discovery" services that bridge our physical and virtual worlds. In the so-called digital twin, a virtual copy of physical assets will be connected with the physical world. You will be able to access locally decentralized data as well as data stored centrally in the cloud.

- **Proactive:** Voice assistants will grow smart enough to anticipate our needs in advance. For example, VAs will reorder supplies when they are running low, automate routine tasks such as turning on or off the alarm or heater, and schedule appointments before being asked to do so.
- **Stronger AI:** Conversational AI is becoming a "people-literate technology" capable of detecting our needs and intents based on our past behavior.[18] Instead of expecting users to follow predefined commands or sequences, conversational AI will be able to learn from historical interactions and adapt to our individual needs based on the context and nuance, shifting the cognitive load from users to AI.
- **Voice search diverging from web search:** Voice search is growing exponentially. It is said that half of all online searches will be spoken by 2020.[19] Eventually, search will move from question-and-answer responses to query-and-action facilitation.[20] In other words, we will use voice search to perform tasks, make decisions, and take actions instead of merely as a tool for obtaining answers. In daily life, voice search will help us get directions, renew library checkouts, and make reservations or purchases.

Preparing for the Change

As organizations enter the voice computing era, forward-thinking leaders and decision makers should grow the capacity of organizations and their employees with the following preparatory actions:

- **Educate** themselves on this emerging technology, assess its possible applications within the context of their organization, and define their AI strategies.
- **Create** a conducive environment, fostering an organizational culture that supports learning and experimentation.
- **Provide** financial support and a safety net that tolerates taking calculated risks. Further, acknowledge that mistakes or failures are part of the learning process in acquiring new knowledge, insights, and skills from new technology implementation. Reward individuals who are willing to operate outside the comfort zone.
- **Establish** a research and development framework and agenda and provide adequate resources, including funding and staff time, for such endeavors.
- **Offer** training and education for employees to learn and test the technology.
- **Grow** expertise from within. Take advantage of the free resources and rich learning network available from tech companies. Below are the resources available from major players:
  - **Alexa Skills Kit:** the software development kit for developers to learn and build voice-driven applications, called skills, based on Amazon's voice technologies
  - **SiriKit:** Apple's version of a toolkit for developers to integrate their iOS- or WatchOS- based application with Siri
  - **Conversational Actions on Google:** the development platform where developers can build applications, called actions, for Google Assistant using the Google Cloud Platform

Alexa Skills Kit
https://developer.amazon.com/en-US/alexa/alexa-skills-kit

SiriKit
https://developer.apple.com/siri/

Actions on Google
https://developers.google.com/assistant/conversational

Meanwhile, organizations may want to form a working group or interest group with members from relevant functional units to assess the potential adoption of voice technology. Possible assignments and activities of the group may include the following:

- **Conduct** a needs assessment, SWOT analysis, and environmental scan and make recommendations based on the outcomes of the research and study.
- **Identify** promising use cases. Answer key questions such as these: What experiences do we want our patrons and employees to have with this technology? What organizational values do these experiences convey? How will this service powered by voice technology shape our overall user experience?
- **Assess** the potential resource needs, including cost, staffing, and time.
- If the outcomes are positive, **formulate** possible projects that align with the organization's mission and strategic plan.
- **Pilot** a voice technology project on a small scale.
- **Explore** the possibility of collaborating with like-minded units within the organization; form partnerships to share the cost, expertise, and risk while supporting a common patron base and organizational goals.
- **Seek out** local expertise and learn about their projects; explore the possibility of collaboration.

Table 4.2
Needs assessment plan for implementing Amazon Alexa at a large academic library

Stakeholders (who will use this service)	What will be learned	How to collect data	Info to be gathered
Undergraduate students	Assess undergraduate students' interests in using Alexa to learn about library collections and services.	Focus group	Do they have an Alexa device? Have they used an Alexa device? What do they use Alexa for? What information might they want from a library or university Alexa application?
Graduate students	Assess graduate students' interests in using Alexa to learn about library collections and services.	Focus group	Do they have an Alexa device? Have they used an Alexa device? What do they use Alexa for? What information might they want from a library or university Alexa application?
Faculty and staff	Gauge the interest of faculty and staff in using Alexa to learn about library collections and services.	Surveys	Do they have an Alexa device? Have they used an Alexa device? What do they use Alexa for? What information might they want from a library or university Alexa application?
Alumni and visitors	Survey alumni and visitors' interests in using Alexa to learn about library collections and services.	In-person interview	Do they have an Alexa device? Have they used an Alexa device? Will they use Alexa to look up library or university information?

- **Lead** and guide an organizational discussion about how to leverage AI and voice technology for business value.

Needs assessment and SWOT analysis are two useful exercises for organizations to investigate the appropriateness of adopting voice technology before committing resources. Both strategies also offer an excellent opportunity for an organization to learn about the technology itself as well as user needs.

Needs Assessment

Libraries interested in exploring voice technology and its possible applications should conduct a needs assessment exercise to gauge the interest and desire of their key stakeholder groups. Needs assessment is a systematic process that relies upon data collection and collaboration to identify the gaps between the current (what is) and the desired state (what should be).[21] Through interviews, focus group studies, surveys, and observations, libraries collect data from the user community on a specific issue or area of need. By analyzing such data, libraries can make informed decisions, prioritize needs, and take appropriate action. Needs assessment can help organizations to identify and solve existing problems, determine future opportunities and needs, improve performance and services, develop strategic goals and priorities, and align resources with strategy.[22] In practice, needs assessment has been used to improve library services to patrons, to assess library training needs, and to reevaluate library space usage.[23] Table 4.2 provides an example of a needs assessment data collection plan on implementing Alexa at a large research university.

SWOT Analysis

Another way to assess timing of implementing a new technology before pouring resources into it is to conduct a strengths, weaknesses, opportunities, and threats (SWOT) analysis. When considering a new technology, service offering, or strategic direction, libraries can employ SWOT analysis and conduct an environmental scan to facilitate the decision-making process. SWOT analysis maps an organization's *internal* strengths and weaknesses, as well as the *external* environment's opportunities and threats related to the organization's initiative. Through SWOT analysis, organizations can identify their favorable and unfavorable internal factors (strengths and weaknesses) and external factors (opportunities and threats) that might affect the success and performance of the initiative. The findings allow organizations to strategically chart their direction more effectively.[24] Armed with a better understanding, organizations can leverage their strengths to realize new opportunities while avoiding or minimizing any potential negative impact and remediating or overcoming potential threats.

SWOT analysis has been widely employed by libraries to assess programs and new initiatives,

Table 4.3
SWOT analysis of implementing Alexa at a large academic library

	Strengths	Weaknesses
Internal to Library	S1: Dedicated employees; willing to learn new technology; innovative and creative S2: Alignment with library's strategic goals S3: Adequate IT infrastructure S4: Competent IT professionals S5: Administrative support	W1: Resources/sustainability—funding, staffing W2: Competing priorities W3: Data policy—lack of campus-wide data policies W4: Learning curve W5: Concerns/resistance from some employees
	Opportunities	**Threats**
External to Library	O1: Strategic/symbolic value—forward-thinking and innovative, meeting organization's mission, strategic goals O2: Alternative channel for accessing resources O3: Accessibility—hands-free, adaptive technology, potential for challenged patrons O4: Productivity—automate tasks, cover FAQs O5: Collaboration—with other campus units, external partners (vendors, other libraries)	T1: Privacy concern—privacy and surveillance issues and other nefarious practices with voice technology T2: Security concern—hacking, liability, data breaches T3: Proprietary technology—no open standards yet T4: Sustainability—competition from Apple, Google, Microsoft T5: Questionable content, algorithmic bias, lack of transparency

including adoption of social media to promote library services, library instruction, and holograms in cultural institutions.[25] Table 4.3 presents a sample SWOT analysis on implementing Alexa at a large academic library.

Data Governance

Because voice technology can amass enormous volumes of personal data, it creates a higher potential and risk for fraud, identity theft, and hacking. Organizations should pay particular attention to fortifying the security measures of their IT infrastructure while ensuring a thorough and updated data governance policy and data management practices are in place. To earn trust from patrons, leaders and decision makers need to do the following:

- **Be aware of**, and be able to mitigate, multiple layers of concerns and risks from ethical, privacy, security, and regulatory aspects[26]
- **Establish** governance for AI-related technologies and ethical and privacy guidelines
- **Formulate** and set up data governance rules and policies
- **Enforce** appropriate data curation and use practice
- **Communicate** about and discuss openly issues and concerns with patrons and employees
- **Be informed** about technology-based bias, data and algorithmic bias, and lack of transparency of proprietary technology and content
- **Develop** an overarching set of values and principles of technology use to earn trust[27]
- **Ensure** employees' understanding of such policies and values through training and education

Conclusion

Applications of AI-fueled innovations are proliferating in all business sectors, including education. Forward-thinking and tech-savvy information professionals should seek opportunities to explore AI and voice technologies and identify possible and promising voice applications to enhance services, augment productivity, and innovate operations and services. Organizations also need to develop policies, practices, security measures, data governance models, and data risk management programs to mitigate privacy, security, and ethics concerns.

Our relationship with computers and technology will continue to evolve in the near future. Voice assistants are becoming more adept and attuned to our needs and are more intertwined with our personal lives. They will know a whole lot more about us and anticipate our needs in the years to come, increasingly assuming the intermediary role for quick and one-shot answers and even making choices for us in anticipation of our preferences. To remain a source of authenticated and valuable information, libraries, information organizations, and information professionals should rethink their role and relationship with patrons in the voice-based information landscape.

Notes

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