

Mastering the mind

Toronto researcher has changed the scientific world's understanding of how memory works But experimental psychologist Endel Tulving wears honours lightly, Barbara Turnbull writes [ONT Edition]

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Author: Barbara Turnbull
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Toronto researcher Endel Tulving says his memory is getting worse year by year.

That's not surprising. After all, he is 79.

But if studying memory could ward off the natural neurological impairment that comes with age, Tulving would never forget a thing.

The Estonian-born immigrant was named an Officer of the Order of Canada in July for his contributions to memory research, with seminal discoveries dotting an academic journey he began in the 1950s at the University of Toronto studying psychology.

Now at Baycrest's Rotman Research Institute, Tulving has not yet finished that career.

An award as august as Canada's highest honour is by no means a first for Tulving. According to his boss, Rotman's director Don Stuss, "He's won every prize but the Nobel."

The list of Tulving's academic positions, fellowships, royal society memberships and awards of achievement - including a Gairdner International Award last year - reads impossibly long.

Tulving seems humble to a fault, insisting by email and in person that he is uninteresting and unworthy of a profile in a newspaper. But one conversation shows another side.

Start talking about his body of work and he'll admit to being "smugly satisfied with it." But he quickly adds, "I could not have said anything as silly as that if it weren't for the many other people in my field who agree with me."

That point is indisputable.

"He is a major figure in experimental psychology, arguably the most major figure internationally in memory at the present time," says Fergus Craik, a fellow Rotman researcher and former head of U of T's psychology department. "He was very much instrumental in bringing memory and the study of memory into prominence."

That's not bad for someone who chose the area because he lacked access to the technology needed to continue the vision research he did at Harvard for his PhD in 1957.

Memory work didn't require special resources. All Tulving had to use were cards and other objects that subjects were asked to remember.

"I wanted to improve what we know - to research with real people out there in the world," he says.

That meant first learning how to study people - how we think, how we perceive and, ultimately for him, how we remember.

Little was known about how memory functions when Tulving's first breakthrough came in 1956, with the publication of his paper explaining why repetition helps memory. While the notion of repetition seems self-evident, it turns out that how the repetitions are spaced apart is crucial - the farther apart, the better. One repetition a day for six days is better than one repetition an hour for six hours.

Tulving has an unmistakably professorial air. He would be imposing, were it not for his kind manner. He makes his points with a dry wit that must have been a welcome addition to his lectures during his teaching years.

The son of a judge, he went to a private boys' school - always scoring top of his class, but not wildly enthusiastic about the curriculum. He was more interested in athletics than academics, excelling in both winter and summer sports, most notably track and field. Summers were spent at the family farm, where he built a primitive workout space and worked on running 100 metres in less than 12 seconds.

Science was no draw in Tulving's teen years. He thought everything was already known about subjects like physics,

chemistry and botany. His interests were more philosophical, leading him to wonder about things like time, when it began and what was there before it existed.

"I was a great reader," he says. "I loved books - all fiction, the more imaginative the better. True life stories, they were boring. Now I realize how uneducated I was."

Then came World War II. Aside from scarce rations, Estonians fared well until 1944, when Russia invaded.

The family had a plan to flee together but, in the chaos, Tulving, who was then 17, and his younger brother were separated from their parents. He and his brother made it to Germany. His parents' escape was thwarted by a storm. By the time it abated, Russian soldiers had taken over.

Tulving would not see his parents for more than 22 years. For 14 of those years, he and his brother did not know their parents were alive. The parents thought the two boys were dead, having been told that witnesses saw them fatally shot.

Until Joseph Stalin died in 1953, it was too risky to try contacting anyone in Estonia, Tulving says.

"I did not know where to write. I did know our old home had burned down, because the whole town was burned down."

With the war over, Tulving had one year left of high school, which he finished in Germany while doing various jobs. He discovered psychology during that year. For the next two years, he polished his English and worked as a translator and tutor.

He met his future wife Ruth when he tutored her in mathematics. They were engaged before he left for Canada in 1949 and she came the following year.

Canada was looking for workers and hopeful immigrants had to sign contracts agreeing to perform manual labour for one year. Tulving was to be a railroad worker, putting in 10 hours a day, six days a week, for \$36 a week - a princely sum to which he readily agreed. But on the boat over, he was told there were no more railroad jobs and he would have to work as a farm hand, earning \$45 a month.

Shortly after arriving, Tulving was accepted at Dartmouth College on full scholarship. He couldn't leave Canada but, impressed with his obvious intelligence, the farmer he was working for released him after two months, letting him pursue an education at U of T.

Endel and Ruth married and had two daughters. Elo, the first of two daughters Elo who is now a lawyer, and Linda, a doctor. The Tulvings have five grandchildren. "For the first five years of our marriage, we didn't have enough money to go have a meal in a restaurant," Tulving recalls. "But the nice thing was that we didn't feel poor or underprivileged. We were so happy that we had found a home in a free country."

The budding scientist made fast friends. After Elo's birth, he was presented with a package from his university colleagues containing a pink baby's sweater, surrounded by \$1 bills. He found the gesture overwhelming.

"When did I feel at home (in Canada)? If I had to put a date to it, I might say that date."

Tulving eventually connected with his parents, who came to live with him in Toronto in 1966. They stayed four years, then went back to Estonia and lived into their early 80s. Tulving and his wife bought an apartment in the capital city of Tallinn, where they frequently visit.

As his family was growing, Tulving was growing as a scientist. His initial work on memory focused on organization, or how the brain processes and stores information for future recall.

"One of the hallmarks of good memory is that it is organized, Craik says of Tulving's work. "He looked at how we can measure organization and what does it mean."

Tulving used a method called free recall learning, in which subjects were given a list of words and asked to recall them in any order. In repeating the exercise with the same list of words in different orders, subjects typically started to form associations, grouping the words according to how he or she organized them. The more effectively a person organized, the more words were recalled.

"That work remains highly influential. It's part of the classic core of memory theory still today," Craik says.

Tulving then established that we have different memory systems, identifying episodic (experience-based) and semantic (knowledge-based) memory, the particular characteristics of those systems and how they relate to each other.

An episodic memory is self-centred, recalling details of your last meal consumed or remembering things that happened to you on your last vacation. Semantic memory is general knowledge, like the fact that snow is white and cold.

After retiring from the University of Toronto in the early 1990s and starting at the Rotman, Tulving clarified how memory actually works in the brain, with technological breakthroughs in imaging that made the work possible.

"Relating what we know about the behaviour of memory to the underlying neural structures is not at all obvious," Craik says. "That's real science."

Although Tulving's era of experimentation is over, he shrugs off the notion of retirement.

"I have been retired most of my life," he says. "That means most of the time I have been doing what I wanted to do."

He follows current publications, making sense of today's research and writing about it.

"There are so many researchers around, so much information is being produced, that I think there ought to be a law against doing further research of that type. What we should do now...(is) just call it quits and think 'What does it all mean?'"

As for memory loss, Tulving says his previous belief - that it would be horrible to live without memory - changed after studying a man known as KC, a Mississauga resident who lost all memory after a brain injury sustained in a motorcycle crash. KC remembers nothing from his past and nothing that happens to him moment by moment.

Tulving spent countless hours, over many months, with KC, who was 30 years his junior. KC provided a window into a world with not one single memory. He might discuss a subject like consciousness, but forget it as soon as the chat ended.

Though most people find the notion of complete amnesia terrifying and unfathomable, KC scored his own happiness four out of five.

When asked how long he wanted to live, his response was, "I guess 100 would be good," Tulving recalls.

"If he does not know that he's missing something, his whole personal history, but otherwise feels no pain and gets pleasure out of things - this is where I changed my mind. It's the thought that makes it so unacceptable to most people."

KC taught Tulving that no one can judge another's quality of life. Tulving concluded that happiness is not measured by memory, but by special moments that make life worthwhile. He realized KC is still having such moments.

[Illustration]

Keith Beaty toronto star After more than half a century studying memory, Endel Tulving won't quit. "I have been retired most of my life," he says. "That means most of the time I have been doing what I wanted to do." Keith Beaty TORONTO STAR Endel Tulving, who found refuge in Canada as a teenager after World War II, came as a farm labourer but was able to soon go to the University of Toronto. His first breakthrough came in 1956 with a paper explaining why repetition helps memory. Keith Beaty TORONTO STAR Endel Tulving, who found refuge in Canada as a teenager after World War II, came as a farm labourer but was able to soon go to the University of Toronto. His first breakthrough came in 1956 with a paper explaining why repetition helps memory.

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