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The Human Advantage Index

Preserving, Strengthening, and Measuring Human Capability in an AI-Enabled World

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Executive Summary

Artificial intelligence now performs a growing share of the cognitive work that once defined human expertise. The research reviewed in this paper points to a clear conclusion: human advantage in an AI-enabled world depends less on what AI cannot do and more on whether people keep, and keep building, the capacities that let them direct, question, and add to what AI produces.

The evidence shows two trajectories. Used deliberately, AI raises productivity, quality, and even creativity, sometimes by large margins [3–5, 9, 14]. Used passively, the same tools are associated with lower critical thinking, weaker skill retention, narrower creative output, and measurable deskilling, even among experienced professionals [2, 6, 7, 13, 14]. The technology is the same in both cases. What differs is how people engage with it.

The Human Advantage Index (HAI) is designed to measure the human side of that equation. It assesses ten interconnected capabilities:

Capability	Core Question
Agency	Do I initiate and direct my own work and choices?
Critical Thinking	Do I examine claims, including AI outputs, before accepting them?
Judgment	Do I make sound decisions when information is incomplete and stakes are real?
Creativity	Do I generate ideas that go beyond recombining what already exists?
Connection	Do I build relationships of trust and mutual understanding?
Learning	Am I still building skill and understanding, rather than outsourcing them?
Adaptability	Do I adjust effectively as tools, roles, and conditions change?
Meaning	Does my work feel worthwhile and connected to a purpose I value?
Resilience	Do I recover and grow after setbacks and sustained uncertainty?
Possibility	Do I see and commit to futures that the past does not predict?

The HAI is a short, self-scored instrument: three items per capability, rated on a five-point agreement scale over the past three months. It produces a profile across the ten capabilities that individuals, leaders, and organizations can use to see where human capacity is growing, where it may be eroding, and where to invest. For organizations, the self-assessment can be paired with an objective analysis of how people actually use AI tools and tracked against business metrics, so that every company can answer a central question: what is our Human Advantage Index, and how does it link to revenue and ROI?

This paper sets out the evidence behind the Index, defines each capability, explains how the instrument is built and scored, describes its applications, and states its current limitations and the research needed to establish norms and validity.

1. Introduction: The Changing Nature of Human Advantage

As artificial intelligence becomes increasingly capable of performing tasks once considered uniquely human, the nature of human advantage is changing. Research suggests that AI is particularly effective at automating repetitive tasks, pattern recognition, information processing, standardized analysis, predictive modeling, and routine decision-making [1]. At the same time, AI is increasingly demonstrating capabilities in creativity, reasoning, problem-solving, and other complex cognitive activities [1, 3, 14].

This raises a fundamental question: If AI can perform an expanding range of human cognitive tasks, where does human advantage reside, and how can we preserve, strengthen, and measure it?

The answer may lie not simply in identifying what AI cannot do, but in understanding the human capacities that enable people to contribute meaningfully, exercise independent judgment, generate new possibilities, build relationships, and navigate an increasingly complex world. Importantly, these capacities are not necessarily

fixed or immune to technological change. They may be strengthened through thoughtful engagement with AI or weakened through excessive dependence on it [2].

To address this challenge, we propose the Human Advantage Index (HAI), a framework designed to assess ten interconnected capabilities that shape how people think, act, relate, and contribute in an AI-enabled world: Agency, Critical Thinking, Judgment, Creativity, Connection, Learning, Adaptability, Meaning, Resilience, and Possibility. Together, these capabilities provide a foundation for understanding not only what makes human contributions valuable, but also whether our growing reliance on AI is expanding or diminishing our capacity to realize that value.

How This Paper Is Organized

Section 2 reviews what current research says about the respective strengths of humans and AI and about how they perform together. Section 3 examines the newer and more urgent body of evidence on how AI use itself changes human skill and thinking. Section 4 introduces the HAI framework, and Section 5 describes each of the ten capabilities in turn. Section 6 explains how the instrument is built, scored, and interpreted. Section 7 outlines applications for individuals, leaders, and organizations. Section 8 shows how corporations can use the Index, including an objective analysis of AI interactions and its link to revenue and ROI. Section 9 sets out limitations and the research agenda, and Section 10 concludes.

2. What the Evidence Says About Human and AI Strengths

The research consensus is that AI and human intelligence are complementary, and that the value of combining them depends heavily on how the work is divided and who decides when to rely on AI.

2.1 A Review of Human and AI Competencies

Akuma and Vaswani reviewed 20 scholarly works published between 2010 and 2024, using qualitative thematic analysis to examine the competencies of human and artificial intelligence, their potential for collaboration, and the ethical questions raised by integrating them [1]. Their review found that AI substantially augments human capability in sectors such as healthcare, education, and the creative industries. It also found that AI introduces serious ethical challenges, including bias, fairness, and job displacement [1].

Three conclusions from the review shape the HAI:

- **Collaboration over competition.** The authors argue that human and artificial intelligence should be approached as partners rather than rivals, with attention to where AI can complement human decision-making and creativity [1].
- **Human oversight is essential.** Ethical deployment, transparency, and accountability all depend on people who can supervise AI systems and govern how they are used [1].
- **Reskilling matters.** The review calls for reskilling programs and bias mitigation so that human capability keeps pace with AI adoption [1].

Each of these conclusions assumes something the review does not measure: that the humans involved retain the agency, critical thinking, and judgment required to collaborate, oversee, and adapt. The HAI is built to measure exactly those assumptions.

2.2 What May Remain Distinctively Human

The neuroscientist Ken Mogi approaches the question of human advantage from consciousness research [33]. He observes that each new AI system removes something from the list of abilities once considered uniquely human. Board games such as chess and Go went first, and language tasks once treated as tests of human-level understanding are now being matched as well [33]. In his framing, the uniquely human domain is whatever remains after every AI capability is subtracted, and it narrows as AI systems multiply [33].

Mogi argues that what may remain are forms of processing that depend on conscious awareness. He proposes several candidate domains: flexible control of attention, robust handling of new contexts, choice and decision-making, integrating a wide range of sensory information, and embodied cognition [33]. A central distinction in his account is that acquiring new skills and making decisions in unfamiliar situations typically require conscious processing, while carrying out well-learned skills proceeds largely without awareness [33]. Large language models, trained in advance on vast amounts of data, resemble the second kind of processing more than the first [33].

Mogi also gives metacognition a central role. People can usually judge how confident they are in their own statements and catch their own errors, while comparable methods have not been established for AI, which is one reason AI systems can produce fluent statements that are false [33]. He also points to the conscious capacity to stop, or veto, an action judged inappropriate in a given context [33].

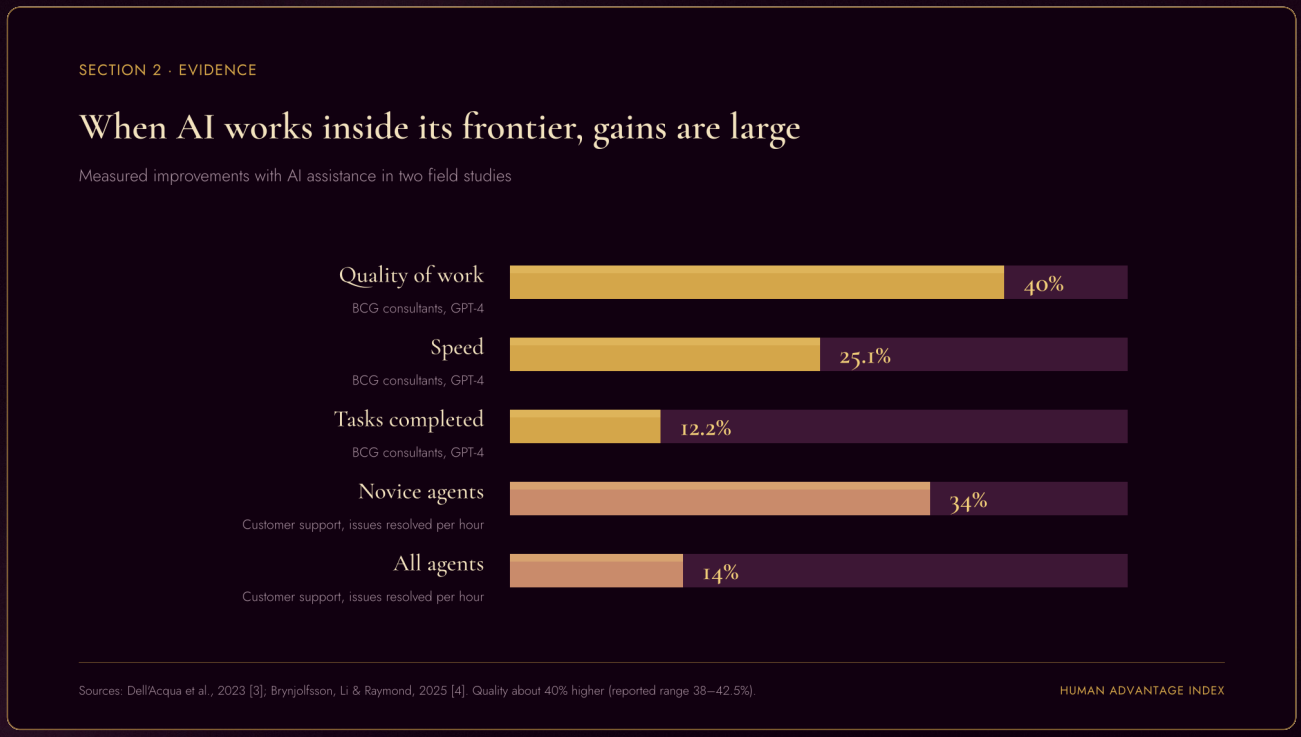
From this he draws a practical conclusion: an effective division of labor would treat AI as an extension of the brain's automatic, unconscious processing, while people keep the conscious work of judging, choosing, and handling the new. AI, in his view, should augment these human computations rather than try to replace them [33].

Mogi presents his central hypothesis, which he calls "conscious supremacy," as speculative, and he notes that specific computations unique to consciousness have not yet been identified [33]. The HAI does not depend on that hypothesis. His account is useful because it converges with the behavioral evidence: the capacities he identifies correspond closely to Judgment, Learning, Adaptability, Agency, and Critical Thinking. It also sharpens a risk. If learning in new situations requires conscious effort, and AI takes over that effort, people may skip the very phase in which skill is built, which is consistent with the learning losses described in Section 3 [13].

2.3 What Happens When Humans and AI Work Together

Field and experimental studies now give a more precise picture of when AI helps and when it does not.

Study	Setting and Sample	Main Finding
Dell'Acqua et al., 2023 [3]	758 Boston Consulting Group consultants, randomized	On tasks inside AI's capability frontier, consultants with GPT-4 completed 12.2% more tasks, worked 25.1% faster, and produced work rated about 40% higher in quality. On a task outside the frontier, AI users were less likely to reach the correct answer.
Brynjolfsson, Li, and Raymond, 2025 [4]	5,179 customer support agents, staggered rollout	An AI assistant raised issues resolved per hour by 14% on average and by 34% for novice and lower-skilled agents, with minimal gains for the most experienced.
Vaccaro, Almaatouq, and Malone, 2024 [5]	Meta-analysis of 106 experiments and 370 effect sizes	On average, human–AI combinations performed worse than the best of humans or AI alone, though they did outperform humans alone. Combinations showed more promise on tasks that create content than on decision tasks.



Two patterns stand out. First, AI's capabilities are uneven. Dell'Acqua and colleagues describe a "jagged technological frontier," in which tasks that look equally difficult to an expert can fall on opposite sides of what AI does well [3]. Second, the benefits of combination are not automatic. They appear when people can tell when AI is adding

value and when it is not, and they disappear when people defer to AI outside its competence [3, 5].

In other words, the most valuable human contribution in a human–AI system is often the capacity to evaluate, decide, and redirect. That is a human capability, and it can be strengthened or lost.

2.4 What Employers Say They Need

Employer surveys point in the same direction. The World Economic Forum's *Future of Jobs Report 2025*, drawing on more than 1,000 employers representing over 14 million workers in 55 economies, found that analytical thinking was considered a core skill by 69% of employers, followed by resilience, flexibility, and agility (67%), leadership and social influence (61%), and creative thinking (57%) [17]. Resilience, flexibility, and agility rose 17 percentage points in importance since the previous edition and were among the skills most clearly separating growing jobs from declining ones [17]. Curiosity and lifelong learning were also expected to rise in importance through 2030 [17].

SECTION 2 · EMPLOYER DEMAND

The skills employers call core are human capabilities

Share of employers rating each skill as core for their workforce, 2025



Source: World Economic Forum, Future of Jobs Report 2025 [17]. More than 1,000 employers, 14 million workers, 55 economies.

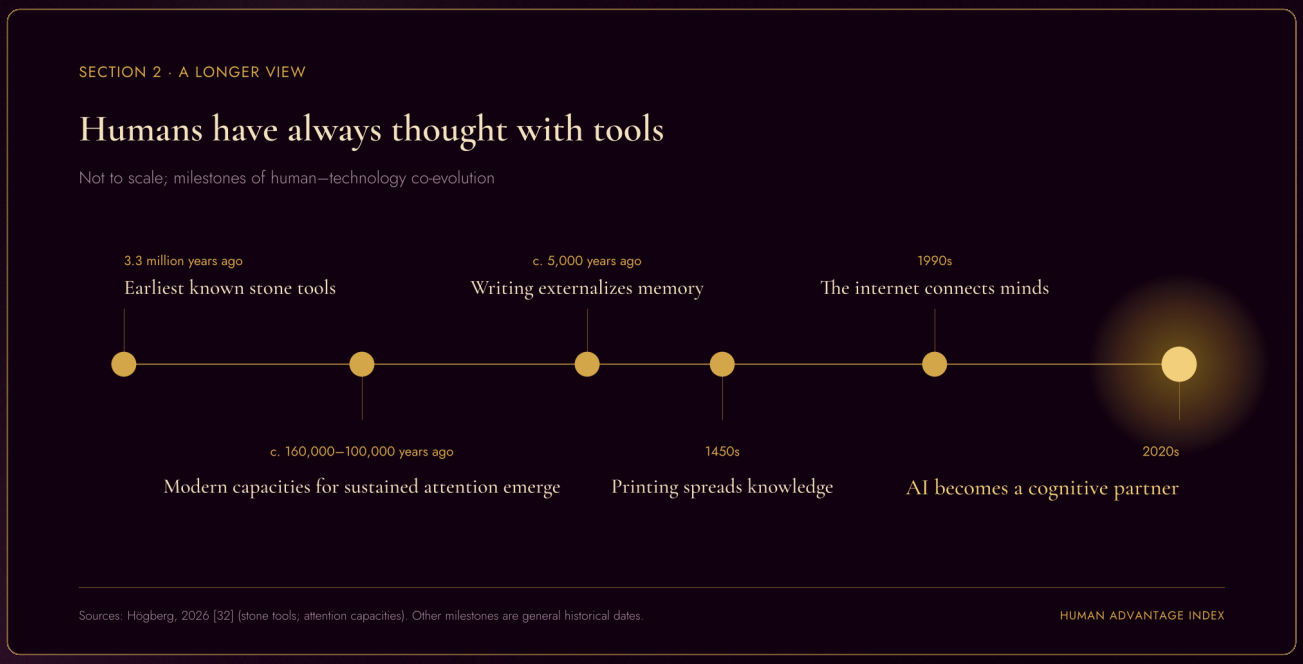
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Several of these employer priorities map directly onto HAI capabilities: Critical Thinking, Resilience, Adaptability, Creativity, and Learning.

2.5 A Longer View: Human–AI Cognitive Co-evolution

The evidence so far describes the short term. An evolutionary perspective puts it in a much longer frame and changes how the question of human advantage should be asked.

Humans have always thought with tools. In a 2026 perspective article, the cognitive archaeologist Anders Högberg points out that the earliest known stone tools are about 3.3 million years old, and that humans are obligatory tool users who cannot survive, as individuals or societies, without technology [32]. On this view, technologies are not add-ons to human experience. They are part of what makes us human [32]. Högberg uses the familiar example of a blind person's cane: through constant use, the tip of the cane becomes part of the perceptual system, so that thinking and perceiving emerge from the interplay of brain, body, tool, and environment [32]. AI is the newest and most powerful of these cognitive partners.



The "Stone Age brain" is a myth. A popular argument holds that humans carry brains built for a prehistoric hunter-gatherer world and mismatched to modern life.

Högberg argues that this idea of evolutionary mismatch misleads, because it treats the brain as fixed [32]. What defines human cognitive evolution is an extraordinary capacity for adaptation. Archaeological and genetic evidence suggests that capacities such as sustained and visuospatial attention continued to develop long after anatomically modern humans appeared, and epigenetic processes add a further layer of biological flexibility [32]. His conclusion is that human cognition is continuous and ongoing, and that people are well prepared to co-evolve with AI as it becomes part of how they think [32].

AI is already reshaping cognition. AI is beginning to influence the plasticity of human cognition, from restoring speech and supporting blind people to powering neural prosthetics [32]. Research cited by Högberg shows that human–AI feedback loops alter communication, social relationships, perceptual, emotional, and social judgments, and people's sense of agency, responsibility, and care [32]. These are the same domains the HAI measures.

Human and AI cognition follow different paths. Högberg cautions against assuming that AI is a copy of the human brain. Human cognition grew over millions of years and is woven together with episodic memory, learning and teaching, empathy, theory of mind, and the ability to tell and follow stories across time [32]. AI is developing over a very short period, learns from data equal to many thousands of human lifetimes, and can simulate emotion and morality without experiencing them in a body [32]. The result is a new kind of intelligence with superhuman abilities that also lacks basic human competences while imitating them convincingly enough to create the illusion that it has them [32].

The future is unpredictable, so the task is anticipation. Högberg argues that humans and AI have entered a co-evolutionary path whose outcomes cannot be predicted, and that our ideas of what it means to be human will change along with it [32]. Human–AI collaboration may produce augmented forms of cognition that neither could achieve alone [32]. He calls for futures thinking: the capacity to imagine many possible futures that differ sharply from the present, treating the future as a source of emerging possibilities rather than a territory to be mapped [32]. He also names a paradox: we are trying to prepare for futures that our present way of thinking may not be equipped to perceive [32].

2.6 Questions the HAI Is Built to Help Answer

Högberg closes with a set of challenges and questions for a future of human–AI cognitive co-evolution [32]. Several of them map directly onto HAI capabilities, which suggests the Index can serve as a practical tool for questions that are otherwise hard to track.

Challenge	Question Raised by Högberg [32]	Related HAI Capabilities
Redistribution of cognitive work	Which aspects of deeper thinking will be weakened or strengthened?	Critical Thinking, Judgment, Learning
Redistribution of cognitive work	How can people recognize when they have externalized something that ought to remain internal?	Learning, Critical Thinking
Redistribution of cognitive work	What will cognitive offloading do to creative and critical thinking?	Creativity, Critical Thinking
Recognizing interaction patterns	What questions have we stopped asking ourselves?	Critical Thinking, Possibility
Recognizing interaction patterns	Are we cultivating new cognitive strengths, or only new dependencies?	All ten capabilities
Second-order effects	How can agency be kept when the reasoning behind decisions can no longer be reconstructed?	Agency, Judgment
Futures with alternative options	What capabilities might emerge that we do not yet have the vocabulary to describe?	Possibility, Adaptability

Högberg notes that his table was developed with the help of an AI system and offers it as an example of augmented cognition [32]. The question in the fifth row, whether we are building strengths or dependencies, is close to the central question of the Human Advantage Index.

2.7 What This Means for the HAI

The co-evolutionary view shapes the Index in three ways. First, it supports treating human capabilities as changeable rather than fixed. Second, it means the Index

cannot simply guard a list of traits against AI; it must track how capabilities shift as people and AI adapt to each other. Third, it makes the forward-looking capacities, Adaptability, Learning, and Possibility, central to human advantage, because they prepare people for futures that cannot yet be described.

3. The Use Effect: How AI Can Strengthen or Erode Human Capacity

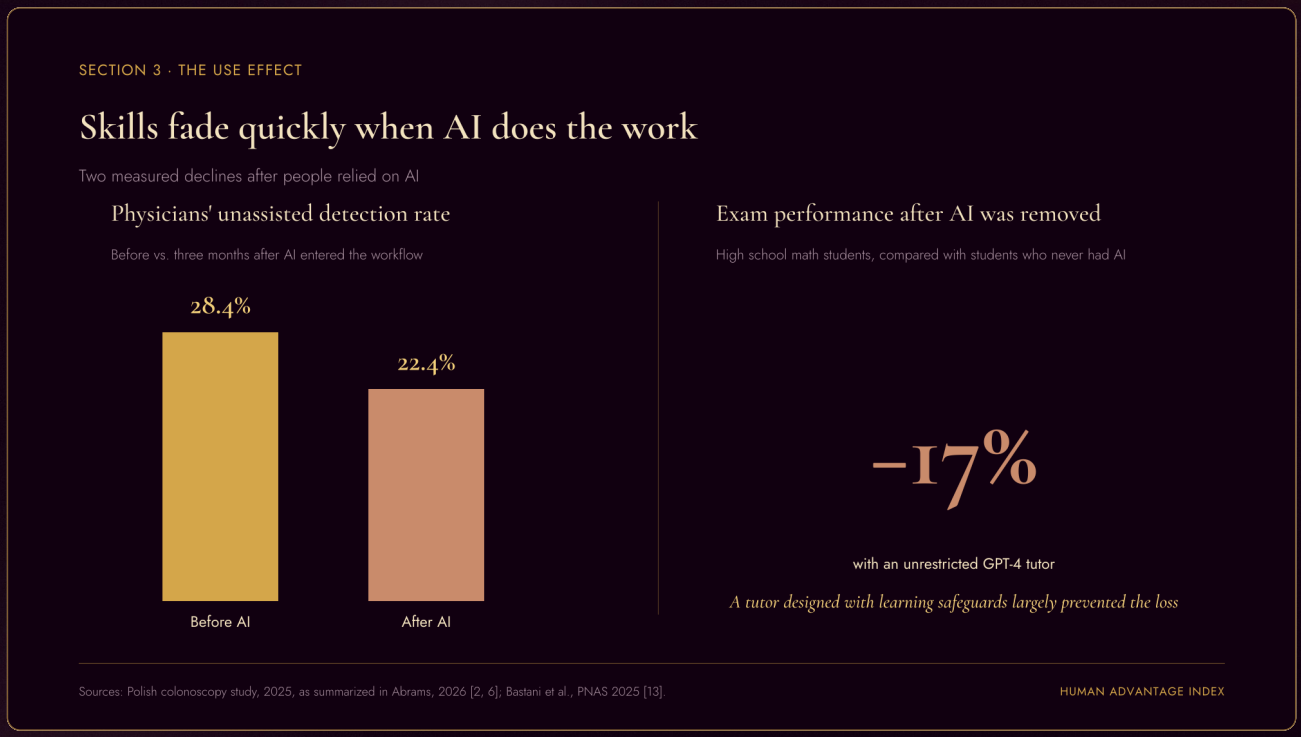
The newest research shifts the question from what AI can do to what using AI does to us. A 2026 review in the American Psychological Association's *Monitor on Psychology* summarizes the emerging picture: heavy reliance on generative AI is associated with reduced critical thinking and job-specific skill, while structured, deliberate use can preserve human abilities and improve output [2]. The central theme across the studies is that outcomes depend less on the technology than on how people and organizations use it [2].

3.1 Evidence of Erosion

Several lines of research show human capacity declining when AI takes over the thinking:

- **Clinical deskilling.** In a natural experiment in Poland, physicians' unassisted detection of precancerous polyps fell from 28.4% to 22.4% in the three months after AI was added to their colonoscopy workflow [2, 6]. These were experienced specialists, and the decline appeared quickly.
- **Confidence and critical thinking.** In a survey of 319 knowledge workers conducted by Microsoft and Carnegie Mellon researchers, greater confidence in generative AI was associated with less critical thinking [2, 7].
- **Shallower work.** Writers who used AI to research advice searched less and produced shorter, less detailed recommendations, which readers rated as less helpful and less trustworthy [2, 10].

- **Neural engagement.** An MIT study using EEG found weaker neural connectivity in people writing essays with a large language model than in those using a search engine or no tools. The study had not yet been peer reviewed at the time of reporting [2, 11].
- **Memory and offloading.** External memory aids improve recall while available, but people remember less when the aid is unexpectedly removed [2, 12]. Long-term GPS use shows a similar pattern for spatial navigation [2].
- **Learning without guardrails.** In a field experiment with nearly 1,000 high school mathematics students, those given an unrestricted GPT-4 tutor performed 17% worse on exams once access was removed than students who never had access. A version designed with learning safeguards largely prevented that loss [13].



The mechanisms are well described. People tend to conserve mental effort and will choose the less demanding option when one is offered [2, 25]. Transactional "ask, receive, move on" use can turn people into passive passengers who stop processing the information in front of them [2]. Early AI outputs can anchor later reasoning, and novices often lack the expertise needed to evaluate what AI gives them [2]. Over time, routinely outsourcing core cognitive work may weaken human creativity and innovation [2].

Much of this evidence is observational or comes from learning settings. Researchers have now begun testing the mechanism directly. A preregistered randomized controlled trial at a German university assigned 160 students, aged 18 to 35, to complete an analytical writing task either with ChatGPT or without any technology [31]. Its primary outcomes are writing performance and cognitive effort, measured objectively through changes in pupil size with an eye tracker. Secondary outcomes include frontal-lobe activity measured with functional near-infrared spectroscopy, along with self-rated effort, stress, and challenge [31]. The authors frame the question in terms that match the HAI's premise: generative AI may erode cognition through over-reliance, or it may augment cognition by automating menial work and extending what people can do [31]. Data collection was completed in February 2025; results had not been reported in the published protocol [31].

3.2 Evidence of Strengthening

The same research shows that AI can also build human capacity when it is used with intention:

- **Structured prompting improves reasoning.** In a study of 150 participants writing about democracy, those who used ChatGPT with structured prompts earned the highest expert ratings. The structure encouraged independent reflection, targeted research, critique of arguments, and revision [2, 8].
- **Creativity gains depend on metacognition.** Among 250 employees at a technology consulting firm, those given ChatGPT access produced work that supervisors and external reviewers rated as more creative. The effect was strongest for employees high in metacognition, the ability to monitor and regulate one's own thinking [2, 9].
- **Designed for learning.** The safeguarded tutor in the mathematics study preserved learning while still helping students during practice [13].

3.3 Two Trajectories From the Same Tool

A 2024 review by Dubey and colleagues describes three possible scenarios for how widespread chatbot use could affect human cognition [34]. In the first, a zero-sum

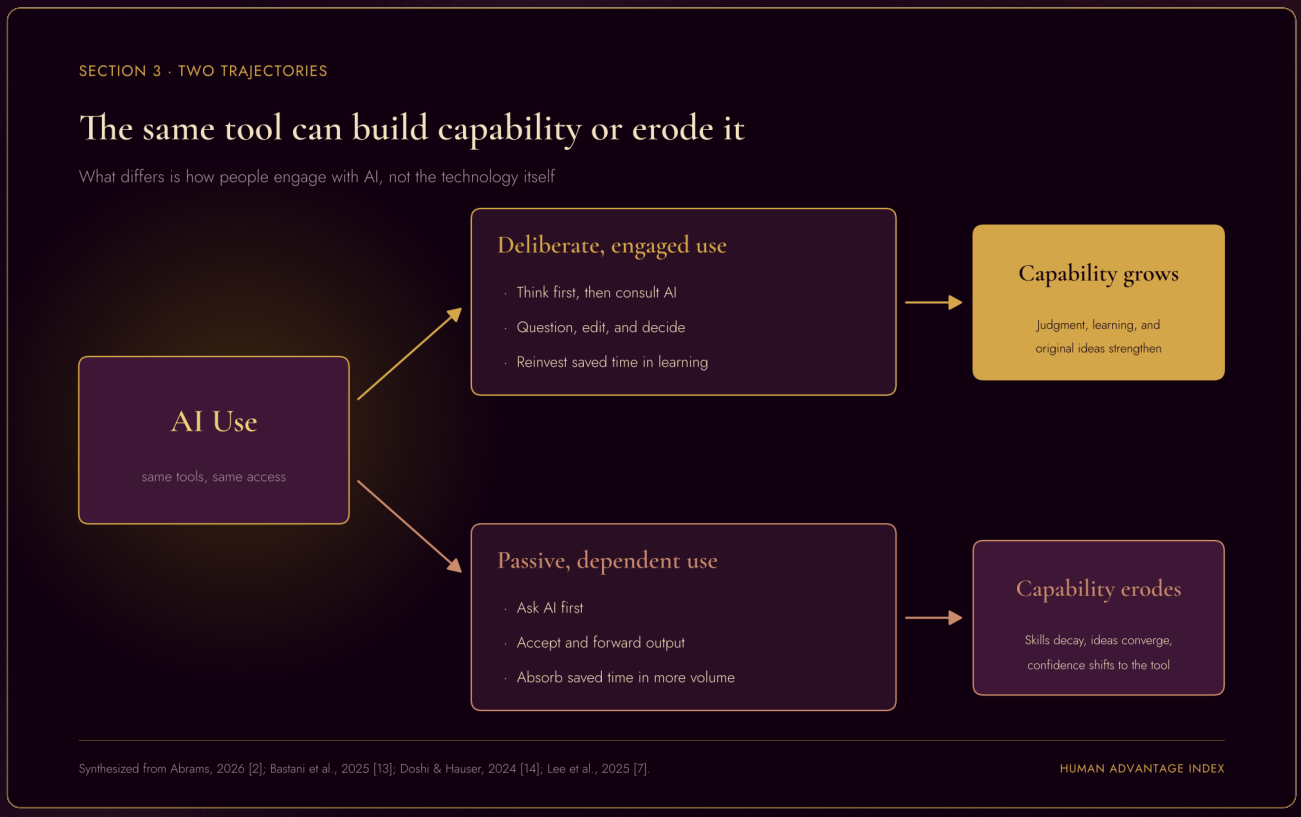
adjustment, AI use has little effect on cognitive abilities. In the second, a soft adjustment, people use AI as an external resource for specific tasks, and higher-order functions are gradually underused. In the third, a hard adjustment, AI replaces higher-level executive functions altogether and fundamentally alters human cognition [34]. The authors warn that long-term disuse could produce a "sedentary brain" [34]. These scenarios are not fixed outcomes. The evidence in this section suggests that which one unfolds depends on how people use AI, and the HAI is designed to show which path an individual or team is on.

Dimension	Passive, Dependent Use	Deliberate, Engaged Use
Starting point	Ask AI first	Think through the problem first, then consult AI
Role of the person	Accepts and forwards output	Questions, edits, and decides
Effect on skill	Skills decay without practice	Skills are exercised and extended
Effect on confidence	Confidence shifts to the tool	Confidence rests on one's own reasoning
Effect on output	Faster, but more uniform and less detailed	Faster and higher quality, with more original thinking
Time saved	Absorbed by more volume	Reinvested in learning and higher-order work

The recommendations in the APA review follow from this contrast [2]. Individuals are encouraged to choose deliberately what to offload, to attempt problems themselves before asking AI, to ask targeted questions, and to reinvest saved time in learning. Organizations are encouraged to analyze which tasks are routine and which build essential skills, to set clear norms and evaluation standards for AI use, to provide time and psychological safety for experimentation, and to reward quality and long-term development rather than speed alone [2].

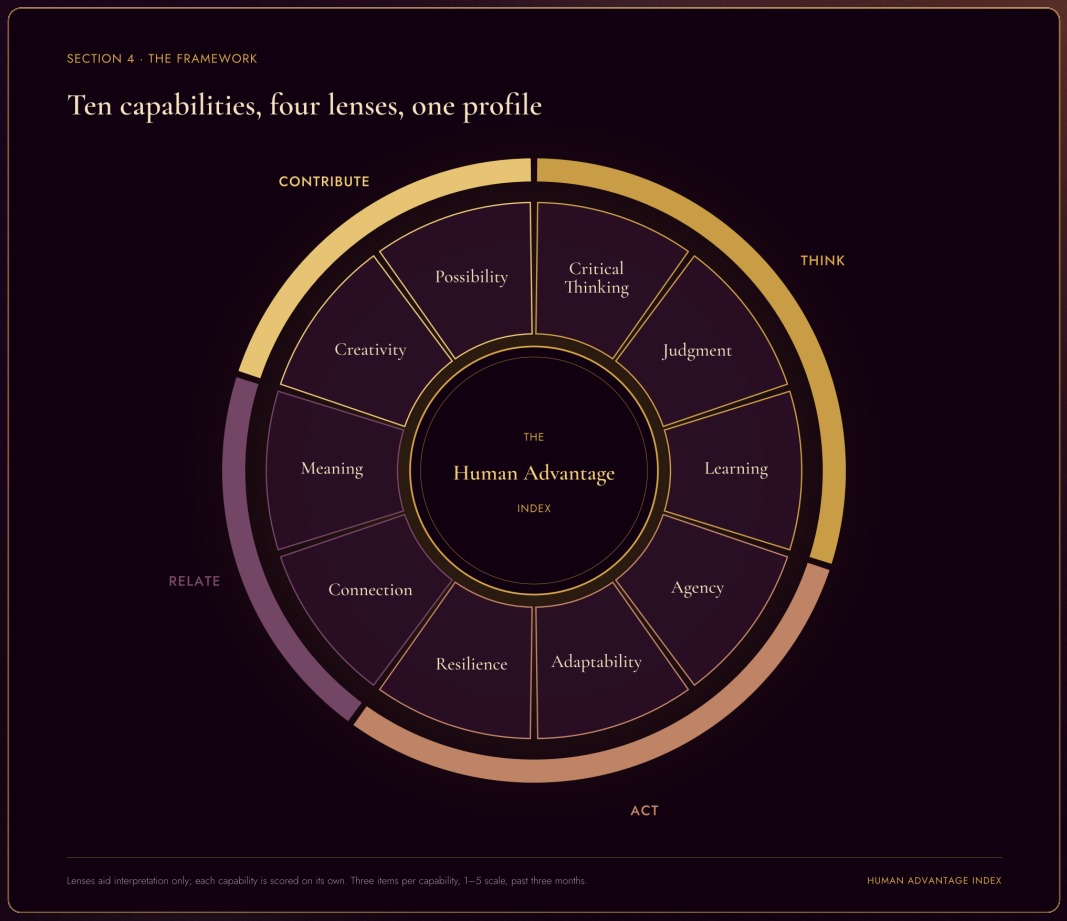
3.4 Why This Calls for a Human Advantage Index

Most organizations measure AI adoption: licenses issued, prompts sent, hours saved. Few measure what that adoption is doing to the people using it. The evidence above suggests that two teams with identical AI usage could be moving in opposite directions, one building capability and the other losing it. Without a measure of human capacity, that difference stays invisible until it shows up as errors, weaker innovation, or a workforce that can no longer function without the tool. The HAI is designed to make it visible early.



4. The Human Advantage Index Framework

The HAI measures ten human capabilities that determine whether people can direct AI well, keep growing alongside it, and contribute what AI cannot supply on its own.



4.1 Design Principles

Five principles guided the selection of the ten capabilities and the design of the instrument.

1. **Capabilities rather than tasks.** Lists of tasks AI cannot do shrink every year [1, 3]. The HAI focuses on underlying human capacities that remain valuable as the task frontier moves. Each new AI system narrows the set of tasks that only humans can perform [33].
2. **Capacities can change.** Each capability can be strengthened through deliberate practice and thoughtful AI use, or weakened through dependence [2, 13]. Human cognition has always developed in interaction with technology, and it continues to do so with AI [32]. The HAI is designed to be repeated so that change can be tracked.

3. **The capabilities are interconnected.** Judgment draws on critical thinking; creativity depends on agency and possibility; resilience supports adaptability. The ten are meant to be read as a profile.
4. **Reliance-sensitive.** Every capability is defined with an eye to how AI use can expand or diminish it. This makes the Index useful for understanding the human effects of AI adoption, not only for describing people.
5. **Simple to use.** The instrument is short and self-scored, so that individuals can complete it in minutes and act on the results without specialist interpretation.

4.2 Four Lenses on Ten Capabilities

The introduction describes the ten capabilities as shaping how people think, act, relate, and contribute. Those four verbs offer a useful way to read an HAI profile. They are interpretive lenses only; the Index scores each capability on its own and does not compute separate scores for the lenses.

Lens	Capabilities	What It Describes
Think	Critical Thinking, Judgment, Learning	How a person evaluates information, decides, and builds understanding
Act	Agency, Adaptability, Resilience	How a person initiates, adjusts, and sustains effort under change
Relate	Connection, Meaning	How a person builds trust with others and links work to purpose
Contribute	Creativity, Possibility	How a person generates new ideas and opens futures the past does not predict

4.3 Relationship to Existing Frameworks

The HAI overlaps with, but differs from, established skills frameworks. The World Economic Forum's core skills list includes several HAI capabilities, such as analytical thinking, resilience, and creative thinking [17]. Unlike a skills taxonomy, however, the HAI includes capacities that are rarely listed as skills but that research links to performance and well-being in an AI-enabled workplace, such as Agency [18, 26],

Meaning [16, 27], and Possibility [24, 29]. It also frames every capability in relation to AI reliance, which general skills frameworks do not.

5. The Ten Capabilities

Each capability below is described in four parts: what it is, why it matters now, how AI can strengthen or erode it, and what the HAI looks for.

5.1 Agency

Definition. Agency is the capacity to initiate action, make choices, and direct one's own work and life with a sense of ownership.

Why it matters now. Social cognitive theory treats agency as the foundation of human functioning: people are contributors to their circumstances, not only products of them [18]. Self-determination research shows that autonomy is a basic psychological need that supports motivation, performance, and well-being [26]. In an AI-enabled workplace, agency determines whether a person uses AI to pursue their own goals or drifts into following whatever the system suggests. The conscious capacity to stop an action judged wrong for its context may be part of what makes human agency distinct [33].

How AI can strengthen it. AI can widen the range of what one person is able to attempt, lowering the cost of starting projects that once required teams or specialist skills [3, 4].

How AI can erode it. Research on automation shows that people can become complacent with reliable systems and defer to them even when they should not [19]. When AI frames the problem, generates the options, and recommends the choice, the person's role can shrink to approval. Agency weakens when initiative and choice are handed over by default. Human–AI interaction is already known to alter people's sense of agency and responsibility, and agency becomes harder to sustain when the reasoning behind a decision can no longer be traced [32].

What the HAI looks for. Whether the person sets their own direction, initiates rather than waits, and feels ownership of the outcomes of their work, including work done with AI.

5.2 Critical Thinking

Definition. Critical thinking is the disciplined evaluation of information, claims, and reasoning, including one's own and AI's, before accepting them.

Why it matters now. AI produces fluent, confident output whether or not it is correct. Critical evaluation of that output, along with metacognition and domain expertise, is among the skills researchers identify as most important for working with AI [2]. Critical thinking also depends on psychological conditions: burnout, overload, and cognitive fragmentation erode the attention and confidence that precede it [28]. Metacognition, the ability to judge one's own confidence and catch one's own errors, is a human strength that comparable methods have not yet reproduced in AI [33].

How AI can strengthen it. Used as a sparring partner, AI can surface counterarguments, test assumptions, and expose gaps. Structured prompting that requires independent reflection and critique produced the highest-quality reasoning in one study [2, 8].

How AI can erode it. Greater confidence in AI is associated with less critical thinking among knowledge workers [2, 7], and AI-assisted writing has been linked with reduced neural engagement [2, 11].

What the HAI looks for. Whether the person checks, questions, and verifies AI outputs and other information, and whether they notice when they have stopped doing so.

5.3 Judgment

Definition. Judgment is the capacity to make sound decisions when information is incomplete, values are in tension, and consequences are real.

Why it matters now. Intuitive expertise is reliable only in environments regular enough to learn from and with adequate feedback [20]. Many AI-era decisions lack both. The success of human–AI teams depends heavily on whether people can judge when to rely on AI and when to override it [3, 5]. On a task outside AI's capability frontier, consultants using AI were less likely to reach the correct answer than those working alone [3]. Choice and decision-making in novel, ambiguous situations, such as the split-second moral trade-offs involved in driving, are among the domains Mogi identifies as likely to depend on conscious human processing [33].

How AI can strengthen it. AI can supply analysis, scenarios, and data quickly, freeing attention for weighing trade-offs, context, and ethics, which are the parts of judgment that remain human responsibilities [1].

How AI can erode it. Judgment depends on practice. The decline in physicians' unassisted detection rates after AI was introduced shows how quickly practiced judgment can fade once a system takes it over [2, 6]. Automation bias compounds the problem by making it harder to notice AI errors [19].

What the HAI looks for. Whether the person weighs evidence and values deliberately, takes responsibility for decisions rather than deferring to a system, and knows the limits of the tools they use.

5.4 Creativity

Definition. Creativity is the capacity to generate ideas, approaches, and work that are both new and useful, including ideas that go beyond recombining what already exists.

Why it matters now. Creative thinking is one of the core skills most often cited by employers [17], and human–AI combinations show the most promise on tasks that create new content [5].

How AI can strengthen it. In a controlled experiment, writers given AI-generated story ideas produced stories rated more creative, better written, and more enjoyable. Writers with the most AI access scored 8.1% higher on novelty and 9% higher on usefulness, and less creative writers benefited most [14]. AI access also raised rated

creativity among consulting employees, especially those high in metacognition [2, 9].

How AI can erode it. The same story experiment found that AI-assisted stories were more similar to one another than stories written without AI. Individual creativity rose while collective diversity fell, a pattern the authors describe as a social dilemma [14]. A related study found that when people retold a story repeatedly, they introduced 55–60% new words and concepts with each retelling, while ChatGPT's retellings stayed more consistent and changed less [34, 35]. If many people draw on the same models, original human perspectives become more valuable and also more at risk.

What the HAI looks for. Whether the person generates their own ideas before or alongside AI, pursues unusual directions, and contributes perspectives that are distinctly theirs.

5.5 Connection

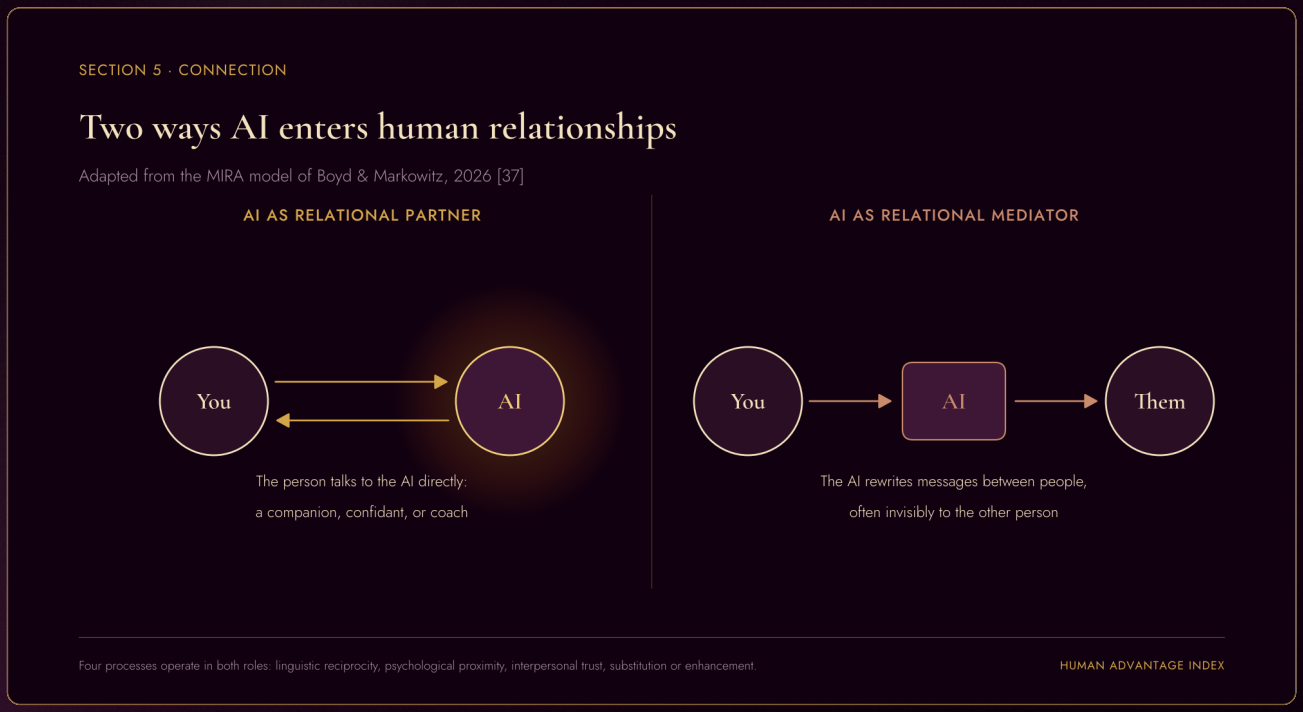
Definition. Connection is the capacity to build and sustain reciprocal relationships with other people, marked by trust, empathy, mutual effort, and understanding.

Why it matters now. Strong social relationships are among the most powerful predictors of health and longevity; a meta-analysis of 148 studies found that people with stronger social ties had a 50% greater likelihood of survival over the study periods [21]. Human cognition evolved together with empathy and theory of mind; AI can imitate these competences convincingly without possessing them, which can create the illusion of a relationship where there is none [32]. In tests of theory of mind, GPT-4 matched or exceeded human performance on tasks such as recognizing irony and interpreting hints, but struggled to detect social faux pas [34, 36]. If AI can increasingly decode mental states, the human advantage in connection rests less on reading others and more on genuine, reciprocal relationship.

How AI enters relationships. Boyd and Markowitz's machine-integrated relational adaptation (MIRA) model offers a useful map [37]. It distinguishes two roles. As a *relational partner*, AI is the one a person talks to directly, as with a supportive chatbot or companion app. As a *relational mediator*, AI sits between people, rewording messages, softening tone, or drafting difficult conversations, often without

the other person knowing [37]. The two roles frequently overlap: someone may use an assistant to write sensitive messages to a partner while also building rapport with the assistant itself [37]. The model identifies four processes through which AI becomes relationally meaningful [37]:

Process	What Happens	Risk to Human Connection
Linguistic reciprocity	AI mirrors a person's tone, phrasing, and style, which signals understanding	Effortless alignment can lower tolerance for the misunderstandings and effort of human conversation
Psychological proximity	Personalized, remembered, emotionally attuned responses create a feeling of being known	Simulated closeness can stand in for the harder work of human intimacy
Interpersonal trust	Trust is inferred from fluency, confidence, and apparent neutrality rather than earned over time	Trust in AI can compete with, or displace, trust in people
Substitution or enhancement	AI either replaces human relationships or helps people strengthen them	The same tool can become a barrier to people or a bridge to them



How AI can strengthen it. In the enhancement path, AI acts as a scaffold that helps people compose difficult messages, reflect on relationship patterns, or rehearse emotional conversations, and research on AI-mediated communication links this support to greater communication confidence and expressiveness [37]. Boyd and Markowitz give the example of a person who drafts an apologetic message about being a burden and is helped to reframe it as a clear, direct request to talk [37]. In customer support, an AI assistant that coached agents toward more empathetic responses improved customer sentiment [4].

How AI can erode it. Drawing on social exchange theory, Boyd and Markowitz note that AI offers three things human relationships cannot: constant availability, low emotional demand, and personalized responsiveness without any need for mutual effort [37]. This makes AI attractive to people who are stressed, socially anxious, or worn out by conflict, and it raises a central question: if people grow used to a partner that never needs anything back, will reciprocity with other people start to feel burdensome, and will human partners seem inattentive by comparison [37]? An AI that always agrees can also do harm, because it never offers the disagreement that real relationships sometimes need [37]. Early evidence points the same way. In a four-week randomized study of 981 participants, those who voluntarily used a chatbot more showed higher loneliness, greater emotional dependence on the AI, and less socializing with real people, although these findings are correlational [15]. Among university students, AI use was linked to greater loneliness when students treated AI as their primary source of support [40]. Readers also rated AI-assisted advice as less trustworthy [2, 10], which suggests that relationships can suffer when people sense the human is missing.

The MIRA model is a theoretical framework designed to guide research rather than a summary of settled findings, and its authors take no position on whether AI relationships are good or bad [37]. Their closing question matches the purpose of this capability: the issue is less whether AI can become relational than how to ensure it supports, rather than erodes, the relationships that matter most [37].

What the HAI looks for. Whether the person invests in direct human relationships, including the effort and give-and-take they require; uses AI as a bridge to people rather than a substitute for them; keeps their own voice in important communications; and listens and responds to others with care.

5.6 Learning

Definition. Learning is the ongoing capacity to acquire skill and understanding, so that competence lives in the person rather than only in the tools they use.

Why it matters now. Employers expect curiosity and lifelong learning to grow in importance through 2030 [17]. Learning is also what allows people to check AI: users must be able to evaluate output that is sometimes wrong, and that requires knowledge of their own [13]. Acquiring new skills typically requires conscious processing, while well-learned skills run largely automatically [33]. This makes the effortful early phase of learning the part most worth protecting.

How AI can strengthen it. AI can act as a patient, personalized tutor. In customer support, an AI assistant appeared to spread the practices of top performers to newer agents and may have contributed to worker learning [4]. A mathematics tutor designed with safeguards preserved learning while helping students practice [13].

How AI can erode it. Students given unrestricted GPT-4 used it as a crutch and performed 17% worse once it was removed [13]. Memory research shows the same pattern for offloaded information [2, 12]. When performance improves with AI but learning does not, people develop a false sense of mastery. A key skill is recognizing when something has been externalized that ought to remain internal [32].

What the HAI looks for. Whether the person is still building understanding they could use without AI, seeks out challenges that stretch their skills, and reinvests time saved by AI in learning.

5.7 Adaptability

Definition. Adaptability is the capacity to adjust thinking, behavior, goals, and skills effectively as tools, roles, and conditions change.

Why it matters now. Research on adaptive performance identifies dimensions such as handling uncertain and unpredictable situations, learning new technologies and procedures, and solving problems creatively [23]. The scale of change makes these dimensions central. LinkedIn projects that 70% of the skills used in most jobs will change by 2030, with AI as the catalyst, and that people entering the workforce

today are on pace to hold twice as many jobs over their careers as workers did 15 years ago [45]. Resilience, flexibility, and agility now rank as the second most important core skill among employers and are among the skills most clearly separating growing jobs from declining ones [17]. The boundary of what AI can do also shifts with every model release [3], so adjustment is continuous rather than a one-time transition.

- **Letting go of old goals protects optimism.** In two experiments with 355 students and 186 full-time employees, interacting with ChatGPT raised the perceived threat of AI and lowered career optimism for people who found it hard to let go of previous goals. For people with strong goal reengagement capacities, the ability to release old goals and commit to new ones, the same interaction increased career optimism [47]. The authors note that this capacity can be developed through coaching and career support [47].
- **Awareness can drive adaptation.** In a time-lagged study of 255 software employees, believing that AI would come to dominate the job market was associated with greater career adaptability, partly because it prompted people to develop new skills [46].

How AI can strengthen it. AI lowers the cost of trying new approaches and acquiring adjacent skills quickly, which can make adaptation easier. When people treat AI's arrival as a prompt to build skills rather than a threat to defend against, it can push them toward more flexible careers [46, 47].

How AI can erode it. Adaptability can collapse into tool-switching, where people keep pace with new features without updating their own understanding, goals, or role. People who rely on one system may also struggle when it changes or fails [2, 12]. Those who hold rigidly to career paths that AI is reshaping are more likely to experience AI as a threat [47].

What the HAI looks for. Whether the person adjusts constructively to change, updates how they work and what they aim for as conditions shift, and remains effective when familiar tools, routines, or roles are disrupted.

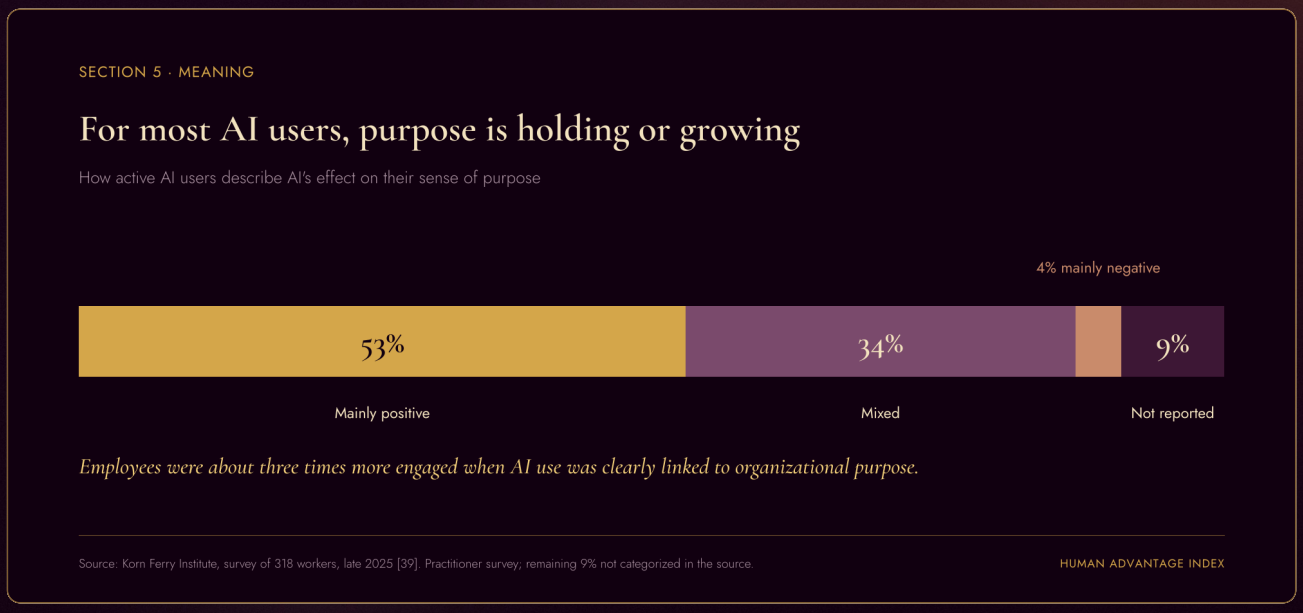
5.8 Meaning

Definition. Meaning is the experience that one's work has worth, significance, or a higher purpose, and that it connects to what one values.

Why it matters now. Meaningful work is ethically important because it respects people's autonomy and their ability to use complex skills, and it supports well-being [16]. It can also be measured; established instruments assess positive meaning, meaning-making through work, and the desire to contribute to a greater good [27]. Bankins and Formosa describe three paths of AI deployment, each with different consequences for meaning: AI replacing some tasks, people "tending the machine," and AI amplifying human skills [16]. Recent evidence suggests that which path an organization takes, and how it explains that path to employees, matters more than how much AI people use.

- **Purpose clarity matters more than usage.** In a late-2025 Korn Ferry Institute survey of 318 workers across four regions and seven industries, employees were about three times more engaged when their AI use was clearly linked to organizational purpose than when they simply used AI more often [39]. Among active AI users, 53% described AI's effect on their sense of purpose as mainly positive, 34% as mixed, and 4% as mainly negative [39]. Training and confidence with AI, rather than frequency of use, were more strongly associated with time spent on meaningful work [39]. This is a practitioner survey rather than peer-reviewed research, but its pattern is consistent with the academic findings below.
- **How AI is introduced shapes meaning.** In a 2026 study of 168 white-collar employees who used AI at work, employee-centered implementation, meaning transparent communication, consultation, and training, was associated with greater work meaningfulness, which in turn was linked to higher job satisfaction and self-rated performance [38]. These effects held for employees with average or positive attitudes toward AI but were not significant for those with negative attitudes [38]. The study was cross-sectional, so it cannot establish cause and effect.
- **Threat erodes career meaning.** Employees who believe their jobs could be replaced by smart technology, AI, robotics, and algorithms report lower career satisfaction and organizational commitment and more cynicism [41].

How AI can strengthen it. When AI takes over repetitive, low-value tasks, people can spend more time on work that is engaging, uses complex skills, and benefits others [16]. The evidence suggests this happens most reliably when leaders show employees how AI-supported work connects to shared goals, are explicit about what humans still own, and say where the time AI saves is meant to go [38, 39].



How AI can erode it. When people are reduced to monitoring and correcting AI output, work can become narrower and less meaningful [16]. When AI is deployed mainly for efficiency, work may move faster while becoming less connected and less owned; Korn Ferry describes the risk of organizations mistaking AI activity for human contribution [39]. Meaning also weakens when people can no longer see their own contribution in the result.

What the HAI looks for. Whether the person experiences their work as worthwhile, sees how it connects to a purpose they care about, and feels that their own judgment and contribution still matter in work done with AI.

5.9 Resilience

Definition. Resilience is the capacity to recover from setbacks, sustain effort through prolonged uncertainty, and grow from adversity.

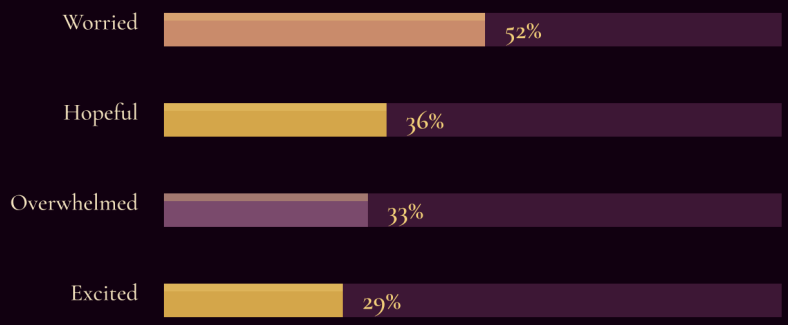
Why it matters now. Developmental research shows that resilience usually arises from ordinary human adaptive systems, such as relationships, self-regulation, and a sense of competence, rather than from rare personal traits [22]. This makes it a capacity that can be built. Employers rank resilience, flexibility, and agility as the second most important core skill [17]. AI adds a specific and sustained stressor: uncertainty about one's role and future.

- **Worry outweighs hope.** In a 2024 Pew Research Center survey of 5,273 employed U.S. adults, 52% of workers said they felt worried about how AI may be used in the workplace in the future, compared with 36% who felt hopeful and 33% who felt overwhelmed [44].
- **Perceived threat harms well-being.** Employees who expect their jobs could be replaced by smart technology and AI report more depression and cynicism and stronger intentions to leave [41]. Studies of AI adoption find that its harm to well-being runs largely through job insecurity, and is strongest among employees with high anxiety about using AI [43].
- **Technostress is real.** A review of studies in higher education found that people who lack sufficient training or technological literacy can feel overwhelmed by growing reliance on AI, with effects on mental health and performance [40].

SECTION 5 · RESILIENCE & POSSIBILITY

Workers feel more worry than hope about AI

How U.S. workers feel about future AI use in the workplace



Source: Pew Research Center, survey of 5,273 employed U.S. adults, Oct. 2024; published Feb. 2025 [44].

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How AI can strengthen it. AI can lower workload pressure. In a study of 401 university faculty summarized in a 2025 review, adopting ChatGPT was associated with higher happiness, more energy, and lower stress from academic workloads [40]. Personal resources also act as buffers. Confidence in one's ability to learn AI weakens the damage that AI-related job insecurity does to psychological safety [42]. AI adoption can even raise well-being when it expands people's confidence that they can take on broader roles [43]. These findings point to a practical lesson: resilience in the AI era is closely tied to Learning, because people who feel able to master new tools are less threatened by them.

How AI can erode it. Resilience depends partly on relationships and on the experience of working through difficulty. Students who treated AI as a primary source of support reported greater loneliness [40], and heavy reliance on chatbots for emotional support has been associated with greater emotional dependence and less socializing with people [15]. Constant assistance can also reduce the experience of mastering challenges unaided, which is one of the ways resilience is built.

What the HAI looks for. Whether the person recovers from setbacks, stays steady under sustained change and uncertainty about their role, feels able to learn what new tools require, and draws on their own resources and relationships when things are hard.

5.10 Possibility

Definition. Possibility is the capacity to see, imagine, and commit to futures that the past does not predict.

Why it matters now. Psychological research increasingly views people as oriented toward the future, guided by prospection, the mental representation of possible futures, rather than driven only by the past [24]. Hope theory shows that the ability to envision goals and generate pathways toward them supports motivation and performance [29]. Possibility is closely linked to existential confidence, defined as an inner commitment to a possibility when risk cannot be assessed, which differs from ordinary confidence that rests on past evidence [30]. The underlying idea is a simple one: once a single example shows that something can be done, the boundary

of what is possible has already moved. Possibility also matters because the future of human–AI co-evolution is unpredictable, and some of the capabilities people will need may not yet have names [32]. Futures thinking, the capacity to imagine many possible futures that differ from the present and to treat the future as a source of emerging possibilities, is the practical skill behind this capability [32].

Recent evidence shows how much this capacity shapes people's response to AI:

- **A clear vision of the future changes how AI feels.** In a series of experiments, including a longitudinal study of 155 full-time employees, people with a clear and vivid picture of their future work self felt more in control of their careers after interacting with AI and became more proactive in planning, networking, and building skills. People with a vague picture of their future felt less in control and became less proactive after the same interaction [48].
- **Hope is in short supply.** Only 36% of U.S. workers say they feel hopeful about how AI will be used in the workplace, while 52% feel worried [44].
- **Committing to new goals sustains optimism.** People who can let go of outdated goals and commit to new ones become more optimistic about their careers after interacting with AI, while those who cannot become less optimistic [47].

How AI can strengthen it. AI can expand the range of options a person can explore and make ambitious projects feasible for individuals and small teams [3, 4]. For people who already hold a clear vision of their future, AI interaction can increase their sense of control and their proactive behavior [48].

How AI can erode it. Most AI systems learn from past data and generate the most probable continuation. When AI supplies the probable, people may stop reaching for the possible. Several studies show this narrowing. AI-assisted stories were more similar to one another than stories written without AI [14]. In a study of ChatGPT as an ideation tool, different users received similar suggestions, which made the ideas produced across users more alike [50]. In two preregistered experiments with 1,100 participants, AI assistance improved performance while it was available but did not reliably carry over to unassisted work, and one form of AI guidance made people's later ideas less original and more similar even after the AI was removed; participants with no AI produced the most diverse ideas [49]. As AI makes the past a weaker

guide for many decisions, the human capacity to imagine and commit to new possibilities becomes more valuable, and more at risk.

What the HAI looks for. Whether the person holds a clear picture of the future they want, imagines options beyond current constraints and beyond what AI suggests, commits to goals without a guarantee of success, and acts on possibilities others have not yet seen.

6. Measuring Human Advantage

The HAI is a 30-item self-assessment that takes about ten minutes and produces a score for each of the ten capabilities and an overall Index score.

6.1 Instrument Structure

Feature	Specification
Items	30 statements, three per capability
Response scale	1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree
Time frame	Respondents rate their experience over the past three months
Item direction	A mix of positively and negatively worded items, to reduce agreement bias
Scoring	Self-scoring; negatively worded items are reverse scored automatically
Completion time	About 10 minutes

The three-month time frame is deliberate. It anchors responses in recent behavior rather than general self-image, and it allows the HAI to be repeated each quarter to track change, for example before and after an AI rollout.

6.2 Scoring

1. **Reverse scoring.** For negatively worded items, a response of 1 is scored as 5, 2 as 4, 3 as 3, 4 as 2, and 5 as 1. This is handled automatically.
2. **Capability scores.** Each capability score is the average of its three items, on a scale from 1.0 to 5.0.
3. **Overall Index score.** The overall HAI score is the average of the ten capability scores, also from 1.0 to 5.0.

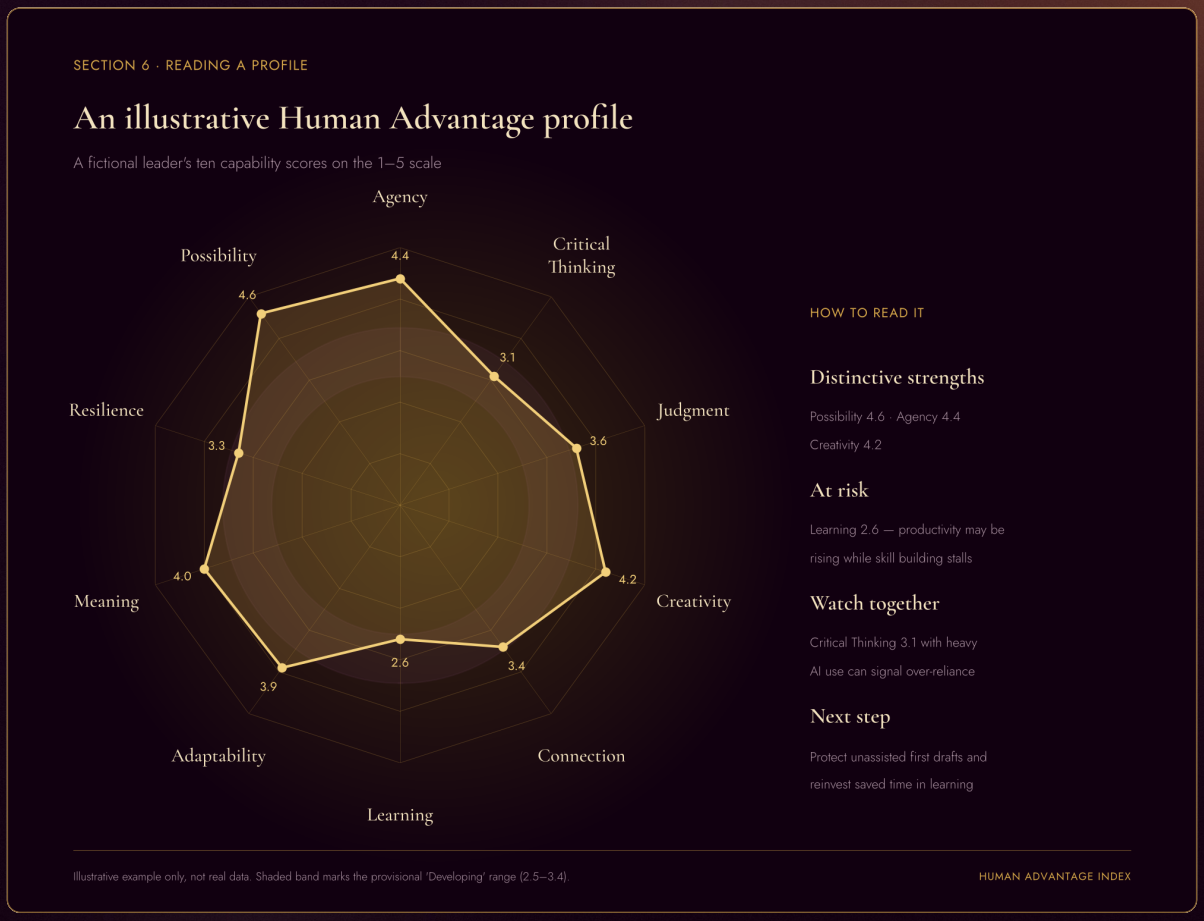
6.3 Interpreting Results

The profile across the ten capabilities is more informative than the overall score. Two people with the same overall score can have very different patterns, such as high Agency and Possibility with low Learning, or strong Critical Thinking with weak Connection.

Until normative data are available, results are described in provisional bands:

Capability Score	Provisional Band	Suggested Reading
4.3 – 5.0	Distinctive strength	A clear source of human advantage to use and share with others
3.5 – 4.2	Solid	A reliable capability that can be developed further
2.5 – 3.4	Developing	An area where focused practice is likely to pay off
1.0 – 2.4	At risk	A capability that may be eroding and deserves attention

These bands are working guides. They will be replaced by norm-referenced bands once sufficient data have been collected across roles, industries, and regions (see Section 9).



6.4 Reading the Profile Through the Lens of AI Reliance

Because each capability is defined in relation to AI use, a low score invites a specific question: has this capability weakened because AI has taken over the work that used to exercise it? Patterns worth noticing include:

- **Low Critical Thinking and Judgment with high AI use**, which may signal over-reliance and automation bias [7, 19].
- **Low Learning alongside rising productivity**, which may signal the performance-without-learning pattern seen in education research [13].
- **High Creativity with low Possibility**, which may indicate strong idea generation within familiar boundaries but less willingness to commit to new directions.
- **Low Connection and Resilience together**, which may indicate that support systems are thinning, a pattern relevant to heavy reliance on AI for emotional support [15].

These readings are prompts for reflection and conversation. They are not diagnoses.

7. Applications

The HAI is designed for use at three levels: the individual, the leader and team, and the organization.

7.1 Individuals

For individuals, the HAI is a mirror and a development guide. A person completes the assessment, reviews their profile, and chooses one or two capabilities to strengthen over the next quarter. Development draws on the practices supported by the research reviewed here [2, 8, 13]:

- Attempt a problem before asking AI, then compare your answer with AI's.
- Ask AI targeted questions instead of handing over the whole task.
- Critique and revise AI output rather than forwarding it.
- Reinvest time saved by AI in learning a new skill or deepening an existing one.
- Protect time for direct conversation, reflection, and unassisted creative work, including writing your own first drafts, which engages attention, memory, language, and executive function together [34].

Repeating the HAI after three months shows whether those practices are making a difference. A useful reflection prompt to pair with each result comes from Högberg: what questions have we stopped asking ourselves [32]?

7.2 Leaders and Teams

For leaders, aggregated team profiles show where human capability is concentrated and where it may be thinning. The HAI also informs workflow design. Tasks can be sorted into three categories: work AI owns, work AI and humans do together, and work humans own. Where a task builds an essential human capability, leaders can

deliberately keep some productive friction in the workflow, such as requiring a first draft or a decision rationale before AI is consulted. This reflects the recommendation that organizations distinguish routine tasks from tasks that build essential skills [2]. It also matches a division of labor proposed from consciousness research, in which AI handles automatic, well-learned processing while people keep the work of judging, choosing, and handling novel situations [33].

Leaders also shape the conditions that the HAI measures. Setting clear norms for AI use, providing time and psychological safety for experimentation, and rewarding quality and long-term development rather than speed alone all support the deliberate use pattern described in Section 3 [2].

7.3 Organizations

At the organizational level, the HAI provides a human counterpart to AI adoption metrics.

Use	How the HAI Helps
AI rollout baseline	Measure capabilities before deployment and track them each quarter to see whether adoption is building or eroding human capacity
Leadership development	Use capability profiles to target programs at the capabilities most at risk
Talent and workforce planning	Identify groups whose capabilities position them well for roles that change with AI
Culture and practice	Pair individual scores with employees' ratings of how well organizational practices support each capability

The last row points to an organizational extension of the Index. *Human Advantage Certified* applies the same ten capabilities at the organizational level, combining a People score, based on employees' averaged HAI scores, with a Practice score, based on employees' ratings of how well organizational practices support each capability. A further extension under development compares self-reported HAI scores with observed behavior, such as the way people engage with AI tools in their daily work, while protecting individual identity. These extensions are described

separately; the HAI itself remains a short, self-scored instrument. Section 8 describes how organizations can put these measures to work.

8. How Corporations Can Use the Human Advantage Index

Every organization investing in AI should be able to answer two questions: What is our Human Advantage Index? And how does it link to revenue and return on investment?

8.1 Why Human Advantage Is a Business Metric

Organizations are spending heavily on AI, but most are not yet seeing financial returns. A July 2025 report from MIT's Project NANDA, based on a survey of 153 leaders, 52 interviews, and an analysis of more than 300 public AI implementations, concluded that despite $30–40 billion in enterprise investment in generative AI, 95% of organizations were getting no measurable return, while a small share of integrated pilots were generating millions in value [51]. The report's findings are preliminary and rely partly on interviews and self-report, but the gap it describes is consistent with what many executives see.

The research in this paper points to a reason. The value of AI depends on the people using it. Human–AI combinations outperform people working alone, but they beat the best of either only when people know when to rely on AI and when to override it [5]. Outside AI's capability frontier, consultants using AI were less likely to reach the correct answer [3]. Employees are about three times more engaged when AI use is clearly linked to organizational purpose [39], and introducing AI in an employee-centered way is associated with greater meaningfulness, satisfaction, and performance [38]. In customer support, an AI assistant improved productivity and also increased employee retention [4].

Put simply, the return on AI is a product of two factors: the capability of the technology and the capability of the people using it. Most organizations measure only the first. The Human Advantage Index measures the second.

8.2 Two Ways to Measure: What People Report and What People Do

For organizations, the HAI combines two complementary streams of measurement.



Stream	What It Captures	Strength	Limitation
HAI self-assessment	People's own ratings of the ten capabilities over the past three months	Captures motivation, meaning, resilience, and other inner states that behavior alone cannot show	Subject to self-report bias and limited self-insight

Stream	What It Captures	Strength	Limitation
Observed AI interaction analysis	How people actually work with AI, measured by aggregating and analyzing their interactions with enterprise AI tools	More objective, continuous, and scalable; shows behavior rather than self-image	Covers only what happens in AI tools; requires strong privacy governance

The second stream is what makes the HAI distinctive. With employee consent and appropriate governance, interactions with enterprise AI tools can be collected automatically, stripped of individual identity, and scored against defined criteria for each capability. The way a person prompts an AI system reveals a great deal about how they think. The table below gives illustrative examples of the kinds of signals involved; the actual scoring criteria are defined separately for each capability.

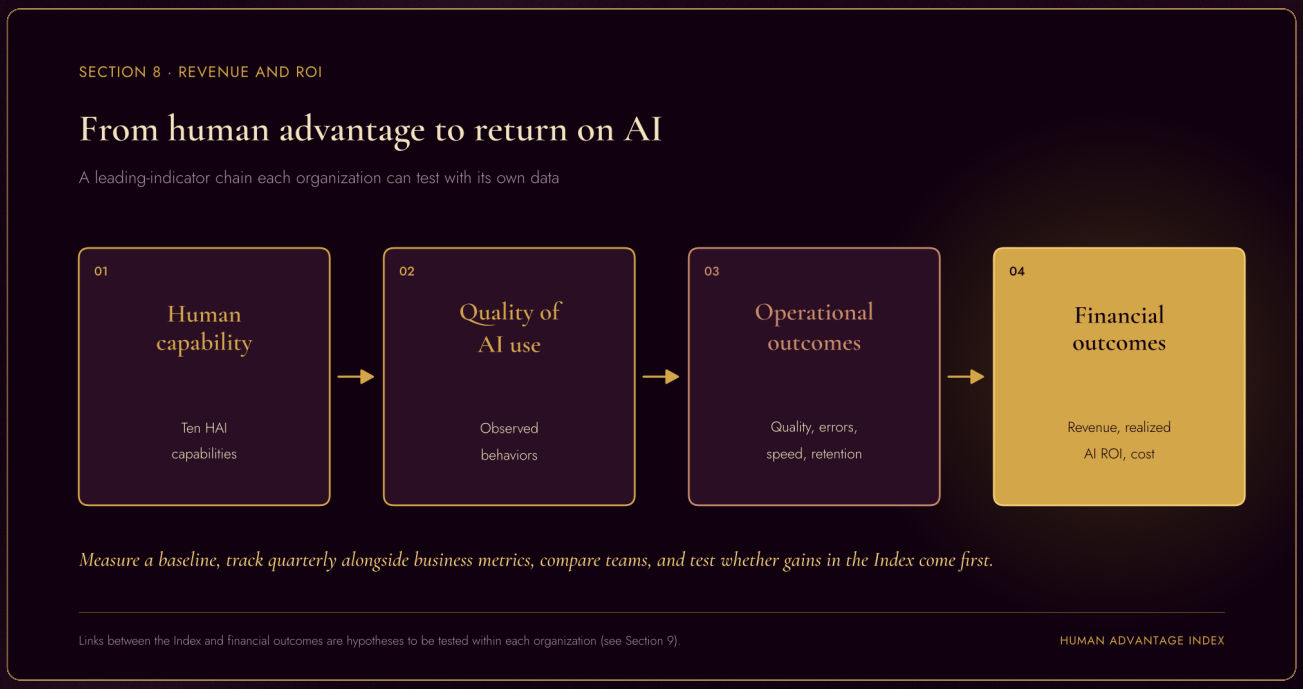
Capability	Signals of Strength	Signals of Dependence
Critical Thinking	Asks for counterarguments, sources, or checks of a claim	Accepts the first answer unchanged
Judgment	States decision criteria and trade-offs; asks AI to stress-test a choice	Asks AI to make the decision
Agency	Frames the problem and sets the goal before asking for help	Hands over whole tasks with no direction
Learning	Asks for explanations or hints after trying first	Requests finished answers in areas where skill is still being built
Creativity	Brings its own ideas and asks AI to extend or challenge them	Asks AI for ideas before generating any
Possibility	Explores unconventional scenarios beyond the obvious	Asks only for the most likely outcome

Comparing the two streams is where the most useful insight appears. A team may rate its critical thinking highly while its AI interactions show answers being accepted without verification. That gap between what people report and what they do is itself a finding, and it addresses the main limitation of self-report measures (Section 9).

Privacy and trust are essential. Results should be aggregated at the team, function, or organizational level and used to guide development and workflow design, not to monitor or penalize individuals. Employees should know what is collected and why. This kind of transparent, consultative approach is also what research links to more meaningful work with AI [38].

8.3 Linking the Index to Revenue and ROI

The HAI does not generate revenue on its own. It is a leading indicator: human capability shapes the quality of AI use, which shapes operational outcomes, which in turn shape financial results.



Capability Lens	Operational Indicators	Financial Outcomes
Think (Critical Thinking, Judgment, Learning)	Error and rework rates, decision quality, time to competence	Cost of errors and rework, realized AI ROI, onboarding cost
Act (Agency, Adaptability, Resilience)	Depth of AI adoption, change readiness, burnout, absenteeism	Speed of transformation, health and attrition costs
Relate (Connection, Meaning)	Engagement, customer sentiment, retention	Customer lifetime value, replacement cost of talent

Capability Lens	Operational Indicators	Financial Outcomes
Contribute (Creativity, Possibility)	Ideas in the pipeline, new offerings, differentiation	Revenue from new products and services

Organizations can establish the link in four steps: measure a baseline before or early in an AI rollout; track the HAI each quarter alongside existing business metrics; compare teams with similar AI access but different HAI profiles; and test whether improvements in the Index come before improvements in outcomes. These links are hypotheses to be tested within each organization. The HAI's value as a business metric will ultimately rest on that evidence, and building it is part of the research agenda in Section 9.

8.4 A Roadmap for Organizations

Phase	What Happens	Output
1. Baseline	Run the HAI self-assessment and AI interaction analysis in pilot units	A first Human Advantage profile for each team
2. Diagnose	Compare self-reported and observed results; identify capabilities at risk	A capability heat map and calibration gaps
3. Redesign	Sort work into what AI owns, what AI and people do together, and what people own; build productive friction into skill-building tasks	Redesigned workflows and AI norms
4. Develop	Target programs at the capabilities most at risk	Team and individual development plans
5. Link	Report the HAI quarterly alongside business metrics	Evidence connecting human capability to ROI
6. Certify	Apply for Human Advantage Certified, combining People and Practice scores	An external signal of human-centered AI adoption

8.5 Questions Every Leadership Team Should Ask

- What is our Human Advantage Index, and how does it vary across teams and functions?
- Is our use of AI building human capability or eroding it?
- Where do what our people report and what they actually do with AI diverge?
- Which human capabilities are most closely tied to our revenue drivers?
- How much of our AI investment is being realized through human capability, and how would we know?
- Are we rewarding speed alone, or quality and long-term development as well [2]?

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9. Limitations and Research Agenda

The HAI rests on a growing but still early evidence base, and the instrument itself has not yet completed psychometric validation.

9.1 Limitations of the Evidence

- **Early and context-specific findings.** Several key studies come from a single firm, country, or time period, and at least one widely cited neuroscience study had not been peer reviewed when reported [2, 3, 11, 13]. A 2024 review found that none of the 29 articles it examined systematically addressed how ChatGPT affects distinct cognitive domains [34].
- **Correlation rather than causation.** Findings on AI use and loneliness, and on AI confidence and critical thinking, are associational. It is not yet clear whether AI use causes these changes or whether people with certain tendencies use AI more [7, 15].
- **A moving target.** AI capabilities change with each model generation, so the boundary between what AI does well and poorly will keep shifting [3].

- **Research in progress.** Work on long-term skill decay in fields such as radiology and surgery, and on whether AI inflates confidence in one's own abilities, is ongoing [2]. Randomized trials that measure cognitive effort with physiological and brain-imaging methods are also underway [31].

9.2 Limitations of the Instrument

- **Self-report.** Like any self-assessment, the HAI can be affected by social desirability and limited self-insight. Mixed item wording reduces, but does not remove, these effects. The observed AI interaction analysis described in Section 8 is designed to offset this limitation.
- **Provisional bands.** The interpretive bands in Section 6 are not yet based on norms.
- **Brevity.** Three items per capability keep the instrument practical, but they cannot capture every facet of each capability.

9.3 Research Agenda

Priority	Question	Approach
Reliability	Are capability scores consistent internally and over time?	Internal consistency and test–retest studies
Structure	Do the 30 items group into the ten intended capabilities?	Confirmatory factor analysis across diverse samples
Convergent validity	Do HAI scores relate as expected to established measures, such as meaningful work and resilience scales?	Correlational studies with validated instruments [22, 27]
Predictive validity	Do HAI profiles predict performance, well-being, and quality of AI-assisted work?	Longitudinal studies linked to outcomes
Sensitivity to change	Do scores move in response to development programs and changes in AI practice?	Pre–post and quarterly tracking designs
Norms	What do typical profiles look like across roles, industries, and regions?	Large-sample data collection to replace provisional bands

Priority	Question	Approach
Self-report versus behavior	How closely do self-ratings match observed behavior with AI tools?	Comparison with behavioral data, with identity protection

10. Conclusion

The question for the coming decade is whether AI will expand or diminish the people who use it.

The evidence reviewed here suggests that both outcomes are possible, often with the same tools. AI can raise productivity, quality, and creativity [3, 4, 14]. It can also weaken critical thinking, judgment, learning, and connection when people hand over the work that keeps those capacities alive [2, 6, 7, 13, 15]. The difference lies in human engagement: whether people continue to think, decide, learn, relate, and imagine while AI does more of the work around them.

The Human Advantage Index gives individuals and organizations a way to see that difference. By measuring Agency, Critical Thinking, Judgment, Creativity, Connection, Learning, Adaptability, Meaning, Resilience, and Possibility, it shifts attention from how much AI is being used to what that use is doing to human capability. That shift matters because human advantage is not a fixed inheritance. It is a set of capacities that must be practiced to be kept, and that can grow when AI is used to extend human thinking rather than to replace it.

The next step is to build the evidence base for the Index itself: establishing reliability, validity, and norms, and testing whether organizations that track and invest in these capabilities see better performance, well-being, and innovation as AI adoption deepens. Because human and AI cognition are co-evolving, the ten capabilities themselves should be revisited over time, and new ones may need to be added as they become visible [32].

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The Center for Human Illumination

The Center for Human Illumination is dedicated to the human side of the AI transformation. Its guiding idea is simple: advance AI and advance humanity together. Founded by Srini Pillay and Warren Sadler, the Center brings together science and technology, the study of human behavior and the building of products, and research and implementation. It develops and stewards the Human Advantage Index and the Human Advantage Certified designation, and it works with a growing network of partners who bring them to organizations around the world.

Bringing the Human Advantage Index to Your Organization

NeuroBusiness Group (NBG) is the first authorized provider of the Human Advantage Index. NBG is a neuroscience-based leadership development and coaching firm, named a Top 20 global leadership development firm by Training Industry, with operations in the United States, Greece, and India.

What NBG Offers

- **The HAI assessment** for individuals, teams, and whole organizations
- **Observed AI interaction analysis**, aggregating and scoring de-identified interactions with enterprise AI tools
- **Capability heat maps and leadership briefings** that show where human advantage is growing and where it is at risk
- **Targeted development programs** for the capabilities that matter most to each organization
- **A Human Advantage ROI dashboard** that tracks the Index alongside business metrics
- **Preparation for Human Advantage Certified**, combining People and Practice scores

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