MOVING ON
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Imagine, the first news you got after the birth of your first child was that Rudi Dutschke was shot. So did my parents. Luckily, most Swabians don't believe in fate, so this coincidence neither biased my political opinion nor influenced my choice of study. If anything was fateful for me, it was the contagious fascination of a school teacher and the inspiration of a charismatic mentor. Both of them convinced me that studying biology at the University of Tübingen and the University of Sussex was the right thing to do. Later, my graduation year at the Department of Biological Cybernetics in Tübingen, as well as my dissertation years at the Centre of Visual Sciences of the Australian National University in Canberra and at the Neurobiology Department of the University of Bielefeld, set the trend in my current thinking – and beliefs. One of these beliefs is that genuine understanding in science requires a formal theoretical concept. If you can't model it, you can't be sure. In 1998, the appointment as Wissenschaftlicher Assistent at the Biocybernetics Department in Bielefeld introduced a slight change in my projects. They became less cellular and more system-oriented, less sensory and more motor – more SensoryMotor, perhaps. – Address: Abt. 4: Biologische Kybernetik, Universität Bielefeld, Postfach 10 01 31, 33501 Bielefeld.

A Postdoc Among Legends

How great is it for a postdoc to join a group of enthusiastic scientists, to meet them on a regular basis, to exchange ideas with them, to learn about their scientific motifs and to appreciate their expertise for months? How much can one benefit from a loose cooperation of bright people with sufficient common interest to make it effective and with the necessary

differences in background and approach to make it a challenge? I consider it an outstanding gift to have had the chance to meet, get to know and work with the other three members of the locomotion group. Their ideas, suggestions, hints and thoughts have left many traces in my current view on neural control of locomotion and have added a new twist to my current projects. Perhaps my benefit was due to the fact that the four of us made up a nearly perfect two-by-two block design of scientific interest, exploring a theory-physiology gradient and a vertebrate-invertebrate gradient across the same topic.

Having been the least renowned, least experienced and least tenured of the group, I appreciate that the Wiko took considerable risk in inviting me (but sure enough, they also invited an entire group of risk experts), because nobody on the planet could have possibly had a reliable and objective indicator of why it would have been more appropriate to support me rather than another postdoc. Even more so, I hope that I filled my role in the group in a way that helped to encourage the Wiko panel to take the same risk again in future years and to offer more postdocs the same chance that I had.

Workshop and *studium generale*

I would describe my stay at the Wiko as a mix of workshop, practical and *studium generale*. It was arguably the most intense workshop on the biomechanics of walking one could imagine. Felix Zajac, our first workshop tutor, gave us several lectures on his generic muscle model, the pivot around which most current models on vertebrate biomechanics turn. Bob Full gave a set of lectures on insect muscle and the biomechanics of hexapod walking. His favorite theme, the pogo stick (a spring-mass model), impressed me not only because it is a powerful concept to analyze and simulate various kinds of movements. Also, it is a topic around which a cross-disciplinary research network of biologists, engineers and mathematicians has created synergy effects that all participants seem to benefit from. Finally, Arnim Henze taught me how to calculate the inverse dynamics of an insect limb, opening up a whole new range of studies that I can now manage myself. Also, my stay was a productive programming practical, giving me time to implement many routines that I now frequently use, and even to learn a new programming language (Python). Both the workshop and the practical are already helping me to reconcile some conceptual differences in locomotion models. Hopefully, the continued cooperation of our group will witness the merging of behavior-based control circuits made of Artificial Neural Networks (e.g. the Bielefeld WalkNet) and physiology-based logical sets of coordination rules (e.g.

the current version of the Wiko stick-insect model). Who knows, maybe Örjan Ekeberg's dynamic models can become for a "Wiko locomotion research network" what the pogo stick has become for Bob Full and his colleagues.

Although less focused and often a little dogmatic, the *studium generale*, consisting of the weekly Tuesday colloquia and some lunch discussions, provided a further source of insight. It encouraged me to present my own area of research in a slightly different light than I usually do. I thought, why not draw a picture of "Biological Cybernetics" using a few historical examples that are representative of its conceptual insights for neuroscience, but that also allow long-term evaluation of its successes, relevance and limits. On top of that, I attempted to embed two of my own projects into the general framework of my seminar. As expected, at least when speaking to an exclusively clever but also outrageously mixed audience, the responses afterward were rather incongruent: Physically, they ranged from enthusiastic shoulder-patting to facial expressions that I attributed to the first signs of a major depression. Verbally, they ranged from something like a "profound plea against positivism" to a "presentation of rigorous experimental conduct". The world of science never agrees, and general students of science generally get many study details wrong. But what about the main message? The experience made me wonder whether I would ever manage to get everyone in my audience to take home the same message. So far, I fear that this will only happen with trivial, incredibly bad or cancelled seminars.

Vocal Resources – Social Bonds

During one of the Thursday evening dinners, the conversation came to music, giving rise to the plan to organize an informal singing group. It all started out with a very funny, entertaining and rather out-of-tune evening rehearsal on the top floor of the Villa Walther. The location of this first meeting provided for immediate positive expert rating (The musically well-trained neighbor residents, Gérard Mortier to the East and Helmut Lachenmann to the North, never disapproved of our performance, at least not that I would have heard of it. Rather, one of them ever joined the group later on. Soon, the sing-along developed into a regular social event, starting with one or two rounds, followed by a motette (Tallis), a pop song (Beatles) or a folk song (Bellmann). Even a hippy hit made it into the Wiko singing charts of year 2002, possibly because many of the singers have been Mamas and Papas for some time.

In the meantime, Helmut Lachenmann had introduced me to his music, the sophisticated usage of the piano pedal, and the art of perforating a glissando into a quasi-arpeggio. In return, I re-introduced him, a sorcerer of sound, to his own vocal resources of sound.

The past five months were truly exceptional for me – as a postdoc among legends, as a student of biomechanics, and as a social singer. They brought back to me a notion of idealism in science that had been partly eaten away by a kind of mid-life cynicism nourished by akward science politics and the usual everyday mediocrity.

A less scientific, but rather influential outcome of my stay in Berlin was that I now firmly believe in two things that I had formerly only suspected to be true: First, I could live without the natural sciences, although I wouldn't like to, but I'd always keep singing. Second, moving on does not require locomotion.

References that Grew and Developed in Berlin

Dürr, Volker and A. Krause. 2002. "Design of a biomimetic active tactile sensor for legged locomotion." In *CLAWAR 2002 – Climbing and Walking Robots and the Support Technologies for Mobile Machines – Fifth Inter Conference,* edited by Philippe Bidaud and Faiz Ben Amar, 255–262. London: Professional Engineering Publishing.

Dürr, Volker, A. Krause, J. Schmitz, and H. Cruse. "Neuroethological concepts and their transfer to walking machines." *Int. J. Robotics Res.* 22, 3, in press.

Dürr, Volker and T. Matheson, submitted. "Graded limb targeting in an insect is caused by the shift of a single movement pattern."

Dürr, Volker, in prep. "Insect curve walking: kinematic transitions versus steady states." Two abstract versions of this study have been published in Volker Dürr and T. Authmann. 2002. *Zoology* 105 Supplement V, 66 and in Volker Dürr. 2002. *Soc. Neurosci. Abstracts* 28.