

How to Extend Your Mind

By Annie Murphy Paul

Based on *The Extended Mind: The Power of Thinking Outside the Brain*

Ours is a brain-centric culture: we expect that lump of tissue in our skulls to solve problems, pay attention, remember facts, and come up with creative ideas. But though we're always hearing about how "astonishing" the human brain is, how "extraordinary," the truth is that it's quite limited in what it can do on its own.

We transcend the limits of this quirky and idiosyncratic organ by thinking *outside* the brain: that is, by using external resources to enhance our mental processes. These outside-the-head resources include the sensations and movements of our bodies; the physical spaces in which we learn and work; and the social interactions we engage in with others.

Below I've assembled a catalog of practical strategies for extending your mind. My hope is that—at moments when you feel like you have no choice but to push your brain harder, or when your brain has let you down by being distractible, forgetful, or sluggish—you can turn to this catalog and select a strategy that will allow you to make an end run around that fallible organ.

Thinking with Interoception

"Interoception" is the capacity to sense our internal signals. People who learn how to tune into these inner cues can use them to make better decisions, to muster more mental resilience, and to exhibit greater emotional intelligence.

- 1. Perform a body scan:** The body scan is meditative exercise in which you direct non-judgmental attention to each part of your body in turn. Practicing this exercise daily will [improve your ability](#) to perceive interoceptive sensations.
- 2. Keep an interoceptive journal:** An interoceptive journal is structured writing exercise in which you record the [interoceptive sensations](#) you feel as you contemplate a decision—and then, later, track how the decision turned out.
- 3. Label your internal sensations:** Affect labeling is an activity in which you notice and name each interoceptive sensation you are experiencing. Research shows that engaging in affective labeling [immediately reduces](#) anxiety and distress.
- 4. Try cognitive reappraisal:** Cognitive reappraisal is an exercise in which you take the basic building blocks of your interoceptive sensations and re-appraise them as representing a *positive* emotion—for example, excitement instead of nervousness. Engaging in cognitive appraisal reduces negative affect and [improves performance](#).
- 5. Fill in a body map:** A body map is an outline of the human body on which you can note what you're feeling and where the feeling makes itself known. Completing a body map can help you become [more aware](#) of your internal signals and where in the body they are arising.
- 6. Engage your social interoception:** Social interception is the process of tuning into the sensations of your *own* body in order to better understand what *other* people are feeling. Habitually engaging your [social interoception](#) allows you to be more empathetic and more emotionally intelligent.
- 7. Make sure you experience “C touch”:** Human skin is innervated with a network of fibers, called “C-tactile afferents,” that respond to gentle, caressing touch. Research has found that we [experience C touch](#) more like an interoceptive signal than like an exteroceptive one (that is, a stimulus arriving from outside the body). Receiving C touch

from another person, or providing it for yourself, has a [calming, soothing](#) effect on the nervous system.

Thinking with Movement

Humans didn't evolve to think while sitting still. Moving your body in specific ways while engaging in mental work can help you to think more effectively, more efficiently, and more creatively.

8. **Engage in micro-movements:** Micro-movements are small movements of the body, such as those we make when we're working at a standing desk; they help keep us [alert and engaged](#).
9. **Play with fidget objects:** Keeping a variety of objects to manipulate on your desk [can help](#) sharpen your focus, improve your mood, and increase your creativity. Different kinds of objects may generate usefully different mental states.
10. **Sweat before you sit:** Trying taking a "[movement break](#)" instead of a coffee break; engaging in brisk physical activity just before you sit down to think will boost your [mental acuity](#).
11. **Achieve a state of "hypofrontality":** Very vigorous and sustained exercise temporarily inhibits the activity of the prefrontal cortex, the brain's taskmaster and critic—allowing [more creative](#) and original ideas to emerge.
12. **Act out the abstract:** In order to commit knowledge more firmly to memory, find a way to act it out with whole-body movements. Research on the "[enactment effect](#)" shows that we remember what we *do* much better than what we read or hear.
13. **Teach to the body:** When learning about abstract concepts (say, "vector" or "torque" in physics), provide the body with a [physical experience](#) of the concept that can be drawn

upon when thinking about it later. The brain apprehends the abstract much more readily when it is “grounded” in bodily experience.

14. **Move as if *you are it*:** In order to understand an entity from the inside, or to make discoveries about that entity, try [embodying it](#)—moving as if you *are* the thing you are learning and thinking about.

15. **Enact a metaphor:** Stimulate your imagination by acting out the motions implied in [metaphorical phrases](#) like “thinking outside the box” and “on the one hand . . . on the other hand.” Such “metaphorical movements” help prod the brain into the state of mind the metaphor describes.

Thinking with Gesture

Gesture isn’t mere hand-waving; it’s an essential part of a cognitive loop in which our hand motions influence our thoughts and vice versa. Becoming more aware of gesture, and using it more intentionally, can help us think more cogently, speak more fluently, and understand others more deeply.

16. **Rehearse your gestures:** Plan for and practice the gestures you will make in a presentation just as you would rehearse the words you intend to say. [Be sure](#) to include both *beat* gestures (motions that convey emphasis) and *symbolic* gestures (motions that capture meaning).

17. **Explicitly encourage gesture:** When instructing a child or a student, or helping a friend or a colleague brainstorm, offer [a suggestion](#): “Could you try moving your hands as you say that?”

18. **Choose gesture-heavy videos:** When selecting instructional videos to watch, [choose those](#) in which the instructor’s hands are visible and mobile.

19. **Include your hands in the conversation:** When you're on a Zoom call, or teaching via video, make sure that your viewers can see your hands. Using your hands to gesture will make [your own speech](#) more fluent, and will help your audience remember what you say.
20. **Listen to gesture:** Pay close attention to the hand motions of learners, especially at moments when what their hands are "saying" is different from the message conveyed by their words. This mismatched state indicates they are [ready to learn](#) and receptive to instruction.
21. **Supply "visual artifacts":** People are more likely to gesture (and in so doing acquire a deeper understanding) when there are [relevant objects](#) nearby to gesture *at*.
22. **Put yourself on the spot:** Improvising a description or an explanation is hard mental work, so [we offload](#) some of it onto our hands. The increased rate of gesture prompted by the act of improvisation can help us develop a deeper understanding of the material we're talking about.
23. **Promote spatial play:** Play with spatially-oriented toys and games leads children to [gesture more](#); girls, in particular, benefit from increased opportunities to engage in gesture during play.
24. **For every word, a gesture:** Pair each new vocabulary word to be learned with a gesture in order to [reinforce memory](#). When you add a hand motion to the actions of reading or speaking aloud a word, you're sinking another "hook" into the material that will allow you to reel it in later.
25. **Let your hands share the burden:** Allow your hand gestures to "hold" some of your [mental contents](#), thereby lightening your cognitive load.

Over eons of evolution, our perceptual faculties were “tuned” to the kind of sensory information present in nature. While spending time in built interiors and urban settings *drains* our attentional resources, spending time outside refills the tank, restoring our ability to focus.

26. Apply “environmental self-regulation”: Instead of trying to get a grip on your thoughts and feelings from the inside, use exposure to the [outside world](#)—especially nature—to restore your equilibrium and refresh your attention.

27. Practice “soft gazing”: When in nature, allow yourself to relinquish the sharp-edged focus that is required by school and work. Let your gaze become [relaxed and diffuse](#), drawn here and there by whatever attracts it.

28. Engage in “open monitoring”: When in nature, respond to everything you experience with an attitude of [non-judgmental acceptance](#). This mode will give a rest to the areas of your brain responsible for maintaining “executive function,” restoring them to full strength for when you return to school or work.

29. Follow an “awareness plan”: If you prefer a more structured experience, you can approach your time outside with an “awareness plan”: a [set of exercises](#) to be carried out while you are experiencing a natural setting. For example, you might imagine that you are an artist looking for inspiration for a painting, or you might look around and find a metaphor that captures your current life situation.

30. Take an “awe walk”: Spend time outdoors, allowing yourself to wonder at and be moved by nature’s majesty. Psychologists have found that awe can act as a “reset button” for the human brain, shaking us loose from old patterns and opening us up to [new possibilities](#).

31. **Activate the “three-day effect”:** Plan for an [extended exposure](#) to nature, ideally at least three days in length. Research has demonstrated that such sustained time in nature leads to an increase in creative thinking.
32. **Seek out “micro-restorative opportunities”:** Research shows that looking at a scene of natural greenery—even through a window—for as little as [40 seconds offers](#) mental benefits, including improved concentration.
33. **Bring nature inside:** Natural light, potted plants, and even images and motifs borrowed from nature help us enter a state of [relaxed alertness](#). In addition, try this: During a break from working or learning, try watching a [nature video](#) instead of turning to the news or to social media.
34. **Meditate outdoors:** Many beginning meditators find it hard to focus on their breath and to avoid getting caught up in their thoughts. Research shows that meditating outdoors requires less effort and is [easier to sustain](#).

Thinking with Built Spaces

We spend more than 90 percent of our time indoors, yet many of the spaces we occupy are not well-designed for extending the mind. We can take intentional steps to rearrange our working, learning, and living spaces so that they support intelligent thought.

35. **Implement “sensory reduction”:** Reduce the amount of environmental stimuli your brain has to attend to by doing your thinking inside a quiet, enclosed space—or even by closing your eyes. Imposing such [sensory reduction](#) generates a state of “stimuli hunger”, in which weakly-activated internal knowledge (barely-remembered facts, elusive imaginative notions) becomes more readily accessible.

- 36. Listen to instrumental music:** Music can stimulate and energize us as we work; however, [listening to music](#) with lyrics forces our brains to devote some measure of mental bandwidth to processing the lyrics' semantic content. Instrumental music offers the best of both worlds.
- 37. Secure a room of your own:** Thinking, learning, and working in a space over which you feel [ownership and control](#) gives you a feeling of empowerment, which in turn increases productivity and creativity. Tip: When negotiating, try if at all possible to do it in your own space; research shows that people negotiating on their [home turf](#) claim significantly more value than visitors.
- 38. Give yourself some privacy:** Shielding yourself from the [gaze of others](#) reduces cognitive load and encourages experimentation. Feeling “on display” all the time consumes [mental bandwidth](#) that could otherwise be applied to thinking.
- 39. Fill your space with “evocative objects”:** Visual reminders of identity—[who you are](#), and what you're doing in that space—can put you in an optimal frame of mind for thinking. Objects representing your deepest values and ideals may be especially effective when hidden from others and visible [only to you](#).
- 40. Appoint your space with cues of belonging:** Inspect your work or learning space for cues that signal exclusion; these should be removed and replaced with cues that [signal belonging](#). People think and work best in a space in which they feel that they are welcomed and included.
- 41. Ensure that online “spaces” convey belonging:** Websites, digital communications, and online platforms all carry messages about who belongs and who doesn't. Make sure these messages [extend a welcome](#) to all who encounter them.

42. **Seek out spaces that are rich in “signification”:** The modern world is full of generic, characterless spaces, incapable of inspiring interesting thoughts. Try to spend time in spaces that are [richly endowed](#) with mentally-stimulating features.

Thinking with the Space of Ideas

We all tend to do too much “in our heads.” We think more effectively and more efficiently when we find ways to offload our mental contents onto physical space—whether it be the space whiteboard, a physical model, or a bunch of Post-It Notes. We can then interact with our ideas as if they were physical objects or a 3-D landscape, applying the spatial and navigational capacities that come so naturally to human beings.

43. **Build a “memory palace”:** A memory palace is a mental exercise of association that draws on humans’ powerful [spatial memory capacity](#) in the service of remembering important information. To construct one, connect each item of information you must remember to a location along a well-practiced route you call up in your mind.

44. **Create a “concept map”:** The brain treats abstract ideas [like a landscape](#) through which it must navigate. A [concept map](#) makes this mental terrain visible, allowing us to recognize patterns and make new connections.

45. **Enlarge your digital display:** Invest in a larger computer screen, or set up multiple monitors, in order to make the most of your powerful faculties of [physical navigation](#). These embodied resources are wasted when we scroll and zoom on a small screen.

46. **Write it down:** Our culture values “doing things in your head,” but research shows that writing down your thoughts [carries benefits](#) for memory, problem-solving, and creativity. Try keeping a [field notebook](#), for example, in which you regularly record and review your observations.

47. **Sketch it out:** Drawing the concept you're thinking about has benefits above and beyond writing about it in words. It doesn't matter if you "can't draw"—simply attempting to capture a concept in [visual terms](#) will deepen your understanding and reinforce your memory.
48. **Create a “conversation” between eye and hand:** We're used to assuming that the brain formulates a plan and then tells the hand how to execute it. Artists, designers, and architects know that a more fruitful approach is to allow the actions of the hand to inform the brain in a [back-and-forth exchange](#).
49. **Make it physical:** The human brain evolved to manipulate physical objects, not to contemplate abstract ideas. Whenever possible, create a concrete model or representation of the concept you're thinking about, and then use your whole body to [interact with it](#)—moving around it so that you see it from different perspectives, manipulating its elements and trying out new combinations.

Thinking with Experts

Our systems of academic education and workplace training are based on experts teaching novices—but experts often fail to convey all that they know, because their knowledge is so well-practiced as to become “automatized.” Research is revealing more effective ways of transferring expertise from one mind to another.

50. **Engage in a “cognitive apprenticeship”:** Apprenticeships are a time-tested way to learn—but most work these days is knowledge work, meaning that instructors and managers must endeavor to [make visible](#) the processes that are occurring *inside* their heads, instead of out in the world, as an old-fashioned tailor or blacksmith could do.

51. **Choose a model to imitate:** Our culture values innovation and originality, but often the most efficient and effective approach to [solving a problem](#) is to copy what someone else has already done.
52. **Crack the “correspondence problem”:** The challenge of intelligent imitation involves solving what psychologists call the [correspondence problem](#): adapting an existing solution to a new situation. Researchers have identified the three steps required to do so successfully.
53. **Encourage close observation:** Children in other cultures commonly learn by observing and imitating their elders. Research has found that American children are not so adept at this practice—but that these capacities can be [deliberately cultivated](#).
54. **Exhibit model work:** We expect students and employees to produce excellent work without first showing them [what excellence looks like](#). Displaying model examples need not threaten people’s self-esteem or quash their creativity; it can inspire them to do their own best work.
55. **Re-enact being a novice:** In order to make their expert knowledge more accessible to beginners, instructors and managers can try turning themselves into [novices again](#)—for example, by deliberately making a well-practiced task more difficult, thereby re-exposing themselves to the struggles of a novice.
56. **Break it down:** Experts tend to organize their knowledge into “chunks”—agglomerated masses of information that can seem impenetrable to novices. They can help learners begin to acquire mastery by [breaking down](#) their knowledge into smaller steps, and then smaller steps still—even “micro-steps.”
57. **Employ the “caricature advantage”:** For an expert, the most important aspects of a given scenario “pop out” at first glance. For novices, that same scenario is an

undifferentiated mass of information. Experts can help by deliberately [exaggerating and distorting](#)—caricaturing—the aspects of a scenario that they want novices to notice.

- 58. Ensure that categories convey useful information:** Experts classify objects and information according to their [deep function](#): what they do, what they're good for. Novices are prone to be distracted by mere surface aspects. Experts can help by supplying meaningful categories: for example, classifying wines by the type of food they should accompany, rather than by grape or region.

Thinking with Peers

Our notion of how to engage in challenging work or learning usually involves sitting alone and thinking hard—but in fact we think best when we think *socially*. Social activities we engage in with peers, like storytelling, debating, and teaching, activate cognitive processes that remain dormant when we think by ourselves.

- 59. Take advantage of the “protégé effect”:** The act of [teaching someone else](#) leads the *teacher* to learn—even more than the student. As highly social creatures, we're more motivated by the goal of conveying information to others than by the goal of simply studying for its own sake. Even struggling learners can benefit, by teaching younger students or by teaching their family members.

- 60. Create an instructional video:** Teaching-for-learning can produce benefits for the teacher even when there are no “students” present. [Recording a video](#) generates feelings of “social presence”—the feeling that others are watching—leading many of the same factors involved in face-to-face teaching to kick in.

61. **Promote “productive agency”**: Create opportunities for student-teachers to enjoy the [fruits of their labors](#): it’s motivating for people to see their pupils exhibiting and applying the knowledge they have been taught.
62. **Set up a “cascading mentorship”**: A senior group can teach a more junior group, who can in turn instruct a still-less-experienced group, thereby [multiplying the benefits](#) of teaching-to-learn.
63. **Start an argument**: We are all susceptible to the “confirmation bias,” in which we look for evidence that confirms what we already believe. However, this apparently unavoidable bias may actually be the product of reasoning *alone*. Research shows we’re capable of circumventing it when we [engage in a debate](#) with another person. Humans are blind to the flaws in their own arguments, but skilled at picking apart the arguments of others.
64. **Try to have “strong opinions, weakly held”**: Debates tend to generate the most accurate and constructive outcomes when those participating make a strong case for their point of view while [remaining open](#) to others’ perspectives.
65. **Find the underlying dispute**: Much of what we learn in educational and professional settings is boring and forgettable because it’s been drained of all conflict, presented as settled wisdom. But almost every topic can be reinvigorated by casting it in terms of a [“constructive controversy.”](#)
66. **Generate “the accountability effect”**: When people know they will have to [defend their point of view](#) against the critiques of others, they prepare more assiduously, gathering more supporting information and constructing stronger arguments.
67. **Externalize the argument in your head**: Rather than refereeing an internal debate, hold the debate out loud, with a real person [representing each position](#). Distributing points of view in this fashion will relieve you of cognitive load, allowing you to evaluate the points being made on their merits.

68. Tell a story: Whenever possible, put directions and instructions in the form of a story.

Stories are full of the tacit information—about *how* and *when* to do something—that allows listeners to actually [apply the knowledge](#) they hear about. Moreover, stories are “[psychologically privileged](#)” by the human brain: we listen to them more attentively, understand them more thoroughly, and remember them more accurately than other kinds of information.

69. Make space and time for stories: Students and employees will naturally [swap useful stories](#) if given the opportunity to do so.

Thinking with Groups

The days of the lone genius are over; in our era, the sheer abundance of information and the increasing specialization of knowledge mean that we have to trade our habits of individual thinking for new practices that activate the powerful “group mind.”

70. Move in sync: Engaging in [coordinated physical movement](#) with others will lead you to like them more, identify with them more closely, and cooperate with them more effectively. This could even take the form of a shared stroll: Research shows that when people walk together, they automatically and unconsciously [match up](#) their bodily movements.

71. Induce a shared emotional experience: Feeling an [intense emotion together](#)—excitement, hope, even fear (think of an audience watching a horror movie)—bonds people together and allows them to work together more cooperatively.

72. Engage in shared rituals: Ritual activities in which people do the same thing at the same time—even if it’s simply sharing a meal together—promote a sense of belonging

and [mutual trust](#). (Try to ensure that the meal is served [family style](#), and that the menu includes [spicy foods](#).)

73. **Get everyone talking:** In order to benefit from the insight and knowledge of everyone on the team, carefully [structure group communication](#): ask the least-senior people to speak first, for example, or have everyone write out their comments before a meeting begins. Meanwhile, leaders can (at least initially) adopt an inquisitive and [“self-silencing”](#) stance.

74. **Leave “traces” of your thinking:** Group work is often frustrating because we fail to accommodate the transition from thinking inside our own heads to thinking as part of a group. People engaged in collective thinking need to [signpost their mental activity](#) for others.

75. **Acknowledge, repeat, rephrase, and elaborate:** Make sure everyone is on the same page by [following this formula](#) for communication.

76. **Create “shared artifacts”:** Group work is facilitated by the production of [such artifacts](#), which should be *large, complex, persistent, and revisable*. Bonus: when such artifacts are available, people tend to gesture at them—enhancing their own understanding and that of their team members.

77. **Build a “transactive memory system”:** A transactive memory system allows a team of people to have [access to the information](#) stored in their teammates’ heads, thereby multiplying their individual memory capacity. For such a system to operate smoothly, it’s necessary to clearly designate who is in charge of knowing what, and keep this shared mental “directory” up to date.

78. **Appoint a “meta-knowledge champion”:** If each teammate is the “knowledge champion” of her own area of expertise, the meta-knowledge champion is in charge of knowing [who knows what](#). This individual helps to ensure that questions and tasks are efficiently dispatched to the correct individual.

79. **Generate a sense of “shared fate”**: A sense of group motivation arises when the fates of each individual are bound up with one another—when they [rise or fall together](#). Adjust the incentives and rewards offered to group members such that the outcome, good or bad, is experienced the same way by all.

80. **Implement the “jigsaw classroom”**: This instructional technique, invented in the midst of the desegregation battles of the early 1970s, has been shown to increase [cooperation and teamwork](#) even as it boosts learning.