

# [R]EVOLUTION COMING SOON

A conversation with Professor Ryszard Tadeusiewicz about curiosity, myth of the artificial intelligence, metallurgy and why people desire so much imagined worlds

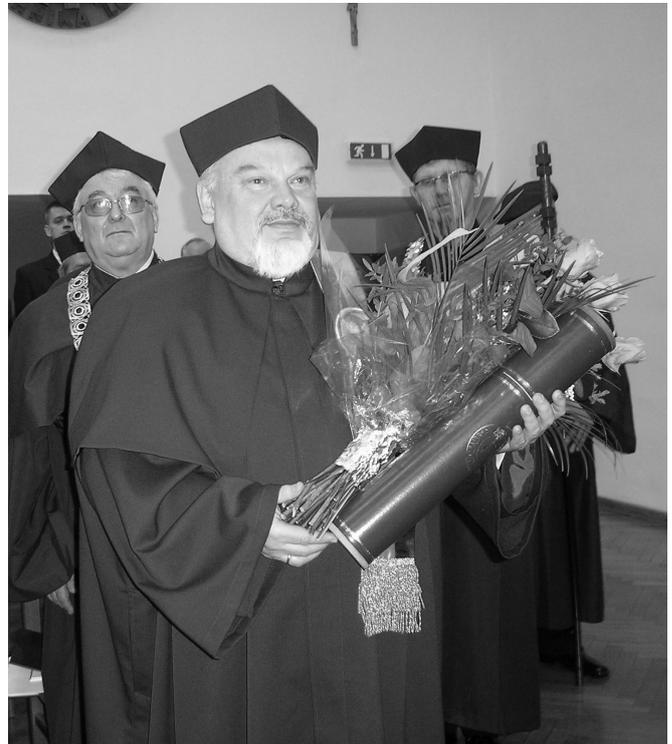
Born in 1947 Professor **Ryszard Tadeusiewicz** works for AGH University of Technology in Cracow since 1971. He was three times the President of AGH - in 1998-2008 years that rendered him the longest incumbent University President in Poland.

He studied at the Electric Faculty of AGH University of Technology, which graduated with honours in 1971, medicine at the Medical Academy in Cracow (nowadays Collegium Medicum of Jagiellonian University), and economy at Cracov University of Economy. He worked for all this universities, as well as few others in Cracow, including Jan Matejko Academy of Fine Arts in Cracow.

He holds the honorary doctorates of 11 universities. Member of many societies from all over the world: Académie Européenne des Sciences, des Arts et des Letters in Paris, Polish Academy of Sciences in Warsaw, Polish Academy of Arts and Sciences in Cracow, Russian Academy of Natural Sciences in Moscow, IEEE Senior Member, International Neural Network Society (Washington D.C.), Signal Processing Society, Society on Engineering in Medicine and Biology, IFAC Technical Committee on Artificial Intelligence in Real-Time Control, Association of Computing Machinery, Society of Photo-Optical Instrumentation Engineers, and many others. Head of COMPUTER Vision section in EU programme TEMPUS.

He wrote over 500 articles and more 70 books. Professor Tadeusiewicz is a well known popularizer of science; he wrote few hundred popular articles, few books presenting difficult issues in accessible way (without mathematical formulas), radio and tv appearances (lectures, talks, shows, etc.).

Few years ago he funded a bronze statue of a student girl sitting on the bench in AGH campus. The model was his wife.



*Professor Tadeusiewicz has been recently awarded honorary doctorate by Lublin University of Technology, Poland.*

**JAMRIS: Professor Tadeusiewicz, you said once that you never gave up despite of many failures in your life.**

Ryszard Tadeusiewicz - Yes, exactly yes.

**J: However, looking at your curriculum vitae I have an impression that you have never failed!**

Let me draw an analogy. When my students are going to me they believe blindly in everything what is written in wise books; they believe that neural networks are almost like the philosophers' stone which puzzles everything scientific problems out, which can be taught everything and start to think instead of us, instead of using the human brain. I explain to them: so it happens that if scientist or scholar carries research out, and this research gives an interesting and valuable result, then he or she writes an article to an journal, a paper to an international conference, even a book. All in fulfilled bookshelves in libraries making an impression that universal method has been developed. Whereas, on one successful researcher cases even two can failure. They do not write articles or books, do not attend conferences to complain of their un-success. They are a "grey background". Because in everybody's c.v. only successful things are mentioned; this life looks like journey from one brilliant success to another. Reality is much more complex. Every success means not less than one failure. On human being experience, on

someone's professional background failures have often greater influence than successes. The success is easy-going. Everybody was born to success. It seems to me that in many fields succed is achieved by receiving the Fortune's blows in such a way that the failure gives strength instead discouragement. Who acquires this art, might be sure that he or she perseverance will be rewarded.

**J: Were any of your projects, e.g. any neural networks, failure?**

Yes, well, even not long ago. We have just worked on creating a neural network that could forecast or optimise cooling grade of the castings. An experienced moulder knows that sometimes way of cooling is more important than form and method of casting. We were trying to find a neural network, which could learn to optimise cooling process from point of view of assumed crystal structure of this casting. We constructed a huge test-bed, registering strategy as well as cooling result, and it was found out that our neural network cannot manage all these elements together, that the task is too difficult. A failure.

**J: But statue of your wife was cast in traditional way?**

Yes, because it that case the art was much more important than inner casting structure. This casting need not to fulfil any special resistance requirements.

**J: I heard about some aesthetical problems with wrists of this statue. There's a rumour that your wife protested against that project.**

I had been trying to recall through that statue a memory from my youth, which had had a big influence on me, which had inspired me, and maybe had been decisive for all my further life. I did notice details but I was concerned on general, summary impression. But when my wife saw the statue she cried at once "Oh no, I do not have hands like these! My palms are tiny, fine, and slender", which confirms the common saying that women perceive themselves through details whereas men perceive things in general.

**J: How the students reacted when the statue appeared on the bank?**

Agreeably.

**J: Do they sit down near it?**

Yes, they do, even they meet there. Sometimes someone leaves bunch of flowers, and once when the winter came students tied up a scarf on her neck. I photographed through this sculpture a certain real event. When I came first time into the building of AGH University of Science and Technology I was a shy, confused, and puzzled graduate from high school with a humanistic profile. A boy from a little town. I remember that first thing I saw was a fascinating girl. Maybe she was a little confused like me.

**J: How a boy interested in humanities went to the school of technology?**

I was fascinated in technology from early years of my life. I graduated the high school in Myślenice, a town on the road from Kraków to Zakopane. In this town there was only one technical high school, known by a low level of education. On the other hand, there was the comprehensive high school that many Roman Church's bishops graduated from because of a high level of Latin and ancient Greek; it was a very good and respected school. We were proud of being students of that school, we were perceived as the elite, the cream of the cream of the local society. The second cause was that in the primary school I won the championship in Poland's history. It was a local sensation because I was a student from a small school. The truth was that even my pocket money I used to spend on technical magazines and books, and I used to read all books from our local library. The works of Stanisław Lem, especially.

**J: There is a conversation about „electron mind“ in The Astronauts...**

Exactly, he inspired me in a certain way. I must confess that the one of most beautiful moments of my life I experienced in Poznań: driving a car and listening to the radio I suddenly heard that Stanisław Lem referred to my research. In one of his books *Imaginary Magnitude* he even mentioned my name as a creator of a new technical field, which inspired him – artificial intelligence and neural networks. It was an awesome, untold happy moment, because Lem is an icon, extremely important figure inspiring my imagination.

**J: Looking at your research interests, e.g. neural networks, appears the question about a soul.**

I tried to struggle with this problem. Some time ago there was a conference on relations between science and religion organized by the bishop of Tarnów. I delivered a lecture, which has been an attempt to respond to a question „Can research on brain, intelligence, and modelling of human mind through e.g. neural networks, can lead us to recognize “mystery of the soul” in an asymptotic sense?“

**J: Let me ask you this question: do your neural networks have a soul? Could it be possible at all?**

No, my networks do not have any soul; moreover, in the mentioned lecture I wrote that these planes do not intersect. In my opinion neural networks and computer modelling have many advantages useful to explore the scope of a pure intellect, logical action, motivation, control, even free will. Neural networks are „intellect in test-tube“, really a tiny thing. There is difficult to examine in the ocean but if we take a sample of seawater and test it in a laboratory, we may find out a lot that will be proved in the whole ocean. The same situation we have in the case of cybernetic modelling of our minds' elements – at least if we are talking about information computing and learning. It is possible to simplify real brain's complexity to extremely simple model that a neural network is, and later to perform simulation results. In my last book, for example, which has extremely popular character and it does not include any mathematical formula, I showed that some phenomena observed during neural network's learning are strictly similar to dreams.

**J: They say that your networks cheat.**

Yes, they also cheat if they only may.

**J: But you caught them on the spot?**

Yes, because this is quite easy. We have all elements under control in this case.

**J: Therefore your networks have bad character traits?**

(Laugh) They have inherited many various features. If we create something following us, the human being, we cannot limit to good qualities only; bad attributes appear as well. So we can find out many things about the human mind thanks to neural networks, but phenomenon of ego is the deepest mystery for me. The awareness of self-being is a key, I suppose.

**J: Have these neural networks got awareness you have mentioned?**

No, they have not. We still cannot find anatomical or psychological fundamentals of this awareness in our bodies. In the human brain we can localize points responsible for e.g. perception of speech, touch, or behaviour control. Nature has localized suitable functions with unique precision. Let take some diseases, aphasia for example, which depends on a selective impoverishment of language communication. Some patients speak seemingly as healthy people but they have enormous difficulties with speaking about actions. Inserting an electrode into test animal's body one can produce an attack of fury or fear,

one can make that rabbit will cuddle a ball of cotton wool, even it has not any young, because maternal feelings have been induced. However we cannot advance to response on where in our huge, complex and great mechanism of our thinking self-identity, consciousness and sense of autonomy ego from rest of the world. Awareness that I exist and I have certain purposes, are generated by my mind, not given from the outside. It has nothing common with intellectual processes. Something that eludes our lancets, our electrodes, our magnetic resonance, and what probably catches on „mystery of the soul“. Something what even a fly escaping from a swatter has, though computers and neural networks do not have this. It is much more than bare computing.

***J: Does this mean that if one tries to destroy a neural network it will not defend itself?***

No, because a network has no sense of self-identity. Of course, we can program defensive actions, but this element is performed like other loaded commands. For us self-defence is like breathing, too obvious to speak. There is *differentia specifica*. We will entrust our health and life to robots because their hands do not tremble. But the aim of every machine is outside of it. Simple word „I“ differs us from the machines.

***J: Does not the revolution of the machines pose a threat to us?***

No because of reasons that I mentioned above. Only something having the self-consciousness can revolt. People have always been revolting, but we have never heard about any organized rebellion in the animal world, although animals are very often treated in a cruel way by their owners. A beaten dog can bite an aggressor, but any poultry on the farm will not revolt even under threat of extraction because of bird flu.

***J: In science-fiction movies we often can see some weird creature: a computer which has a mind. There are two options: it is new created existence or someone else's consciousness was transferred into this computer. I have two questions: is an operation like this possible, and if the response is „yes“, and we could take your fiend's mind and put it into a computer, let's call it „Paul 1“, in what way mind like this could develop? What dangers could appear?***

That is impossible because we can model everything however under a condition that we recognize it before. Let's take an example, if a painter would want to paint your portrait he has to know you really well, otherwise he can produce a photograph only – a simple replica of your facial features. Good portrait shows also temper, sensibility etc. The same situation we have with a model. A cybernetic model is successful and satisfactory for the creator if and only if deep seated in a tissue of our conscious and given before knowledge operates well. This is the source. To recall a story – there was a mathematician in France, his name was Wronski. He maintained he found out a formula describing the God. He endeavoured to the Absolute through the manipulation of mathematical elements, whereas the essence of the Absolute is the infinity, which cannot be constructed from finite parts.

***J: I have heard that you have recently started interesting in antropomorphic robots.***

It is impressive for everyone: a machine that looks, behaves and operates like a human. The vision of the antropomorphic robots is not only dreamers' vision. On the contrary, we are faced with necessity of them. The room, in which we are, is completely constructed in relation to bipedal creature. It is much more easier to construct mechanism mimicking the human than to produce a situation like, for example, in a car factory. The proliferation of robotics through the implementation of a single function is adequate to industrial process automatization. Because of that we need an anthropomorphic robot, not other else. We do not construct a doll for play; we create helper and assistant, so it has to be similar to us. It is the matter of comfort. Nobody will not rebuild a house because of artificial housemaid.

***J: Is a scientist a creator?***

Yes, certainly. I would say paraphrasing Plato that a scientist is a demiurge, because we can model not only genuine reality, but also can refer to imaginary existence – mathematical formulas, programmes, graphical elements. It gives extraordinary satisfaction, when the real word becomes more intriguing. They say that we aim to inform society and knowledge-based economy, in which knowledge will be the superior value. However, we are talking about created not reproduced knowledge. Information recited by student during the examination is not true, useful knowledge. It might sound cruel, because of much effort of this student, but it is true. Of course, creation of new existences involves issue of moral responsibility. Not everything, what is possible, should be done. Science does not depend only on question „how to do it“, we also have to ask “do we really need it” or “to create a new technology”? Nobody gets two times into the same river; one cannot withdraw developed technology. It will spread out among the people, and will change their behaviour. People are becoming addicted so easy. Technology has a great influence on all spheres, including customs and morals. The some young man who well dressed comes to the opera, covered by nickname in the Internet blasphemes and insults others in way for he never dared to do face to face. We are the hunter who can easy exterminate whole fauna.

***J: Making notes before this interview I planned to ask you about a thing that you want to create the most; however after your last words another issue slides over: what are you afraid of? What will you not create for sure?***

A long time ago I gave up some work. My research on automatic speech recognition systems was the first in Poland. The topic became extremely popular in those times; so I gave up. I was convinced that only Poles could develop adequate systems for Polish language – like English native people work on this system for English language. Also, I was sure so many scientists were working on speech recognition that there was not necessity to my work. I started interesting in automatic image recognition, and later automatic image understanding. I made an error; good system for the Polish speech does not exist

till now. I must say I regret a little. I do not assert that my person guaranteed development of successful system. So, I am guilty for that you will have to write this interview by yourself, word by word.

**J: You were talking about an automatic recognition and automatic understanding. What is the difference between these terms?**

Well, from a few years I have been trying to prove that images, beyond visual level – colour, shape, light, have also the level of meaning. I deal with medical images, for those this meaning level means diagnosis, prognosis and therapy. I have to recognize the nature of the process deforming organs to can counteract successfully. Within last 10 years I have finally managed that images includes meaning level, and if we manage to penetrate into this sphere thanks to sufficiently smart tools, we will can achieve some important things, e.g. smart searching visual information in the Internet. Currently to find an image you have to use a word describing this picture, but you cannot use an image as an example for searching. In other words, you find a picture you need only if someone who put I in into Internet used a certain word. Automatic recognition assumes that someone determined categories before, and only role recognizing person or machine is to allocate an image in suitable class.

**J: But there is so much data!**

Yes, but the first and foremost matter here is arbitrary. Decisions on assigning to a class are made *a priori*. My research team tries to reach and model the meaning level in – generally speaking – multimedia situations. We try to automate the process of medical diagnosis – the situation in that a computer firstly recognizes and categorizes a problem, and after that draws up a prognosis, diagnosis or medical case's aetiology. Understanding means much more than only catching and assigning of flashing image.

**J: At which stage these researches currently are?**

In some fields it is already working, although it still needs widening and deepening. I suppose that within next ten years this technology will pave the way entirely. Few years ago nobody believed in automatic understanding yet. Editors crossed out this term and wrote „automatic recognition“ adding a comment that author should improve his or her English skills. Today term „automatic understanding“ is used concurrently with „automatic recognition“.

**J: I do not want my next question to seem untimely, so I will ask you in that way: looking at your whole life from what you want to be mostly remembered?**

I would like very much to have achievements in the future, from which I will be respected and esteemed. Everything what we did and what we lived through is beyond us now. Consummation deprives of charm. There is no work from that I am completely glad and which I would like to make symbol of my life. I hope that it is still before me.

Warsaw, 11<sup>th</sup> December 2007