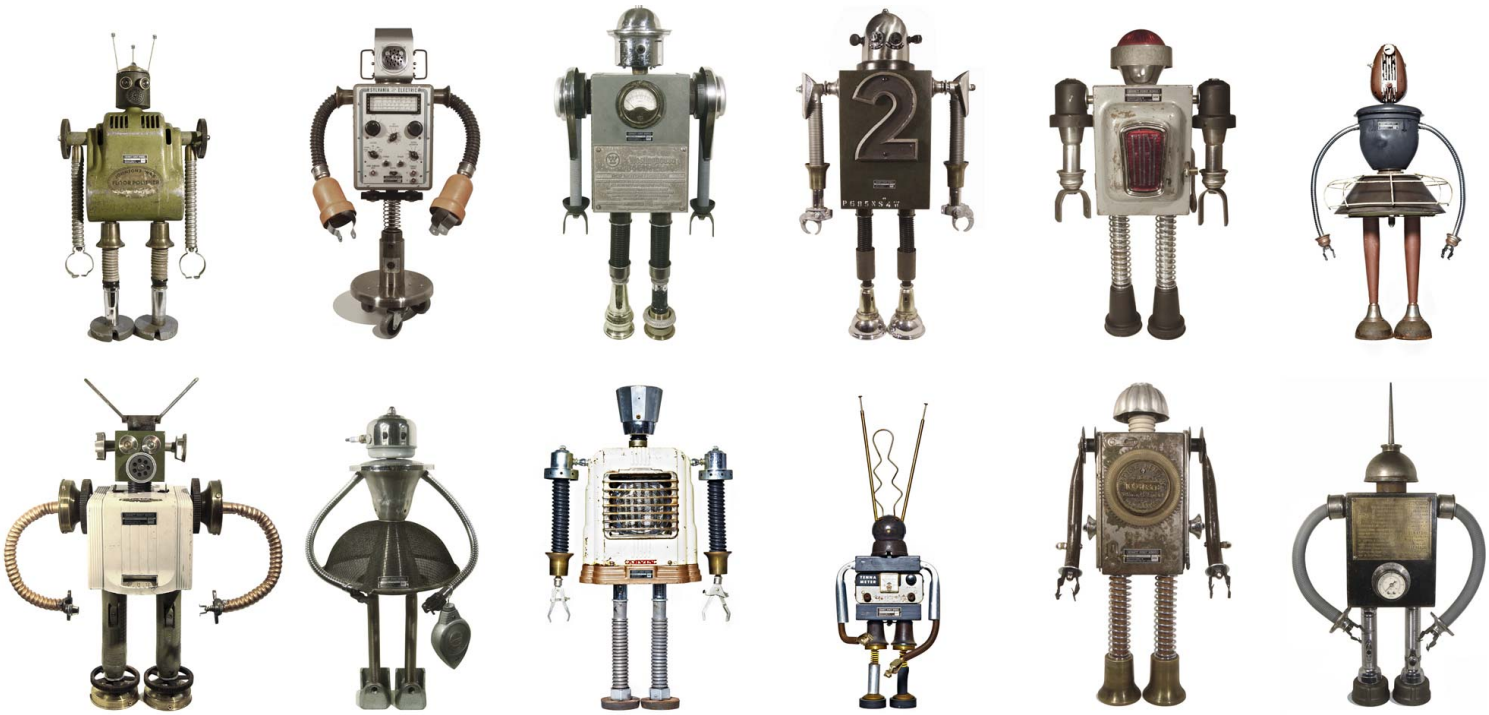
Harvard Business Review



TECHNOLOGY

Beyond Automation

by Thomas H. Davenport and Julia Kirby

FROM THE JUNE 2015 ISSUE

After hearing of a recent Oxford University study on advancing automation and its potential to displace workers, Yuh-Mei Hutt, of Tallahassee, Florida, wrote, “The idea that half of today’s jobs may vanish has changed my view of my children’s future.” Hutt was reacting not only as a mother; she heads a business and occasionally blogs about emerging technologies. Familiar as she is with the upside of computerization, the downside looms large. “How will they compete against AI?” she asked. “How will they compete against a much older and experienced workforce vying for even fewer positions?”

Suddenly, it seems, people in all walks of life are becoming very concerned about advancing automation. And they should be: Unless we find as many tasks to give humans as we find to take away from them, all the social and psychological ills of joblessness will grow, from

economic recession to youth unemployment to individual crises of identity. That's especially true now that automation is coming to knowledge work, in the form of artificial intelligence. Knowledge work—which we'll define loosely as work that is more mental than manual, involves consequential decision making, and has traditionally required a college education—accounts for a large proportion of jobs in today's mature economies. It is the high ground to which humanity has retreated as machines have taken over less cognitively challenging work. But in the very foreseeable future, as the Gartner analyst Nigel Rayner says, "many of the things executives do today will be automated."

Three Eras of Automation

If this wave of automation seems scarier than previous ones, it's for good reason. As machines encroach on decision making, it's hard to see the higher ground to which humans might move.

ERA ONE 19TH CENTURY
Machines take away the **dirty and dangerous**—industrial equipment, from looms to the cotton gin, relieves humans of onerous manual labor.

ERA TWO 20TH CENTURY
Machines take away the **dull**—automated interfaces, from airline kiosks to call centers, relieve humans of routine service transactions and clerical chores.

ERA THREE 21ST CENTURY
Machines take away **decisions**—intelligent systems, from airfare pricing to IBM's Watson, make better choices than humans, reliably and fast.

SOURCE THOMAS H. DAVENPORT AND JULIA KIRBY
FROM "BEYOND AUTOMATION," JUNE 2015

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What if we were to reframe the situation? What if, rather than asking the traditional question—What tasks currently performed by humans will soon be done more cheaply and rapidly by machines?—we ask a new one: What new feats might people achieve if they had better thinking machines to assist them? Instead of seeing work as a zero-sum game with machines taking an ever greater share, we might see growing possibilities for employment. We could reframe the threat of *automation* as an opportunity for *augmentation*.

The two of us have been looking at cases in which knowledge workers collaborate with machines to do things that neither could do well on their own. And as automation makes greater incursions into their workplaces, these people respond with a surprisingly broad repertoire of moves. Conventional wisdom is that as machines threaten their livelihood,

humans must invest in ever higher levels of formal education to keep ahead. In truth, as we will discuss below, smart people are taking five approaches to making their peace with smart machines.

What Is Augmentation?

David Autor, an economist at MIT who closely tracks the effects of automation on labor markets, recently complained that "journalists and expert commentators overstate the extent of machine substitution for human labor and ignore the strong complementarities that increase productivity, raise earnings, and augment demand for skilled labor." He pointed to the immense challenge of applying machines to any tasks that call for flexibility, judgment, or common sense, and then pushed his point further. "Tasks that cannot be substituted by computerization are generally complemented by it," he wrote. "This point is as fundamental as it is overlooked."

A search for the complementarities to which Autor was referring is at the heart of what we call an augmentation strategy. It stands in stark contrast to the automation strategies that efficiency-minded enterprises have pursued in the past. Automation starts with a baseline of what people do in a given job and subtracts from that. It deploys computers to chip away at the tasks humans perform as soon as those tasks can be codified. Aiming for increased automation promises cost savings but limits us to thinking within the parameters of work that is being accomplished today.

> Smart machines can be our partners and collaborators in creative problem solving.

Augmentation, in contrast, means starting with what humans do today and figuring out how that work could be deepened rather than diminished by a greater use of machines. Some thoughtful knowledge workers see this clearly. Camille Nicita, for example, is the CEO of Gongos, a company in metropolitan Detroit that helps clients gain consumer insights—a line of work that some would say is under threat as big data reveals all about buying behavior. Nicita concedes that sophisticated decision analytics based on large data sets will uncover

new and important insights. But, she says, that will give her people the opportunity to go deeper and offer clients “context, humanization, and the ‘why’ behind big data.” Her shop will increasingly “go beyond analysis and translate that data in a way that informs business decisions through synthesis and the power of great narrative.” Fortunately, computers aren’t very good at that sort of thing.

Intelligent machines, Nicita thinks—and this is the core belief of an augmentation strategy—do not usher people out the door, much less relegate them to doing the bidding of robot overlords. In some cases these machines will allow us to take on tasks that are superior—more sophisticated, more fulfilling, better suited to our strengths—to anything we have given up. In other cases the tasks will simply be different from anything computers can do well. In almost all situations, however, they will be less codified and structured; otherwise computers would already have taken them over.

We propose a change in mindset, on the part of both workers and providers of work, that will lead to different outcomes—a change from pursuing automation to promoting augmentation. This seemingly simple terminological shift will have deep implications for how organizations are managed and how individuals strive to succeed. Knowledge workers will come to see smart machines as partners and collaborators in creative problem solving.

This new mindset could change the future.

Five Steps to Consider

Let’s assume that computers are going to make their mark in your line of work. Indeed, let’s posit that software will soon perform most of the cognitive heavy lifting you do in your job and, as far as the essential day-to-day operation of the enterprise is concerned, make decisions as good as (probably better than) those made by 90% of the people who currently hold it. What should your strategy be to remain gainfully employed? From an augmentation perspective, people might renegotiate their relationship to machines and realign their contributions in five ways.

Step up.

Your best strategy may be to head for still higher intellectual ground. There will always be jobs for people who are capable of more big-picture thinking and a higher level of abstraction than computers are. In essence this is the same advice that has always been offered and taken as automation has encroached on human work: Let the machine do the things that are beneath you, and take the opportunity to engage with higher-order concerns.

Niven Narain, a cancer researcher, provides a great example. In 2005 he cofounded Berg, a start-up in Framingham, Massachusetts, to apply artificial intelligence to the discovery of new drugs. Berg's facility has high-throughput mass spectrometers that run around the clock and produce trillions of data points from their analysis of blood and tissue, along with powerful computers that look for patterns suggesting that certain molecules could be effective. "The last thing you want to do now," Narain told a reporter in March 2015, "is have a hundred biochemists...going through this data and saying, 'Oh, I kind of like this one over here.'" But he also employs a hundred biochemists. Their objective is not to crunch all those numbers and produce a hypothesis about a certain molecule's potential. Rather, they pick up at the point where the math leaves off, the machine has produced a hypothesis, and the investigation of its viability begins.

Narain stepped up by seeing an opportunity to develop drugs in a new way. That takes lots of experience, insight, and the ability to understand quickly how the world is changing. Likewise, one interpretation of the success of today's ultrarich Wall Street investment bankers and hedge fund titans is that they have stepped up above automated trading and portfolio management systems.

Five Paths Toward Employability

People have alternatives for how they'll work with machines. Here's a look at them in one realm: marketing.

	HOW YOU ADD VALUE	EXAMPLE	HOW YOU PREPARE IF THIS IS YOUR STRATEGY
1 STEP UP	You may be senior management material—you're better at considering the big picture than any computer is.	A *brand manager* orchestrates all the activities required to position a brand successfully.	Get that MBA or PhD and constantly challenge yourself to gain broader perspective on your work.
2 STEP ASIDE	You bring strengths to the table that aren't about purely rational, codifiable cognition.	A *creative* can intuit which concept will resonate with sophisticated customers.	Develop your "multiple intelligences" beyond IQ and gain tacit knowledge through apprenticeships.
3 STEP IN	You understand how software makes routine decisions, so you monitor and modify its function and outputs.	A *pricing expert* relies on computers to optimize pricing on a daily basis and intervenes as necessary for special cases or experiments.	Pursue some STEM education and keep updating your business domain expertise.
4 STEP NARROWLY	You specialize in something for which no computer program has yet been developed (although theoretically it could be).	A "*wrap advertising*" *specialist* has deep expertise in using vehicles as mobile billboards.	Look for a narrow niche and master it by doing the work with focus and passion.
5 STEP FORWARD	You build the next generation or application of smart machines—perhaps for a vendor of them.	A *digital innovator* seizes on a new way to use data to optimize some key decision, such as cable video ad buys.	Stay at the cutting edge in computer science, artificial intelligence, and analytics. Learn to spot candidates for automation.

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If stepping up is your chosen approach, you will probably need a long education. A master's degree or a doctorate will serve you well as a job applicant. Once inside an organization, your objective must be to stay broadly informed and creative enough to be part of its ongoing innovation and strategy efforts. Ideally you'll aspire to a senior management role and thus seize the opportunities you identify. Listen to Barney Harford, the CEO of Orbitz—a business that has done more than most to eliminate knowledge worker jobs. To hire for the tasks he

still requires people to do, Harford looks for “T-shaped” individuals. Orbitz needs “people who can go really deep in their particular area of expertise,” he says, “and also go really broad and have that kind of curiosity about the overall organization and how their particular piece of the pie fits into it.” That’s good guidance for any knowledge worker who wants to step up: Start thinking more synthetically—in the old sense of that term. Find ways to rely on machines to do your intellectual spadework, without losing knowledge of how they do it. Harford has done that by applying “machine learning” to the generation of algorithms that match customers with the travel experiences they desire.

Step aside.

Stepping up may be an option for only a small minority of the labor force. But a lot of brain work is equally valuable and also cannot be codified. Stepping aside means using mental strengths that aren’t about purely rational cognition but draw on what the psychologist Howard Gardner has called our “multiple intelligences.” You might focus on the “interpersonal” and “intrapersonal” intelligences—knowing how to work well with other people and understanding your own interests, goals, and strengths.

The legendary thoroughbred trainer D. Wayne Lukas can’t articulate exactly how he manages to see the potential in a yearling. He just does. Apple’s revered designer Jonathan Ive can’t download his taste to a computer. Ricky Gervais makes people laugh at material a machine would never dream up. Do they all use computers in their daily work lives? Unquestionably. But their genius has been to discover the ineffable strengths they possess and to spend as much time as possible putting them to work. Machines can perform numerous ancillary tasks that would otherwise encroach on the ability of these professionals to do what they do best.

We don’t want to create the impression that stepping aside is purely for artists. Senior lawyers, for example, are thoroughly versed in the law but are rarely their firms’ deep-dive experts on all its fine points. They devote much of their energy to winning new work (usually the chief reason they get promoted) and acting as wise counselors to their clients. With machines digesting legal documents and suggesting courses of action and arguments, senior

lawyers will have more capacity to do the rest of their job well. The same is true for many other professionals, such as senior accountants, architects, investment bankers, and consultants.

Take the realm of elder care, in which robotics manufacturers see great potential for automation. This isn't often treated as a nuanced or a particularly intellectual line of human work. We were struck, therefore, by a recent essay by the teacher, coach, and blogger Heather Plett. She wrote of her mother's palliative care provider, "She was *holding space* for us," and explained: "What does it mean to *hold space* for someone else? It means that we are willing to walk alongside another person in whatever journey they're on without judging them, making them feel inadequate, trying to fix them, or trying to impact the outcome. When we hold space for other people, we open our hearts, offer unconditional support, and let go of judgement and control."

True, hospice care is an extreme example of a situation requiring the human touch. But empathy is valuable in any setting that has customers, coworkers, and owners.

If stepping aside is your strategy, you need to focus on your uncodifiable strengths, first discovering them and then diligently working to heighten them. In the process you should identify other masters of the tacit trade you're pursuing and find ways to work with them, whether as collaborator or apprentice. You may have to develop a greater respect for the intelligences you have beyond IQ, which decades of schooling might well have devalued. These, too, can be deliberately honed—they are no more or less God-given than your capacity for calculus.

Step in.

Back in 1967, having witnessed the first attempts to automate knowledge work, Peter Drucker declared of the computer: "It's a total moron." It's a lot less moronic now, but its relentless logic still occasionally arrives at decisions whose improvement wouldn't require a human genius.

Perhaps you saw a 2014 story in the *New York Times* about a man who had just changed jobs and applied to refinance his mortgage. Even though he'd had a steady government job for eight years and a steady teaching job for more than 20 years before that, he was turned down for the loan. The automated system that evaluated his application recognized that the projected payments were well within his income level, but it was smart enough to seize on a risk marker: His new career would involve a great deal more variation and uncertainty in earnings.

Or maybe that system wasn't so smart. The man was Ben Bernanke, a former chairman of the U.S. Federal Reserve, who had just signed a book contract for more than a million dollars and was headed for a lucrative stint on the lecture circuit. This is a prime example of why, when computers make decisions, we will always need people who can step in and save us from their worst tendencies.

> A lot of brain work—including empathy—cannot be codified.

Those capable of stepping in know how to monitor and modify the work of computers. Taxes may increasingly be done by computer, but smart accountants look out for the mistakes that automated programs—and the programs' human users—often make. Ad buying in digital marketing is almost exclusively automated these days, but only people can say when some "programmatic" buy would actually hurt the brand and how the logic behind it might be tuned.

Here you might ask, Just who is augmenting whom (or what) in this situation? It's a good moment to emphasize that in an augmentation environment, support is mutual. The human ensures that the computer is doing a good job and makes it better. This is the point being made by all those people who encourage more STEM (science, technology, engineering, and math) education. They envision a work world largely made up of stepping-in positions. But if this is your strategy, you'll also need to develop your powers of observation, translation, and human connection.

Step narrowly.

This approach involves finding a specialty within your profession that wouldn't be economical to automate. In Boston, near the headquarters of Dunkin' Donuts, a reporter recently peered into "the secret world of the Dunkin' Donuts franchise kings." One of them, Gary Joyal, makes a good living (if his Rolls-Royce is any indication) by connecting buyers and sellers of Dunkin' Donuts franchises. As the *Boston Globe* put it, Joyal "uses his encyclopedic knowledge of franchisees—and often their family situations, income portfolios, and estate plans—to make himself an indispensable player for buyers and sellers alike." So far he has helped to broker half a billion dollars' worth of deals.

Could Joyal's encyclopedic knowledge be encoded in software? Probably. But no one would make enough doing so to put a Rolls in the driveway. It's just too small a category. The same is true of Claire Bustarret's work. *Johns Hopkins Magazine* reports that Bustarret "has made a career out of knowing paper like other French people know wine." Her ability to determine from a sheet's texture, feel, and fibers when and where the paper was made is extremely valuable to historians and art authenticators. Maybe what she knows could be put in a database, and her analytical techniques could be automated. But in the meantime, she would have learned more.

Those who step narrowly find such niches and burrow deep inside them. They are hedgehogs to the stepping-up foxes among us. Although most of them have the benefit of a formal education, the expertise that fuels their earning power is gained through on-the-job training—and the discipline of focus. If this is your strategy, start making a name for yourself as the person who goes a mile deep on a subject an inch wide. That won't mean you can't also have other interests, but professionally you'll have a very distinct brand. How might machines augment you? You'll build your own databases and routines for keeping current, and connect with systems that combine your very specialized output with that of others.

Step forward.

Finally, stepping forward means constructing the next generation of computing and AI tools. It's still true that behind every great machine is a person—in fact, many people. Someone decides that the Dunkin' Franchise Optimizer is a bad investment, or that the application of AI to cancer drug discovery is a good one. Someone has to build the next great automated insurance-underwriting solution. Someone intuits the human need for a better system; someone identifies the part of it that can be codified; someone writes the code; and someone designs the conditions under which it will be applied.

Clearly this is a realm in which knowledge workers need strong skills in computer science, artificial intelligence, and analytics. In his book *Data-ism,* Steve Lohr offers stories of some of the people doing this work. For example, at the E. & J. Gallo Winery, an executive named Nick Dokoozlian teams up with Hendrik Hamann, a member of IBM's research staff, to find a way to harness the data required for "precision agriculture" at scale. In other words, they want to automate the painstaking craft of giving each grapevine exactly the care and feeding it needs to thrive. This isn't amateur hour. Hamann is a physicist with a thorough knowledge of IBM's prior application of networked sensors. Dokoozlian earned his doctorate in plant physiology at what Lohr informs us is the MIT of wine science—the University of California at Davis—and then taught there for 15 years. We're tempted to say that this team knows wine the way some French people know paper.

Stepping forward means bringing about machines' next level of encroachment, but it involves work that is itself highly augmented by software. A glance at Hamann's LinkedIn page is sufficient to make the point: He's been "endorsed" by contacts for his expert use of simulations, algorithms, machine learning, mathematical modeling, and more. But spotting the right next opportunity for automation requires much more than technical chops. If this is your strategy, you'll reach the top of your field if you can also think outside the box, perceive where today's computers fall short, and envision tools that don't yet exist. Someday, perhaps, even a lot of software development will be automated; but as Bill Gates recently observed, programming is "safe for now."

Why Employers Love Augmentation (or Should)

Our conversations to date with professionals in a wide range of fields—radiologists, financial advisers, teachers, architects, journalists, lawyers, accountants, marketers, and other experts of many kinds—suggest that whatever the field, any of the five steps we've just laid out is possible. Not all of them are right for a given individual, but if you can figure out which one is right for you, you'll be on your way to an augmentation strategy.

You might not get very far, however, if employers in your field don't buy in to augmentation. The world suffers from an automation mindset today, after all, because businesses have taken us down that path. Managers are always acutely aware of the downside of human employees —or, to use the technologist's favored dysphemism for them, "wetware." Henry Ford famously said, "Why is it every time I ask for a pair of hands, they come with a brain attached?"

For augmentation to work, employers must be convinced that the combination of humans and computers is better than either working alone. That realization will dawn as it becomes increasingly clear that enterprise success depends much more on constant innovation than on cost efficiency. Employers have tended to see machines and people as substitute goods: If one is more expensive, it makes sense to swap in the other. But that makes sense only under static conditions, when we can safely assume that tomorrow's tasks will be the same as today's.

Yuh-Mei Hutt told us that in her small business (Golden Lighting, a manufacturer of residential fixtures), automation has made operations much more efficient. But that means profitability depends now more than ever on the creativity of her people. Her designers need to know about trends in the interior design world and in lighting technology and must find fresh ways to pull them together. Her salespeople rely on CRM software, but their edge comes from how well they connect in person with retail buyers.

In an era of innovation, the emphasis has to be on the upside of people. They will always be the source of next-generation ideas and the element of operations that is hardest for competitors to replicate. (If you think employees today lack loyalty, you haven't noticed how fast software takes up with your rivals.) Yes, people are variable and unpredictable; capable of

selfishness, boredom, and dishonesty; hard to teach and quick to tire—all things that robots are not. But with the proper augmentation, you can get the most out of the positive qualities on which they also hold a monopoly. As computerization turns everything that can be programmed into table stakes, those are the only qualities that will set you apart.

Winning a Different Kind of Race

To be sure, many of the things knowledge workers do today will soon be automated. For example, the future role of humans in financial advising isn't fully clear, but it's unlikely that those who remain in the field will have as their primary role recommending an optimal portfolio of stocks and bonds. In a recent conversation, one financial adviser seemed worried: "Our advice to clients isn't fully automated yet," he said, "but it's feeling more and more robotic. My comments to clients are increasingly supposed to follow a script, and we are strongly encouraged to move clients into the use of these online tools." He expressed his biggest fear outright: "I'm thinking that over time they will phase us out altogether." But the next words out of his mouth more than hinted at his salvation: "Reading scripts is obviously something a computer can do; convincing a client to invest more money requires some more skills. I'm already often more of a psychiatrist than a stockbroker."

That's not a step down. It's at least a step aside, and probably a step up. The adviser and his firm need only to see it that way and then build on it. For the foreseeable future, prompting savers and investors to make wiser financial choices will not be an automated task.

The strategy that will work in the long term, for employers and the employed, is to view smart machines as our partners and collaborators in knowledge work. By emphasizing augmentation, we can remove the threat of automation and turn the race with the machine into a relay rather than a dash. Those who are able to smoothly transfer the baton to and from a computer will be the winners.

A version of this article appeared in the June 2015 issue (pp.58–65) of *Harvard Business Review*.

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Ramesh Ramakrishnan 5 months ago

@Julia - Great note. People with 'step forward' type of mind set often look at ways to bring new value (disruptive value, perhaps) and people from other categories end up adapting. Automation and (Re)alignment needs to go hand in hand. In the social, sharing and digital era, companies are competing and at times collaborating with each other, so the ones that would lead would be the ones that can handle this change better. Hence Co-existence can work well if the boundaries, strengths are respected and weaknesses are complemented.

The current generation doesn't seem to have any issues of co-existence with the industrialization approach

over the last few centuries perhaps because it was normal for us, but perhaps it was the new-normal for the population that experienced that shift. Though the rate of change now is at a different level, perhaps kids in 2020 onwards will build a skill of identifying the new wave and effortlessly re-align themselves. Automation and (re)alignment are critical for enterprises now, but the same will soon become norm for people in their personal lives. Maybe that will be an inflexion point in 'Co-existence'. Interesting times ahead! Cheers, Ramesh Ramakrishnan (@Ramesh_Ramki)

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