

The second category to be decided in the sixth edition of the awards

Marvin Minsky, founding father of artificial intelligence, wins the BBVA Foundation Frontiers of Knowledge Award in Information and Communication Technologies

- The artificial intelligence field, in which Minsky is a towering figure, has contributed decisively to enlarging the role of computers – from calculating machines to universal machines – and facilitating more intuitive forms of interaction between people and computer devices
- Convinced that machines can be made as intelligent as people, Minsky laments that not enough human or financial resources are being devoted to the project
- The jury singles out his influential role in defining the field, and in mentoring many of the leading minds in today's artificial intelligence community

Madrid, January 14, 2014.- The BBVA Foundation Frontiers of Knowledge Award in the Information and Communication Technologies category goes in this sixth edition to American Marvin Minsky, regarded as a founding father of the artificial intelligence field. Minsky is also the author of key theoretical and practical contributions in mathematics, cognitive science, robotics and philosophy. A co-founder of the prestigious Artificial Intelligence Laboratory at the Massachusetts Institute of Technology, he was also instrumental in establishing the MIT Media Lab.

After expressing his contentment at receiving the award, Minsky declared himself firmly convinced that we will one day make machines as smart as humans. On how long this might take, he is less optimistic: "It depends how many people we have working on the right problems. Right now, there is a shortage of both researchers and funding." True to his reputation as a scientific iconoclast, he adds ruefully: "Artificial intelligence contributed many ideas and methods between the 1960s and 1980s, and then its influence become smaller. I haven't seen many advances in recent years, because the money is going more to short-term applications than basic research."

In the words of the jury's citation: "His work on machine learning, on systems integrating robotics, language, perception and planning, as well as on frame-based knowledge representation, shaped the field of artificial intelligence."

Minsky (New York, United States, 1927) is Professor of Electrical Engineering and Computer Science at MIT, as well as Toshiba Professor of Media Arts and Sciences. In the 1950s, he became one of the founders of a whole new scientific field, artificial intelligence (AI), whose goal was to transform the computers of the time – essentially calculating machines – into intelligent devices able to incorporate functions mimicking human capabilities and thought. The impact of this shift was immense, since it marked the start of the conventional computer's transformation into the first universal machine in history, through the progressive addition of new capabilities and its application to countless areas with a bearing on our daily lives.

The image of the computer as a giant calculator employed by a select group of organizations (corporations, governments, a handful of universities) gave way – thanks to the AI field – to the now familiar machine ubiquitous in the technology around us and which we use intuitively every day.

Minsky views the brain as a machine whose functioning can be studied and replicated in a computer, which would teach us, in turn, to better understand the human brain and higher-level mental functions. And some of his most inspirational work centers on the attempt to endow machines with common sense, i.e., the knowledge we humans acquire through experience.

He has also tried to account for diverse phenomena of cognition, language understanding and visual perception using the theory of frames, an omnipresent form of representing and storing knowledge by reference to the hierarchical relations between objects. Frames function as organized deposits of earlier knowledge and experience that enable us to process information.

Birth of a new field

Artificial intelligence officially came into being as a discipline at a computer science conference in Dartmouth College (New Hampshire, United States) back in 1956. The founders of the new field were John McCarthy of Stanford University, Allen Newell and Herbert Simon from Carnegie Mellon University, and Minsky himself, the group's only surviving member.

Computers were just starting to show their power to handle previously unsuspected tasks, and the field was rich in every kind of promise. Minsky went so far as to affirm that "in one generation, the problem of creating 'artificial intelligence' will be essentially solved." Although it would later become clear that the process was a lot more complex, artificial intelligence research has since yielded innumerable applications ranging from medical diagnosis, unmanned drones and intelligent robotics to a long list of expert systems that solve problems using the same approach as human specialists. The field also shares theoretical roots with the idea that computers should approximate the workings of the human

brain, not the other way round, which has led to developments facilitating intuitive communication with machines.

Fascinated since his student days – at Harvard University – by the workings of the brain and the emergence of its cognitive functions, Minsky has led the quest to endow computers with common sense. For, to borrow his own analogy, if a young child knows not to use a building block that's already in the tower or that to drag an object he has to pull not push the string, how can we teach a computer what seems to easy to the human brain? "We rarely recognize how wonderful it is that a person can traverse an entire lifetime without making a really serious mistake, like putting a fork in one's eye or using a window instead of a door," writes Minsky in one of his best-known works, 1985's *The Society of Mind*.

In this book, Minsky expounds his mechanistic vision of how the human mind works, describing intelligence as a result of the interaction between myriad non-intelligent parts. In its sequel, *The Emotion Machine*, he extends his theory to the realm of feelings and emotions, which would simply be a product of multiple levels of processes. Hence his comment in an interview that: "Emotions are just a specific way of solving problems. For instance, when you choose to be angry, it's so you can solve a problem really fast."

Implications and applications

This vision has immediate philosophical implications for computer science: building a human-equivalent intelligence is not a utopia. After all, Minsky once quipped that the mind was a "meat machine". In his essay *Why People Think Computers Can't*, published in 1982, he writes: "when computers first appeared, most of their designers intended them for nothing except to do huge, mindless computations. That's why the things were called "computers". Yet even then, a few pioneers (...) envisioned what's now called artificial intelligence or AI". They saw that computers might possibly go beyond arithmetic, and maybe imitate the processes that go on inside human brains. (...) Still 'computer experts' say machines will never really think. If so, how could they be so smart, and yet so dumb?"

Despite his initial optimism, the progress of AI has shown that it is easier to get a machine to solve complex operations and apply expert processes than to make a medical diagnosis or behave commonsensically. But in the pursuit of these goals, computers have become humanity's first universal machine, with multiple capabilities beyond mere computation, and applications in almost every parcel of our lives.

Minsky's is also the mind behind inventions like the first neural network learning machine (SNARC) in 1951; the first head-mounted graphical display in 1963; and the confocal scanning microscope (patented 1957), still widely used in biology for its ability to reconstruct 3D images.

A devotee of science fiction, "where you find really bright authors and great ideas", Minsky was an advisor to Stanley Kubrick in the making of *2001 A Space*

Odyssey, and in fact during the shoot came close to being flattened by a falling piece of set. Asked why forty years later there are still no computers as intelligent as HAL, he insists that the problem lies in the lack of funds for research.

Minsky believes there is a feedback between our understanding of mind and machine: that as we find more ways to make machines behave more sensibly, we will also learn more about our own mental processes. The loop will continue, he predicts in an essay, until we are faced with the dilemma of whether or not to create machines more intelligent than us. "We are fortunate to be able to leave that decision to future generations. No one can tell where we will get to, but right now one thing is sure: there's something wrong with any claim to know, today, of any basic differences between the minds of men and those of possible machines."

Bio notes

Marvin Minsky graduated in mathematics from Harvard University (1946) and went on to complete his PhD at the University of Princeton (1954). In 1959, he took up a professorship at the Massachusetts Institute of Technology (MIT), where he was co-founder, with John McCarthy of the Artificial Intelligence Laboratory. Appointed Professor of Electrical Engineering and Computer Science at MIT in 1974, he combined this post with that of Donner Professor of Science until 1989.

Since 1990, he has held the Toshiba Professorship of Media Arts and Sciences, devoted to the most advanced IT research. His many honors include the Turing Award (1969) and membership of the IEEE Intelligent Systems Hall of Fame (2011), and he belongs to prestigious scientific societies including the American Academy of Arts and Sciences or the American Association for Artificial Intelligence.

Minsky has also influenced future generations through his PhD mentoring work, with many students going on to occupy top research positions in the AI and computer science worlds.

The BBVA Foundation Frontiers of Knowledge Awards

The BBVA Foundation promotes, funds and disseminates world-class scientific research and artistic creation, in the conviction that science, culture and knowledge in its broadest sense hold the key to a better future for people. The Foundation designs and implements its programs in partnership with leading scientific and cultural organizations in Spain and abroad, seeking to identify and prioritize those projects with the power to move forward the frontiers of the known world.

The BBVA Foundation established its Frontiers of Knowledge Awards in 2008 to recognize the authors of outstanding contributions and radical advances in a broad range of scientific and technological areas congruent with the knowledge map of the late 20th and 21st centuries, and others that address central challenges, such as climate change and development cooperation, deserving of

greater visibility and recognition. Their **eight categories** include classical areas like *Basic Sciences (Physics, Chemistry and Mathematics)* and *Biomedicine*, and other, more recent areas characteristic of our time, ranging from *Information and Communication Technologies*, *Ecology and Conservation Biology*, *Climate Change* and *Economics, Finance and Management* to *Development Cooperation* and the innovative realm of artistic creation that is *Contemporary Music*.

The **juries** in each category are made up of leading international experts in their respective fields, whose involvement endorses the rigor of the awards and has indeed been instrumental in consolidating their prestige.

The variety and quality of the **nominations** received from eminent figures in leading academic and research organizations all around the planet are an indicator of the excellent reception the Frontiers of Knowledge Awards have enjoyed from the global scientific community.

The BBVA Foundation is aided in the organization of the awards by the **Spanish National Research Council (CSIC)**, the country's premier multidisciplinary research organization. The CSIC is responsible for appointing the Technical Evaluation Committees that undertake an initial assessment of candidates and draw up a reasoned shortlist for the consideration of the juries.

In the Information and Communication Technologies category, Committee members were Manuel Lozano, Institute for Microelectronics of Barcelona, National Microelectronics Center (CSIC), and coordinator of the Council's Physical Sciences and Technologies Area; Diego Córdoba, Institute of Mathematical Sciences (CSIC-Universidad Complutense de Madrid-Universidad Autónoma de Madrid-Universidad Carlos III); Alberto Sanfeliu, Institute of Robotics and Applied Informatics (CSIC-Universidad Politécnica de Cataluña); and Ángela Ribeiro, Center for Automation and Robotics (CSIC-Universidad Politécnica de Madrid).

The BBVA Foundation Frontiers of Knowledge Awards, devised and organized from Spain, provide an international showcase for the best qualities of Spanish science. Their credibility, the stature of the institutions, research centers and scientists involved in nominating and assessing candidates, and the excellence of the laureates in all editions have earned them a place among the world's foremost award schemes.

Information and Communication Technologies jury

The jury in this category was chaired by **George Gottlob**, Professor of Computer Science at the University of Oxford (United Kingdom), with **Ramón López de Mántaras**, Director of the Artificial Intelligence Research Institute of the Spanish National Research Council (CSIC) acting as secretary. Remaining members were **Oussama Khatib**, Professor in the Artificial Intelligence Laboratory in the Computer Sciences Department of Stanford University (United States), **Rudolf Kruse**, Head of the Department of Knowledge Processing and Language Engineering at Otto-

von-Guerike-Universität Magdeburg (Germany), **Mateo Varelo**, Director of the Barcelona Supercomputing Center (Spain) and **Joos Vandewalle**, Head of the SDC Division in the Department of Electrical Engineering at Katholieke Universiteit Leuven (Belgium).

Previous laureates

The 2012 award went to **Loffi A. Zadeh**, for the invention and development of fuzzy logic, which has enabled machines to work with imprecise concepts, as humans do, and thus secure more efficient results more aligned with reality.

The winner in the previous edition was American electronic engineer **Carver Mead**, for being “the most influential thinker and pioneer” of the silicon age, and enabling “the development of the billion-transistor processors that drive the electronic devices – laptops, tablets, smartphones, DVD players – ubiquitous in our daily lives.”

American mathematician **Donald E. Knuth** took the award in the third edition for “making computer programming into a science.” The work of this “giant among giants,” in the words of the jury’s citation, is considered the scaffolding upon which modern computer programs are built. Preceding him was engineer and mathematician **Thomas Kailath**, for a mathematical development permitting the production of increasingly small size chips. Finally, the winner in the inaugural edition was Israeli **Jacob Ziv**, the mind behind such hugely popular file formats as MP3, JPG or PDF.

UPCOMING AWARD ANNOUNCEMENTS

CATEGORY	DATE
Basic Sciences	January 21, 2014
Biomedicine	January 28, 2014
Ecology and Conservation Biology	February 4, 2014
Contemporary Music	February 11, 2014
Economics, Finance and Management	February 18, 2014
Development Cooperation	February 25, 2014

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