UNIVERSITAT OBERTA
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DOCTORA *HONORIS CAUSA*

Hanna Damásio

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Hanna Damásio

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DECISION OF THE EXECUTIVE MANAGEMENT COMMITTEE

Decision of the Executive Management Committee of the Universitat Oberta de Catalunya whereby Ms Hanna Damásio is invested with an honorary doctorate.

At the ordinary session held in Barcelona on 27 January 2012, the Executive Management Committee of the Universitat Oberta de Catalunya unanimously decided to invest Ms Hanna Damásio with an honorary doctorate. This is the highest academic distinction awarded as an honour to an individual in recognition of their merits and work.

Chair in Psychology and Neuroscience and Director of the Dornsife Neuroimaging Center at the University of Southern California, she is recognised worldwide as a pioneer in the use of digital imaging technology for the study, diagnosis and teaching about brain lesions. In 1994, Oxford University Press published her first brain atlas based on images obtained from computerized axial tomography, which, in several republications, is considered a basic text for medicine faculties the world over. Hanna Damásio symbolises the spirit of technological innovation serving research, education and the wellbeing of individuals, which forms the basis of the scientific and educational work of the Universitat Oberta de Catalunya.

Given all this and more, the UOC Executive Management Committee is delighted to invest Ms Hanna Damásio as an honorary doctor of the Universitat Oberta de Catalunya.

As General Secretary of the UOC, I hereby bear witness to this decision with the corresponding approval of the President of the UOC.

Llorenç Valverde
General Secretary of the UOC
Barcelona, 27 January 2012

LAUDATIO

LAUDATIO FOR PROFESSOR HANNA DAMÁSIO ON THE OCCASION OF HER INVESTITURE AS HONORARY DOCTOR BY THE UNIVERSITAT OBERTA DE CATALUNYA

Barcelona, 23 October 2012

Promoter: Professor Manuel Castells

The Universitat Oberta de Catalunya is proud to bestow an honorary doctorate, our highest academic distinction, upon Professor Hanna Damásio, one of the most important neuroscientists of our time, an extraordinary scientific innovator who has opened the door for the rigorous study of the living brain, thus allowing us to lift the veil of mystery corresponding to the old question about the meaning of being human. Her decisive contributions to neuroscience stem from her scientific passion for brain anatomy. Quick to detect, in the 1970s, the potential that the development of new radiological technologies offered, Hanna Damásio investigated neuroanatomy with computerized x-ray tomographic scans. Later, as magnetic resonance imaging became available, she perfected that new field of neuroscience and defined its contours in her classic book "Human Brain Anatomy in Computerized Images", published by Oxford University Press in 1995, and in a second, updated edition in 2005. Studied in schools of medicine and psychology departments around the world, that book is considered to be the first atlas of the brain based on computerized images. She also pioneered the **lesion method** of studying the brain, a major breakthrough in neuroscience. Being a practicing neuroscientist as well as a neurologist, she knew that one of the most effective approaches to investigating the human mind was to examine patients who had suffered brain lesions, searching for correlations between the results of acquired brain damage and behavioral changes. By applying new knowledge from computerized neuroanatomy to systematic studies involving many brain-damaged patients, she was able to revitalize the lesion method in the 1980s, and paved the way for numerous discoveries on the brain substrates of language, memory, emotion and decision making, producing several studies that have become a cornerstone of the current stream of research known as social neuroscience. The first systematic formulation of her lesion method of studying the brain came in her co-authored, award-winning book "Lesion Analysis in Neuropsychology", published in 1989 by Oxford University Press. She continues to make new discoveries in that area, such as those reported in her recent co-authored article "Understanding Otherness: the Neural Bases of Action, Comprehension and Brain Empathy in a Congenital Amputee", published in the journal *Cerebral Cortex* in 2011.

Hanna Damásio's work is characterized by her extreme methodological rigor. She does draw substantial inferences that illuminate the workings of the human mind, but never departs from careful, detailed observation of her findings. She always bases her analysis on studies using functional imaging (fMRI) and other techniques, and she continues to work on the development of new imaging technologies in collaboration with engineering colleagues.

Hanna Damásio's scientific output is nothing short of extraordinary, not only in its quality, but also in its quantity. In addition to the two fundamental books mentioned previously and other co-authored books, she has published 213 articles in major scientific journals of the caliber of *Nature*, *Science*, *Brain* and *Journal of Neuroscience*, as well as dozens of peer-reviewed research abstracts.

Her scientific endeavor has taken her to many cities and countries, from her native Lisbon to the University of Iowa, a leading medical school in the United States, and to the University of Southern California in Los Angeles. She is a medical doctor, a graduate of the University of Lisbon Medical School, where she was an intern and a resident at the University Hospital. She also studied and researched in Boston's Aphasia Research Center, Columbia University in New York, the National Hospital for Nervous Diseases in London, and Princess Margaret Migraine Clinic, likewise in London. She was appointed Professor, and then Distinguished Professor of Neurology at the University of Iowa in 1985, where she directed the Laboratory for Neuroimaging and Human Neuroanatomy.

In 2005 she joined the University of Southern California, Los Angeles, where she is currently University Professor, as well as Dana Dornsife Professor of Neuroscience and Professor of Psychology, Neuroscience, and Neurology. She directs the Dornsife Imaging Center at the University of Southern California, a center devoted to elucidating the neurobiology of mind and behavior, in health and disease, using the most advanced brain imaging technology. The Center works closely with the Brain and Creativity Institute at the University of Southern California, whose research is focused on understanding the brain basis of social behavior. Incidentally, creativity lies at the heart of Hanna Damásio's work and life. She is not only a towering figure in neuroscience, but also an artist, having drawn, painted and sculpted over the years. She is indeed a Renaissance woman.

Professor Hanna Damásio has received numerous distinctions and honors, including several honorary doctorates, among them one conferred upon her by the École Polytechnique Fédérale de Lausanne, one of Europe's leading engineering schools, reflecting the prestige her work enjoys in the technological community. Her research has been consistently supported by grants from the U.S. National Science Foundation for over two decades.

In acknowledging the importance of the contribution of Hanna Damásio, our University is not simply honoring a great scientist. We recognize the significance of her work for our specific field of education and research, and we identify closely with her style of intellectual innovation. That is because the discoveries of Hanna Damásio have direct, substantial implications for the learning processes at the heart of our mission. That can be verified, for instance, in her co-authored text "Social Conduct, Neurobiology, and Education", her contribution to the collective volume "Learning in the Global Era", published by the University of California Press in 2007. Furthermore, the UOC was founded at the meeting place between technological innovation and educational innovation, using new information and communication technologies to develop new ways of learning and understanding. The initiative is similar to the project that Hanna Damásio conceived and subsequently put into practice, that of using new digital technologies to expand the frontiers of knowledge on the human mind. The better we know the human mind, and the more we create a virtuous feedback loop between information technology and the technology of information, the more we will advance in the transformation of education in the digital age. In that difficult but essential mission, the discoveries, methodology and scientific example of Hanna Damásio will be of utmost help to and meaningful inspiration for the UOC's endeavor.

For this, we thank you, Hanna, for your teaching, and for your willingness to honor us by honoring you. Welcome to our community.

Acceptance Speech by Hanna Damásio as honorary doctor

THE DREAM OF VISUALIZING BRAIN FUNCTION

The adventure of modern science has taken unexpected turns. In the first part of the twentieth century the public's mind was captivated by particle physics. After the Second World War two major developments demanded attention: the invention of the computer, which opened the way for the digital revolution, and the discovery of the structure of DNA, which paved the way for modern biology. The last quarter of the twentieth century, however, belongs to a quieter development whose scale and consequences are only now becoming apparent. The development had to do with the attempt to understand how the human brain produces mind and behavior, an effort known as cognitive neuroscience.

The attempt had begun a century before, led by European neurologists and psychiatrists, from the Iberian Peninsula to Scandinavia and the British Isles. In spite of some important results, however, the effort had been gradually abandoned. There was one simple reason for the failure: lack of technical power. Sigmund Freud is a good example of the problem. Freud began his career as a neurologist, intent on discovering how the brain works to produce emotions, ideas, language, and behavior. Even before the nineteenth century had ended, however, he had left the original project and concentrated instead on what the techniques of the time permitted him to do: investigate the mind rather than the brain. The change of direction, from neurology to psychology and psychiatry was a personal success. It made him far more famous than he could have expected to be had he insisted on pursuing his original goals. And, surely enough, Freudian thinking, no matter what one may think of psychoanalysis today, was a valuable contribution to science. But the change also made obvious the fact that, without new and probing techniques, the elucidation of the connection between mind and brain would have to wait.

In keeping with the gradual development of technical power to analyze the human brain, and with the complexity of the problem itself, the revolution of cognitive neuroscience did not begin with a spectacular coup comparable to the discovery of the structure of

DNA. Instead, it grew slowly, bit by bit, and it only picked up speed in the 1990s and in the early days of the twenty-first century.

From my perspective, however, the revolution came just in time because I had the good fortune of witnessing many of its developments, quite closely, and of being involved in their application. I have also been fortunate to participate in exciting discoveries that were only possible because of the availability of the new techniques.

I would like to illustrate for you the situation I described as well as some of the progress that has been made in this field. I will do so by touching on a few important issues of theory and method, followed by a few examples of specific advances.

Brains are made up of individual cells — the neurons that Ramon y Cajal famously described.

In the human brain there are trillions of neurons and it is apparent that all mind processes and behaviors are produced by the cooperation of many neurons, not by one neuron alone, and not by all neurons together. The secret to understanding the secrets of the brain sits, in effect, with the mode of organization of the neurons such that they can deliver different functions. Neurons are organized to form *neural tissues*, whose details can be seen under the microscope, and neural tissues are grouped together in *nuclei* and in *regions*, many of which can be seen by the naked eye. Nuclei and regions are linked together in *systems* most of which are actually *macroscopic*.

For over a century the principal way of investigating the higher brain functions relied on two types of correlations. The correlation of microscopic anatomy of neural brain tissue or microscopic neuropathology of diseased brain tissue, on the one hand, with certain normal psychological functions or malfunctions on the other. The correlation, of course, was indirect. The other type of correlation was made between an area of brain damage and a specific defect of mind or behavior developed by a neurological patient as a result of disease. This correlation could be suspected but could only be confirmed by autopsy, after the patient died. In spite of all these limitations, nineteenth-century neurologists such as Paul Broca, Carl Wernicke, and Jules Dejerine were able to identify, quite correctly, a number of brain regions related to language — comprehension, production, reading and writing.

But since it was not possible to visualize directly the normal or diseased brain regions and systems, the science proceeded slowly and by approximation. Neurologists were at the mercy of the vagaries of neurological disease.

One other pioneer neuroscientist from the Iberian Peninsula, the Portuguese Egas Moniz, made a bold step toward the right goal, in 1928, with the invention of cerebral angiography. Angiography did not allow us to see brain tissue directly but it could show blood vessels displaced by a tumor or blood vessels missing as a result of a stroke.

I began my training as a neurologist and neuroscientist in Lisbon, in the institution where angiography was born, and Almeida Lima, who, as an extremely young neurosurgeon, had performed the very first cerebral angiography, was one of my early mentors. But while I was happy to belong to that tradition I was acutely aware of its limitations. From the point of view of clinical diagnosis this was indeed a revolutionary development. But scientifically it was not yet what was needed. The much needed visualization of *living* human tissue was still not available. In fact, as I contemplated my future, no new radiological technique aimed at visualizing the living brain had been developed in over five decades. Then suddenly, and luckily for me, in 1973, computerized X-ray tomography was invented. This is what became known as CT scanning or CAT scanning. I was just beginning my career and it changed my outlook and my possibilities.

The first images were rough but still, they were images of living brains.

By the mid to late seventies, after I had moved to the United States, the quality of CT had improved and by the early 1980s structural magnetic resonance (MR) scanning appeared. The dream of studying human neuroanatomy in the living, with considerable precision and in a non-invasive, non-harmful way, had become reality and the title of one of my books indicates that the dream had come true.

It was even possible to vindicate the nineteenth-century scientists whose suppositions often went unconfirmed. For example, in 1848 and 1868, John Harlow had predicted that his patient Phineas Gage had sustained damage to a sector of the prefrontal cortex as a result of a bizarre accident in which an explosion had sent an iron bar across his skull. The damage, Harlow thought, was the cause of the disturbance of social behavior that Gage developed after the accident. This was a brilliant interpretation that modern neuroscience has repeatedly confirmed and that has major implications for our understanding of human behavior. But Gage had died without an autopsy and so Harlow's interpretation was never verified or denied. In 1994, we were able to reconstruct Gage's brain lesion using measurements of his skull and modern imaging methods.

Today it is possible to peer into our brains using a variety of functional imaging techniques.

Today we can even study the connections that neural pathways establish across the brain, the web of connections that link the neural systems whose operation is the secret behind our minds and behavior.

Closing Comments

Powerful techniques are essential but they cannot be expected do the job alone. Sound theory, well constructed hypotheses, and careful experimental design are just as indispensable, as is, of course, a wise interpretation of the facts.

The ultimate consequences of all this technical progress is to permit, at long last, a fruitful crossroads where cognitive neuroscience will meet with social sciences, political sciences, economics, humanities, and several relevant aspects of medicine, neurology, psychiatry, and pediatrics.

Hanna Damásio
University Professor
Dana Dornsife Professor of Neuroscience
Director, Dornsife Neuroscience Imaging Center
University of Southern California, Los Angeles

Closing speech
Imma Tubella

THE DREAM OF VISUALISING THE NETWORK SOCIETY'S ANATOMY

I have found this speech very difficult to prepare. Professor Castells has always told me to only agree to talk about subjects with which I am unfamiliar, as that is the way to begin to understand them. I am used to doing just that, as I firmly believe that taking information from one context and placing it in another is the key to innovation.

Interactivity, interconnection, networks, cooperation and "sharism" are words that, while very old, have been evoking utterly new images in less than the last ten years. I must say that I had always been fascinated by Kropotkin's *Mutual Aid*, which I read in my grandfather's library as a teenager. Perhaps that is why I let the concept of the internet seduce me.

Not long ago, the world was dumb and we were clever. But the computer-assisted world is becoming very clever and faster than we are. Very soon our collective technological intelligence will outperform the individual organic ones both in speed and integration.

Those are the words of Derrick de Kerckhove in his 1995 book *The Skin of Culture*.

With his characteristic optimism, he went on to say: *It will be interesting to know how this unified cognitive organization will take care of the environment and poverty, and what criteria it will dictate for genetic engineering. For the time being, relax. We are not there yet.*

Where are we 17 years later? We now know, for example, that our technological intelligence is not collective but rather connected. We also know that the synergies involved in communicating via the internet have made it the means of communication *par excellence*. Interactivity, hypertextuality and connectivity have generated new social and personal cognitive habits. ICTs and the networks they help create are actually having a far greater effect on our minds than books or television did in the past. The tools that aid our mental processes in our multimedia environment can shape our thoughts much more comprehensively than TV ever did.

Our computer screens are becoming the channel through which our imagination and memory encounter those of many other people.

Authors as diverse as Sherry Turkle and James Olds refer to the fascinating connectivist theory of the mind, according to which information is a node and knowledge is a connection. From the perspective of connectivism, Olds says, the ego could be reconstructed as a distributed system. Consciousness could be viewed as a technical device by means of which the brain represents its own output for itself. He compares the brain to a computer's monitor, a screen, emphasising its passive quality.

According to neuroethics researcher Kathinka Evers, humans differ from all other mammals in that our brain is incomplete at birth and much of our life is spent developing it.

The internet is, by definition, a collective and connective medium. In the network society, the degree of cooperation between individual minds is increasing exponentially, with a result similar to Lorenz's butterfly effect, thus named on the basis of an ancient Chinese proverb that says the movement of a butterfly's wings can be felt and have effects on the other side of the world. The butterfly effect is one of the characteristics of the behaviour of a chaotic system very similar to that of networks, in which variables change and are transformed in a complex, self-organised fashion.

The increase in network-based human interaction, be it personal, social or institutional, is concentrating and magnifying *our* power, demonstrating the meaning of another ancient proverb, this one Japanese, according to which none of us is as intelligent as all of us. To put it another way, *we* are more intelligent than *I*. Today's keywords are connectivity, collaboration and cooperation among equals, as Professor Damásio underlined in her speech. In the network society, we either share and collaborate or we vanish. That is difficult to grasp, both individually and collectively, but we are beginning to be able to draw on multiple examples that show it to be true. We are dealing with a paradigm shift, a new form of production which entrusts the creation of value to the collective, be it in the economic, cultural or social arena. Nowadays, cooperation is profitable and, in addition to generating value, it is free.

The literature on the network society's anatomy and structure includes theoretical approaches from disciplines such as neuroscience and physics. The physicist Fritjof Capra defines being ecologically literate as understanding the principles of organisation of ecosystems and using them as a model for the creation of sustainable human communities. Capra identifies five major principles of ecological literacy, namely interdependence (or connected independence), flexibility, diversity, cooperation and biomimicry. The term biomimicry refers to the tendency to imitate nature when reconstructing social systems.

The internet is developing exponential connections in the way a brain does in the learning process. Just like an organism's neurobiological system, the Net needs to evolve, to establish more contacts and connections. That is the very aspect that defines it. The nervous system is not inflexible; on the contrary, it changes and evolves thanks to multiple, varied interactions. It is as if the Net were discovering a way to imitate the physical and biological body in the social sphere. In that regard, in their 2007 publication *Topological relationships between brain and social networks*, Sakata and Yamamori point out topological similarities between the brain and social networks. Both systems have similar principles of organisation and share the value of reciprocality. They both learn and correct themselves.

Curiously, I have noticed that any attempt to compare the way the brain works to the way computers work creates a certain degree of discomfort, probably because the topic in question has given rise to much debate and controversy. However, the extent of that controversy makes the theme a recurring one. I have read somewhere –and I apologise to Professor Damásio for daring to talk about the brain- that the organ in question owes its power not so much to the speed of its individual switches but more to the way in which they connect with one another. It is actually the interconnection between those neurons that enables the brain to recognise patterns and, thus, to learn. Unlike computers, however, neural networks learn from their mistakes.

We have a certain inclination to compare ourselves to computers, and perhaps that is the source of the discomfort I mentioned earlier. We tend to think that our brain is not quick enough, which is probably true, but maybe we are forgetting that our brain does not need to be quick but rather intelligent, well integrated and, above all, well connected.

In any case, the UOC community, which, from the perspectives of its various disciplines, studies the internet and networks, is aware that cyberspace is not neutral, that it does not have a clear limit, that it is neither stable nor centralised, that it is an organic medium in constant motion and that it behaves like a self-organised system. We know that the internet is the first medium to be simultaneously oral, visual and written, public and private, individual and collective, and that individual minds and the collective mind are linking up via open, globally connected networks. That results in an awareness of time: real time, virtual time, personal time, social time. As Professor de Kerckhove says in *The Skin of Culture*, what is happening is easier to sense than to see. We lack the "technical power" to which Professor Damásio referred at the beginning of her speech, when explaining why Freud focused more on the mind than on the brain. It would be wonderful if she were able to contribute to visualising what happens on the internet as significantly as she has to visualising what happens in the brain. In any case, I am grateful for her closing words, in which she spoke of the need for neuroscience to engage with social and economic sciences and aspects of medicine, neurology, psychiatry and paediatrics.

To conclude, I would add that dialogue between the neuroscience community and the education community is increasingly necessary, with a view to attaining an understanding of the major cultural and behavioural changes entailed by information and communication technologies' impact on not only the creation, dissemination and assimilation of knowledge but also people's everyday lives.

Maybe that will be easier to achieve now that the UOC community has the enormous privilege of being able to call Professor Hanna Damásio one of its members. In any case, it is with the aim of expressing our admiration and respect that we are conferring the highest academic distinction upon Professor Damásio.

HANNA DAMÁSIO, M.D.

Hanna Damásio M.D. is University Professor, Dana Dornsife Professor of Neuroscience and Director of the Dana and David Dornsife Cognitive Neuroscience Imaging Center at the University of Southern California. Using computerized tomography and magnetic resonance scanning she has developed methods of investigating human brain structure (such as Brainvox), and studied functions such as language, memory and emotion, using both the lesion method and functional neuroimaging. In parallel with her studies on the human mind she is actively involved in collaboration with engineering colleagues in the development of a new generation of image analysis tools. In addition to numerous highly cited scientific articles she is the author of the award-winning *Lesion Analysis in Neuropsychology* (Oxford University Press), and of *Human Brain Anatomy in Computerized Images* (also Oxford University Press), the first brain atlas based on computerized imaging data. Hanna Damásio is a Fellow of the American Academy of Arts and Sciences and of the American Neurological Association. She shared the Signoret Prize and the Pessoa Prize with Antonio Damásio, and holds honorary doctorates from the École Polytechnique Fédérale de Lausanne and the universities of Aachen and Lisbon. In January 2011, she was named USC University Professor.

The Center she directs works closely with the Brain and Creativity Institute.

(For more information go to the Dornsife Imaging Center website at http://brainimaging.usc.edu and the Brain and Creativity Institute website at http://www.usc.edu/bci/)

GAUDEAMUS IGITUR

Gaudeamus igitur
Iuvenes dum sumus, (bis)
post iucundam iuventutem,
post molestam senectutem,
nos habebit humus (bis).

Ubi sunt qui ante nos
In mundo fuere? (bis)
Adeas ad inferos,
Transeas ad superos,
Hos si vis videre (bis).

Vivat academia,
vivant professores! (bis)
Vivat membrum quodlibet,
vivant membra quaelibet,
semper sint in flore (bis).