

Old schooled: You never stop learning like a child By David Robson

New Scientist #2918, 23 May 2013

The adult brain is far more malleable than we thought, and so learning can be child's play if you know how.

Some 36-year-olds choose to collect vintage wine, vinyl records or sports memorabilia. For Richard Simcott, it is languages. His itch to learn has led him to study more than 30 foreign tongues – and he's not ready to give up.

During our conversation in a London restaurant, he reels off sentences in Spanish, Turkish and Icelandic as easily as I can name the pizza and pasta on our menu. He has learned Dutch on the streets of Rotterdam, Czech in Prague and Polish during a house share with some architects. At home, he talks to his wife in fluent Macedonian.

What's remarkable about Simcott isn't just the number and diversity of languages he has mastered. It's his age. Long before grey hairs appear and waistlines expand, the mind's cogs are meant to seize up, making it difficult to pick up any new skill, be it a language, the flute, or archery. Even if Simcott had primed his mind for new languages while at school, he should have faced a steep decline in his abilities as the years went by – yet he still devours unfamiliar grammars and strange vocabularies to a high level. "My linguistic landscape is always changing," he says. "If you're school-aged, or middle-aged – I don't think there's a big difference."

A decade ago, few neuroscientists would have agreed that adults can rival the learning talents of children. But we needn't be so defeatist. The mature brain, it turns out, is more supple than anyone thought. "The idea that there's a critical period for learning in childhood is overrated," says Gary Marcus, a psychologist at New York University. What's more, we now understand the best techniques to accelerate knowledge and skill acquisition in adults, so can perhaps unveil a few tricks of the trade of super-learners like Simcott. Whatever you want to learn, it's never too late to charge those grey cells.

The idea that the mind fossilises as it ages is culturally entrenched. The phrase "an old dog will learn no tricks" is recorded in an 18th century book of proverbs and is probably hundreds of years older.

When researchers finally began to investigate the adult brain's malleability in the 1960s, their results appeared to agree with the saying. Most insights came indirectly from studies of perception, which suggested that an individual's visual abilities were capped at a young age. For example, restricting young animals' vision for a few weeks after birth means they will never manage to see normally. The same is true for people born with cataracts or a lazy eye – repair too late, and the brain fails to use the eye properly for life. "For a very long time, it seemed that those constraints were set in stone after that critical period," says Daphne Bavelier at the University of Rochester, New York.

These are extreme circumstances, of course, but the evidence suggested that the same neural fossilisation would stifle other kinds of learning. Many of the studies looked at language development – particularly in families of immigrants. While the children picked up new tongues with ease, their parents were still stuttering broken sentences. But if there is a critical period for foreign language learning, everyone should be affected equally; Simcott's ability to master a host of languages should be as impossible as a dog playing the piano.

Bearing this in mind, Ellen Bialystok at York University in Toronto, Canada, recently turned to the US census records, which detailed the linguistic skills of more than 2 million Hispanic and Chinese immigrants. A "critical period" for learning a second language in infancy should have created a sharp difference between those who had moved country in early childhood and those who were uprooted in adolescence. In reality? "There was absolutely no discontinuity," Bialystok says.

Instead, she saw a very gradual decline with age among immigrants – which could reflect differences in environment as much as the adults' rusty brain circuits. "People talk more slowly and clearly to children in short, simple sentences," she says. "And the child's entire social and educational network is organised around that language."

Yet while Bialystok's study suggested that adult brains are more pliable than had once been imagined, there was still the suspicion that children might have the edge in certain skills. Adult learners sometimes find it harder to learn to sing in tune, hit a home run or mimic an accent convincingly. At first glance, the problem might seem to lie in adults' perception and motor skills. Learning involving these abilities differs from the acquisition of factual knowledge, because it needs us to rewire the eyes, ears and muscles.

It's something that Marcus can identify with. At the age of 38, he devoted himself to learning the guitar, an experience he detailed in his book *Guitar Zero*. "My family's initial response was laughter – but they soon saw I was making progress," he says. Still, during his research, he attended a musical summer camp for 8 to 15-year-olds. He says he was quicker to catch on to the structure of songs, but his younger bandmates had better coordination and sense of pitch.

Yet the available evidence hints that children may not always be inherently better at such tasks. One study by Yang Zhang at the University of Minnesota in Minneapolis that focused on the acquisition of foreign accents in adults suggests we may simply be suffering from poor tuition. When the researchers gave them recordings that mimicked the exaggerated baby talk of cooing mothers, the adult learners progressed rapidly.

Nor do adults necessarily fumble over the intricate movements that are crucial for music or sport. When volunteers visiting Virginia Penhune's lab at Concordia University in Montreal, Canada, learned to press keys in a certain sequence, at certain times – essentially a boiled-down version of keyboard practice – the adults tended to outshine the younger volunteers.

During a more challenging test of hand-eye coordination, nearly 1000 volunteers of all age groups learned to juggle over a series of six training sessions. As you might expect, the senior citizens aged 60 to 80 began with some hesitation, but they soon caught up with the 30-year-olds and by the end of the trials all the adults were juggling more confidently than the 5 to 10-year-olds.

Old dogs, then, are much more adaptable than folklore would have it – and if we do have deficits, they aren't insurmountable. The reason that children appear to be better learners may have more to do with their environment, and factors such as physical fitness (see "Faster body, faster mind").

Indeed, many researchers believe that an adult's lifestyle may be the biggest obstacle. "A child's sole occupation is learning to speak and move around," says Ed Cooke, a cognitive scientist who has won many memory contests. "If an adult had that kind of time to spend on attentive learning, I'd be very disappointed if they didn't do a good job."

A glut of free time and a carefree existence are out of reach for most of us, but there are other behaviours that boost children's learning, and these habits can be easily integrated into even an adult's schedule. For example, children are continually quizzed on what they know – and for good reason: countless studies have shown that testing doubles long-term recall, outperforming all other memory tactics. Yet most adults attempting to learn new skills will rely more on self-testing which, let's be honest, happens less often.

That's why Cooke developed a website, called *Memrise*, which helps take some of the pain out of testing and, crucially, can integrate learning into the adult day. It is designed to track your learning curve with cunningly timed tests that force you to retrieve the information just as you are about to forget it.

Memrise engages your brain to the greatest possible extent," says Cooke, who has himself used the site to learn thousands of words of foreign vocabulary. Users can create their own courses – the topics range from art to zoology – and importantly, it is easy to load the site in the few spare minutes of your lunch break or while you are waiting for a train. Cooke also plans to launch a smartphone app.

What about tasks that involve perceptual learning or motor skills – like battling against a lifetime of tone deafness, or perfecting that golf swing? Here too, there are guiding principles that can help you rediscover the seemingly effortless learning of youth.

Adults can hamper progress with their own perfectionism: whereas children throw themselves into tasks, adults often agonise over the mechanics of the movements, trying to conceptualise exactly what is required. This could be one of our biggest downfalls. "Adults think so much more about what they are doing," says Gabriele Wulf at the University of Nevada, Las Vegas. "Children just copy what they see."

Wulf's work over the past decade shows that you should focus on the outcome of your actions rather than the intricacies of the movements. She applies this finding in her own life: as a keen golfer, she has found it is better to think about the swing of the club, for instance, rather than the position of her hands. "I'm always trying to find where best to focus my attention," she says. Similarly, if you are learning to sing, then you should concentrate on the tone of the voice, rather than on the larynx or the placement of the tongue. Study after study shows that simply shifting your mindset in this way accelerates your learning– perhaps by encouraging the subconscious, automatic movements that mark proficiency.

Misplaced conscientiousness may also lead adults to rely on overly rigid practice regimes that stifle long-term learning. The adult talent for perseverance, it seems, is not always a virtue. Left to their own devices, most people segment their sessions into separate blocks – when learning basketball, for instance, they may work on each shot in turn, perhaps because they feel a desire to master it. The approach may bring rapid improvements at first, but a host of studies have found that the refined technique is soon forgotten.

Instead, you do better to take a carousel approach, quickly rotating through the different skills to be practised without lingering too long on each one. Although the reason is still unclear, it seems that jumping between skills makes your mind work a little harder when applying what you've learned, helping you to retain the knowledge in the long term – a finding that has helped people improve in activities ranging from tennis and kayaking to pistol shooting.

Such an approach might not be to everyone's taste – with intricate skills, it might feel like you are making no progress. But even if you do revert to stints of lengthy practice, you can still reap some of the same benefits by occasionally trying out your skills in an unfamiliar situation. In tennis, you might move to a different part of the court for a couple of serves before returning to the regular position; while playing scales on a musical instrument, you might switch hands temporarily. According to work by Arnaud Boutin at the Leibniz Research Centre for Working Environment and Human Factors in Dortmund, Germany, venturing out of your comfort zone in this way helps to ensure that you improve your overall performance rather than confining your progress to the single task at hand. "Otherwise, the longer you practise, the harder it becomes to transfer the skills that you've learned to new situations," says Boutin.

If none of that helps you learn like a child, simply adopting the arrogance of youth may do no harm. "As we get older, we lose our confidence, and I'm convinced that has a big impact on performance," says Wulf. To test the assumption, she recently trained a small group of people to pitch a ball. While half were given no encouragement, she offered the others a sham test, rigged to demonstrate that their abilities were above average. They learned to pitch on target with much greater accuracy than those who didn't get an ego boost.

Whether your itch to learn will ever match Simcott's appetite for foreign languages is another matter. "What I do – it's like an extreme sport. There's no need to learn that many languages," he says. He has recently turned to Chinese, and has no plans to stop after that. "I'm like a linguistic butterfly. There's always another, really far away, that suddenly feels appealing." Still, embrace the idea that your mind is as capable as Simcott's, and the lure of extreme learning might take hold of you too.

Faster body, faster mind

The key to a spry mind in old age may be as simple as a walk in the park.

Over the past few years, it has become clear that poor physical fitness – including factors such as obesity and cardiovascular health – can be as damaging to our brains as they are to our sex appeal, reducing the long-distance connections between neurons and shrinking the hippocampus, which is involved in learning and memory. For this reason, the general decline in health as we age may also contribute to the gradual decrease in mental skills – including our capacity to learn new skills, fuelling the idea that you can't teach an old dog new tricks (see main story).

Thankfully, the changes are reversible, according to Arthur Kramer, who has worked with senior citizens in his lab at the University of Illinois at Urbana-Champaign. Typically, the studies demanded a mild exercise regime, asking volunteers to walk for 40-minute periods, 3 days a week for a year, for example. "I wouldn't say these old folks would win any races, but they could certainly go further and faster by the end," he says.

Imaging their brains before and after training, he found that hippocampi had expanded, perhaps through the growth of new brain cells or an increase in synaptic connections between neurons. Just as importantly, much of the long-distance communication across the brain was restored to its former glory. "The senior citizens' connectivity was equivalent to a 30-year-old's," says Kramer. The result is a general cognitive boost, including improved attention, which should aid learning of any new skill.