

# Working and Learning Wisely

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## Introduction

*“The best way to predict the future is to invent it” – Alan Kay*

Working and learning are both being impacted by the changes we’re seeing. As things move faster, we need to cope, but we’re also experiencing increasing support opportunities. We need to explore the possibilities to be able to make decisions about what can, and should, look to in moving forward. And we want to so guided by principle.

Several new developments are underpinning what we can do. For one, technology is providing new tools in ways that increase our ability to be effective. New capabilities within and between systems have exponential opportunities. Our applications can be smarter, the platforms can provide meaningful additional capabilities, and the network not only ties it together, but adds its own potential.

Similarly, our understanding of our own thinking has advanced. We have better insights that impact how we think, work, *and* learn. We know more about how we work individually and together, at a team and at an organizational level.

Together, these understandings provide rich new ways to think about working and learning. It goes beyond just adding to our ability to do tasks. What we are talking about is changing how we learn at work, how we work together, and how our organization is designed.

Let’s be clear, this is *not* about technology. Instead, it is about what we know about us, what technology can do, and how we can align those better for the good of all.

## The nature of work is changing

It’s no secret nor is it news that the world has changed. By now it is cliché to say that the rate of change is increasing; the evidence is all around us. Then it is incumbent on us to identify the factors so we can develop a framework that provides the necessary agility and resiliency.

### *Change*

Things are moving faster. Our times for idea generation and realization have dropped. We generate information faster, leading to an overload. And, the rate of increase is increasing!

We’re also seeing greater change. These new ideas mean more variation. Our models of the world are also being refined, and as Dave Snowden’s Cynefin models helps us understand, there’s more chaos than we expected. Things aren’t as predictable as we thought.

As a consequence, we’re having to face more ambiguity and more unique situations; what’s required of work is changing. In the industrial age, our organizations were looking for precision in doing what those at the highest level had deemed appropriate. Optimal execution is no longer the key to success, and is, instead, just the cost of entry. In these increasingly turbulent times, x

continual innovation will be the necessary differentiator. That comes from a different type of thinking.

### *Technology*

On our side is an increasing understanding of ourselves and our world. Despite the recognition of increasing variability, we also are getting better models to understand the tools we have. At the forefront is the technology. Our computers continue to increase in processing power, with abilities now to deal with vast quantities of data, and in multiple ways.

Coupled with this processing power are new ways of interacting with us. More powerful displays and new form factors from mobile to wearables and even embedded computation exist. Virtual and augmented reality begins to offer immersive and annotated experiences.

These computers are not independent. Instead, they are now linked in more and more intricate ways, with networks and data exchanges providing ways to not only share data but tap into each other for computational exchanges as well.

The vast amount of data being generated provides not only storage challenges, but new opportunities as well. The processing power on tap, combined with the availability of combining data across systems means the ability to look for new patterns. Data and text mining, combined with powerful analytics, means new insights.

A new source of data is the increasing prevalence of sensors embedded in devices of all sorts. From digital instrumenting of a myriad of devices through the variety of sensors onboard new mobile devices, these sensors are enabling new opportunities. Beyond that, the integration of data *across* these devices, sensor nets, are providing a window on changes both geo- and demographic.

One particular computational effort has provided new insights into our operation and new data opportunities. Artificial intelligence (AI), the effort to derive human-like intelligence out of digital computation, has yielded new and different processing outcomes. Neural networks, based upon our cognitive architecture, have yielded machine learning and deep learning models that can improve upon our performance in narrow tasks, and look for patterns our architecture cannot.

### *Work*

These changes in technology are fundamentally influencing work. Data analytics, empowered by the increases in computing power and the connectivity of networks, are providing new commercial and scientific insights. Our models of the world, such as climate and energy, are vastly more complex and useful. Similarly, we are gaining insights into human behavior. These *can* be used for bad or good purposes, of course, and there are complex issues entailed.

The impacts are at every level. At the individual level, capabilities at the desktop are increasing, while the ability to increasingly work ubiquitously is empowering more flexibility. At team levels, the ability to collaborate is enhanced through networked technologies. At the community level, sharing of ideas is empowered with the ability to connect both within and without the organization. The broader connection between the organization and society as a whole also impacts organizational insights and behaviors.

We do see upheaval as these new technologies can automate work, and increasing categories of work are disappearing. For other categories of work, these technologies are empowering, providing new tools for greater reach and richer outcomes. It's up to us to decide how we want to leverage this power. Existing forces of commercial endeavors are being challenged by growing recognitions that greater issues are involved. Environment and societal impacts are increasingly of concern and are driving explorations of new approaches.

### *Opportunity*

The capabilities of AI have led to concerns about computers 'replacing' humans. While efforts will continue to expand those capabilities, at the current time and in the near future, these concerns have limitations.

While AI can replace the rote tasks humans perform, this can be viewed as a benefit. Our minds are not good at rote, instead we are better pattern-matchers and, importantly, meaning-makers. A case can be made that we *should* have computers doing rote tasks, freeing us from being cogs in the machine and to do the meaningful tasks that leverage our unique abilities.

A recognition of our capabilities and those of computers suggests an important, and different, approach than competition. The fundamental and complementary capabilities suggest that our focus should be on looking at how to couple technology with people to create optimal solutions. The vision should be one of a disconnected cyborg, where we are augmented, but externally through computational capabilities. There are circumstances where we will be, and are, embedding computational devices inside the human body, but the vision here is of a non-invasive approach.

This approach has been termed Intelligence Augmentation (IA), a legacy of the lifelong contributions of Douglas Engelbart. His vision of augmentation foresaw and sparked innovations in our digital environment that are only yet being achieved today.

What's required to truly capitalize on the possibilities of intelligence augmentation? We need to combine an understanding of the technology capabilities of the technology outlined above with a similar understanding of our own cognitive architecture. And new models of cognition challenge existing thinking, but empower new models that offer opportunities for truly valuable IA.

### Our understanding of thinking is changing

To truly leverage this opportunity, we need to understand the intelligence side as well as the augmentation. Our picture of our own thinking has gone beyond the original model of everything in the head, and these new perspectives imply important new things for how we think, work, and learn. We need to detail these features to comprehend the implications for augmentation with technology.

I should be clear, I'm *not* talking about some of the results coming from new findings from magnetic resonance imaging. While there are new results coming regularly, they tend to be at the neural level, and, as yet, have limited practical application to work. Despite the claims of neuro this and brain-based that, the findings that are meaningful are at a higher level, at the cognitive level.

The short version of the cognitive model is that information enters our heads into ‘sensory store’, which has vast capacity but short duration. Our attention determines what of that vast store makes it into our extremely limited working memory. This is our conscious thinking, and it’s limited in capacity, though through experience we can ‘chunk’ information and handle larger concepts.

What’s repeatedly stored and retrieved, as well as elaborated by connections to other knowledge, is what gets transferred to long term memory. That’s what learning is. Long term memory stores more conceptually than specifically, in models rather than exact details. We then choose actions consciously by bringing in those models to apply to contexts, predicting outcomes and choosing the best decision. What’s been practiced sufficiently can be acted upon by pure recognition, and bypass working memory.

An artifact of this is the conscious processing in working memory for decisions, as Kahneman tells us in *Thinking Fast and Slow*, is effortful and we often use the shorthand of more automatic decisions. Further, that effort reduces our ability to make good decisions until we sleep and restore our abilities.

### *Situated*

One of the important understandings that emerged is that our thinking is not the formal logical models we assumed. Our cognitive architecture is powerful as a pattern-matcher and meaning-maker. We look for explanatory stories. However, there’s also some randomness in our architecture (it’s evolutionarily adaptive). This means that we’re bad at repeated rote execution, remembering arbitrary facts and details, and processing large quantities of data. Of course, digital technologies are the exact opposite. We already have a powerful argument for the IA approach.

It’s also the case that our brains create models that explain the world, and these models are reactivated when relevant. However, so too are the contextual details. These patterns create a whole that’s doesn’t separate out the logic from the situation; our resulting thinking is emergent, as Andy Clark’s *Being There* suggests. Instead of formally invoking specific understandings in particular situations, our thinking is more contextualized. What we might consider a heinous affront, for instance, in one situation would be a clever retort in another.

The implications of this mean that we should recognize that individuals might need support in context to help focus on germane elements. We would want to provide contextually relevant support. And create environments where our emergent possibilities are valued.

### *Distributed*

A second recognition is that our thinking is not just in our heads. As Ed Hutchins pointed out in *Cognition in the Wild*, our thinking is distributed across our artifacts. We use external representations to represent some of our understandings.

For instance, we use artifacts such as spreadsheets, databases, networks, and graphics to represent information in ways that speech isn’t sufficient to capture. Our thinking is linear in working memory, despite the fact that the underlying architecture is parallel. Our use of external representations complements our limited working memory, externalizing the cognitive load.

When we're operating consciously, and that's where organizations can find the greatest value, we will need to recognize and leverage external representations. We have to abandon the notion that all information can reside in the head, and adjust accordingly. We should deliberately be thinking about what can and must be in the world to facilitate optimal decision making.

Importantly, we should recognize that there may be multiple representations that are aligning to serve as the bases for decision making. The grounds for decision making, say a business plan, may be across a spreadsheet, a flowchart, a canvas, and more. And our conscious choices around these tools are important. What is the right suite of representations for a task? How do we systematically collaborate across these representations? Can we have them to hand? And, I'll suggest, we're not quite mature in this area.

### *Social*

The notion of distribution, of course, isn't across just tools, but people. In Hutchins' investigation, people were part of the distributed cognition as well. Social cognition is an important part of the equation. Who's collaborating? Who brings what to the party? Who owns what parts of the information? How do we work together productively? These are questions where the answers are emerging.

The research shows that the output is better when people are involved. The oft quoted "the room is smarter than the smartest person in the room" is true, with a caveat. That caveat is 'if you manage the process right'. Otherwise, the room can be as smart as the most authoritative or the most dominant person in the room. And that's not the best choice. What we now know are many of the factors that influence this.

So, for example, brainstorming's been criticized for not being successful. What's wrong here are the nuances: that you can't just put people into a room and start brainstorming. There're critical factors, such as initial preparation, everyone thinking individually first, diverging before converging, etc. Design Thinking has risen as a synthesis of good practices that evolved from practices across a variety of design disciplines, and represents a useful framework. Details such as empathy for the users, double-diamond about diverge/converge on both the problem understanding before again for the problem solution, and more, are important.

Also important, it is becoming clear, are the details around the culture of innovation. The best thinking comes from environments where there's accountability, but also 'psychological safety'. Amy Edmondson raised this in her research and her book *Teaming* and now, I believe, in a subsequent book. It has to be safe to share, not just successes, but learnings. I talk about the Miranda Organization, where anything you say can and will be held against you. That organization is all to prevalent, yet learning isn't happening there. Instead, you need to be able to share mistakes as well as wins. You don't want to celebrate the mistakes, but you can celebrate the lessons learned!

Edmondson and her colleagues Gino & Garvin came up with a lovely dissection of the dimensions of a learning organization. The atmosphere included, in addition to safety: diversity, open-mindedness, and time for reflection. Diversity has to be not just tolerated, but valued. The right team, mentioned above, comes with as diverse as group as possible in terms of complementary skills, knowledge, and characteristics, as long as they share the values around the project they are assigned. Any organization where they say "that's not how we do it here" isn't

open-minded, and instead you want that says “let’s try it”. And time for reflection becomes critical in looking at the longer-term picture.

I talk about fast and slow innovation. Fast is when people are assigned to solve a particular problem, doing research, coming up with a new design, or just trouble-shooting. Let’s be clear, in all these instances, the answer isn’t known before you start, so they’re learning! They’re just not formal learning. Yet our principles of learning should be robust enough to apply here as well.

Slow innovation is, on the other hand, the ongoing percolation of ideas. Stephen Johnson, in *Where Good Ideas Come From* lets us know that new breakthroughs don’t come from someone going away and coming up with a new idea solo. Instead, they come from ongoing exposure to new ideas, what he calls ‘the adjacent possible’, as well as creative friction internally and externally to the organization. It’s an environment with time and tolerance for experimentation, a habit of sharing, and systematically developing the necessary skills and facilitating processes.

The workplace of the future is a learning workplace, continually in the background as well as actively in the foreground. Leaders have to not just support, but actively embody the principles, being first to learn ‘out loud’ (or, as Jane Bozarth suggests, *Show Your Work*). If they don’t, will anyone truly believe it’s safe?

Learning is a fundamental outcome of our cognition. New models of cognition suggest that what drives behaviors is minimizing the gap between what we expect and what occurs. This drives one of two behaviors: either avoidance of the unpredictable, or continual exploration and learning. The latter is what we’d like to see, but it requires nurturing, with both active facilitation and a nurturing culture.

## A powerful intersection

So how does intelligence augmentation play a role? How does technology facilitate? It helps to go back to the model of optimal execution and continual innovation as a start. We can look to both the optimal execution side to see the opportunities, and similarly the continual innovation side as well.

### *Formal Learning*

For one, we now have powerful new adjuncts for formal learning. For one, we can customize the experience to the learner. This does not mean ‘learning styles’, as has robustly been debunked, but instead acting on learner’s previous experiences, responsibilities or interests, and on their behavior during learning. We can skip unnecessary elements, use specifically relevant examples, and, much like computer games, optimize challenge.

Too often our models of learning have focused on knowledge and recitation, yet learning science tells us that the critical elements are meaningful practice and guided reflection. So we’re also on the cusp of being able to create artificial and mixed realities that can create more powerful practice opportunities, immersive simulations (which can and should be tuned to game-like experiences).

Live practice in many domains has typically been fraught with peril: not just customers and revenue lost, but possibly lives. Similarly, individual mentoring doesn’t scale well. We’ve used technologies from simulations and virtual worlds in the past, but the tools are coming even more

powerful. Virtual reality takes virtual worlds and makes them even more immersive. And we can build richer visual environments even for simulations that aren't physically immersive.

Our ability to scaffold learning beyond the 'event' model has similarly expanded. We can provide reactivations over time to help cement learning. We can capture live performances after formal instruction, and share, bringing in scheduled visits with mentors at appropriate performance points.

### *Workflow learning*

We can also bring learning into the workflow, as Jay Cross let us know in *Informal Learning*. With increasingly context-aware programs and mobile, we can know what people are doing and push specific learnings around what they're doing. Moreover, we can fade that support as practice opportunities increase, passing on responsibility to the performers.

IBM, a number of years ago talked about three types of work learning: work apart learning, work-embedded learning, and work-enabled learning. The former is the typical 'event' model, the second was in the workflow, and the latter was linking what happened in the workflow to facilitated reflection. Of course, they're ideally linked together. The point being that we can increasingly use technology to improve all three. The limits are no longer the technology, the limits are between our ears.

### *Performance Support*

Work-embedded learning is really performance support, in this model, through the *Electronic Performance Support Systems* Gloria Gery championed. Here the goal is to ensure the performer succeeds, whether they learn anything or not. Too often, we try to put knowledge in the head when it resides more naturally in the world. Things that are changing fast, are too arbitrary or large, and various rote things are best stored or even done in and by the system.

We have cognitive gaps based upon our architecture, which means we skip steps, can prematurely converge, are unable to diverge or check with others, etc. So, we've developed powerful support tools: checklists (as in Atul Gawande's *The Checklist Manifesto*), decision-trees, lookup tables, How-Tos, search capabilities, and more. We can now keep these updated and bring them to the point of need.

If you've ever used a YouTube video to fix something, you know what I'm talking about. I fixed my dryer with one. If I ever have to do it again, I hope I can find the same video, because I remember essentially nothing from it, *but that's OK!* The goal was to fix the dryer, not for me to learn anything. And that's the point.

Increasingly a new technology is bring new capabilities to these tasks: augmented reality. Here our senses are augmented, whereby the world is annotated in ways that reveal hidden aspects to make us more successful. So, for instance, images of functioning and trouble-shooting and repair steps can be laid over machinery, and artificial presences in the environment can inform and guide. This can play a role in formal learning too, showing hidden operations, that we want people to comprehend, not just execute against.

## *Informal Learning*

The real direction, as the above suggests, is augmenting our ability to move forward. As suggested, we need to be better able to innovate, whether fast *or* slow. And technology gives us new capabilities. We have better ways to process information on our own *and* together. Jane Hart, in her Modern Workplace Learning framework, we need an elegant segue from formal to informal, not having them separate and ‘owned’ by L&D. It’s about facilitation, not presentation.

And this transition from formal to informal is about helping individuals to take ownership of their own learning. One way to think about this is Harold Jarche’s model for Personal Knowledge Mastery. His Seek - Sense - Share framework suggests that we need continual sources of ideas, we need to actively process it, and share our learnings as a reciprocal participant. He emphasizes both collaboration and what he points to as cooperation. The distinction he makes is that collaboration is typically enjoined (in the sense of ‘fast’ innovation), but cooperation means the willingness to share and provide input even when it’s optional.

I think this makes sense for organizations too, in that our learnings alone can contribute to organizational learnings as well. What is collaboratively or cooperatively learned and shared is critical to organizational learning.

And we have powerful tools to support these activities. We have ways to access, and filter, sources of information to get inputs both direct and lateral. We have richer searching capabilities, and the ability to also set up feeds of specific input. AI is also providing the ability to serendipitously search for relevant information that we might not otherwise discover.

We have richer tools to support our own representations and collaborative mechanisms. Beyond words and numbers, we have an increasing ability to create and share visual representations, taking advantage of our rich imagery and spatial reasoning. They can go beyond diagrams to semantic maps and more. We can also propose and even model experiments, and simulate outcomes with digital tools.

And we have these capabilities that we can share with others. Not just passing around files, but going to one place and editing. We can do that simultaneously, see the history of changes. Currently, some tools can even integrate voice or video or screen sharing, and more is undoubtedly coming.

And our communication tools are similarly increasing in power, adding fundamentally new capabilities. The key capability of Twitter, for instance, was essentially unknown before technology created the affordance. And more tools are integrating a variety of different tools, and new formats.

The point is that now we’ve not only broken the barriers of geography and time, we’ve empowered ourselves with new abilities to represent and share our understandings.

## A wise future

And this is, I think, the core issue. We’re not just amplifying our abilities, as David Jonassen suggested when he talked about cognitive tools. It’s not walking faster or running, it’s the invention of the wheel. We’ve moved beyond using tools in the ways we used to do things, and are unleashing new capabilities.

And, I've long argued that it's important to do so in ways that align with how we think, work, and learn. That includes our cognitive capabilities, but more. That *also* includes the emotions, ethics or values, and culture.

Research has increasingly shown that emotions play a complex role in our thinking and learning. For one, we know that motivation and anxiety can affect our learning. And emotions have influences on decision-making as well. Thus, our cognitive model has to go beyond the purely rational. Newer models of mind consider the relationships between cognitive, affective, and conative elements, where affective are your feelings and conation is about your intention to act.

Culture also impacts, as was previously discussed. This holds true for formal learning, and both fast and slow innovation. This does have to be coupled with accountability, but, ultimately, we need an environment that facilitates our willingness to provide our best efforts in our endeavors.

This comes down to what we think matters. I think we err too much on the side of 'smart', yet there are reasons to think that's not optimal. Too often, smart decisions are a product of the current constraints. One has only to think of McClean & Elkind's *The Smartest Guys in the Room* and Enron to realize how we can go awry.

What do we have as an alternative? If what we've been doing is making people smart, what's the next step? If we think of the DIKW path (data-information-knowledge-wisdom), maybe we could aim to make people wise. Robert Sternberg has a model of wisdom that suggests that wise decisions are made: for both short- *and* long-term perspectives; for ourselves, those we have responsibility for, *and* society as a whole; *and* with an explicit consideration of the values that are being incorporated.

It's that latter that, I think, has the possibility to give us some new direction and opportunities. How can we make explicit the values and ethics that underpin our thinking, working, and learning? Because I think there's an opportunity there to improve our decision making.

We have amazing capabilities that transforming our ability to work alone *and* together. Coupled with a growing awareness of how we work best, we have the opportunity to transform. We can start talking about working not just smart, but wise. We can, and should, explicitly consider the values we believe in, and design environments for thinking, working, and learning that reflect those. Our work *should* be wise, as should our learnings; sharing, experimentation, and more.

I want to suggest that our short- and long-term interests, for ourselves, our organizations, and society at large, as best served when we work to value people, not exploit them. By creating workplaces that optimize our ability to do the things that we care about, augmented by technology in the most effective ways, we create workplaces that are not only efficient and effective, but humane. And that, I believe, is a noble, and even wise, goal.