Interview – Mastery of Multimedia

Furht, Borko

1. **What is the essence of the contribution for which you received your highest recognition?**

In the mid 90s, my graduate students and I invented and developed two crucial technologies that enabled video and audio broadcasting over the Internet. These two technologies include a new video compression technique based on the 3-dimensional Discrete Cosine Transform, which outperforms MPEG compression schemes in terms of the compression ratio and real-time transmission, and IPSI mulcast, which is an innovative Internet broadcast protocol, which provides inexpensive, efficient, and reliable audio and video broadcasting. The technologies have been reported in a number of publications, including several IEEE articles.

2. **What are the impacts of these contributions?**

These contributions represent the pioneering work in the field of peer-to-peer networks, which are today commonly used for video and audio broadcasting. Much of research work worldwide was based on these contributions.

3. **What are the applications of your contribution that may change everyday life?**

The applications of these technologies are tremendous, and include various applications of Internet-based broadcasting of video and audio, which today allow crisp audio and full-screen, high-quality video on-demand. When the technologies were developed, the start-up company Pipe Dream in West Palm Beach was founded in 1997. Several of my students worked in the company, and I served on the Board of Directors. The company has developed the first software product for video and audio broadcasting over the Internet. Later, the company was acquired by another company.

4. **Can you tell us, what are the issues that we have to teach our kids, so they become creative when they finish studies?**

It is very difficult to teach "creativity". Therefore, I will begin with the skills that students, who will become engineers and scientists, need to possess in order to be successful in today's world. In my time, we needed to be good mathematicians and understand technical issues. However, in today's global world, a successful engineer and scientist should also have other skills, including communication and writing skills, understand various cultures, and also possess interdisciplinary skills (for example bioinformatics or business management).

The role of a good teacher is to identify promising students and challenge them with projects and problems, which will develop their creativity.

5. **What are the major things to keep in mind, when you form a team for a scientific experiment, or similar?**

I will present my views, which relates to my experience when initiating a new research (rather than a scientific experiment) and establishing a research team.

First, the research begins with selecting the right topic of research. It is very important to understand very well what has been already done, so you don't "reinvent the wheel!" This phase consists of studying the literature including patents.

In today's world, it is almost impossible to conduct research, which is not funded. So, the second phase consists of finding sources for your research. In my case, these are either

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Dr. Borko Furht is with the Florida Atlantic University, Department of Computer Science and Engineering (e-mail: borko@cse.fau.edu)

government agencies, such as NSF, NASA, Department of Defense, and NIH, or private high-tech corporations. This phase consists of writing and submitting research proposals, contacting government agencies, and talking to industry representatives.

Once when the research funding is assured, the scientific team is created depending on the available finds. For large, interdisciplinary projects we include researchers and graduate students with various expertises from different departments, even colleges or universities. For small projects, a typical team consists of a few graduate students.

6. What are the people to avoid, when trying to generate a breakthrough achievement?

First, try to avoid publishing it, before protecting it. Protect it first, by applying for the patent. Patent takes lots of time to get approved; however, you can always apply for provisional patent, which can be obtained in a very short time and is valid for a year.

Second, make sure that you are the first in generating "this breakthrough achievement". I have seen many cases where researchers "invented" something that was invented earlier by simply not doing a good homework in researching the literature.

7. What is your opinion about the impact of math?

In my time, math was a very important topic for engineering students. It still is, if it is taught correctly. European students are much better in math than American students, which is a big weakness in American schools. On the other hand, American students are more pragmatic and practical.

The recipe is to find a good balance between theory (in this case math) and applications (specifically in terms of computer applications).

8. When targeting a major breakthrough, how sensitive one has to be about the direct interests of tax-payers?

In our case, this is very well defined at the university level. Every patent invented by a researcher at the university belongs to the university (it is the state university, so it basically belongs to tax payers). If the patent invention generates some revenues through licenses, than university gets 70% and the individual inventor gets 30%. This sounds a fair game.

9. What is the driving force that motivates a person like you to continue to create and generate results after he receives such a big prize?

Most researchers are not motivated with monitory awards; it is typically curiosity which motivates and drives true researchers to continue their work until they can produce. In our College, we have a famous researcher Dr. Bill Glenn, who is 82 years old and has 128 patents. He is still very active and he recently submitted another patent. In USA there is a relatively new law (about 15 years old) that university professors do not ever need to retire unless they select to do so. This gives them the opportunity to continue their creative work all their lives!

10. For a small nation like Serbia, what is your advice, which road to take, when it comes to science?

Leading scientific forums in Serbia, such as Academy of Science and Ministry of Science, should develop a long-term vision which scientific areas should be developed in Serbia and provide funding to these areas. It would be very wrong for a small nation like Serbia to try to do research in many different areas; this would be wasting of resources. In my field of computing and engineering, I see a great chance for Serbian researchers to conduct applied research and development in the areas of software development and Internet engineering. I would be delighted to see a number of start-up companies in these areas, which today can easily grow and become

another Google, or YouTube, or Facebook. For this kind of businesses, with great ideas you don't need to be in USA; you can be in Serbia and be very successful worldwide!

11. Major impression about Serbian scientists that you met abroad?

Being a Serbian, who left Serbia in 1981 and went to become a professor in USA, I met a large number of Serbians before and after. I also had several PhD students from Serbia who graduated under my supervision. I am currently supervising three PhD students, two from Serbia and one from Montenegro.

I am proud to say that my best students were always from Serbia. They were all superb; they successfully completed their work toward their PhD degree in a record time, and they are all very successful today. For example, Dr. Daniel Socek, who graduated several years ago in the area of multimedia encryption, has a very successful consulting company in USA in this field; his main client is Real Networks Company. Dr. Dubravko Culibrk, who also graduated several years ago with the PhD degree, is the only Serbian student who decided to return to Serbia; he is currently Docent at the University of Novi Sad.

Besides my students, I met many Serbian scientists in USA and elsewhere. They are all very successful in their fields of expertise. My very close personal and professional friend is Dr. Leon Alakalai, who finished electrical engineering at the University of Belgrade and later received his PhD from UCLA in Los Angeles. He is one of the leading researchers and a manager of Robotic Lunar Exploration at NASA JPL Center in Pasadena, California. He recently became a member of the International Academy of Astronautics.

There are many other examples of successful Serbian scientists and researchers.

12. Major impressions from your visits to Serbia?

I visit Serbia every year, and I see some improvements from year to year. Belgrade looks nicer every time. As usually, restaurants are full, people are smart, tall and beautiful (young people!). Some of them are happy, some of them not!

In terms of research and science, my impression is that there is no vision, no collaboration, no team and interdisciplinary work, no focus on "niche" research. I can only see some individual success stories. Good researchers/scientists are just trying to survive doing mostly consulting and not true research. No available funds for grand research projects that can motivate researchers in a small nation like Serbia

I don't see that with this kind of research politics and research strategy Serbia will ever become visible on the world research scene!

13. Major impression about the University of Belgrade?

It is a great university, great people, and great students! However, there is a lack of well-developed research strategy and funding for research. Professors (potential researchers) are mostly focused on teaching and consulting and less on true applied research. The university definitely needs significant increase of resources to become a world-accepted research institution.

Dr. Furht has over twenty five years of academic and industry experience in the field computer science and engineering. He is Professor and Chairman of the Department of Computer Science at Florida Atlantic University (FAU) in Boca Raton, Florida. He has been a PI or Co-PI of a number of large projects funded by various government agencies such as NSF, ONR, NASA, and from industrial corporations, including IBM, Motorola, Hewlett Packard, Xerox, and others. He is an author of more than 250 technical and scientific publications, including 28 books.