CHAPTER FOURTEEN

The Future of Artificial Intelligence

David A. Bray

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THE FUTURE OF ARTIFICIAL INTELLIGENCE

By David A. Bray

Imagine being able to visit a disability claims office in a digital environment. Imagine a patent examiner equipped with digital assistants that could do the bulk of administrative work behind processing patents. Artificial intelligence (AI) may make both of these scenarios a reality. This chapter addresses the question of how advances in and adoption of AI will transform public service over the next twenty years. AI has dual meanings:

- artificial intelligence
- augmented intelligence, specifically how human capabilities can be improved by pairing them with machines to collectively work smarter

Most of the benefits to government will come from a people-centered approach of pairing humans with machine learning to amplify human strengths via augmented intelligence. Such a people-centered approach means that the success of public service in the future depends on identifying beneficial ways to augment the extant human abilities of networked, cross-sector teams—who want to improve the delivery of public service—with digital assistants and learning machines to amplify the team's strengths, mitigate any possible blind spots, and increase the capabilities of the team as a whole.

This chapter breaks down the possibilities into the near-term future (2020-2025), the medium-term future (2025-2030), and the long-term future (2030-2040), and then focuses on specific initiatives that are likely to be launched to employ AI to transform the public sector.

The Near-Term Future (2020-2025)

The near-term future includes using AI in specialized applications to support the information and logistics functions traditionally performed by government to provide government services. It is important to note that when deciding where to use AI, public servants determine to what degree the machines providing this assistance operate autonomously vs. semi-autonomously.[1] For the near future, most machines will probably provide support that still requires a human to act or make a decision.

For all the near-term future possibilities discussed below, government should implement "public review boards" that look at the diversity, consistency, and appropriateness of the data used. Without diverse or consistent data, the AI trained by the data may make decisions that erode public trust. Without appropriate use of data, public trust may also erode. For representative government, using "public review boards" in a form akin to a random jury selection process may be one way to ensure improved oversight. Such

activities would also involve outreach efforts by public service organizations, to increase digital literacy and the understanding of AI and what it can do. Following are some examples of how AI will be deployed in the near future.

Increased Use of AI-Supported Assistance for Individuals Seeking Government Information. Several cities already have "311" telephone lines and mobile apps to assist individuals with non-emergency city services as well as to provide information on programs, events, and activities in the city. Such public-facing services will employ AI to help individuals with their questions. Humans would still need to be in the loop for new questions where the AI does not know the answer, or instances where the AI is uncertain about the question being asked. Such AI assistance will also help government employees with questions about onboarding, starting a new role, help with an existing role, retiring, and other internal service queries.

Increased Use of AI-Supported Assistance for Talent Management and Skills Matching. AI will help community members find new jobs and tailor training to hone and improve their skills for upward mobility in their jobs. Unemployment and career assistance services will provide an AI assistant via phone or at a physical career support center. The AI assistant will serve as a personal scout for new jobs based on questions answered by the individual about their skills, abilities, and desired work. The AI assistant will also help with tailored training opportunities accessible through in-person community colleges or online. Such AI assistance for talent management and skills matching will also be employed internally to government itself, to help the existing government workforce find new work opportunities and tailor individual training to further develop skills and abilities.

Increased Use of AI-Supported Review of Public Applications and Filings. Current government functions often entail detailed forms and processes to either prove or approve services to the public. Such functions include licenses, land and jurisdictional approvals, individual claims, payment processing, and travel-related documents. The current linear process of such applications is outdated, usually requiring a human to identify the right form, fill it out, and submit it—only to find that another form was needed or more information was required. Instead, AI assistants will provide more tailored support to individuals, to better understand what they are applying for and pre-review a public application or filing prior to human approval.

Increased Use of AI-Supported Legal, Financial and Ethics Reviews. Legal, financial, and ethics reviews often entail a rules-based approach of reviewing information submitted to ensure it comports with specified requirements. Such reviews fit well with how AI can assist humans. An AI assistant will do the initial review, let an individual know if more information is required, and provide a preliminary result for final review by a human.

Increased Use of AI-Supported Detection of Fake Images, Videos, and Audio Files. It currently is possible to "clone" someone's face to an image or video of someone else's body. Voices also can be "cloned" to produce audio recordings that sound like someone saying something they did not say.

Detecting such fake files requires detailed analysis and pattern matching, looking for inconsistences. An AI can support a human in detecting such irregularities.

Increased Use of AI-Supported Biometrics for Boarding Planes, Crossing Borders. Machines are also good at identifying the biometrics that make one individual different from another. Within sufficient training, an AI application will identify a person based on their face—and possibly other factors, such as their fingerprints or the sound of their voice. Such biometrics would allow individuals to board planes and cross borders without having to carry a physical identification card.

A Brief History of Artificial Intelligence

In 1943, a young academic by the name of Herbert A. Simon received his PhD from University of Chicago with a doctoral thesis focused on administrative behavior within organizations. He wrote his thesis after co-authoring an earlier study in 1939, entitled *Measuring Municipal Activities*, with Clarence Ridley.[2] From research into administration behaviors and municipal administration, Simon would later contribute to the first wave in the field of artificial intelligence, specifically *problem-solving algorithms*. In 1957, he partnered with Allen Newell to develop a General Problem Solver that separated information about a problem from the strategy required to solve a problem.[3] For his contributions to the fields of artificial intelligence, information processing, decision making, and problem solving, both he and Allen Newell received the Turing Award from the Association for Computing Machinery in 1975.[4]

Since then, the field of AI has experienced two more waves of innovation. Starting in the mid-1960s, the second wave of AI innovation included *expert systems* represented mainly as "if-then" statements instead of procedural code. The goal of such systems was to perform tasks that expert humans also could do, such as evaluate geological sites or perform medical diagnoses.[5] In parallel, advances taught machines to solve problems, specifically to intelligently play human games, including IBM Deep Blue playing against chess masters in the late 1990s. Later, IBM Watson won against two *Jeopardy!* Champions in 2011. Google DeepMind's AlphaGo won against a top-ranked world Go player in 2016.[6] A Carnegie Mellon University poker AI won a 20-day tournament in 2017.[7]

Approximately fifteen years into the start of the 21st century, cumulative advances in the speed, size, and scale of microprocessors and computer memory reached a tipping point that triggered a third wave of AI innovation. Some of the algorithms originally envisioned by AI pioneers, such as the backpropagation algorithm that allows neural networks to solve problems far faster than earlier approaches to machine learning, could now be run at sufficient speeds to make the algorithms valuable to solve real-world problems.[8] Machine learning is a branch of AI that employs large data sets to statistically train a machine to make accurate categorizations of what something is or is not; e.g., training a machine to identify images accurately of different objects, places, or entities.[9]

Increased Use of AI-Supported Assistance for Analyzing Geospatial Data. In the next few years, an explosion of geospatial data will become available from drones for civilian purposes, private cube satellites, and sensors associated with the "internet of things." AI can assist in making sense of all that information—as well as identifying patterns of importance to improve the delivery of public services. To do this appropriately, the public will need to have conversations and greater insights into what information is being collected and for what purposes.

The Medium-Term Future (2025-2030)

The medium-term future includes AI moving from specialized applications to embedding AI in all operations to support both the operations of government and the interpretation and decision-related functions traditionally done by government to improve public services. AI will become an essential component of all government operations in this time period.

For all the medium-term future possibilities discussed below, public service will need to solve growing cybersecurity challenges.[10] If more public service functions are supported by AI, then any activity to alter an AI algorithm—or worse, the data used to train the AI—could cause the AI to make decisions that hurt people, harm property, or erode trust. A new science of understanding the resiliency, and by extension the brittleness, of AI apps to disruption by false data or other exploits will need to be developed if both the public and the public service workforce is to trust interactions with AI. Following are some examples of AI-enabled public services.

Use of AI-Enabled Delivery of Materials and Provision of Transportation. By 2025, engineers probably will have solved the limitation of autonomous vehicles to intelligently navigate in heavy rain or snowy conditions. This would allow public services to be paired with AI-enabled autonomous vehicles to include fire and emergency services.

Use of AI-Enabled Robots to Offset Repetitive and Manually-Intensive Work. One of the current limitations of robots today is that most cannot grip

objects as well as a human. By 2025, engineers will probably have solved this limitation, making robots paired with AI a beneficial mechanism for the delivery of materials to support public service. This will include using AI for civil construction efforts, disaster response, healthcare, or other public functions.

Use of AI-Enabled "Tipping and Cueing" of Areas to Focus On. In a world in which more and more data is being produced by sensors connected to the "internet of everything," by 2025 AI will have advanced to the point where it will be monitoring different data streams for patterns of interest—or irregularities—that can then cue a human expert to look at something further. The human will then take an action that would further educate the AI for additional patterns to seek. This will include helping public service experts monitoring agricultural and health conditions in a geographic area.

Use of AI-Enabled Digital Assistants to Detect and Help Understand Biases. We all have implicit biases. Each of us have biases that we accumulate from our past experiences, including our early childhood. Some of these biases are discriminatory, such as an implicit preference for people who look like us or a favoritism to people who are taller and exhibit other physical traits. For public service, such implicit biases should not discourage a diverse workforce that seeks to serve the public. By 2025, AI will help hold up a "digital mirror" to compare our decisions and other interactions with those of others. This can help each of us understand where our biases are and what to do so that we may become less biased. Such an activity will also start to probe the boundary between the tacit, implicit knowledge a public service expert accumulates and the explicit knowledge they can articulate and share.

Use of AI-Enabled "Digital Twins" of Real-World Dynamics. Through extending the data collected from the future "internet of everything," by 2025 AI will allow public service organizations to build models of real-world dynamics—either of actual physical assets or social interactions. Such models will create highly accurate "digital twins" that would allow individuals in public service to experiment with certain scenarios in a digital environment. Individuals will also do training for crisis response and other high-intensity environments in a "digital twin" scenario, with AI providing recommendations on how to improve based on performance in the digital environment.

The Long-Term Future (2030-2040)

In 2030 and beyond, there are "farther out" ideas for the future of AI in public service. While predicting the specific future capabilities of AI is difficult, we assume advances will continue in the speed, size, and scale of microprocessors and computer memory to enable faster delivery of all the assisting and enabling functions of public service referenced earlier in this chapter. We can anticipate that the adoption of quantum computing, sophisticated augmented reality, and other techniques will be used to fundamentally transform the role of government to a more personalized approach in which government can respond to the unique needs of each citizen. The job of government will be

radically changed.

The ability for AI to work with and help humans better act, respond, and provide public services should be fairly robust by this point. At this point, we could imagine a future where "krewes" of humans augmented with machines perform the work of public service, perhaps on a part-time basis if other predictions associated with the future of work also occur by 2030.

By 2030, functions that used to be provided solely by government agencies may now be provided either through a part-time workforce or a "Public Service Corps" willing to spend some hours a week on efforts assigned to them by a coordinating public service AI. This "Public Service Corps" would embody what science-fiction author Bruce Sterling once dubbed a "krewe."[11]

For a krewe, the entity of importance is not an individual per se. Rather, it is the combined abilities of a team of human individuals augmented with intelligent assistants and relevant information streams to do the work they need to do. A diverse krewe brings many different perspectives to a scenario, ideally overcoming any specific individual biases.

In such a futuristic scenario, several of the rote and repetitive functions currently performed by government would be performed by AI in a semi-automated fashion such that applications associated with civil society activities are pre-screened and feedback provided to human applicants prior to a final human determination. Humans will still be involved for the more creative and final decision roles. The need for clerical workers or administrative workers to process applications will have gone down significantly.

Individuals can work part-time because the machines will do much of the work in the background. In such a civil society, choosing to work in public service is seen as a true service. Individuals may be able to work in the private sector in areas that AI assistants determine do not create conflict with their public service assignments. For humans working with AIs in krewes, it also would be important to identify mechanisms to reward a whole-of-team outcome and performance instead of solely individual actions. By working together, humans and machines, the krewe would be collectively more intelligent and capable than any one individual alone.

AI can match humans into different ad-hoc teams or krewes to fit a specific public service goal or problem set. If an emergent event or crisis occurs, AI can help identify who is available to assist with what activities—and even help coordinate swarming activities of both humans and machines to assist with the response to the event. AI can learn which humans work better on specific tasks with other humans, and AI may even be able to identify which robots or parts of the AI hardware might be faulty or near-failing and thus need repair.

Such a future would represent a major disruption to how government and public service currently function. This disruption would impact the workforce, policies, budgetary allocations, and administrative processes associated with current civil society functions. Such a future might impact military and intelligence functions in similar ways, with individuals who had already signed-up

to serve being "called up" by an AI if an urgent need matching their skill set arose, for example responding to a cyber event or helping with some other national security event.

Alternative Scenarios for the Future

While "long-term" futures are difficult to envision, it is possible to set forth two contrasting scenarios for the future of AI in public service.

Scenario One: An Optimistic View of the Future

In order to achieve the vision of "A Public Service 'Of the People, By the People, For the People,'" government workers will need to overcome budgetary challenges, potentially restrictive policies, ossifying processes, aging legacy IT systems, and skepticism to the point of strong distrust of the activities of government. With strong support, both from the public and elected political leaders, our representative government will be able to cross the chasm between how government currently operates and the ways in which public service could be dramatically transformed and deliver vastly better services and results to the public in 2040.

While this chapter presents potential milestones for where AI in public service could go, there will need to be experiments to gain expertise on the best way to align policies, people, processes, and technology to achieve desired goals. Unlike the venture capital community in the private sector, public service operates with money from taxpayers who have a right to expect that their money is spent wisely. This can create an environment in which maintaining the status quo, instead of attempting to embrace AI, may slow or prevent a government from achieving the benefits of AI.

The public will also rightfully need to be informed about what AI and algorithms do and how they are being used. Transparency in these activities will be key to engender public trust. Public discussions on what data should be used to train and inform AI activities will need to occur. A workforce savvy enough to keep up with both the technologies associated with AI—and more importantly the civil, legal, and people-centered impacts of such technologies in public service—will need to be recruited and retained.

Safe spaces to learn and explore how AI can improve public service—and then to translate these activities into public service-wide scaled activities—will need to be put in place.[12] Without safe spaces and possibly high-priority goals, anything that appears to have gone wrong or not worked on the first try may be politicized and prevent representative governments from being able to adapt to the rapidly accelerating age of AI. For public service to become more agile and

resilient, the barriers will come not from technology. Rather, the barriers will be human-centered, coming from a risk-averse political culture unwilling to make mistakes in areas where it is okay to make mistakes (i.e., the mistakes do not harm people or property), learning, adapting, and improving.

Scenario Two: A Pessimistic View of the Future

An alternative, cautionary note for the future of AI and public service is one in which AI is used by government, well-intended or not, to monitor the activities of individuals. Instead of empowering individuals, AI is used to sort and filter behaviors that the government does not permit. No insight into what AI and its algorithms are doing for the government is shared with the public, and the public does not know that they each have different risk, credit, and behavioral scores that influence what they can and cannot do in society.

Such a scenario would be a pessimistic one in which people are dehumanized and disconnected from engaging in civil society. Distrust in public service is heightened and no one feels like they can help make a difference. While the foreseen uses of AI discussed in this chapter seek to prevent such a scenario, the cautionary note that it could occur is worth remembering – if only to emphasize why a more people-centered "better way forward" is needed for the future of AI and public service ahead.

As we embrace the future of AI in public service, we must recognize that AI technologies will reflect the choices we humans make about how to use it, whom to include, and how to ensure the diversity, consistency, and appropriateness of AI's activities within civil societies. Since we are human, not all decisions made initially will be perfect. However, with an environment that encourages informed experimentation and appropriate safeguards to protect the public, we can course-correct and over time improve how civil society operates for the future ahead.

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Endnotes

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