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The Symbiosis of Humans and Machines: Planning for Our AI-Augmented Future

With human workers at all levels increasingly collaborating with intelligent machines, here's how organizations can develop the new disciplines needed to optimize the capabilities of both.

Center For
The Future of Work

Executive Summary

Our work of tomorrow is going to look vastly different from the work we do today. Artificial intelligence (AI) is augmenting workers in certain roles, and soon this trend will expand to the vast majority of the workforce, allowing humans to do the work that matters and, in the process, vastly improving workforce productivity and effectiveness. Rather than being concerned about a jobless future, organizations are now called upon to prepare for work that's enhanced through the collaboration of humans and machines.

Already, we've seen the real-world impact of intelligent systems, with faster processes, improved accuracy, and more incisive insights and predictions in the healthcare, professional services, financial services, manufacturing and legal industries. Even leadership is becoming more data-driven and rigorous through collaboration with smart machines.

Organizations are clamoring to incorporate AI into their front ends to enhance the customer experience, and into their middle and back ends to drive agility, speed and productivity. Our research indicates that the revenue impact of new technologies, including AI, is $634 billion globally.[1] In addition to targeting direct cost take-out and revenue enhancement through AI, many organizations are also starting to embrace the holistic organizational improvements that can be gained through use of this technology, including improving the employee experience.

To better understand the augmented workforce, Cognizant's Center for the Future of Work analyzed industry-leading case studies, interviewed industry experts and closely examined the extensive literature on the subject. Key insights from our research include:

▎ **The job of identifying where to embed AI into the workplace is a new discipline for global business leaders.** Organizations will need to think beyond the purely technological factors required and address changes across the organizational and cultural realms.

▎ **Job roles need to be considered as a collection of tasks that are shared by human workers and AI systems.** Based on our research, we've developed a "task master model," which can help organizations view jobs as a collection of individual tasks with varying levels of relevance for AI vs. human work, and optimize the capabilities of both.

▎ **Human resources will be a key player.** HR will need to help leaders navigate the shift to an augmented workforce, as well as assess its own transition to AI-human symbiosis. Certain job roles in the HR department will disappear, some will be enhanced, core functions will remain, and new ones will emerge. This is the beginning of a new era for HR.

DISPELLING THE MYTHS: MACHINES NEED US

AI needs to be complemented by human capabilities that include empathy, critical thinking, creativity, strategy, technological management and imagination.

The main idea behind AI–human collaboration is that it's a symbiotic relationship: Working together, each can produce results that exceed what either can achieve alone. The corollary to this is that AI systems rely on human input just as much as human workers rely on intelligent automation.

For example, a team at Harvard Medical School showed that deep-learning algorithms designed to identify cancer in lymph node images yielded significantly better results when combined with analysis from human pathologists. Through collaboration, the pathologists and AI algorithms achieved a 99.5% success rate in accurate cancer diagnosis[2] vs 97.1% when the AI system acted alone (see Figure 1).
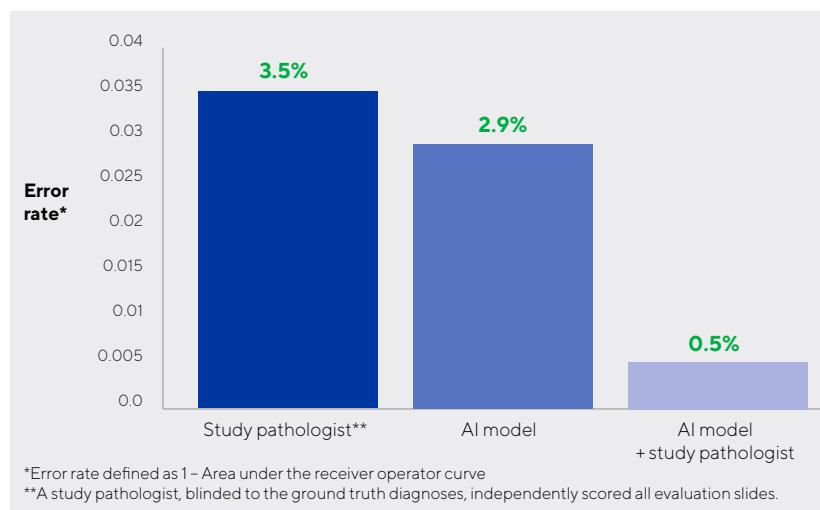
So rather than thinking of AI as a superpower in and of itself, it's essential to view intelligent systems as augmenting human work. The inherent power of AI lies in its ability to deliver the "science" of work – i.e., rapid analysis of millions of calculations a second and the ability to present these in an easily consumed fashion.

The foil to this "science" of work is the human "art" of work. AI findings need to be contextualized into scenarios that lie outside of a preconceived data set. AI needs to be complemented by human capabilities that include empathy, critical thinking, creativity, strategy, technological management and imagination.[3] These are the human qualities that will increasingly be emphasized and relied upon in the future of augmented work and will help to drive value to levels beyond which either a human or machine could achieve in isolation.

Think of a chemical company that performs quality control by microscopically scanning samples of each batch of its product. Traditionally, this process is slow and manually conducted by a highly qualified chemical engineer. By applying AI, the system can weed out abnormal results so the human worker can focus time and attention on the relevant and challenging findings.

This symbiotic relationship is what will define work moving forward.

AI plus pathologist is greater than pathologist or AI alone

*Error rate defined as 1 – Area under the receiver operator curve
**A study pathologist, blinded to the ground truth diagnoses, independently scored all evaluation slides.

Source: https://blogs.nvidia.com/blog/2016/09/19/deep-learning-breast-cancer-diagnosis/
Figure 1

THE TASK MASTER MODEL: ATOMIZING JOB RESPONSIBILITIES

To understand which tasks should be allocated to intelligent machines vs. humans, organizations need to see work in a new light. On close examination, work is not a homogenous succession of five eight-hour days a week. Neither can it be viewed as a broadly defined set of work functions, i.e., research, quality control, product development, etc.

Instead, work is a collection of individual activities, such as physically connecting wires in a manufacturing process, reporting irregularities to a legal team or logging parts received in a shipment, each of which has a unique set of required skills and behaviors. By analyzing the individual components of job roles, organizations can better assess which are best suited for human workers vs. intelligent systems.

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One way to do this is to categorize the minute functions or tasks within a job role into two buckets: rote, repetitive work with little need for creativity but potentially high amounts of calculation and attention to detail, and then collaborative, social work with high business impact. In our previous study "Space Matters," we dubbed these two types of work as "red tasks" and "blue tasks."[4] Of course, this is not a purely black-and-white analysis, and attention needs to be paid to the interplay and overlap between these two types of work.

"Blue" tasks – which demand judgment, empathy and creativity – are better performed by people than machines. This type of work relies on people gathering together to iterate, experiment, discuss, create and innovate. It relies on visual cues, emotion, proximity, empathy, ethics, teamwork and social context. Think of engagement with an irate customer, corporate networking or exception handling. These blue tasks are what will define human value in the workplace in years to come.

"Red" tasks," on the other hand, involve complex data analysis, repetition, pattern recognition and a low level of human interaction. Think of document scanning, individual parts logging, customer data entry or highly structured risk analysis. These are the tasks with which AI excels.

Organizations can tune the interplay of humans and machines by applying AI to "red" tasks, thus facilitating workers to better focus on their blue tasks. We call this the "task master model."

We've designed two task master frameworks, one for cognitive and one for physical tasks, to help organizations optimize human-AI collaboration by assessing the level of "red" and "blue" work within the myriad tasks that make up a particular job.

The physical task master model

Within the physical task master model, we analyze tasks according to two criteria: the relative social interaction each entails and the dexterity and structure each requires (see Figure 2).

Businesses need to assess the social interaction involved within each task, as well as the level of dexterity and structure involved. For example, a highly structured physical task with low social needs and low dexterity requirements (lower left quadrant), such as packing containers, welding or soldering, can be relatively simply automated. On the other hand, an unstructured physical task requiring high dexterity and high social skills (upper right quadrant), such as bandaging the wound of a distraught child, cannot be automated.

Assessing the AI-human equation for physical tasks

The red and blue designations within each quadrant provide guidance as to the nature of each task, with blue representing human tasks and red representing tasks that can be automated. The bottom right quadrant is both red and blue, as tasks within this quadrant are not yet automatable, but over time, this will slowly change as intelligent machines become more dexterous and able to handle increasingly unstructured physical tasks.
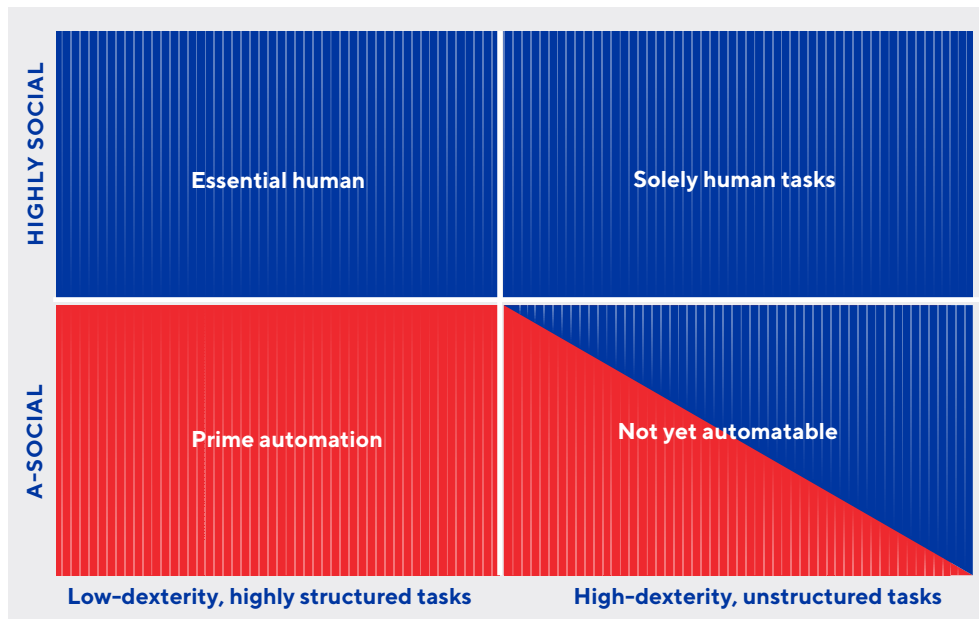
Source: Cognizant Center for the Future of Work, with inspiration from *AI Superpowers* by Kai-Fu Lee[5]
Figure 2

But what about the gray areas in-between? For high-dexterity physical tasks that don't involve social interaction (lower right quadrant) and are unstructured, such as fitting a kitchen sink, automation could in time perform these tasks but not currently. However, automation available today could be used to make this task more efficient; think of an augmented reality headset providing prompts to the plumber. While the human will remain at the center of these tasks for the foreseeable future, there would be potential for augmentation within the task, tightening the alignment betwee n human and machine work.

Lastly, for relatively structured, low-dexterity tasks that involve high social interaction (upper left quadrant),[5] these will remain in the hands of humans indefinitely. Examples include a masseuse or personal trainer. However, even these roles could potentially benefit from AI augmentation moving forward. The massage therapist could use an AI-enabled system that highlights specific areas of the patient's body that require further attention, or a personal trainer could use AI visualization software to provide guidance on a client's workout form, current heart rate or muscle weaknesses.

Quick Take

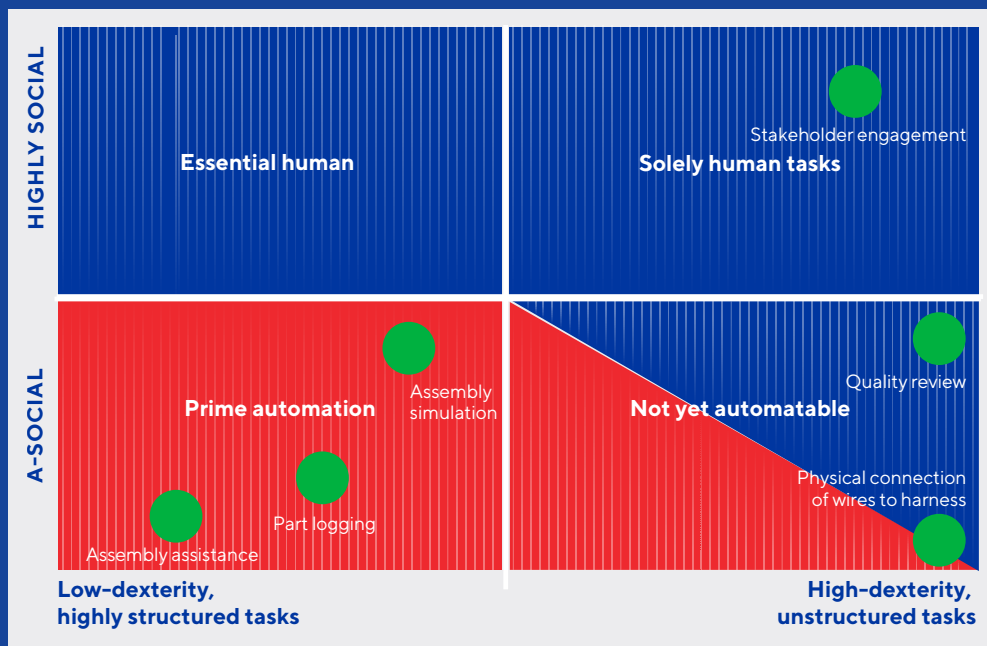## Bringing the physical task master model to life: wiring aircraft 25% faster

Boeing was experiencing slow build times and massive worker strain in its wire assembly division.[6] This highly complex task was previously completed with workers referring to massive manuals to reference-check thousands of connections in a wiring loom. Digitizing this information made it easier to find, but the constant toggling between laptop screen and wiring work caused immense eyestrain and did little to improve productivity.

Boeing then introduced AR headsets equipped with natural language processing capabilities. Workers can now ask the headset to describe next possible connections, with the response delivered via an AR interface or hands-on video. This has reduced the production time of wiring looms by 25%.

Seen through the task master model, a low-dexterity, highly structured tasks that involves no human interaction includes parts logging. This is, therefore, a prime task to be automated. However, the physical connection of wires to the harness, while not requiring any social interaction, does require a high degree of dexterity and, therefore, remains the role of the human worker for the time being. Discussions with managers, colleagues and suppliers, however, is and will remain a human task.

AI augmentation of wiring loom workers at Boeing

Source: Cognizant Center for the Future of Work
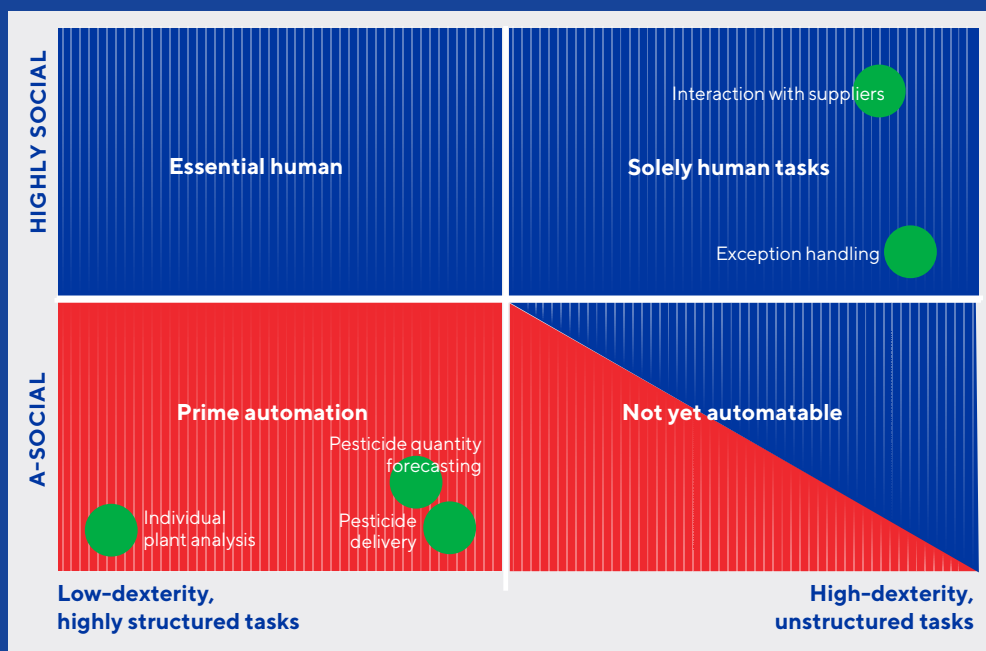Figure 3

Quick Take

Bringing the physical task master model to life: customizing agricultural pesticides

John Deere's machine learning algorithms enable its machinery to detect whether a plant requires application of a pesticide.[7] This results in significant cost savings in materials for farmers while also enhancing the effectiveness of pesticide use, providing greater yields.

Seen through the physical task master model, the job of pesticide control and delivery can be broken down into its minute tasks. Individual plant analysis is relatively structured and doesn't require social interaction; it's also a high-volume task that would be almost impossible for a human to perform at the scale required. This makes it a prime task for AI analytics.

The AI system would also be responsible for delivering the pesticide and forecasting future pesticide requirements. The farmer, on the other hand, would be responsible for interacting with both the equipment and pesticide suppliers, as well as tracking the AI system's decision-making, stepping in to intervene where necessary.

Making farmers more efficient and productive

Source: Cognizant Center for the Future of Work
Figure 4

The cognitive task master model

Within the cognitive task master model, we analyze tasks according to three criteria: the social interaction each task entails, the creativity and strategy required and whether it is transactional/oriented toward optimization.

To establish the human–AI balance for cognitively-oriented jobs, businesses once again need to assess the level of social interaction required for individual tasks, the level of creativity and strategic thinking required, and whether it is transactional in nature and geared toward optimizing an outcome. A key component of assessing the transactional nature of tasks is whether the task happens in isolation from other variables and inputs or is highly constrained in its variable set.

For example, a purely transactional task requiring low social interaction (bottom left quadrant), such as capturing data for invoice processing, can be automated very simply and has a predefined set of variables/inputs.

On the other hand, a highly social and strategically-oriented task (upper right quadrant), such as running a design thinking workshop, cannot be entirely automated, particularly presenting and engaging with participants. Other elements of this task could be augmented by AI, such as providing prompts via an audio headset when presenting.

For tasks with low social requirements but high creativity (lower right quadrant), such as writing a report, AI will slowly creep into this area but not anytime soon. For highly social tasks that are fairly transactional in nature (top left quadrant), such as delivering a prepared presentation at a conference, machines will not be doing this anytime soon.

Assessing the human–AI equation for cognitive tasks

The red and blue designations within each quadrant provide guidance on the nature of the task, with blue representing human tasks and red representing tasks that can be automated. The bottom right quadrant is both red and blue, as tasks within this quadrant are not yet automatable, but over time, this will slowly change as intelligent machines become more creative and able to understand a greater number of contextualized variables, therefore becoming more strategic.
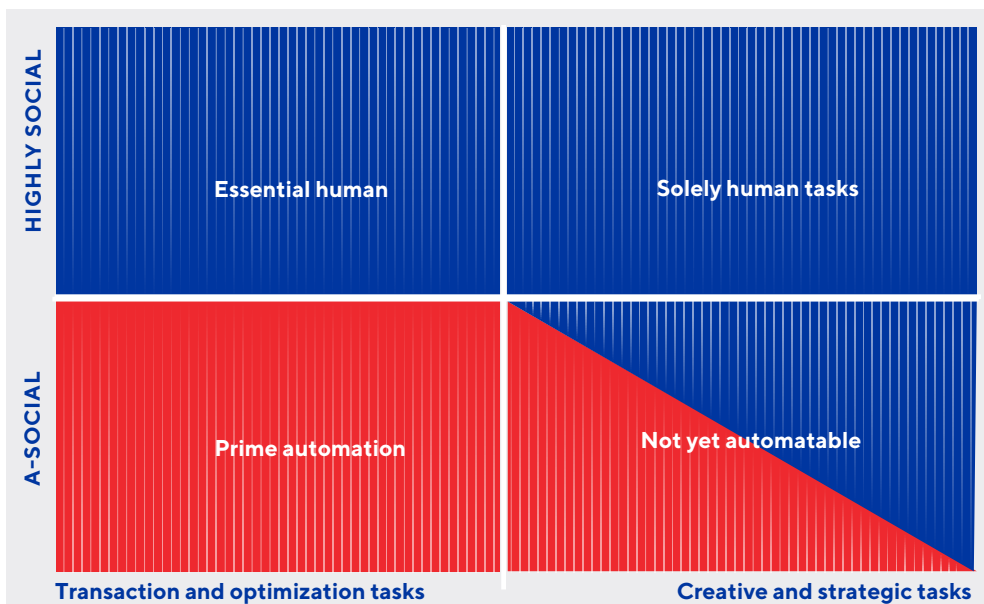
Source: Cognizant Center for the Future of Work with inspiration from *AI Superpowers* by Kai-Fu Lee
Figure 5

Quick Take

Bringing the cognitive task master model to life: accomplishing due diligence in a fraction of the time

A leading global professional services organization wanted to improve its laborious and time-consuming risk management due diligence process. International due diligence involves exhaustive research, with more than 40,000 global sources tracking not only media but also corporate records, financial transactions and legal cases. Results based on analysts' text strings needed to be painstakingly reviewed for each entity before a report could be finalized.

Using APIs to link the company's due diligence software to a machine-learning interface, the system was able to learn many of the researchers' tasks, thereby drastically reducing research time, with 14% of reports complete in one hour. Generation of due diligence reports also increased by up to 30% per year, with increased accuracy.[8]

In this case, due diligence is a multi-faceted role that could not be entirely automated. However, due to the high degree of accuracy required and the scale to which that accuracy is necessary, it's a prime example of how AI can augment the

cognitive worker. Tasks such as stakeholder engagement and irregularity appraisal are complex, strategic and social; therefore, these will remain purely human tasks. Irregularity reporting to legal, while relatively transactional in nature, is highly social due to the conversations required to discuss the intricacies of a specific case.

AI is particularly well-equipped, however, to handle tasks such as word indexing, document scanning and exception risk handling, which it can execute at a scale and accuracy that humans could not.

Augmenting legal analysts to become more effective and strategic
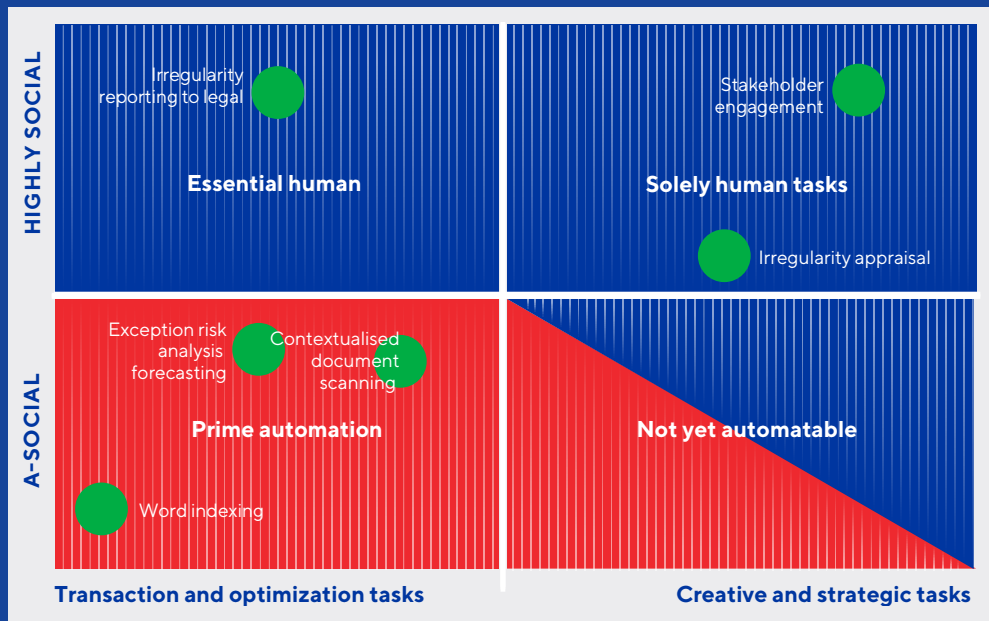
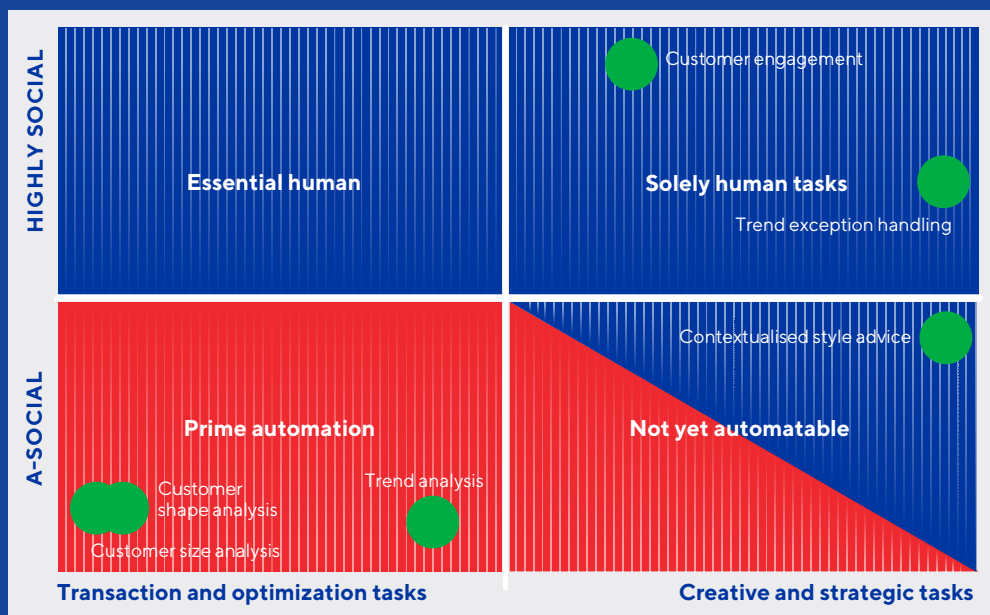Source: Cognizant Center for the Future of Work
Figure 6

Quick Take

Bringing the cognitive task master model to life: your cyborg fashion stylist will see you now

Online fashion is a booming business, and with it, we are seeing the rise of online fashion stylists, including companies like Thread[9] and Trunk Club.[10] Another player in this market, Stitch Fix,[11] is making use of AI to enhance the service its stylists deliver to clients. Algorithms analyze the latest style trends in combination with customer measurements, body type, budget, preference and customer feedback to distill possible garment selections. Stylists then have the final say in what they propose to clients. This drastically reduces the time spent on individual clothing suggestions and provides recommendations to clients that closely match their lifestyle and budgets.[12]

For this example, AI allows agents to focus on client interactions while also exception-handling the system's recommendations. AI systems are used to analyze trends and customer fit to make fashion recommendations that are more astute and accurate than what a human could accomplish at a high scale. This augmented model of customer service is increasingly being used across industries, resulting in less scripted and more customized interactions with call center agents.

Augmenting legal analysts to become more effective and strategic

Source: Cognizant Center for the Future of Work
Figure 7

HR IMPERATIVES IN THE AGE OF THE AUGMENTED WORKFORCE

To adapt to an augmented workforce, businesses need to rethink their culture, processes and talent management strategies. In our recent report "The Culture Cure for Digital," we explored how culture needs to be addressed in the face of digital innovation, including the introduction of the augmented workforce.[13] The millions of dollars invested in a company's digital journey is money wasted if the cultural signals don't encourage needed behavior and attitude changes.

Ultimately, though, the biggest change will involve motivating workers to drive success in the augmented workforce.

Quick Take

The leadership quotient for augmentation

Successfully leading an augmented workforce requires an entirely different approach from what was needed in the past. Leaders need to think beyond incremental improvements in outcomes, such as improving efficiency and costs by 5% a year, and instead aim for step function changes, where improvements of 25% or even 50% can be achieved. Leaders need to instill the right mindset within the workforce to imagine and action these goals.

The following skills can help enhance the "leadership quotient:"

■ **Encourage adaptability**. In a recent survey,[14] 85% of executives said AI would allow their company to maintain a competitive edge. With that much interest, everyone is facing increased competition. Incorporating Agile methodologies is essential. For example, ING has implemented 350 nine-person squads consisting of members from varying business functions to increase agility. The insurer is now releasing software updates on a two- to three-week basis rather than five to six times a year, and has improved customer satisfaction and employee engagement scores.[15]

▌ **Instill vision and purpose**. Leadership needs to define a core vision for its workforce that looks beyond profitability and revenue, and instead focuses on the "why" message: Why are you pursuing the AI augmentation initiative? An example of why this is important is the public backlash to the state of Arkansas's implementation of AI in its Medicaid program.[16] Here AI was primarily used as a cost take-out initiative but failed citizens when insufficient human oversight was applied to monitoring the system's decisions.

Three steps can ensure the organization is guided by a consistent vision:

> Clearly set out the ideals of your organization that you will live and die by.

> Ensure leadership is easily accessible to teams within the business units.

> Incentivize the workforce on KPIs and outcomes that align with the vision, such as customer or employee satisfaction.

▌ **Empower employees**. Leaders need to empower and motivate teams to engage in the "blue" work within their roles. An example of this is UK retailer Dixons Carphone, which uses a bot to suggest add-on items and services to customers, and automatically checks store inventory based on employee questioning, allowing employees to spend more time with consumers on the shop floor.[17] Actions to take include:

> Reduce hierarchical structures internally and encourage collective decision making and feedback.

> Make innovation a cornerstone through design-thinking workshops, hackathons and sprints.

> Set clear objectives for teams and allow them the freedom to meet them however they see fit.

This is why the role of human resources in the augmented workforce cannot be underestimated. Ultimately, HR teams will be leadership's foot soldiers in driving a successful, motivated and innovative augmented workforce. However, HR teams need to look at themselves through the lens of the task master model, identifying areas within their roles that can be augmented through the use of AI systems.

HR now needs to become a strategic business partner to the C-suite, facilitating the implementation of AI into the workforce, preempting skills gaps, helping to implement the corporate vision in the workforce, forming talent clusters to facilitate the strategic vision of the board and advising on cultural issues in the workforce.

HR's retooling imperative

By retooling itself via AI, HR will be able to augment many of its department's more rote tasks and free up time to focus on strategic initiatives that will drive an organization's workforce to its augmented future.

Rote tasks such as leave calculation and benefits administration (see Figure 8) will erode as more emphasis is placed on purely human tasks such as compensation analysis and strategic workforce planning. In addition, certain strategic HR tasks will be augmented, including learning/development and recruiting.

Retooling HR with AI

Rote tasks in the HR value chain that can be automated through AI systems are represented in red. Tasks that can be augmented through AI are in orange. Purely human tasks are in blue. Tasks that will need to be implemented within HR are in green.

HR transactional workload			Performance management	Talent, machine & vision management	
Leave calculation	Employee onboarding	HR core system updates	Performance review	Recruiting	Human & machine management
Termination	Contractor updates	Employee status change	Compensation analysis management	Workspace collaboration & innovation	Strategic workforce planning
Bridge to FTE	Transfer & relocation	Benefits admin	Regulatory compliance	Vision planning & execution	Learning & development

Automated HR · Augmented HR · The human factor · New HR responsibilities

Source: Cognizant Center for the Future of Work
Figure 8

Rehire: the new faces of HR

The future of HR in an augmented organization will require entirely new responsibilities and employees. These new tasks include:

I **Enablement of human-machine collaboration.**[18] An interaction and task planning mechanism will be needed for humans and machines to mutually communicate their capabilities, goals and intentions. The end goal is to create augmented hybrid teams that generate better business outcomes through human-machine collaboration.

I **Workplace and collaboration planning.**[19] To enable co-creation and collaboration, and harness the productive energy AI can unleash, organizations will need to reimagine the interplay between workspace, performance and culture. Ultimately, HR will need to assess how the workspace can facilitate the augmented workforce. Do we need as many desks and cubicles to do "blue" work? Should the workspace feature more planning and collaborating space to help drive agile teams?

I **Vision planning and execution.**[20] HR can assist leadership with creating an overall vision and strategy for the augmented future, and deliver this vision to the workforce on a continual basis. This will be done through consistent messaging, workshops, teaming with business unit leadership and serving as an interface and sounding board for new initiatives to ascertain whether they align with the corporate vision.

An interaction and task planning mechanism will be needed for humans and machines to mutually communicate their capabilities, goals and intentions.

A FINAL WORD

The beauty of an augmented workforce is that it facilitates humans to do work that they naturally excel at, namely social interaction, collaboration, creativity and innovation.

The challenges of successfully implementing an augmentation strategy are complex, but organizations can use the following as a guide to introducing their own augmentation initiative:

| **The future of work is in the details.** The way leaders view roles needs to change. Instead of thinking of "a role," think of a matrix of minute tasks that form the basis of the role. Once jobs are viewed in this manner, it becomes significantly easier to see how they can be augmented.

| **Make your workers more social and their work more impactful.** The beauty of an augmented workforce is that it facilitates humans to do work that they naturally excel at, namely social interaction, collaboration, creativity and innovation. Organizations can now begin to envision a future where machines do the heavy lifting and the humans do the heavy talking.

| **Rethink the leadership quotient.** The skills needed to successfully lead an augmented organization differ from those of traditional business. Leaders need to work alongside intelligent machines, themselves becoming augmented, and embrace adaptability, future vision and empowerment of the workforce.

| **It's HR's time to shine.** HR will be essential in driving the augmented workforce agenda. However, it needs to augment itself in order to reprioritize. The demands on HR will change as it tackles the challenges of the augmented workforce, and new roles and responsibilities will be needed, focusing on workspace, human/machine matching and vision planning and execution.

Organizations around the world are reaching a tipping point: New digital technologies, including AI, are changing the dynamic of how workers deliver value. To facilitate human–AI augmentation, organizations need to hone the new discipline of objectively viewing job roles as collections of tasks. The extent of this augmentation cannot be taken lightly as the potential productivity improvements will prove to be massive. Much of this work will fall on HR's shoulders, requiring HR to first retool itself to usher in the augmented workforce.

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Michael Cook is a Senior Manager in Cognizant's Center for the Future of Work in EMEA. In this role, Mike identifies the changing dynamics that will shape the business ecosystem of the future, delivering original research and analysis of work trends in Europe. Mike also collaborates with a wide range of technology thinkers and academics about what the future of work will look like as digital changes many aspects of our working lives. Mike is an established speaker with broad experience across the services market, including customer experience management, buy-side advisory, talent and workforce solutions, and cybersecurity. Prior to joining Cognizant, Mike served as Global Research Director with HfS Research, where he worked across multiple research topics and led HfS's buy-side focused research program. Mike earned his bachelor's of economics and econometrics and postgraduate qualification of international trade and development from the University of Johannesburg.

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About the Center for the Future of Work

Cognizant's Center for the Future of Work™ is chartered to examine how work is changing, and will change, in response to the emergence of new technologies, new business practices and new workers. The Center provides original research and analysis of work trends and dynamics, and collaborates with a wide range of business, technology and academic thinkers about what the future of work will look like as technology changes so many aspects of our working lives. For more information, visit Cognizant.com/futureofwork, or contact Ben Pring, Cognizant VP and Managing Director of the Center for the Future of Work, at Benjamin.Pring@cognizant.com.

About Cognizant

Cognizant (Nasdaq-100: CTSH) is one of the world's leading professional services companies, transforming clients' business, operating and technology models for the digital era. Our unique industry-based, consultative approach helps clients envision, build and run more innovative and efficient business-es. Headquartered in the U.S., Cognizant is ranked 193 on the Fortune 500 and is consistently listed among the most admired companies in the world. Learn how Cognizant helps clients lead with digital at www.cognizant.com or follow us @Cognizant.

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