THE CONDITIONS OF DEEP LEARNING

MIRA Notebooks

NOTEBOOK 2 · HOW THE BRAIN LEARNS

MIRA and the Thinking Gap

Why the easy reward buries the hard one, and how to train the one muscle we have no spare of

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MIRA model

A student opens the book to study. Within two minutes, without quite deciding to, they have picked up their phone. It is not laziness or lack of willpower: it is that the phone offers, right now, a reward that studying promises three weeks from now. And the brain, when made to choose, almost always stays with the now. The problem is not that student. It is that no one has trained them in the muscle they would need in order to choose differently.

There is a silent crack in the way this generation thinks, and it is not because they are less capable. It is due to a very old brain mechanism that the digital environment has learnt to exploit with unprecedented precision. Understanding that mechanism — and understanding that what is at stake can be trained — is the basis of much of what MIRA proposes.

The easy reward buries the hard one

The human brain does not value all rewards equally: it discounts those that take time to arrive. The same reward is worth less the more distant it is — a phenomenon neuroscience calls *temporal discounting*. Fifty euros today feel more valuable than a hundred a year from now, even though the arithmetic says otherwise, because the future is perceived as abstract and uncertain.[1]

This mechanism made evolutionary sense: for almost all of our species' history, securing immediate food was wiser than planning a future that might never come. The problem is that the world changed far faster than the brain. Today we are still wired for the short term in an environment where almost everything that matters — learning, creating, building a life — demands sustaining effort for months or years with no immediate reward.

And here comes the decisive part. Dopamine, the chemical messenger associated with pleasure and reward, surges with quick, easy gratifications. The brain learns a simple lesson: *this is easy, repeat it*.[2] Digital platforms are designed precisely to trigger that spring: notifications, messages, infinite scrolling — a constant drip of small immediate rewards that the brain chases.[3]

> *Every time the easy, immediate reward is chosen, the hard, distant reward loses a little of its appeal. Not because it is worth less, but because the brain has grown used to not waiting for it. Short-term satisfaction, repeated a thousand times, buries the long-term reward.*

That is the thinking gap: not a deficit of intelligence, but an installed habit of preferring the immediate, which gradually leaves untrained the capacity to sustain effort towards distant goals. And a brain that does not train that capacity loses it — literally.

A single muscle, with no spare

The body has redundancy. There are many muscles, two lungs, two kidneys; if one fails or weakens, others partly compensate. Thinking does not. We depend on a single organ to reason, remember, plan, imagine and decide. There is no second, reserve brain. That is why whatever happens to that single tool — whether it strengthens or atrophies — affects us completely and with no alternative.

And the brain behaves, in a very real sense, like a muscle. Neuroscience has summed it up in a phrase that is now an established principle: *use it or lose it*.[4] The connections between neurons that are used often are reinforced; those that are not used weaken and end up being eliminated in a process called synaptic pruning. The brain, seeking efficiency, removes what is not exercised.

This means that thinking capacities are not a fixed gift one is born with and keeps forever. They are neural pathways that strengthen with use and weaken with disuse — just as a muscle develops with exercise and atrophies with rest.[5] Sustained concentration, the patience for a hard problem, the ability to follow a long argument: all of that is trained. And all of that is lost if it is systematically replaced by the easy reward of the screen.

> *If thinking depends on a single muscle with no spare, training it is not an extracurricular activity: it is the central task of education. A brain always given the easy path does not stay the same — it weakens.*

The good news: what atrophies can be retrained

The same mechanism that explains the problem contains the solution. If thinking capacities weaken with disuse, they are also rebuilt with deliberate use. The brain is plastic throughout life: it reorganises according to what it devotes sustained attention to. What is practised with effort is reinforced structurally.

Even self-control — the capacity to postpone reward, to choose the hard reward over the easy one — works like a muscle: it can be temporarily depleted, but constant practice reconfigures the neural pathways and makes delaying gratification easier over time.[6] It is not a matter of heroic willpower, but of repeated training. What today demands an enormous effort costs a little less tomorrow.

How MIRA trains that muscle: Resilience and Metacognition

This is where the diagnosis becomes a proposal. Two of MIRA's four conditions are, exactly, the training of the muscle that immediacy atrophies.

Resilience trains tolerance for sustained effort. When the model sets a problem that is not solved on the first attempt, a project lasting weeks, an error to be corrected rather than abandoned, it is asking the student for the very opposite of the screen: to keep up the effort when the reward has not yet arrived. Every time a student perseveres in a difficulty instead of seeking immediate relief, they are strengthening the neural pathway that digital immediacy weakens. It is repetition that rebuilds the muscle.

Metacognition trains thinking about one's own thinking. Stopping to plan before acting, monitoring the process while working, reviewing what has been done and learning from error — all of that is the opposite of the immediate, automatic reaction that the digital environment rewards. Metacognition forces the brain to use, again and again, the prefrontal cortex: the seat of deliberate reasoning, planning and impulse control, which is precisely the region the easy reward leaves out of work.

And the two work together, in what the model calls the breathing of learning: Resilience keeps the calm that allows one to go on thinking in the face of difficulty, and Metacognition offers the strategy that reduces frustration. That loop, repeated throughout schooling, is the training programme for the muscle of thinking — the one that rebuilds, effort by effort, what immediate satisfaction erodes.

In summary

The thinking gap is not a problem of capacity, but of training. The brain is wired to prefer the easy, immediate reward, and the digital environment exploits that wiring until it buries the capacity to pursue distant rewards. But thinking depends on a single muscle with no spare, which obeys a simple law: it strengthens with use and atrophies with disuse. The school cannot delegate that training. MIRA takes it on explicitly: Resilience and Metacognition are the exercises that rebuild, day by day, the capacity to think that this generation risks never fully developing.

Notes

1. On temporal/delay discounting: the brain systematically devalues rewards that are delayed in time, preferring smaller, immediate rewards over larger, deferred ones. The relationship is well described by a hyperbolic function and is located in the ventral striatum and the medial prefrontal cortex.
2. Dopamine is the neurotransmitter most associated with pleasure and reward; quick, low-effort gratifications produce surges the brain tends to repeat. High stress reduces prefrontal cortex activity and increases impulsive behaviour.
3. The persuasive design of digital platforms — notifications, messaging, infinite scrolling — is documented as a deliberate trigger of temporal-discounting tendencies: a drip of immediate rewards that makes it hard to put the device down.
4. 'Use it or lose it' is one of the established principles of neuroplasticity (Kleim & Jones): neural pathways that are not exercised weaken and may be eliminated through synaptic pruning, in an atrophy analogous to that of muscle.
5. Neuroplasticity: the brain reorganises structurally throughout life according to use. 'Cells that fire together, wire together': repeated activation strengthens connections; disuse prunes them. The efficiency of change decreases with age, but the capacity remains.
6. Research from the American Psychological Association describes self-control as a resource that works like a muscle: it can be temporarily depleted,

but constant practice reconfigures the neural pathways and makes postponing reward easier over time.