

Mandyam V. Srinivasan

## Vistas Beyond "Active Vision"



I was born in Poona on 15 September 1948. I received my undergraduate degree at Bangalore University, my master's at the Indian Institute of Science, Bangalore, and my Ph.D. at Yale University. I was an Assistant Professor at the University of Zürich from 1982-1985. Since 1985, I have been with the Australian National University in Canberra, where I am presently Professor at the Research School of Biological Sciences, and was Director of the Australian National University's Centre for Visual Sciences from 1994-1996. I was awarded a D.Sc. by the Australian National University in 1994 and was elected to the Australian Academy of Science in 1995. My work focuses on principles of visual processing in simple natural systems, and on the application of these principles to machine vision and robotics. So far, I have published some one hundred research papers and edited one book in this field. — Address: Centre for Visual Sciences, Research School of Biological Sciences, Australian National University, GPO Box 475, Canberra, ACT 2601, Australia.

About a year before I arrived at the Kolleg, I was charged with the somewhat daunting responsibility of assembling a team of four scientists (including myself) to collaborate on a book elucidating the principles of "Active Vision" in animals and machines. Now, nearly two years later, I am happy to report that this project has largely succeeded — despite the uncertainties with regard to the mutual compatibility of the collaborators, who hailed from four different countries — and despite the fact that one collaborator suddenly and unfortunately passed away only a month before we came together in Berlin. The details of this project are described in another section of the *Jahrbuch*, and I shall not repeat them here.

During the academic year, my colleagues in the Active Vision group and I organised a workshop on *Active Vision in Animals and Machines*, from 22-24 March 1997. We were able to attract a number of internationally reputed scientists in the field. The workshop was on the whole very successful, at least in our opinion, because it had the right mix and balance of biologists and engineers to stimulate fruitful discussion in

this interdisciplinary field. Furthermore, we received valuable feedback with regard to the organisation and content of the book that we were writing. The details of this workshop are described in another section of the *Jahrbuch*.

While at the Kolleg, I was also able to attend to a number of other items of my research, free from the other responsibilities that usually preoccupy me at my home institution. For example, one of my Kolleg-colleagues, Dr. Svetha Venkatesh, and I proofread the manuscript for another book which we had edited and which was published in April 1997. There was also time to finish the writing up and submission of manuscripts for a number of papers that were in preparation as I left Canberra for Berlin. I was also able to respond to an invitation by the journal *Nature* to write a "News and Views" commentary on an article published in that journal by another Kolleg-colleague, Dr. Roland Hengstenberg. These publications are listed at the end of this report.

Over the past ten months, I have had the opportunity to visit a number of universities and research institutions in Berlin, as well as elsewhere in Germany and Europe. I was a member of a panel to review a Research Centre at the University of Sussex. I gave seminars on my research at the *Humboldt Universität*, the *Freie Universität* and *Daimler-Benz* (Berlin), the *University of Bielefeld*, the *University of Würzburg*, and the *University of Groningen*. I also gave presentations at the following conferences and symposia: the *Interdisziplinäres Kolleg on Artificial Intelligence* in Günne am Möhnesee, the *Conference Universitaire de Suisse*, Geneva, the opening of the *Centre for Computational Neuroscience* at the University of Sussex, the symposium on *The Retina Sees and the Cortex Believes* at the Australian National University, Canberra, and the *Annual Meeting of the Australian Neuroscience Society* in Newcastle. I participated in the discussion on *Theoretical Biology* in conjunction with the 1997 Old Fellows' meeting at the Kolleg. The Active Vision group also visited the Fraunhofer Institute and Daimler-Benz (Berlin) and Firma Select GmbH (Hartmannsdorf; meeting kindly arranged by my Kolleg-colleague Dr. Roland Hengstenberg) with the objective of exchanging information about our mutual research interests and exploring opportunities for collaborative research. While these activities took some time away from my primary mission at the Kolleg, they were very useful in that they were instrumental in informing others about our research in Canberra and at the *Wiko*, in developing future collaborations, and, hopefully, in better informing other institutions about the *Wiko*. I am grateful to the Kolleg for allowing me time out to respond to these invitations, opportunities, and obligations.

Like many modern *Naturwissenschaftler*, my education has been a rather narrow one, sharply focussed on my area of research. This is unfortunate, but intense specialisation seems to be increasingly necessary in the natural sciences if one is to keep up with the competition — one simply does not have the time or the energy to be as broadly *ausgebildet* as one would like to be. These ten months at the Kolleg have been my first opportunity to listen to and talk with people entirely outside my microcosm: historians, social scientists, philosophers, economists, students of Islam, English literature and so on. I think I have benefited substantially from this intellectual cauldron. I believe that I now have a less blinkered view of the world, and I am grateful to the Kolleg for making this possible. In today's world of ever-increasing specialisation, it is important to be able to stand back and view one's work in a broader context. Unfortunately, I also believe that I have now developed the courage and disposition — like some of my Wiko colleagues — to hold forth at length on topics that I barely understand.

When we first arrived at the Kolleg, the Rector stated that although we were starting with some forty Fellows, there would be forty-four when we left. He was alluding to the Kolleg's observation, from past experience, that the average Fellow increased his/her weight by 10% during the ten-month period. (This statement, made at the welcome dinner, was a compliment directed at the kitchen staff). This statement raised some consternation in me, given not only the continuing presence of starvation in certain parts of the world outside the Kolleg, but also the fact that I was already no longer *schlank*, but *vollschlank*. I am happy to report that the Rector's welcome address inspired me to pursue a regimen of diet and exercise through which I was able to *shed* 10% of my weight during my stay. Assuming that my initial weight was close to the average of this year's cohort of Fellows, and assuming that all of the other Fellows followed the Rector's prediction (which I believe they did), I believe that I was able to reduce the size of this year's leaving cohort from the predicted 44 down to 43.8. My advice to next year's Fellows is: German dessert is excellent, but remember that if a Berliner has a Berliner for dessert every day, there will be 1.1 Berliners at the end of the academic year.

I came to the Wiko with the hope of rejuvenating mind, body and soul. There is no doubt in my mind that this rejuvenation has indeed occurred (although my colleagues might provide a more objective assessment). My wife Jaishree and I are deeply grateful for the warm and unusually generous hospitality that all of the staff of the Kolleg have extended to us; for attending to every little query and difficulty, and for making us feel very much at home at the Kolleg and in Berlin. It would

be no exaggeration to say that these past ten months have been the most memorable period of my life so far. To cite an old *Schlager*... "*Ich hab' noch einen Koffer in Berlin!*"

Publications arising wholly or partly out of work during my stay at the Kolleg:

- *From Living Eyes to Seeing Machines*. M.V. Srinivasan and S. Venkatesh (eds), Oxford University Press (1997).
- "Flies go with the flow". M.V. Srinivasan, *Nature*, 384: 411 (1996).
- "Honeybee vision: analysis of orientation and colour in the lateral, dorsal and ventral fields of view". A.D. Giger and M.V. Srinivasan. *Journal of Experimental Biology* 200: 1271-1280 (1997).
- "Navigation, path planning and homing for autonomous mobile robots using panoramic visual sensors". *Proceedings, AISB Workshop on Spatial Reasoning in Mobile Robots and Animals*, Manchester (1997).
- "Long-term synaptic plasticity in the honeybee". S. Oleskevich, J.D. Clements and M.V. Srinivasan. *Journal of Neurophysiology* (in press).
- "Range estimation using a panoramic visual sensor". J.S. Chahl and M.V. Srinivasan. *Biological Cybernetics* (in press).
- "Reflective surfaces for panoramic imaging". J.S. Chahl and M.V. Srinivasan. *Applied Optics* (in press).
- "Visually mediated odometry in honeybees". M.V. Srinivasan, S.W. Zhang and N. Bidwell, *Journal of Experimental Biology* (in press).
- "Edge detection by landing honeybees: behavioural analysis and model simulations of the underlying mechanism". R. Kern, M. Egelhaaf and M.V. Srinivasan, *Vision Research* (in press).
- "Object-detection by relative motion in freely flying flies". B. Kimmerle, M. Egelhaaf and M.V. Srinivasan, *Naturwissenschaften* (in press).
- "Analysis of pattern orientation in the honeybee: temporal constraints". A.D. Giger and M.V. Srinivasan. *Naturwissenschaften* (in press).
- "Visual control of honeybee flight". M.V. Srinivasan and S.W. Zhang In: *Orientation and Communication in Arthropods*, M. Lehrer (ed), Birkhauser Verlag (in press).