



DOING WHAT YOU DO BEST ÖRJAN EKEBERG

Born in 1954 in Uppsala, Sweden. Master of Engineering Physics 1981, Doctor of Computer Science 1992, Docent 1996. Associate Professor since 1996 at the Department of Computer Science and Numerical Analysis at the Royal Institute of Technology in Stockholm, Sweden. His research initially centered on computational models of neural networks including memory capacity and error-correcting memory retrieval. More recently, he has specialized in the use of computer simulations to study the interaction between neuronal networks and behaviour via muscles and biomechanical properties. In close collaboration with neurophysiologists at the Karolinska Institute, he has developed simulation models of the rhythm-generating neuronal circuits in the spinal cord responsible for swimming in fish. – Address: Nada, KTH, 10044 Stockholm, Sweden. E-mail: Orjan@Nada.Kth.se.

Being a Fellow of the Wissenschaftskolleg has irreversibly changed me as a scientist. I have learned to see my work in a much broader perspective and I have gained a better understanding of how research is being done in completely different fields. In a world where front-line research requires extreme specialization, such interdisciplinary understanding has become a valuable but rare resource.

It is hard to describe in a few words how a fellowship at the Wissenschaftskolleg influences you. The Kolleg can perhaps best be characterized as a “social training camp for researchers”. When arriving, all Fellows have left their fame and authority behind and they are forced to build new social networks from scratch. After one year, new relations have formed and most Fellows have discovered that they did not have to hide behind titles and fame. Instead, the true content of their work becomes the focus. Being allowed to do what

you do best is a refreshing positive experience that makes you grow both professionally and personally. I think that this experience may be the most important aspect of a stay at the Wissenschaftskolleg.

Working Alone

Initially I had the impression that this would be a year when I would work very much alone. In particular, I would have the opportunity to focus on the project of my choice without anyone caring or even knowing what I was doing. Now, at the end of my stay, I find that things turned out very differently. I have had numerous discussions with Co-Fellows on matters that colleagues at my home department know little about and I feel that many Fellows now know and care more about my research than even my colleagues back home.

I am a computer scientist specializing in simulation models of neural networks controlling animal movement. This involves formulating mathematical descriptions of how muscles work and calculating how the resulting forces result in coordinated movements of legs and other body parts. A substantial part of the research also involves finding suitable numerical solution methods and implementing them in programs.

Looking through the list of Co-Fellows before arriving, I quickly concluded that few would be able to contribute much to my work. I saw economists, historians, social scientists, composers, poets, and others, most of whom I had never heard of before. On the other hand, I knew that I would not be entirely left on my own, since I was invited as part of a special interest group on locomotion. This group consisted of a handful of biologists and I realized that I should take advantage of the opportunity to learn as much as possible from them during my stay here.

It turned out that my Co-Fellows were much more interested in my project than I could ever have imagined, and this was by no means limited to the members of the locomotion group. Many regularly asked me about my progress and contributed, perhaps without being aware of it, to my work.

One most important institution at the Kolleg is the colloquium, where every Fellow is supposed to present his or her current research to the other Fellows. The colloquium is a real challenge, since the audience consists of very intelligent persons who know more or less nothing about the subject you are talking about. I made an effort in trying to gloss over the mathematical technicalities of my models and focus on general questions: how can

biological knowledge be transformed into mathematical models and what kind of understanding can one gain from making simulations?

During and after the colloquium, I received feedback on things that are rarely even discussed within the field. The philosophical role of understanding and how simulation fits into the framework of hypotheses and experiments was brought up. My choice of terminology was scrutinized as well as the aesthetic aspects of my illustrations. I was directed to classical literature describing movement control in the context of ballet dancing, which proved to have direct parallels in my models.

During my stay at the Wissenschaftskolleg I have had access to some of the most important persons in their respective fields. During endless lunches and dinner discussions, I have learned a lot about research areas I hardly knew existed. We have had long discussions on subjects like the quality and presentation style in literature research, the objectives of social sciences, the role of evolutionary models in biology, and the relation between micro and macro models in experimental economy, to mention a few examples. The highly specialized nature of modern research makes this kind of general intellectual discussion rare in normal academic life today. Still, for a young, diverse, and in many aspects immature research field like computer science, a perspective on how research is being done in other disciplines is necessary for the maturation of the field.

The Locomotion Group

I was part of a group of four persons interested in the neural control of walking. Ansgar Büschges was the specialist on insects and Keir Pearson on vertebrates. Volker Dürr, who joined us for the last months, had experience with modeling, but on a different level than I was primarily working with. For my project, I decided to develop my simulation program to mimic the two most important experimental animals used in walking research: the cat and the stick insect. In doing so, I counted on collaborating with Ansgar Büschges on the stick insect and with Keir Pearson on the cat.

I knew that successful collaboration can not be taken for granted by just forming a group, especially if you are supposed to work across disciplines. My experience is that there has to be a mutual interest, so that all participants get something out of the collaborative effort. Further, one first obstacle that has to be tackled is the development of a common language and understanding.

Ansgar Büschges and myself shared a huge office in the Villa Jaffé. This made it easy to communicate, and we were encouraged to organize our work to make the most out of this situation. One of the first things we did was to ask for a white-board to make it easier to explain our terms, methods, and thoughts to each other. The first months we had intense and constructive discussions about how simulations could best be used to tackle the unsolved questions that were most urgent in the field. Initially, he had only vague ideas on what could and should be simulated, while I knew very little about the neural control systems, especially of insects.

After the first few months we had a clear view of what could be achieved and could start with the actual modeling work. Ansgar Büschges then set out to search the literature for data needed for the simulations, while I implemented one model of the stick insect and one of the cat, based on this data. Also during this process, it was of great advantage to work so closely together. Whenever I needed to know some detail about the stick insect for my implementation, I could immediately get a response from the other end of the room. Whenever Ansgar had found some potentially relevant article, he could immediately ask me if this would be of use in our current or future version of the model.

In February, Keir Pearson joined the locomotion group, and for me this meant that I now also had an expert in cat locomotion to interact with. With his incredible knowledge and experience at hand, we quickly made progress with the cat model. We could show that a handful of critically chosen neural mechanisms was sufficient for generating a natural walking behaviour. Volker Dürr, our final member of the group, arrived some months later and contributed, among other things, with critical discussions around how to tie the simulations to older models of the stick insect walking system.

I have earlier had a similar collaboration with the neuroscientists of Sten Grillners laboratory in Stockholm, so I knew both how hard and how productive this kind of cross-disciplinary work can be. The environment at the Wissenschaftskolleg is ideal for starting up such collaborative work. The superb library facilities and the possibility to work without distraction make the process of learning each others fields very efficient. Unfortunately, our very productive year at the Kolleg has now come to an end. We are already discussing how to continue our collaboration, hopefully preserving the creative atmosphere we had in Berlin. However, we probably have to accept that a year at the Wissenschaftskolleg is a unique experience.