Summary: AI's Effect on the Workforce

AI development is on a trajectory to automate many jobs, and Americans are worried. 71% of Americans are concerned and 63% support government action, which makes sense given OpenAI's aim to create AI that outperforms humans in most jobs.

AI's capabilities are growing at a remarkable pace, and how jobs are affected will change with continued development. AI is now outperforming humans across many different tests. General-purpose AIs, AIs capable of functioning across modalities and different types of tasks, are further broadening the range of tasks that could be affected.

Change is coming. While we can't be sure of the exact effects AI will have on the workforce, research agrees that change is coming, and that it might come fast. One report found that AI might automate 50% of the average workday **by 2045**. Specific projections differ across studies, but there is some agreement on what and who is at risk:

- Jobs with routine tasks, especially routine cognitive (rather than physical) work
- Work in management, customer operations, and software engineering
- Older, educated, high-wage workers

Large-scale unemployment is possible. AI is only improving as further money is poured into it, and will likely eventually be capable of full automation, of automating all human work. We've never before seen a technology that surpasses humans in *all* tasks, and it would break the previous trend of us adapting from automation by creating new work for ourselves, as AI will be capable of doing the new work too, at a much cheaper rate. The average AI researcher estimates a 50% chance of AI automating all human jobs before 2116.

Legislation can address these risks:

- The bipartisan Jobs of the Future Act of 2023 would **commission a report on potential effects of AI on the workforce and identify policy options**. We support the recommendations made there, and think if passed this would make great strides towards better preparing America for AI's potential effects.
- Congress should **commission a report on how to best address a full automation scenario.** What's missing from the Jobs of the Future Act is preparation for AI that can automate *all* jobs. Korinek (2024) suggests having the Department of Treasury and Department of Health and Human Services develop an operational plan which addresses how changes to the tax code and the social safety net could be used to address mass unemployment.

Full Report: AI's Effect On The Workforce

"A lot of people working on AI pretend that it's only going to be good; it's only going to be a supplement; no one is ever going to be replaced. Jobs are definitely going to go away." — Sam Altman, OpenAI

AI's potential effects on available jobs have left the American public concerned. 71% are concerned about the effects, 60% think AI will decrease available jobs, and a further 21% think their own job will be automated in the next five years. Importantly, Americans want the government to address the risk, with 63% in support government action:

The government should take action to prevent the potential loss of jobs due to AI:	
Strongly agree	27%
Somewhat agree	36%
Somewhat disagree	18%
Strongly disagree	8%
Don't know	11%
Agree (Net)	63%
Disagree (Net)	26%

Their concern may be warranted, given that OpenAI's express mission is building "highly autonomous systems that outperform humans at most economically valuable work" and that experts think such systems could arrive in the next decade.

In this report, we cover both this transformative potential, as well as AI's more predictable near-term effects on the workforce, and then consider what options exist to address these pressing concerns.

The Harm

In 1811, British textile workers began a nearly five-year-long period of protest and rioting. Fearing for the future of their occupation, they lamented the use of new machinery to replace their work, and took to breaking the machines and harassing factory owners who deployed them in an attempt to turn the technological tide back.

These workers were known as the Luddites, a term that has evolved into a pejorative for people who live in the past, who fight senselessly against beneficial progress. Indeed, the Industrial Revolution's technological advancements and economic growth helped improve many people's living standards around the world, particularly over the longer term.

But what actually happened to the historical Luddites as automation unfolded? Largely, their fears came true. "The handloom weavers and frame knitters with their little workshops were quite rapidly wiped out by factories after 1815."

Some have argued that these textile automations were overall beneficial for society even in the short term, because these automations led to a slight net increase in jobs. But this fails to address a separate issue: new jobs can be worse than old jobs. Indeed, after being pushed out of their independent work, the Luddites were left with few options but to take part in factory work and face grueling conditions and long hours. We've seen similar things play out since: for example, the automation of telephone operators' work in the early 1900s forced them into lower-paying occupations and caused many older workers to retire early.

In sum, the story of the historical Luddites highlights two important patterns: long-term positive effects from automation can conceal significant short-term harms, and automation might not lead to fewer jobs but instead force workers to transition into worse jobs. Keep these in mind, as we now turn to survey AI's current effects and where further development might lead us.

What Have We Seen So Far?

AI hasn't caused something similar to the Luddite experience yet, but harm has certainly started to materialize. Copywriter Olivia Lipkin saw her assignments dwindle after the introduction of ChatGPT; at first her managers teased her by referring to her as "Olivia/ChatGPT," joking that ChatGPT could do her job, but it stopped being a joke when she was abruptly fired. Content Writer Eric Fein saw all of his contracts canceled in the same month. These displacements follow from remarkable increases in capabilities, seen below in how quickly AI has surpassed human performance in a number of narrow skills:

Figure 3. AI's Test Scores Relative to Human Performance
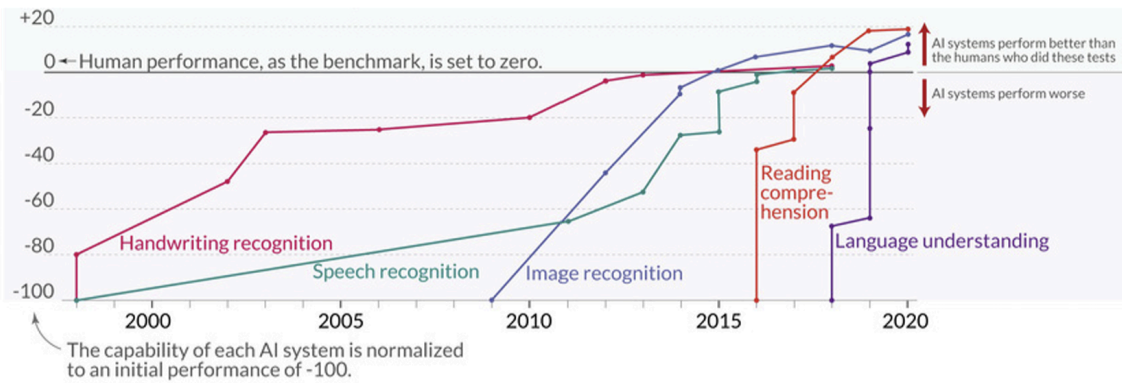
Source: Roser (2022).

But beyond the anecdotes, how many jobs have actually been lost? The best count we have right now is 4,628, but that number is certainly an undercount, especially given recent major layoffs.

This is partly because it's hard to count job losses driven by specific advancements. Google DeepMind's AlphaFold, for example, has nearly solved the 50-year quest to map protein folding, rendering obsolete a projected 1,000,000,000 hours of potential PhD research, but this doesn't translate easily into any number representing jobs lost. There's a pressing need for more data here to understand what exactly we have seen so far, and to better understand this issue as it evolves.

For now, the best we can do is point to trends, like the decline of jobs with tasks related to AI on Upwork (an online freelancing platform) following the release of ChatGPT, or the uptick in companies using AI. Census Bureau surveys find that about 18% of businesses across the Information sector are using AI, and OpenAI reports that 92% of Fortune 500 companies are using ChatGPT in some form.

What has happened to workers displaced by recent AI advancements? Here we have almost no data, and instead must look to the effects of previous automation. One Dutch study examined automation's effect on workers between 2000 and 2016, and found that replacement generally leads to a loss of about 9% of earnings over five years and early retirement for older workers.

But the deepest worries about AI's effect on jobs lie in the future, where we'll turn now.

Where Will Current GPAIs Lead Us?

AI models are developing capabilities at a breakneck speed today. Perhaps the most striking example is general-purpose AIs (GPAIs), AIs capable of functioning across modalities and different types of tasks. We have GPAIs that can hold dynamic verbal conversations, generate music and pictures and videos, summarize entire books at the press of a button, translate text to speech, and plan your vacation:

Plan a two week trip to Spain in the style of Rick Steeves, including hotel recommendations, which prioritizes seeing lesser known parts of the city and connecting to the local culture. No pictures for links or transportation section.

Show drafts ⌄

Unveiling Spain's Enchantment: A Rick Steves-Inspired Two-Week Itinerary

Following Rick Steves' philosophy of slow travel and cultural immersion, this itinerary focuses on off-the-beaten-path gems in Spain. Get ready to savor delicious local cuisine, connect with friendly people, and experience the rich tapestry of Spanish life.

Day 1-3: Barcelona Like a Local

- Accommodation: Hostal Casa Rafecas (Gothic Quarter) - A family-run charming hostal for an authentic experience.

Instead of thronging with Sagrada Familia crowds, delve into the Picasso Museum, appreciating the artistic genius of Spain's most famous painter. Explore the hidden corners of Montjuïc Park, picnicking with locals and soaking in panoramic city views. Don't miss the Poble Español, a village showcasing architectural styles from different

Some think GPAI will play out largely like previous technologies like computers or electricity. They argue GPAI is likely to have similar effects: a change in specific work tasks, but no reduction in work or degradation of work conditions. But there are a number of reasons GPAI is different from these previous technologies:
- Computers started as a narrow technology, primarily used for spreadsheets. They only became a general-purpose technology after decades of further development and other inventions like the internet. In contrast, GPAI is general-purpose from the start.
- Before electricity, steam-powered businesses were structured around vertical factories. This design optimized the distribution of steam energy throughout the production floors. Switching to electricity required more than just updating the power source; it also demanded a redesign of the entire workflow. In contrast, GPAI can be useful without huge supporting adjustments.

- It took years after the introduction of electricity for businesses to redesign and restructure factories to have all operations on a single floor, which led to the development of the assembly line. In contrast, GPAI can immediately enable significant changes in work processes, such as collapsing hierarchies of reporting by giving executives the ability to talk directly with a database using a chatbot.

Some respond that despite these differences, GPAI might augment rather than replace; i.e., it might help workers more efficiently execute their job rather than automate their job away. But it remains unclear whether GPAI will favor augmentation over replacement. Companies who adopted AI in the late 2010s concurrently cut back on their hiring. Further, businesses often even say they're adopting AI to "automate workflows," with one study finding that 54% of businesses that adopt AI do so to automate. And even if GPAI does support augmentation, research has found that augmentation for some roles can mean automation for others[1].

These factors give rise to some worrying predictions from the literature:
- Frey (2017): 47% of jobs are at "high risk," which the authors "expect could be automated very soon, perhaps over the next decade or two."
- Susskind (2020): In the long term, AI is likely to destroy more jobs than it creates due to its rapid advancement across a variety of domains.
- Briggs et al. (2023): AI could automate 300 million jobs worldwide, and partially automate 66% of US jobs. The most exposed workers may see up to 50% of their workload automated.
- RAND (2023): Multiple studies have found some of the most exposed jobs are those expected to see job growth in the coming years.
- Valoir (2023): AI will potentially automate about 40% of the average workday.
- McKinsey (2023): GPAI at its extreme could potentially automate 60 to 70% of the tasks that make up the current average workday.
- Eloundou et al. (2023): "Our findings reveal that around 80% of the U.S. workforce could have at least 10% of their work tasks affected by the introduction of LLMs, while approximately 19% of workers may see at least 50% of their tasks impacted."

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[1] I.e., if someone at the top of a hierarchy is able to use AI to produce some of the data analysis they need to do their job, AI is ostensibly serving an augmenting role, but one which is likely to automate work that lower-level data analysts used to do.

Underneath these predictions lies a range of views on which specific skills or jobs are likely to be impacted[2]. The analysis below displays some of that diversity, showing predictions from some of the most in-depth reports and noting where they agree.

What are general aspects of at-risk work?
- Jobs with more routine[3] elements. This is a consistent finding, and research has also indicated that how routine a job is can decide whether AI augments or automates. Specifically, GPAI could automate routine cognitive work, which is concentrated in middle-wage occupations (e.g., office clerks).
- Jobs with skill ceilings, where there is only so much room to improve the work.
- Jobs with objectives that are easy to measure, as GPAI generally needs a quick feedback loop[4] to be able to improve.

What job types are at risk?
- Customer Operations
  - Since the release of ChatGPT, jobs that involve developing chatbots have increased by 2000% on Upwork, and customer service jobs have declined by 16%. These chatbots are improving rapidly, now capable of dynamic voice conversations that are personalized to you.
  - Klarna, a fintech company, built an AI agent that is handling work equivalent to 700 full-time human agents.
- Legal Services
  - AI is likely to be capable of performing many of the tasks paralegals and legal assistants currently perform. One study indicates that up to 44% of all legal tasks could be automated.
  - AI not only has the knowledge—GPT-4 already scores in the top 10% or top 32% on the Bar exam, depending on which aspiring lawyers you compare it to—but also the ability to automate workflows. Products already exist that can do "document review, deposition preparation and contract analysis."
- Management
  - Across the studies referenced in this report, management is the most mentioned at-risk job type.

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[2] Most of this research has used a similar method, where current AI capabilities are assessed in some manner and then compared to in-depth descriptive data of the skills used in jobs across the US workforce, calculating a job's exposure based on how much its tasks and AI capabilities overlap.
[3] "What makes a task routine is that it follows an explicit, fully specified set of rules and procedures."
[4] I.e., it needs to have outputs which can be scored according to how good they are, or some sort of metric to measure against, to most effectively update and become better at the task.

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- ○ GPAI is already being used to automate management functions like scheduling, training, and evaluation in [call centers](), and has already seen integration in [supply chain management]() elsewhere.
- **[Marketing]() (& Sales)**
  - ○ Ad agencies are already [investing billions]() in AI, and [56%]() of Chief Marketing Officers have already begun using AI. One industry study estimates that AI will automate [7.5%]() of current advertising jobs by 2030.
- **[Office & Administrative Support]() (OAS)**
  - ○ [One report]() put OAS roles as the job type with the highest percentage (46%) of work tasks that could be automated. IBM decided a year ago to [pause hiring]() for many administrative roles, the CEO stating [roughly 7,800 such roles]() could be automated within the next five years.
  - ○ At-risk tasks include [scheduling meetings](), [managing spreadsheets](), [creating invoices](), [managing emails](), and [processing documents]().
- **[Software Engineering]()**
  - ○ OpenAI's product [Codex]() aims to greatly simplify coding so it's possible to code with little to no programming knowledge. It powers Github's Copilot, which is on its way to becoming an [industry standard]().
  - ○ AI startup Cognition's [new AI agent](), Devin, can autonomously resolve nearly 14% of issues found in real-world software engineering projects.
- **[Translation]() (& Interpreters)**
  - ○ AI already powers many of the online translators we use today, and is becoming increasingly capable over time. [Google's translation services]() already offer full document translation, subtitle generation and transcription.
  - ○ Translation jobs on Upwork have [declined 19%]() since the release of ChatGPT, while also seeing 20% reduction in pay.
- **[Transportation & Logistics]()**
  - ○ Autonomous cars are [already]() [safer]() than humans when it comes to driving in cities. There's [early indication]() that autonomous trucking is too, and [autonomous boats]() are quickly improving, already [in use and capable]() of an entire trans-Atlantic journey.
  - ○ Semi-autonomous cars are [available]() to consumers, and Mercedes' CTO expects fully autonomous cars by 2030. Fully autonomous cars are [already on trial]() in various cities.

What workers are most at-risk?

- [Older workers](#)[5], due to their likelihood to be less mobile (more rooted in a given location) and their reduced number of remaining work years (which makes job retraining less attractive).
- [More educated workers](#), especially those with a bachelor's or above whose work focuses on [cognitive skills](#).
- [Male workers](#), given their historical concentration in technical roles that don't involve as much interpersonal skill. However, more recent work has indicated that future trends may be towards greater exposure for [female workers](#).
- [Higher-wage workers](#)—not those at the very top, but those in the top [75 to 95%](#).

The Overall Expectation

To understand the potential scale of this change, consider US employment numbers from the Bureau of Labor Statistics (BLS). Its [May 2022 data](#) found the following number of people working in these at-risk jobs or job types[6]:

- Office & Administrative Support[7] ~18,146,000
- Management ~9,861,000
- Transportation[8] ~3,102,000
- Marketing & Sales[9] ~1,663,000
- Software Developers ~1,534,000
- Legal Services ~345,000
- Writers & Editors ~204,000
- Interpreters & Translators ~52,000

These at-risk workers represent nearly 25%[10] of the total US workforce, potentially every fourth person you know. The point here is not to say that all of these workers will definitely lose their jobs, but rather to connect some of the implicated jobs and job types in the literature to recent employment data to give a sense of the gravity here, the size of the potential effects. AI will certainly [affect jobs and transform the workforce](#); the question is which specific jobs and what options will be left afterwards.

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[5] The age at which someone is considered old ranges, one study finding increased negative effects for those [over 30](#), but the general thrust is that negative effects are likely to grow with age.

[6] These were pulled from different levels of specificity: Major, Minor, Broad and Detailed in descending order of specificity. Office & Administrative support, for example, is a Major category and represents many different Detailed level jobs. You can find each of these by searching on [BLS's website](#).

[7] Specifically: "Office and Administrative Support Occupations" (major, ~18,670,000) - Postal Service Workers (Broad, ~524,000)

[8] Specifically: "Heavy and Tractor-Trailer Truck Drivers" (~2,192,000), "Bus Drivers" (~515,000), & "Taxi Drivers, Shuttle Drivers, and Chauffeurs" (~395,000)

[9] Specifically: "Marketing and Sales Managers" (~865,000) & "Market Research Analysts and Marketing Specialists" (~799,000)

[10] In May 2022, roughly 147,886,000 people were employed, so 33,907,000/147,886,000 = 23.6%

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The [rapid pace](#) of AI development will leave little time to react once significant harms materialize. The faster that AI eliminates new kinds of jobs, the more disorienting and harmful the transition process is likely to be for workers, and [McKinsey's 2023 report](#) estimates that 50% of today's work activities will be automated by 2045, with automation speeding up over time.

Preparation is needed now, not just for the automation that seems possible with current technology, but also the possibility of fully general-purpose AI capable of full automation, which is where we'll turn next.

What Happens When We Get *Fully* General-Purpose AI?

Existing GPAIs are already remarkably multi-purpose, able to perform well across different domains and human abilities, already carrying implications for the future of work. Today, AI can: [drive your car](#), [diagnose your cancer](#), [write poetry on demand](#), [correctly interpret your facial expressions](#), and [design new skyscrapers](#). But these systems are still limited, unable to complete tasks like:

- Launching and fully running a startup that raises $1M in venture capital.
- Generating a high-quality movie that millions of people would pay to watch.
- Proving a major mathematical theorem to be true without looking at an existing proof (e.g., Fermat's Last Theorem).

A fully general-purpose AI would be capable of these and more, from complicated jobs that require a number of different skills and years of experience, to projects on the intellectual cutting-edge that characterizes humanity's most remarkable breakthroughs.

Although there is substantial disagreement on whether and when this is achievable, many AI researchers [and](#) [companies](#) believe that these aren't permanent bottlenecks, but rather areas that AI will expand into in time. A 2023 survey of thousands of AI researchers' opinions found that in aggregate, there is a [50% chance](#) of AI capable of automating all labor by 2116, 48 years earlier than researchers predicted [just a year earlier](#).

Such a vision may sound like sci-fi, but there's a reason AI researchers find it plausible. Trends in AI development indicate that models will continue to become more capable as we throw [more resources at them](#). The computational resources invested in AI training [are doubling](#) multiple times per year, and [have grown](#) by over ten billion times since 2010. And the level of performance achievable with that computing power ("algorithmic progress") [has doubled](#) roughly every eight months since 2014, resulting in a

22,000-fold increase by 2023. If these ordinary trends continue, AI capabilities will continue to grow rapidly.

Further, AI is already contributing to AI research, creating a feedback loop where AI capabilities will improve quicker and quicker as AI automates more tasks in software and hardware R&D. Indeed, one computational model found a 50% chance that AI would go from automating 20% of such tasks to nearly 100% in five years or less. Congress would need to react extraordinarily quickly to an unprecedented pace of technological change, if the model is correct.

Skeptics of large-scale unemployment due to AI point correctly to previous general-purpose technologies like robots and computers, and the fact that they did not take all our jobs. But the introduction of previous technologies always left countless tasks that humans could still do far better than any machine, allowing for many new jobs over the longer term to replace the old. A technology that surpasses humans in *all* tasks would break this trend, with wages declining significantly and likely falling to the operating cost of AI systems.

Given the potential for unprecedented workforce disruption in the coming years, it would be wise to prepare for such a scenario. As Professor Anton Korinek called for in his statement to the U.S. Senate AI Insight Forum on workforce issues, we need policy options that prepare us to address all potential outcomes. We turn to such policies now.

Policies Directed at the Issue

Existing policies have largely focused on ways to address the potential workforce effects from the current generation of AI systems. Most existing legislation is aimed at carving out spaces where AI is restricted: the NO FAKES Act restricting the use of AI to replicate existing artist's work, and the No Robot Bosses Act restricting the use of AI in hiring decisions.

The bipartisan Jobs of the Future Act of 2023 takes a more comprehensive approach, promoting the study of current and potential effects of AI on the workforce as well as policy options to address potential workforce problems. Many of our below recommendations easily slot into the goals of this bill, and if passed this would make great strides towards better preparing America for AI's impacts.

Our Recommendations
Commission a report to gather data on AI-driven workforce displacement and summarize future projections. The lack of data on displacement from AI constrains our ability to effectively react now and to understand trends so that we can project future

displacement. Data collection could be done through the Bureau of Labor Statistics (BLS), or by including these questions as part of the Annual Business Survey run by the Census Bureau, which is already tracking the number of firms adopting AI, and should answer the following:

1. Job Loss and Creation: What sectors (or specific professions) are seeing job loss? What sectors are seeing new jobs as a result of AI?
2. Skill Requirements: What worker skills are being obviated by AI and where is AI being used to augment worker skills?
3. Worker Transitions: For those who have lost their job due to AI, what are their current employment statuses? What jobs are they doing? Are they earning less?

Commission a report to assess what the best retraining program for GPAI is.
The report would ideally consult various relevant stakeholders[11] and consider both how to best technically implement the program and what it should focus on. Regarding implementation, there are a number of ways retraining could be facilitated, many focusing on how such programs could be set up and funded:

- The JOBS Act of 2023 would extend Pell grant eligibility to job retraining programs.
- A joint US-EU report recommends subsidizing intermediaries which share the cost and benefit of training (e.g., Public Employment Services, outplacement offices, temporary help agencies).
- The Workforce Futures Initiative recommends worker-owned personal employment training accounts (PETAs) which would (similarly to retirement accounts) allow workers to contribute pre-tax to an account used for further education or training, augmented by employer or governmental contributions.

The report should also identify skills for workers to study that will be resilient as AI capabilities improve. Orrell and Veldran (2024) suggest training non-cognitive skills (e.g., interpersonal communication, emotional intelligence, leadership), similar to Michael Webb's claim that social skills (e.g., empathy) will be resilient.

Reduce the gap in **tax rates on employing people and deploying equipment.**
Currently, firms and workers are jointly taxed 25-30% for labor, while firms on net are taxed only around 5% for buying equipment (e.g., computers). This creates a strong incentive towards automating rather than complementing labor which can be remedied by changes in tax policy. Some options for doing so are:

- Replacing some payroll taxes with capital gains taxes.

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[11] E.g., government (e.g., the Secretary of Labor), academia (e.g., community colleges), industry (e.g., companies in sectors with expected growth and loss), and workforce-training organizations.

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- Capping the tax deductions a company can claim for buying robotics or software unless the company's payroll is increasing.
- Replacing some personal income taxes with corporate income taxes.

Commission a report on how to best address a full automation scenario. [Korinek (2024)](#) suggests having the U.S. Department of Treasury and Department of Health and Human Services develop an operational plan which addresses how changes to the tax code and the social safety net could be used to address mass unemployment. Given that those who [develop AI](#) and those with [more disposable capital](#) (i.e., bigger businesses) are likely to benefit disproportionately from further development, the report should specifically address how potential changes could protect both small businesses' and everyday Americans' chance to grow and make a living in such a future.