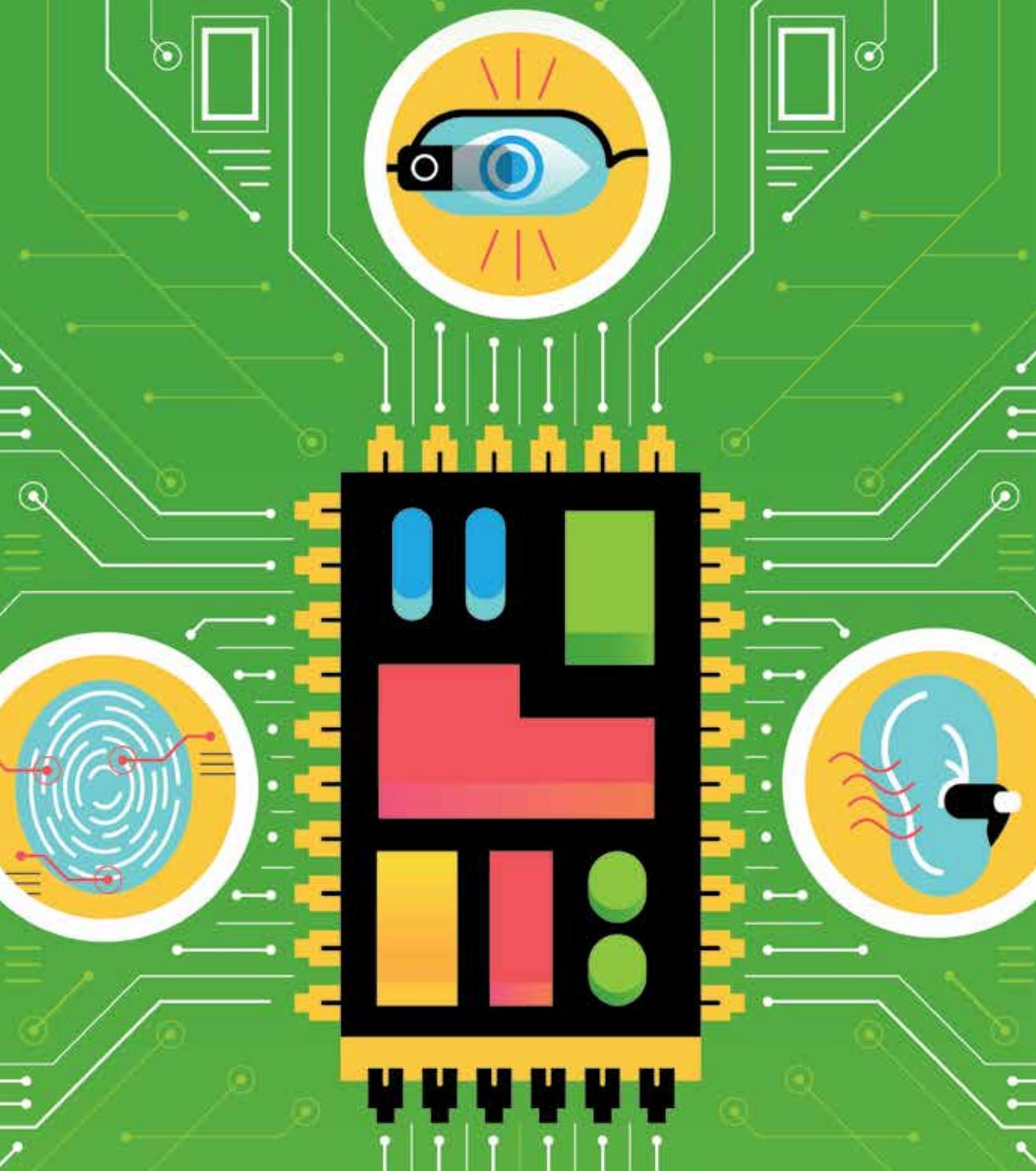


Amplified intelligence

Power to the people



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Analytics techniques are growing in complexity, and companies are applying machine learning and predictive modelling to increasingly massive and complex data sets. Artificial intelligence is now a reality. Its more promising application, however, is not replacing workers but augmenting their capabilities. When built to enhance an individual's knowledge and deployed seamlessly at the point of business impact, advanced analytics can help amplify our intelligence for more effective decision making.

TODAY'S information age could be affectionately called "the rise of the machines." The foundations of data management, business intelligence and reporting have created a massive demand for advanced analytics, predictive modelling, machine learning and artificial intelligence. In near real time, we are now capable of unleashing complex queries and statistical methods, performed on vast volumes of heterogeneous information.

But for all of its promise, big data left unbounded can be a source of financial and intellectual frustration, confusion and exhaustion. The digital universe is expected to grow to 40 zettabytes by 2020 through a 50x explosion in enterprise data.¹ Advanced techniques can be distracting if they aren't properly focused. Leading companies have flipped the script; they are focusing on concrete, bounded questions with meaningful business implications – and using those implications to guide data, tools and technique. The potential of the machine is harnessed around measurable insights.

But true impact comes from putting those insights to work and changing behaviour at the point where decisions are made and processes are performed. That's where amplified intelligence comes in.

Open the pod bay doors

Debate rages around the ethical and sociological implications of artificial intelligence and advanced analytics.² Entrepreneur and futurist Elon Musk said: "We need to be super careful with AI. Potentially more dangerous than nukes."³ At a minimum, entire career paths could be replaced by intelligent automation and made extinct. As researchers pursue general-purpose intelligence capable of unsupervised learning, the long-term implications are anything but clear. But in the meantime, these techniques can be used to supplement the awareness, analysis and conviction with which an individual performs his or her duty – be it an employee, business partner or even a customer.

The motives aren't entirely altruistic . . . or self-preserving. Albert Einstein famously pointed out: "Not everything that can be counted counts. And not everything that counts can be counted."⁴ Business semantics, cultural idiosyncrasies and sparks of creativity remain difficult to codify. Thus, while the silicon and iron (machine layer) of advanced computational horsepower and analytics techniques evolve, the carbon (human) element remains critical to discovering new patterns and identifying the questions that should be asked. Just as autopilot technologies haven't replaced the need for pilots to fly planes, the world of amplified intelligence allows workers to do what they do best: interpreting and reacting to broader context versus focusing on applying standard rules that can be codified and automated by a machine.

This requires a strong commitment to the usability of analytics. For example, how can insights be delivered to a specific individual performing a specific role at a specific time to increase his or her intelligence, efficiency or judgment? Can signals from mobile devices, wearables or ambient computing be incorporated into decision making? And can the resulting analysis be seamlessly and contextually delivered to the individual based on who and where they are, as well as what they are doing? Can text, speech and video analytics offer new ways to interact with systems? Could virtual or augmented reality solutions bring insights to life? How could advanced visualisation support data exploration and pattern discovery when it is most needed? Where could natural language processing be used to not just understand semi-structured and unstructured data (extracting meaning and forming hypotheses), but to encourage conversational interaction with systems instead of via queries, scripts, algorithms or report configurators?

Amplified intelligence creates the potential for significant operational efficiencies and competitive advantage for an

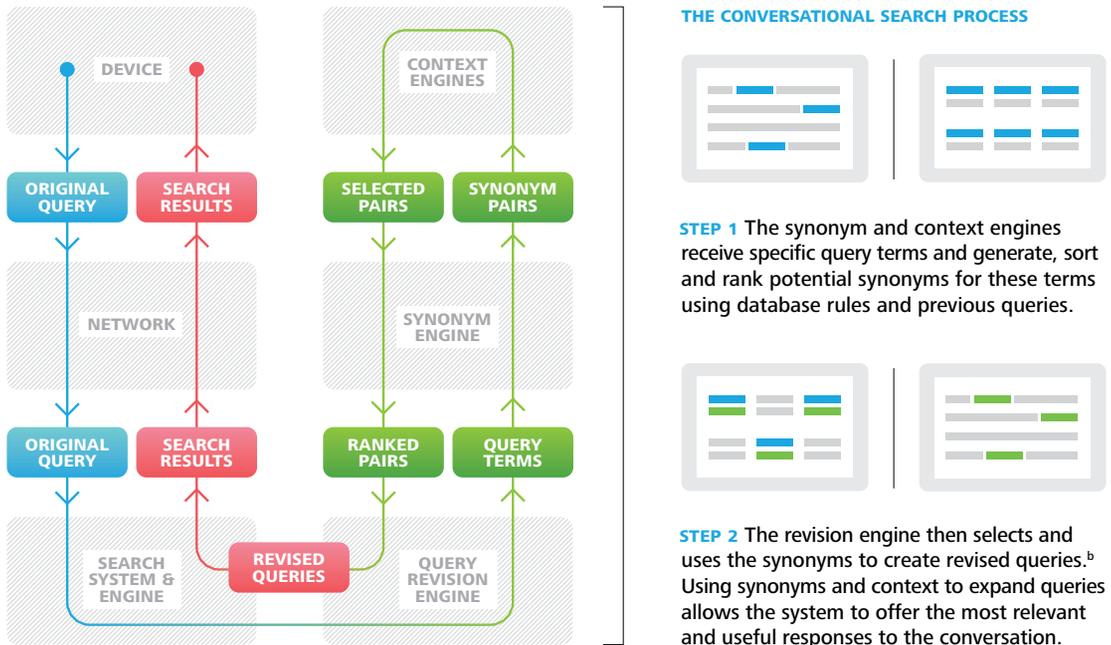
organisation. Discovery, scenario planning and modelling can be delivered to the front lines, informed by contextual cues such as location, historical behaviour and real-time intent. It moves the purview of analytics away from a small number of specialists in back-office functions who act according to theoretical, approximate models of how business occurs. Instead, intelligence is put to use in real time, potentially in the hands of everyone, at the point where it may matter most. The result can be a systemic shift from reactive "sense and respond" behaviours to predictive and proactive solutions. The shift could create less dependency on legacy operating procedures and instinct. The emphasis becomes fact-based decisions informed by sophisticated tools and complex data that are made simple by machine intelligence that can provide insights.

Bold new heights

Amplified intelligence is in its early days, but the potential use cases are extensive. The medical community can now analyse billions of web links to predict the spread of a virus. The intelligence community can now inspect global calls, texts and emails to identify possible terrorists. Farmers can use data collected by their equipment, from almost every foot of each planting row, to increase crop yields.⁵ Companies in fields such as accounting, law and healthcare could let frontline specialists harness research, diagnostics and case histories, which could arm all practitioners with the knowledge of their organisation's leading practices as well as with the whole of academic, clinical and practical experience. Risk and fraud detection, preventative maintenance and productivity plays across the supply chain are also viable candidates. Next-generation soldier programmes are being designed for enhanced vision, hearing and augmented situational awareness delivered in real time in the midst of battle – from maps to facial recognition to advanced weapon system controls.⁶

The technology behind NLP and conversational interaction

Conversational interaction is the ability to understand and answer a string of questions in a dialogue. Analytics engines derive the structure of a query, as well as its intent, through parsing, semantic search, synonyms and, most importantly, context – building upon insight gained through previous queries and cues from behavior, surroundings and knowledge of business processes.^a



Sources: ^aDanny Sullivan, "Google's Impressive 'Conversational Search' Goes Live On Chrome," May 22, 2013, <http://searchengineland.com/googles-impressive-conversational-search-goes-live-on-chrome-160445>, accessed October 14, 2014. ^bAbhijit A. Mahabal et al, "United States Patent 8,538,984 B1: Synonym Identification Based on Co-occurring Terms," September 17, 2013, <http://www.google.com/patents/US8538984>, accessed October 14, 2014.

In these, and other areas, exciting opportunities abound. For the IT department, amplified intelligence offers a chance to emphasise the role it could play in driving the broader analytics journey and directing advances toward use cases with real, measurable impact. Technically, these advances require data, tools and processes to perform core data management, modelling and analysis functions. But it also means moving beyond historical aggregation to a platform for learning, prediction and exploration. Amplified intelligence allows workers to focus on the broader context

while allowing technology to address standard rules that can be codified and executed autonomously.

All together now

The emphasis on usability and deployment moves the information agenda from isolated data scientists to multidisciplinary teams. The agenda should focus on helping end users by understanding their journey, their context and how to enhance and reshape their jobs. Like the revolution in user engagement

that transactional systems have recently experienced, amplified intelligence solutions start from the user down, not from the data model and analytics up. To start the process with users, organisations should identify a crunchy question that, if answered, could significantly improve how a specific individual does his or her job. The process should also understand how an answer could affect how the individual conducts business – where he or she would likely need the information, in what format, when, and via what channel.

Company leaders interested in improving their decision making can use machine learning and other amplified intelligence approaches to generate new growth ideas for their organisations. Amplified intelligence is becoming critical for competitive success around the world, across industries. US-based Uber uses big data to match passengers with car services.⁷ European grocer Tesco leverages big data to capture a disproportionate share of sales from new families and parents.⁸ Effective scenarios should be designed to be deployed for high impact. That impact should inform scope, solutions and iterative development, in

which incremental solutions are tested in real-life scenarios.

The best outcomes will likely be from scenarios where technology or analytics were seen as infeasible or too difficult to take advantage of. New opportunities exist when companies expand information-based decisions beyond just the executive suite's purview into the field by giving managers, sales teams, service techs, case workers and other frontline employees simple tools that harness exceptionally complex intelligence. And, ideally, computational intelligence will be refined and extended by collective intelligence, creating a feedback loop where people are also augmenting the advanced tools and models. Individual creativity and resourcefulness can and should continue to flourish. The goal, however, should be mutual elevation: As machine analytics are enhanced, users have the opportunity for more nuanced and valuable pursuits. As these pursuits become increasingly nuanced and valuable, they put important feedback into the system. The overall outcome: Artificial intelligence amplifies human intelligence to transform business intelligence.

My take

Tom Davenport, President's Distinguished Professor at Babson College/Visiting professor at Harvard Business School/Independent senior advisor to Deloitte Analytics

There is little doubt that computers have taken substantial work away from lower- and middle-skilled jobs. Bank tellers, airline reservations clerks and assembly line workers can all testify to this effect. Thus far, however, high-end knowledge workers have been relatively safe from job encroachment. Computers have certainly changed knowledge work, but they have largely augmented human labour rather than replacing it.

Now, however, knowledge workers face a challenge to their own employment. Analytical and "cognitive computing" technologies can make almost any decision with a high degree of accuracy and reliability. From Jeopardy! questions to cancer diagnosis to credit risk decisions, there seems to be no decision domain that smart machines can't conquer.

Thus far, it's been rare for a manager, professional or highly specialised worker to lose a job for this reason. The decisions automated have been relatively narrow, and only small parts of knowledge workers' roles have been supplanted. For example, while automated radiological image analysis can identify certain cancers, at most their use has been to supply a "second set of eyes" for a radiologist's diagnosis.

However, if my children were planning to become lawyers, doctors, accountants, journalists, teachers, or any of the many other fields for which automated or semi-automated offerings have already been developed, I would have some advice for them (which I am sure they would ignore!). I would advise the following actions:

- Become an expert in their chosen field as quickly as possible. Entry-level jobs are most at risk from automation, but experts are usually still needed to handle the most difficult cases and to advise and develop new rules and algorithms.
 - Develop an understanding of the technologies that are most likely to become important in the industry. For highly quantitative fields, machine learning is a strong candidate; for more textually oriented fields, Watson-like cognitive computing is more likely to be the automating technology.
 - Most of all, I'd advise workers in fields where automation is coming to "make friends with their computers." Learn how they work, what they are good at and their areas of weakness. If possible, learn how to modify and improve them. Understand the implicit assumptions that underlie their models and rules, and under what conditions these assumptions might become invalid.
- Closely monitor automation developments in their chosen field, and monitor which aspects of the profession are most likely to be automated. For example, I suspect that in journalism – already a difficult field because of the decline of print – the most likely candidates are those involving high levels of numerical reporting, such as sports and business journalism. Reporting on elections and political surveys might also be at risk. More investigative and human interest reporting is relatively safe, I suspect.

In the short run, knowledge workers are probably safe from substantial automation, but taking these steps will likely make for a more successful career. In the long run, all bets are off!



Cyber implications

CYBER security and data privacy considerations should be a part of analytics conversations, especially as amplified intelligence moves insights more directly into the heart of how, and where, business occurs. Information should be monitored and protected when it is at rest, in flight and in use. These three scenarios feature different actors using different platforms and that require different cyber security techniques. Moreover, for each scenario, you must know how to manage misuse, respond to breaches and circle back with better security and vigilance.

“At rest” is the traditional view of information security: How does one protect assets from being compromised or stolen? Firewalls, antivirus software, intrusion detection and intrusion prevention systems are still needed, but are increasingly less effective as attackers rapidly evolve their tools and move from “smash and grab” ploys to long-dwell cybercrimes. Instead of an outright offence that may leave telltale signs, attackers gain access and lie dormant – launching incremental, almost imperceptible activities to discover vulnerabilities and gain access to valuable IP.

The additional emphasis on “in flight” and “in use” reflects a shift in how organisations put their underlying data to use. Information is increasingly consumed in the field via mobile, potentially on personally owned consumer devices. Encryption can help with transmission and data retention. Identity, access and entitlement management can help properly control user actions, especially when coupled with two-factor authentication. Application, data and/or device-level containers can protect against attacks on the network, hardware or other resident apps. Again, though, these demonstrated techniques may not be enough, given the growing sophistication of criminal products, services and markets.

Organisations should couple traditional techniques with advanced analytics, amplifying the intelligence of cyber security personnel. Leading cyber initiatives balance reactionary methods with advanced techniques to identify the coming threat and proactively respond. They take a fusion of information from a range of sources with differing conceptual and contextual scope, and combine it with human-centred signals such as locations, identity and social interactions of groups and individuals. This approach has a number of implications. First, it creates the need to adopt a broader cyber intelligence mindset – one that leverages intel from both internal and external sources. Insight pulled from new signals of potentially hostile activities in the network can point to areas where security professionals should focus. Similar to how amplified intelligence informs approaches to business operations, this raw security data should be analysed and presented in ways to augment an individual’s ability to take action.

Machine learning and predictive analytics can take cyber security a step farther. If normal “at rest,” “in flight,” and “in use” behaviour can be baselined, advanced analytics can be applied to detect deviations from the norm. With training to define sensitivities and thresholds, security teams’ capabilities can be amplified with real-time visibility into potential risks when or before they occur. At first, this ability is likely to simply guide manual investigation and response, but eventually it could move to prescriptive handling – potentially enabling security systems to automatically respond to threat intelligence and take action to predict and prevent or promptly detect, isolate, and contain an event when it occurs.

Where do you start?

THE information agenda is not without baggage. But hopefully that baggage includes the foundations needed for strides in amplified intelligence. One size likely won't fit all. Organisations will probably need a variety of approaches, tools and techniques suitable to the question asked and the end users affected. They should also accommodate each scenario's requirements around data velocity, structure, analytics complexity and user interface/deployment vehicles. While individual mileage will vary, some overarching steps can help guide the journey.

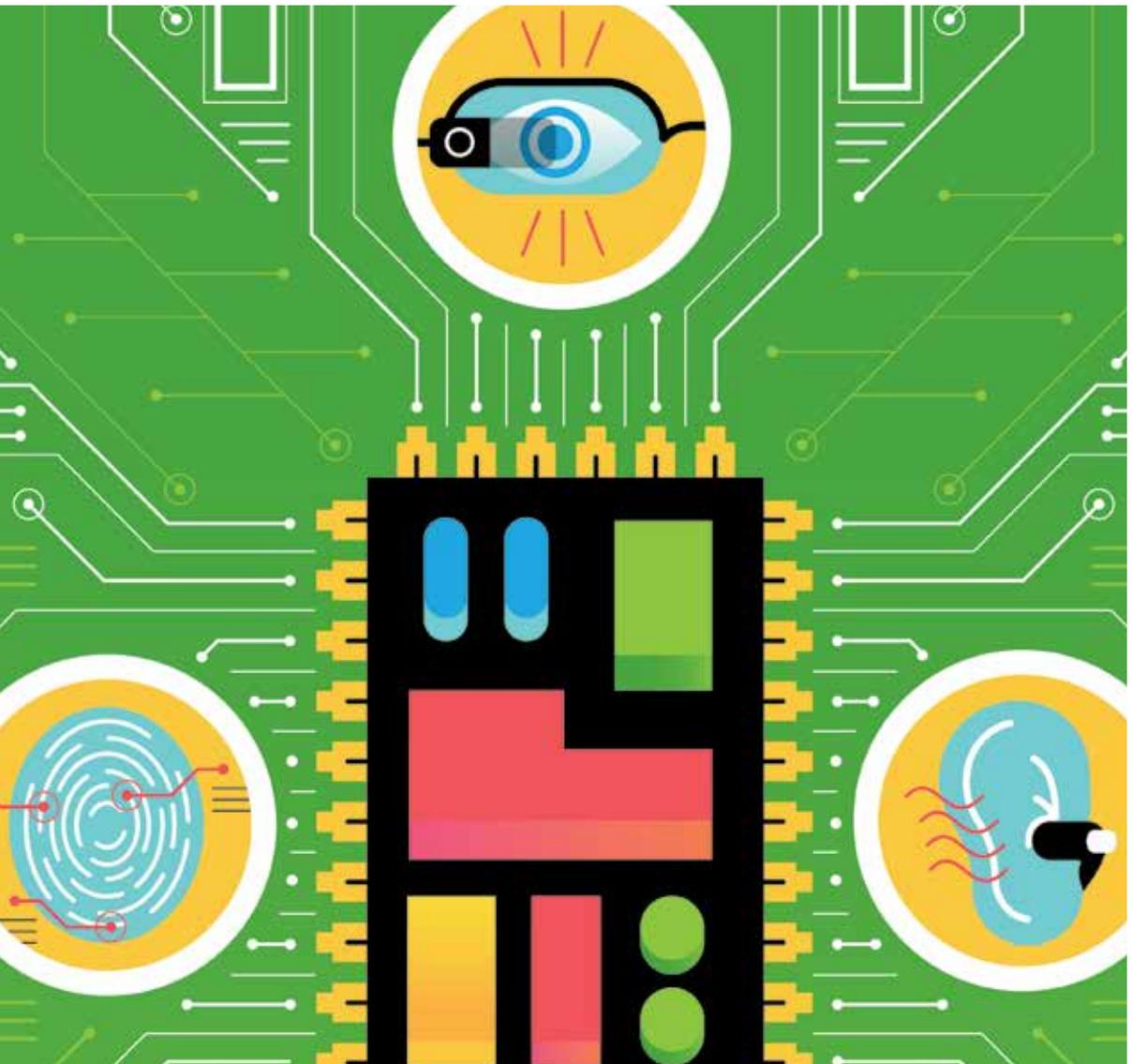
- **Set priorities by asking business**

questions. Organisations can start by asking business leaders for the wish list of questions they would love to be able to answer – about their customers, products, processes, people, markets, facilities or financials. Develop the wish list independent of constraints on what is knowable, answerable or technically feasible. Use the questions to guide priorities and reveal what types of data might be needed – internal and external, structured and unstructured, information already captured versus information not currently measured or stored. Identify what problem-solving techniques may be required: in-memory or massively parallel processing for analysing huge data volumes, deterministic or probabilistic modelling for advanced statistical modeling, visualisation or querying environments for exploration and discovery, or predictive analytics and/or machine learning to automate the formulation of hypotheses.

- **Check your gut.** One of the only things worse than an unanswered question is investing in insights your organisation is not prepared to act on. Ask the hard qualifying question up front: If we are able to answer the high-priority questions, does the organisation have the institutional fortitude required to drive systematic changes? Long-standing assumptions may be challenged and require a different approach to markets, incentives or behaviours. High potential is one thing, but the focus of early efforts should balance the opportunity against expected organisational resistance. It will likely take time to become a data-driven culture.
- **Design from the user down.** Amplified intelligence is about putting advanced analytics in the hands of the individual when he or she needs it. User experience should dictate the format, granularity and decisiveness of how that insight should be provided:
 - *Format* – the channel, notification and interaction method
 - *Granularity* – how much detail is needed and in what context
 - *Decisiveness* – whether responses are descriptive, predictive or prescriptive, which can range from providing passive supporting detail to aid decision making to proactively recommending a response or taking action
- **Expect resistance (which is not futile).** A recent Gartner report found that “by 2020, the majority of knowledge worker career paths will be disrupted by smart machines in both positive and

negative ways.⁹⁹ Investors are aggressively directing capital toward AI and robotics, and venture capital investments in AI have increased by more than 70 percent per year since 2011.¹⁰ Unions and labour groups could impede adoption. Unskilled labour categories may see greater impact, as robotics and machine learning continue to disrupt lines of employment. Transparency of intent will

be important, along with programmes to help retool and redeploy displaced workers. Prioritising investments that live up to the full potential of amplified intelligence means using the technology to enhance the value of the end worker. In a way, amplified intelligence initiatives are a direct investment in the individual that makes them even more valuable to the organisation.



Bottom line

IT'S easy to get stuck on the “what?” of analytics – trying to define conceptual models for the enterprise's wide range of information concerns. Leading companies, however, have aggressively pursued the “so what?” – prioritising crunchy questions with measurable value as the focal points of their endeavours. Amplified intelligence represents the “now what?” of moving from theoretical exercises to deploying solutions where business decisions are actually made. Usability and outcomes should take their rightful place over platforms, tools and data – important ingredients, to be sure, but only part of the recipe. While the machine continues to rise to impressive new heights, its immediate potential comes from putting it in the right hands, in the right manner, when it counts.



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Endnotes

1. Jeff Bertolucci, “10 powerful facts about big data,” *InformationWeek*, June 10, 2014, http://www.informationweek.com/big-data/big-data-analytics/10-powerful-facts-about-big-data/d/d-id/1269522?image_number=4, accessed October 23, 2014.
2. AI Topics.org, “Ethics & social issues,” <http://aitopics.org/topic/ethics-social-issues>, accessed October 23, 2014; Nick Bostrom, “Ethical issues in advanced artificial intelligence,” <http://www.nickbostrom.com/ethics/ai.html>, accessed October 23, 2014; Bianca Bosker, “Google’s new A.I. ethics board might save humanity from extinction,” *Huffington Post*, January 30, 2014, http://www.huffingtonpost.com/2014/01/29/google-ai_n_4683343.html, accessed October 23, 2014.
3. Eliene Augenbraun, “Elon Musk: Artificial intelligence may be ‘more dangerous than nukes,’” *CBSNews*, August 4, 2014, <http://www.cbsnews.com/news/elon-musk-artificial-intelligence-may-be-more-dangerous-than-nukes/>, accessed October 23, 2014.
4. Brent Dykes, “31 essential quotes on analytics and data,” October 25, 2012, <http://www.analyticshero.com/2012/10/25/31-essential-quotes-on-analytics-and-data/>, accessed October 23, 2014.
5. Deloitte University Press, *More growth options up front*, July 17, 2014. <http://dupress.com/articles/more-growth-options-up-front/>, accessed October 23, 2014.
6. Mark Prigg, “Google Glass for war: The US military funded smart helmet that can beam information to soldiers on the battlefield,” *DailyMail*, May 27, 2014, <http://www.dailymail.co.uk/sciencetech/article-2640869/Google-glass-war-US-military-reveals-augmented-reality-soldiers.html#ixzz3OLyXMeYx>, accessed January 9, 2015.
7. Brad Stone, “Invasion of the taxi snatchers: Uber leads an industry’s disruption,” *Bloomberg BusinessWeek*, February 20, 2014, <http://www.businessweek.com/articles/2014-02-20/uber-leads-taxi-industry-disruption-amid-fight-for-riders-drivers>
8. Rohan Patil, “Supermarket Tesco pioneers big data,” *Dataonomy*, February 5, 2014, <http://dataonomy.com/tesco-pioneers-big-data/>, accessed June 30, 2014.
9. Tom Austin, *Top 10 strategic technologies – The rise of smart machines*, Gartner, Inc., January 29, 2014.
10. Deloitte University Press, *Intelligent automation: A new era of innovation*, January 22, 2014, <http://dupress.com/articles/intelligent-automation-a-new-era-of-innovation/>, accessed October 23, 2014.



Notes

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