the two behavioural principles of manfred bonitz

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The Two Behavioural Principles of Manfred Bonitz

A Festschrift for His 80th Birthday

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Foreword

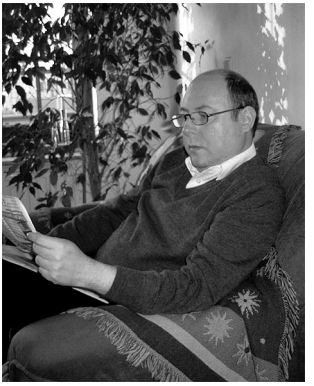
This special issue of the ISSI periodical presents a Festschrift to honour a pioneer in informetrics and scientometrics. We have invited colleagues and friends to submit letters, reminiscences, short contributions but also research papers to this Festschrift in honour of Manfred Bonitz on his 80th birthday.

As many other prominent personalities in our field, Manfred, too, started his career in one of the established science fields. He started up his career in nuclear physics in East-Germany and the former Soviet Union as early as in the 1950s. He remained faithful to his research field for more than 15 years before - in the early 1970s - his research interest turned towards information systems in physics, and somewhat later towards informetrics and scientometrics as well. About these early years in his career as information scientist, little is known to most of the contemporary scientists since his early work in this area was published in East-German and Soviet journals. And now after 50 years of active research in physics, information science and scientometrics he has found a new field of research: the life and work of one of the last great polyhistors and visionaries of the 20th century, Vassily Vassilievich Nalimov.

Jointly with the contributors and congratulants, we wish Manfred all health, energy and prosperity he needs to continue his work.

The Editors

Some Thoughts on Manfred Bonitz's Two Behavioural Principles Governing Research and Communication Processes



Wolfgang Glänzel

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Manfred Bonitz's name is beyond any doubt most likely associated with studies of the Matthew Effect in scientometrics. Maybe the Matthew effect for countries, journals and the Matthew Index are Manfred's most known results in this context. Less known is probably the fact that he has also introduced two basic principles of human behaviour in scientific research and communication. He formulated his principles as early as in the middle of the 1980s. And similarly to his idea of applying the Mertonian notion of the Matthew Effect in the sciences (cf. Merton, 19683) to scientometrics, his universal behavioural principles governing research and communication processes are somewhat related to another basic principle of human behaviour, to Zipf's Principle of Least Effort. This principle, which is only indirectly linked to Zipf's empirical law, name-

ly through the very property of human behaviour not to obey a Gaussian distribution but a rather to follow a power law, is a truly universal one as it can be observed in many areas like evolutionary biology, social behaviour or scholarly communication. In particular,

> "the Principle of Least Effort means… that a person…will strive to solve his problems in such a way as to minimize the total work that he must expend in solving both his immediate problems and his probable future problems…" (Zipf, 1949).

Manfred Bonitz has added two further principles to describe researchers' behaviour in seeking and disseminating information. He called his first law holography principle (cf. Bonitz, 1986) as it describes human behaviour as aiming at at the broadest dissemination, access and retrieval of information.

> "Scientific information 'so behaves' that it is eventually stored everywhere. Scientists 'so behave' that they gain access to their information from everywhere." (Bonitz, 1991)

Its 'temporal' counterpart, the maximum speed principle (cf. Bonitz, 1986) describes human behaviour as aiming at the fastest dissemination, access and retrieval of information.

> "Scientific information 'so behaves' that it reaches its destination in the shortest possible time. Scientists 'so behave' that they acquire their information in the shortest possible time." (Bonitz, 1991)

In fact, these two principles form one single law, in particular, they express the spatial-temporal duality of the same universal principle, the optimum dissemination, access and retrieval of information. By introducing this principle, Manfred proved a true visionary since little was known about the opportunities of the upcoming electronic communication at that time. The opportunities offered by the IT revolution, the electronic communication and the web have speeded up communication by several orders of magnitude. e-communication and e-publication, institutional and personal websites and repositories along with intelligent software solutions have

increased visibility, extended storage capacities and facilitated access and retrieval of scientific information as never before. And scientists make an extensive use of these possibilities.

In this sense, this festschrift, too, is an expression of Manfred's universal principles, as it will be visible and accessible worldwide almost immediately.

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Letters to the Editor

Sauna Science, Manfred Bonitz and the Science of Scientometrics

Tibor Braun

It would not be unexpected when readers of this short note would ask how sauna and scientometrics get to be connected. It's a correct question but in our case the explanation is simple. The bridge is my long lasting friend and colleague Manfred Bonitz. Sounds nice but I think a little bit of explanation is in order.

Once upon a time (about 35 years ago) an official delegation of the Hungarian Academy of Science visited Helsinki, Finland at the invitation of the Finnish sister, institution (the Finnish Academy of Science). It happened to me to be a member of that delegation. In a nutshell, our Finnish colleagues hosted us excellently taking us round in Helsinki and surroundings including museums, concerts (Sibelius) etc. But not unexpectedly presented by the hosts as the highlight of the visit was a boat trip in the Finnish Gulf targeted to a small, pine-forest covered island with a wooden bungalow, otherwise the only building on the island, a true, genuine Finnish sauna. I have never seen and/or taken a sauna-bath before.

We took off our clothes, entered the sauna being heated, they said to the „normal" temperature of 110°C, sat there for 10 minutes being invited afterwards to have a short swimming in the Gulf (3-4 minutes at the water temperature of 12°C). We swam, got back to the sauna for another 10 minutes, swam newly in the Gulf and did that once again for a third time. The first time it was horrible, all during those horrific minutes I was able to think only at survival. The second round was already acceptable, the third one delightful. For short I got back to Budapest as an amateur sauna enthusiast with a firm plan in mind: to build a sauna in my house. Incredible but I did it. My first own, private sauna reached its normal operating temperature (95°C, please note, I am not Finnish) in June, 1992 having beside a cold water shower (16°C, no Finnish gulf available) and I myself and Clara, my spouse had sauna two times a week since.

Pleasant pastime and we did really enjoy it. However after a certain time we noticed that pleasure here, pleasure there, we are desperately uneducated in things we do e.g. we know nothing on the scientific bases of sauna bathing. As many times in my life providence came to the rescue.

It came in the form of a one month visit my long lasting friend and colleague Manfred Bonitz has spent at out ISSRU Budapest working with us on a shared scientometric research project. During our professional chattings I counted him in passing on my sauna adventure in Helsinki and on the building of our own sauna in my house. It came out as totally unexpected news that Manfred built his own sauna in his house in Dresden already about 15 years ago being not only a sauna addict but a very thorough "conaisseur" of all aspects of the practice and theory of sauna science at a very high professional level. I invited him immediately to a visit to our sauna and from that moment on sauna Professor Bonitz became our teacher and mentor in all aspects of sauna science. I have learnt from him that the origin of the sauna is not known but it seems that sauna has been already used by the ancient Indians, the Scythians and the ancient Greek culture. Sauna bath opens the pores on skin and helps the body to remove toxins and other impurities from inside the body and blood. Due to the heat followed by cold bath to relax muscles and ensure the reduction of blood pressure, blood circulation, digestion and breathing get improved. As we sweat more during sauna bath we refresh in mood and health for longer time as the body gets cleansed and muscles are relieved to the feeling of well-being. Sauna-bath is also useful in

joint pains as the warm steam helps blood flow resume effectively in all parts of the body and the contracted muscles are relieved. The heat generated during sauna-bath helps our body in improving our immune system. Manfred knew also and taught us about those medical properties of steam which prove to be of great help in treating problems like cold (sinusitis), bronchitis, laryngitis, etc. He told us that a total of 15-20 minutes of the sauna is almost equivalent to 1-2 hours of brisk walk or one hour of serious gym exercise. Manfred's crown argument was that regular sauna-bath can also help MENTAL relaxation and release tension.

At his next visit Manfred brought us from Dresden wonderful special sauna towels (we are still using them) special equipment as sauna-brushes and different flavouring aroma liquids for flavouring our sauna-bath.

We had wonderful chattings during our joint sauna sessions. Scientometrics topics were in the forefront of those chattings.

In a letter (dated December 21, 1992) I received from Manfred he wrote:

> "Am 5. November, unmittelbar nach meiner Rückkehr von Budapest), schickte ich Dir ein FAX. Darin bat ich Dich freundlich um ein kleines Gutachten für unser Projekt, damitwir eine Verlangerung beantragen konnten".

It handles here on a research project Manfred was leading within the KAI e. V. Germany (Koordinierungs-und Aufbau-Initiative für die Forschung in den Ländern Berlin, Brandenburg, Mecklenburg-Vorpommern, Sachsen, Sachsen-Anhalt und Thüringen).

I have been glad to write the recommendation Manfred was asking for and that text is attached here to show some of the preoccupations Manfred had successfully working on that time. Later on Manfred and his co-workers finished successfully the project and published the results in a couple of fine papers.

At the end of this short souvenir-text it is my special pleasure to wish a very Happy Birthday 80 to you Manfred and to add in German „bis hundertzwanzig".

Appendix

Short report on the co-pattern clustering approach of Dr. M. Bonitz

I consider the co-pattern clustering approach used by Dr. M. Bonitz in his KAI e.V. research project a very original and promising concept which could lead to a better understanding of basic research carried out in different science fields in many countries.

By using ISSRU's /Budapest/ Scientometric Indicators, 1980-1989, computerized database dr. Bonitz began his investigations by clustering co-publication productivity patterns. During his one month study visit to ISSRU /Budapest/ he extended his clustering pattern investigations to national co-observed citations and co-expected citations patterns.

The study of interrelationships of the three co-pattern concepts /i.e. national productivity, observed citations, expected citations/ offers very attractive means for new avenues in the understanding of the mechanism of basic research carried out in different countries.

On the 80th Birthday of my dear friend and colleague Manfred Bonitz.

Eugene Garfield

Chairman Emeritus, ISI
Publisher, The Scientist
3501 Market Street Philadelphia, PA 19104

A decade ago, on March 16, 2001 in Berlin I made the following remarks about Manfred on the occasion of the Colloquium in honor of his 70th birthday. Since then Manfred has expanded his work on the Matthew Effect and worked tirelessly with Jeanna Nalimov to make the work of VV Nalimov better known to the world. Since space is limited I will close by mentioning that I have sent a series of photos taken by my son Joshua during our visit to Dresden in 1995.

Manfred and Natasha Bonitz with Eugene Garfield and his son, Joshua, at the Bonitz home in 1995. Natasha served a magnificient repast!

(The following speech was presented at the *Patterns in Scientific Communication: The Matthew Effect in Science and beyond – Colloquium in Honour of the 70th Birthday of Dr. Manfred Bonitz,* Berlin, March 16, 2001)

> "I do not recall the exact circumstances and events which led Manfred to enter the field of information science about 1970. Until that time he had a highly productive career as a nuclear physicist. In the United States during the 1950's and 1960's many nuclear physicists entered the fields of information science and science policy. Among the many who migrated from physics to information science were Don Swanson, Derek Price, Larry Halperin, William Goffman, among others. Their mathematical skills and training helped illuminate the laws of information science and scientometrics. They stressed the need to maintain a high level of discipline necessary to produce high quality science-based information and bibliometric research. In the East a similar migration from physical science to information science often occurred and calls

to mind such outstanding scholars as Avril Avramescu, Vassily Nalimov, and Gennadi Dubrov, and our friends at VINITI A.I. Mikhailov, R. Gilyarevski, and A. Chernyi."

Thanks to Manfred Bonitz, my work became much better known amongst East and West German readers due especially to the series of book reviews of my Essays of an Information Science volumes which he published over a seventeen-year period. Further, he was an important constructive critic of ISI products, beginning with a review of the ISI Journal Citation Reports® in 1983.

In his work, Manfred has expressed the belief that only truth and scientific relevance should be the criteria for a scientific work to be accepted, that science is universal, and the world-wide scientific community – despite all "social perturbations" – is a kind of ideal society: democratic, objective, just. If you are active in science then you have to compare

Manfred Bonitz and Eugene Garfield in Dresden. May 1995.

yourself with the rest of the world. It took great courage for him to write about GDR-Science in the mirror of international journals, an article which I imagine caused him some trouble at the time. He expressed the view that the Science Citation Index® is an unique mirror of the world-society of science, that it is interdisciplinary and it is – at least – created by scientists themselves. This aspect of the SCI,® I guess, attracted him from the beginning. It made him one of the decisive defenders (even though not without criticism) of the SCI.

In this respect, I cannot fail to mention another unusual scientist from Vladivostok, Victor Vaskovsky who also saw in the SCI these qualities and, like Manfred, became my long-time personal friend and the first Russian member of the editorial board of the SCI.

Manfred's work on "human behavior in scientific communication" was published both in German and English. And he has made numerous contributions, both as an author and editor, to the journal Scientometrics over the last decade. Manfred has always been extremely generous in publishing tributes to information pioneers as in the case of Nalimov, Price, and others. His investigations of the work of Wilhelm Ostwald is also noteworthy.

In the early 90s, Manfred began his work on co-structure cluster maps, leading in more recent times to the magnum opus the Atlas of the Matthew Core Journals. This was created with the help of his long-time collaborator Andrea Scharnhorst. This work followed from his encounter with Robert Merton's 1968 classic paper on the "Matthew Effect" and its follow on in 1988. These papers ultimately brought him in direct in person contact with Professor Merton. I can personally attest that Merton has marveled at the way in which Manfred and his colleagues have developed this theme. As Dr. Merton also points out "Bonitz inaugurated an altogether new phase in the systematic investigation of the phenomena caught up in the concept of the Matthew Effect." The Atlas is a completely unexpected outcome of Merton's original sociological observation of individual behavior which has now been given a global perspective. As Merton observed: "By

ingenious and original use of the Science Citation Index, you have gone on to discover the Matthew Effect for countries."

So I will close this short introduction with a toast to Manfred on his 70th birthday which I am sure we will repeat many times during our social encounters here. I also want to thank you all for coming, and also wish to thank Andrea Scharnhorst, Professor Walther Umstätter, and Dr. Heinrich Parthey for inviting me to begin this happy occasion.

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From Particle to Information Transactions

Peter Ingwersen & Irene Wormell,

Professori Emeriti, formerly Royal School of Library and Information Science, Copenhagen, Denmark

Manfred Bonitz is a good friend of Denmark and in particular Copenhagen. He proves that by speaking selected, always friendly words from that difficult language almost without accent. This attitude is a quality he embraced by often visiting the Niels Bohr Institute (NBI) as nuclear physicist during the 50s and 60s. Here, the atmosphere was always intelligent, curious, open-minded and highly communicative. This scientific and academic style – we believe – Manfred brought with him into his new adopted field of Informetrics and scientific communication.

Like several other physicists and academics from other natural science fields Manfred made that transition a fruitful one by bringing into the new field mathematical skills as well as particular ways of looking at data, information and citation structures. However, only few of those pioneering informetricians also became true 'information scientists', extending their curiosity to encompass, for instance, Information Retrieval or Information Science proper. Therefore, it became a nice achievement that Manfred, like Don Swan-

The Niels Bohr Institute, Blegdamsvej, Copenhagen, 2006. Source: Wikimedia Commons

son from Physics and B.C. Brooks from Mathematics, also became interested in the wider aspects of information transfer, i.e., in Manfred's case scientific communication patterns.

We have been very delighted that Manfred through the years several times returned to Copenhagen, so we could see each other at information science meetings at the Royal School of Library and Information Science. In particular, in activities at the Center for Informetric Studies (CIS), which served as the platform for out common professional interests. He has contributed to our understanding of our own field of information transactions where citations are like particles, in his nice mentoring way – with humor and insight. Manfred, we are grateful for your friendship!

Manfred Bonitz: A Mentor and a Friend

Hildrun Kretschmer

I know the highly productive and creative scientist Manfred Bonitz for more than 30 years and he was my guide in the field of quantitative science studies from the beginning on. A very long time ago, during the time when I was a newcomer in scientometrics, Manfred has successfully encouraged me as well as many other younger scientists.

Later I was strongly impressed – before the German reunification – Manfred was invited by the Editor of the journal *Scientometrics* to act as Guest Editor of a special issue on the topic: *"Scientometrics Research in the German Democratic Republic"* (Scientometrics 18(1990) No. 1-2).

However, also far beyond our small former country, Manfred is well-known all over the world. For example, let me mention here the strong personal contacts to Garfield and Merton.

Regarding personal contacts, he has also invited many international guests for visit his home in Dresden (cf. Liang Liming from China) for interesting and inspiring discussion.

Beyond personal international contacts Manfred was very often visible and highly

active in many international conferences, for example at the ISSI conference in Mexico in 1999 (cf. participants at the sightseeing tour including the marvelous volcano in Colima).

Last but not least let me personally cordially thank Manfred for his strong impact on my own scientific development and future.


6 16:31

Manfred Bonitz: A Generous Gentleman

Valentina Markusova

In a circle of scientometricians there are many colleagues who know Manfred much better than I. But I would like to use this very special occasion to add a few words about Manfred's kindness and generosity. I met Manfred in the office of my colleague, Prof. Ruggero Gilyarevsky in 1980. Ruggero worked on the Russian translation of Manfred's book at that time. Then we only spoke for a few minutes.

In 1993 I arrived in Berlin to participate at the ISSI conference and realized that I did not have any information where the conference would be held and how I could get there. I only had the address of a hotel where I had to stay. To my great relief the first person whom I met in the airport was Manfred. He came to meet someone else, but immediately took me also under his wing. Since that time he became a special friend.

Manfred has always been a very generous person. His life was not easy after the German reunification. Russian researcher's life after the disintegration of Soviet Union was not easy either. Our salary dropped to $6 per a month. To my surprise Manfred asked me to deliver hundred German Marks to his Russian colleague. He sent money to his Russian

friend using a few of our encounters at other international conferences. Another time my colleague who met Manfred just briefly asked him to buy a medicine for her friend. During his next visit to Moscow he brought this medicine and refused to take any money.

Manfred is a wonderful photographer. He takes pictures at all conferences. I remember with a great pleasure the auction which Connie Wilson, Mari Davis and I organized in Sydney during the ISSI conference. His album with pictures was a hit!

I wish Manfred to be full of energy and enthusiasm. I will be very happy to see him again in our office in VINITI. Stay well my dear friend and be happy.

The Bonitz Effect on Scientometrics

Bluma C. Peritz

Hebrew University of Jerusalem

Informetrics is one of the rare truly interdisciplinary research fields, where the range of theoretical and methodological approaches are unlimited, this is probably what makes up the strength of the discipline.

Methods from the Social Sciences and Humanities as well as experimental research in the Natural Sciences are normally applied in various contexts, serving as a base for careful validation and ensuring the scientific value of the analysis.

Researches in Informetrics – Scientometrics have developed each one of them their own expertise and are most of the time identified by their "trade-mark": If it's citation analysis, impact factor, improved impact factor, science policy, sociology of science, mathematical models and laws etc. Manfred's trade-mark and great contribution is "the Matthew Effect in Science" and its application to a variety of data, subjects, using different methods.

Two great men have influenced Manfred's philosophical, theoretical, scientific thinking and research activities, Vassily Nalimov and Robert Merton.

Vassily Nalimov considered one of the fathers of Scientometrics, known to our com-

munity mainly from his book Naukometriya, a book I consulted myself many times giving his excellent and unique information. Nalimov, a mathematician and philosopher with his special views, bringing the past to the present, from Plato to Leibnitz, Wittgenstein and Sartre. His "model of the world" was very influential on Manfred's thinking. Manfred was fortunate to be able to read Nalimov's original work long before some was translated into English and other languages. In Manfred's opinion, his most ingenious book was "Spontaneity of Consciousness". For Manfred most of all he was a "friendly partner for discussion".

Robert Merton is responsible for the revival of the sociology of knowledge. His ideas on the quantitative study of science had great influence on Information Science, Scientometrics.

He provided a theoretical framework for understanding communication behavior and citation practice. He stressed that in the sociology of science it is well known that the recognition of a scientific work within the scientific community is influenced by the social status of individual scientists. This phenomenon is well described in his classical paper "The Matthew Effect on Science" (1968) or the "Matthew Principal".

Inspired by the power of the Matthew Effect Manfred extended the phenomenon to the level of entire countries, to study the characteristics and impact of the effect for countries, the scientific talents of nations. The interesting results triggered a serious of other measurements like markets in science- how to measure their pertaining competition strength, the effect or the two worlds in science. During his research on the Matthew Effect on countries he discovered a new indicator for ranking of journals, which became the "Matthew core journals", and "Matthew index". With the help of the Matthew index a country's rank distribution can be constructed to reflect how effectively each country is taking part in the competition of science.

Manfred began his career in nuclear physics and then migrated like Price, Moravcsik and many others to the fields of informatics, information, scientometrics and scientific communication. He has produced a long list of important publications some with his collaborators E. Bruckner and A. Scharnhorst most notably the Atlas of the Matthew core journals. His "trade-mark" will always be the Matthew Effect and it's variety of interesting research outcomes.

Manfred's passion for photography has created a wonderful photographic data base for most of the conferences he participated at, helping them to be for ever remembered. From the beautiful campus of Rosary College – River Forest,

Chicago 1995, to the floating conference on the Death-sea, Jerusalem 1997 to the volcano eruption Colima 1999 and most moving a picture of Nalimov and Vlachy in a "serious" debate, Chicago 1995.

During one of his visits to Jerusalem as a guest at my home, he offered me an album with a selection of pictures from the different conferences, an album I cherish very much, bringing back such great memories.

Dear Manfred, let me wish you good health, stay alert, you may find some new adaptations of the Matthew Effect, continue to take pictures for many many years to come and especially, keep your youthful smile.

Articles

"Tell me where you are publishing..." – Manfred Bonitz and bibliometrics in East Germany in the 1980s

Hans-Jürgen Czerwon

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Quantitative analyses of publication habits of East German scientists did not stand in the focus of interest of science administrations and heads of East German academic institutions for a long time, although the possibility has been existing to use bibliographic databases from abroad (e.g. INSPEC, INIS). Bibliographic databases were used almost exclusively for the selective dissemination of information (SDI), for example at the Academy of Sciences of the German Democratic Republic (GDR).

The Science Citation Index (print version) and the Journal Citation Reports have been also available in the Central Library of the Academy of Sciences in Berlin since the 1970s. However, there was the problem that the librarians were not aware how these ISI databases could be used. This was especially the case for the application of bibliometric methods to assess the role of scientific journals from the GDR in comparison with international top journals as well as to evaluate the research activities of East German scientists.

It was therefore very important that Manfred Bonitz in a number of papers published 1983 in an East German library science journal pointed to various applications of ISI databases (Bonitz, 1983a, 1983b, 1983c). In another article in a very popular science magazine Manfred appealed to researchers from the GDR to publish important papers in journals with high impact factors (Bonitz, 1985). This was a 'little provocation' because it could be understood as a request to publish in western journals.

Rank	Country	Number of SCI journals
1	USA	1324
2	United Kingdom	561
3	Netherlands	247
4	Federal Republic of Germany	246
5	USSR	131
6	Switzerland	125
7	France	113
8	Japan	88
9	Canada	48
10	Denmark	45
11	**German Democratic Republic**	**44**
12	Italy	39
13	Sweden	36
14	Australia	35
15	Czechoslovakia	27

Table 1: SCI source journals arranged by country of origin, from rank 1 to 15 (1983)

In the 1980s the SCI database has covered permanently more than 40 East German journals, compared with other Central and Eastern European countries quite a lot (Tab.). These journals, however, had relatively low impact factors, they were not among the high ranking journals in their subject categories. There was the dilemma: On the one hand, excellent results should be published in leading international journals, especially papers with coauthors from the West, on the other hand, the standing of East German journals should be improved. It was also evident that English language research papers had to expect a higher impact (citation rate) than papers in German or Russian. It should be mentioned here that Russian language publications were highly desirable because the close co-

operation relations of East Germany with the Soviet Union. By the way, Manfred published many of his articles also in Russian.

The author was inspired by Manfred's work to publish several papers on the role of East German scientific journals in international exchange of information (e.g. Czerwon et al., 1985, Czerwon, 1988) and the publication activities in specific research fields (e.g. Czerwon et al., 1989). Such articles met with a certain response especially among editors of East German science journals. However, in autumn 1989 all these bibliometric analyses were obsolete or no longer suitable for East German science administrators.

With the fall of the Wall and the reunification in 1990 the basic conditions for science, technology and education in East Germany changed completely. As a result of the unification contract (Einigungsvertrag) signed by both German governments, a process of the evaluation and restructuring of nonuniversity research institutes and of universities began. But that is another chapter in the history of research evaluation in Germany.

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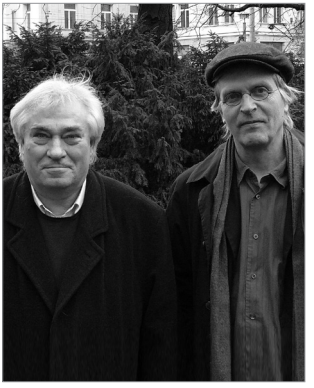
Matthew Effect and Power Laws for Countries, Subfields and Journals



Frank Havemann & Michael Heinz

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Manfred Bonitz is one of the pioneers of bibliometrics and scientometrics. His early works on these topics helped to establish our field in Germany, especially in the Eastern part of it, the former German Democratic Republic.

More than 16 years ago, 1994, on Christmas Eve, Manfred discovered the Matthew Effect for countries (Bonitz, Bruckner, and Scharnhorst, 1997; Bonitz, 2005). Countries in which many scholarly articles are produced obtain more citations per paper than countries with less papers. Eight years ago we together with Roland Wagner-Döbler found the Matthew Effect of journal citations: journals with many papers tend to have more citations per paper than journals with less papers (Havemann, Heinz, and Wagner-Döbler, 2005). We followed Sylvan Katz's approach (1999) who found the Matthew Effect for research subfields with a method different from Manfred's. On average, a paper in a large field gets more citations than papers in small subfields. Katz as we obtained a power law behaviour of the relationship between citations and papers,

he for subfields, we for journals. The exponents he obtained for different years (1981–1992) range from $\alpha = 1.24$ to $\alpha = 1.28$ with r^2 between .91 and .92. In a later paper Sylvan Katz (2000) also provided evidence for power laws for papers of countries and their citations. The exponents he obtained in different disciplines range from 1.14 to 1.21 (r^2 between .91 and .95). This is an independent confirmation of Manfred Bonitz' Matthew Effect for countries.

Sylvan Katz displayed numbers of citations over numbers of papers of 152 subfields in a log-log plot (Katz, 1999, fig. 2). Compared with the subfield cloud our journal cloud is more scattered and has the form of a comet (Havemann et al., 2005, fig. 5). This comet is not parallel to the (dotted) lines corresponding to constant Impact Factors, i.e. big journals tend to have larger Impact Factors than smaller ones. Despite the fact that our journal data are more scattered ($r^2 \approx .57$) than the subfield data, we always get the same exponent $\alpha = 1.25$ of the power law for three periods of time. We analysed the publication windows of 1998–1999, 1999–2000, 2000–2001 and the corresponding citation windows of 2000, 2001, 2002, i.e. we used the same time windows as used for computing Journal-Impact Factors.

For us, Manfred Bonitz's 80th birthday was the perfect occasion to go into yet another direction: We asked ourselves whether a power law scaling for countries could also be found if we used Gross Domestic Product (GDP) instead of paper numbers as the independent variable and number of papers as the dependent one. With data compiled by one of us (Heinz, 2006) we tested this hypothesis for 171 countries with papers in the CD-ROM edition of *Science Citation Index* 2002 (which were also published in 2002). The test confirmed our hypothesis. The figure shows the comet of countries with GDP 2002[1] on *x*-axis and fractionally counted SCI records on *y*-axis.[2] The exponent of the power law is $\alpha = 1.23$ ($r^2 \approx .83$). Countries that are big and affluent tend to produce more results in science per GDP than small and poor countries.[3] The power-law exponent for the top twenty countries with highest GDP is less than one: $\alpha = .88$ ($r^2 = .80$, cf. figure).

In the case of papers and citations it is clear that paper numbers are the independent variable and numbers of citations the dependent one. However, the GDP of a country could also be seen as at least partly depending on its science output. The corresponding power law exponent must be less than

1 http://www.imf.org/external/pubs/ft/weo/2006/01/data/

2 Data available on http://141.20.126.79/~mh/mb_data.csv

3 Note, that the USA at the tail of the comet does not enhance the exponent.

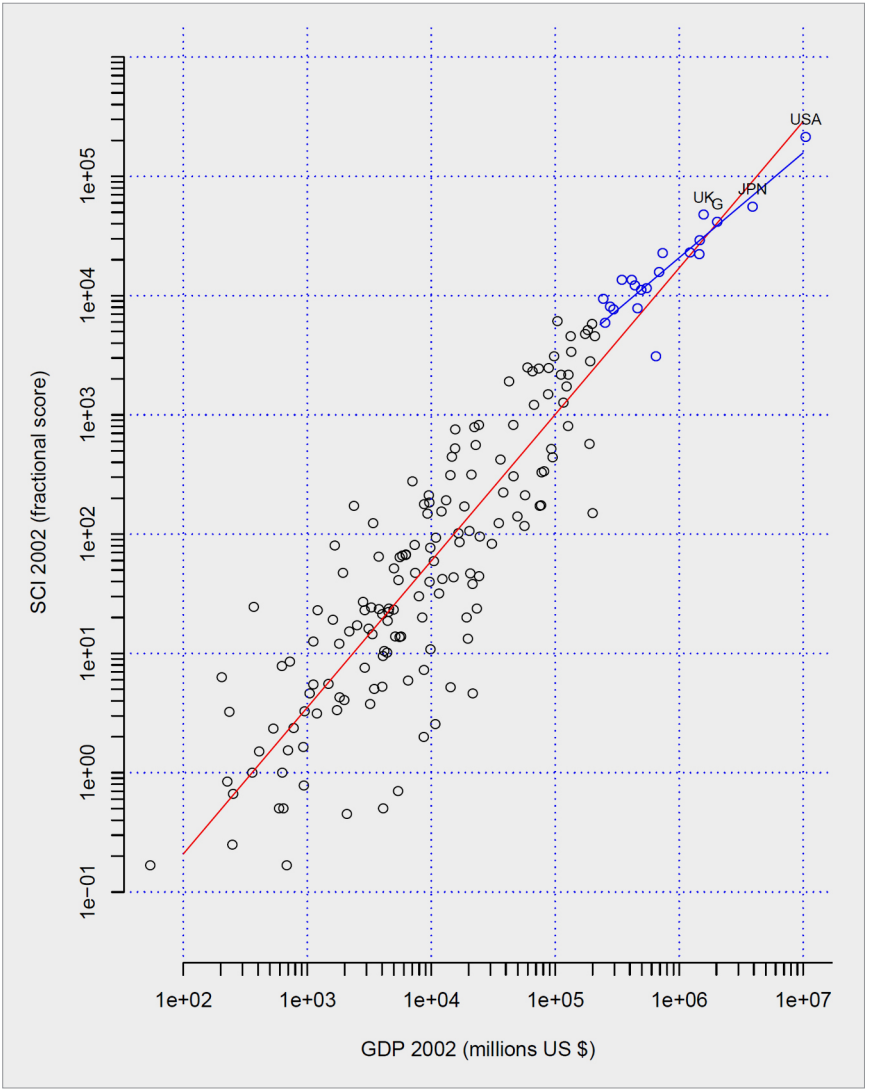

Figure 1: SCI 2002 records vs. GDP in 2002. Red line: regression of all 171 countries, blue line: regression of blue top twenty countries.

one ($\alpha = .67$) because the product of both exponents equals $r^2 \approx .83$. That means that countries undertaking much science tend to get less GDP from each research result then small science players. We might speculate that small countries also make use of research results produced in big ones.

Can our findings be interpreted as a Matthew Effect for countries? GDP is clearly an indicator of size. But do papers in SCI journals indicate recognition of this size analogously to papers and their citations? Countries are given talents (as in St Matthew's gospel) and they make use of them by investing in science not only for their own benefit. Is this an adequate interpretation of the Bible? We postpone the question until our next discussion with Manfred Bonitz.

Dear Manfred, we appreciate the countless hours of stimulating discussion and we have great respect for your commitment to our shared field of research.

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Manfred Bonitz and the Matthew Effect: Quantitative Content Analysis of Citation Contexts

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Introduction

In this brief communication at the occasion of Manfred Bonitz' 80th birthday, I focus on citations of his work in the social sciences. Manfred is best known (to me) for his empirical testing of the *Matthew Effect* (e.g., Bonitz *et al.*, 1997 and 1999; Bonitz & Scharnhorst, 2001). Where is this contribution cited and in which citation contexts? Can a semantic map of these citation contexts inform us about the position of Manfred's work and how can this method be improved? (Leydesdorff & Welbers, in press) Could one perhaps automate citation context analysis in this way? (Small, 1982)

The Matthew Effect – formulated as follows: "For to all those who have, more will be given, and they will have an abundance; but from those who have nothing, even what they have will be taken away" –

was introduced to the sociology of science by Robert K. Merton. Merton (1968) argued that obtaining credit in science is a self-reinforcing process. Barabási (2002) later reintroduced this process as the mechanism of "preferential attachment" and formulated accordingly an algorithm in social network analysis (cf. Price, 1965).

Manfred is primarily a physicist. He published hitherto 212 papers (since 1975 and using the Web of Science in November 2010) of which 48 were attributed to the *Social Science Citation Index*. The 212 papers were cited in 1,007 unique documents contained in the (*Social*) *Science Citation Index*. The titles of these citing documents contain 7,257 non-trivial words. The frequency distribution of these title words shows the predominance of (nuclear) physics in this *œuvre*: "plasma" and "physics" lead the list which each 298 occurrences. "Matthew" follows only at the 116th position with 13 times; not so far behind "scientometrics" on the 76th position with 17 occurrences.

Let us focus on the 48 papers included in the *Social Science Citation Index*. These were cited 165 times by 119 unique documents of which I could retrieve (at the WoS interface) only 113. In these documents 55 words occurred more than twice. I use this set for a co-word analysis and the generation of a semantic map. The method is also further developed.

Results

The basic word-document matrix contains 113 cases (citing documents) and 55 variables (words occurring more than twice in titles of these documents). Factor analysis of the matrix suggests seven orthogonal dimensions (Varimax; SPSS) which cumulatively explain 36.8% of the variance in the matrix. Figure 1 shows the resulting cosine-normalized network data using the algorithm of Kamada & Kawai (1989) for the visualization in Pajek. The nodes are coloured in accordance with the seven factors distinguished on the basis of the so-called scree-plot of the eigenvalues (Figure 2).

The Matthew Effect is indicated by Factor 5 and colored pink in Figure 1. Other words which load on this factor (as variables) are "core," "countries," and "concentration. Other groups are also recognizable, such as a group of words colored green: "impact," "factor," "journal," "evaluation," "research," "researcher," "ranking," and "parameter." Additionally, "scientometric,"

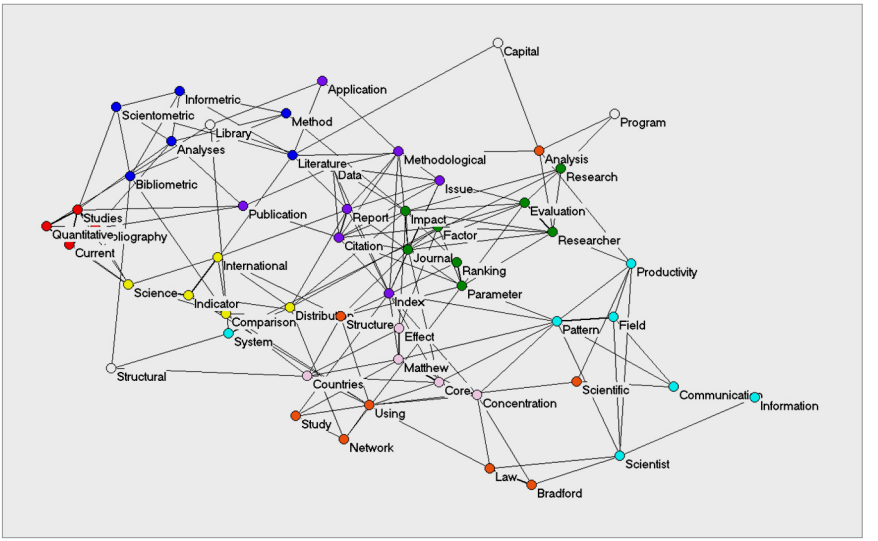

Figure 1: Cosine-normalized map of 55 co-words in 113 titles of citing documents; cosine > 0.2; Kamada & Kawai (1989).

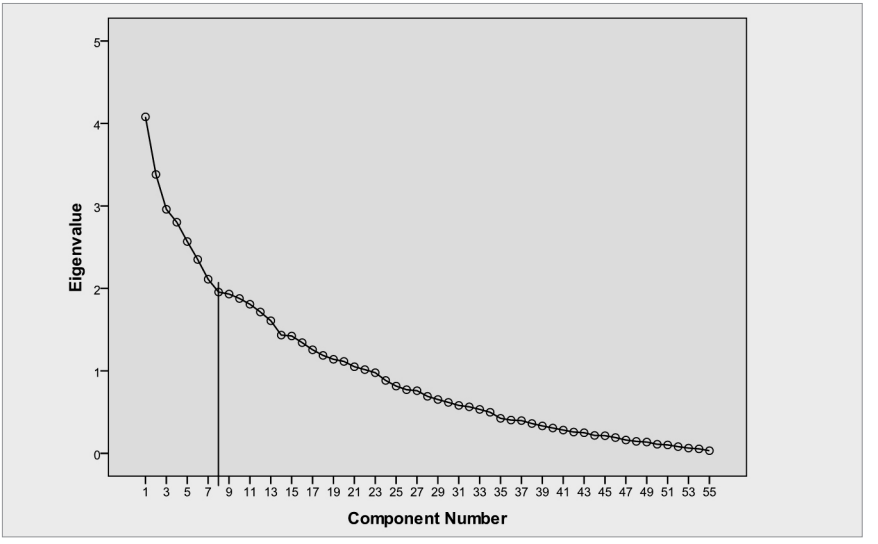

Figure 2: Screeplot of the eigenvalues of principal components using 55 title words in 113 citing documents.

"bibliometric," and "informetric" "analyses" of "literature" and "method" form a blue group at the top-left side of Figure 1. (This grouping corresponds to the negative factor loadings on Factor 6.)

Figure 2 indicates that after seven factors, the so-called "scree" of the hill begins in terms of the distribution of eigenvalues. However, the positive and negative loadings on Factor 6 provide two different groupings, colored blue and light blue in Figure 1, respectively, and on different sides of the figure. The light-blue colored factor covers words such as "productivity," "field," "scientist," "communication," information," and "pattern."

In my opinion, a problem with co-word analysis and semantic mapping is that each combination of words easily suggests an interpretation (Leydesdorff, 1991, 1997). In Leydesdorff (1995), I suggested and elaborated an algorithmic approach based on entropy statistics, but the visualizations are then less attractive and the reasoning is more difficult to follow. In a recent paper, Leydesdorff & Welbers (in press) reviewed the possibilities to improve the statistics, and suggested to use instead of observed frequencies the ratio of observed and expected frequencies of word occurrences. Let me apply this technique to this set and see whether the results can be improved and perhaps be more convincing.

Observed/Expected

A cell value in a matrix (or contingency table) can be measured against its expected value given the other values in this matrix. For example, if one has a matrix with four value 3, 5, 2, and 0 such as in:

3	5	*8*
2	0	*2*
5	*5*	*10*

One can add the margin totals and grand sum of this matrix and compute the expected value for each cell (e_{ij}) from the observed ones (o_{ij}) using

$$e_{ij} = \frac{\sum_i o_{ij} \sum_j o_{ij}}{\sum_i \sum_j o_{ij}} .$$

For example, the expected value of the first cell (e_{11}) above is (8 *5)/10 = 4. The observed/expected ratio consequently is 3/4. (Observed and expected ratios can

also be compared using the formula for χ^2 so that observed values can be tested for statistical significance. See Leydesdorff & Welbers (in press) for more details.)

In the meantime, the programs ti.exe (at http://www.leydesdorff.net/software/ti) and fulltext.exe (at http://www.leydesdorff.net/software/fulltext) for co-word analysis and semantic mapping of titles and texts, respectively, were extended with the option to choose for repeating the analysis with observed/expected ratios as cell values instead of (and after) the analysis with observed frequencies. The conceptual advantage is a normalization. (Other normalizations such as "term-frequency/inversed document frequency" or "tf-idf" are also possible, but in my opinion less easily connected to social-science statistics.)

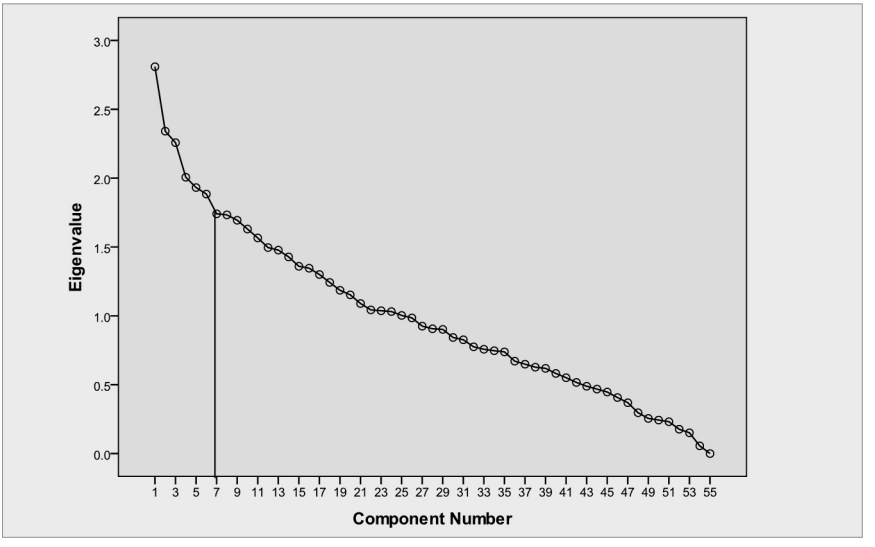

Figure 3: Screeplot of the eigenvalues of principal components using observed/expected values for 55 title words occurring in 113 citing documents.

The observed/expected matrix contains a structure different from the matrix based on observed values. Figure 3 shows the scree plot for precisely the same analysis as above (Figure 2), but now using the obs/exp matrix. Six instead of seven factors are indicated. These six factors explain only 24.1% of the variance. (Seven factors explain 27.2% of the variance.) Thus, the explained variance is lower; the normalization corrects for semantic structure that is incorrectly inferred from the raw data.

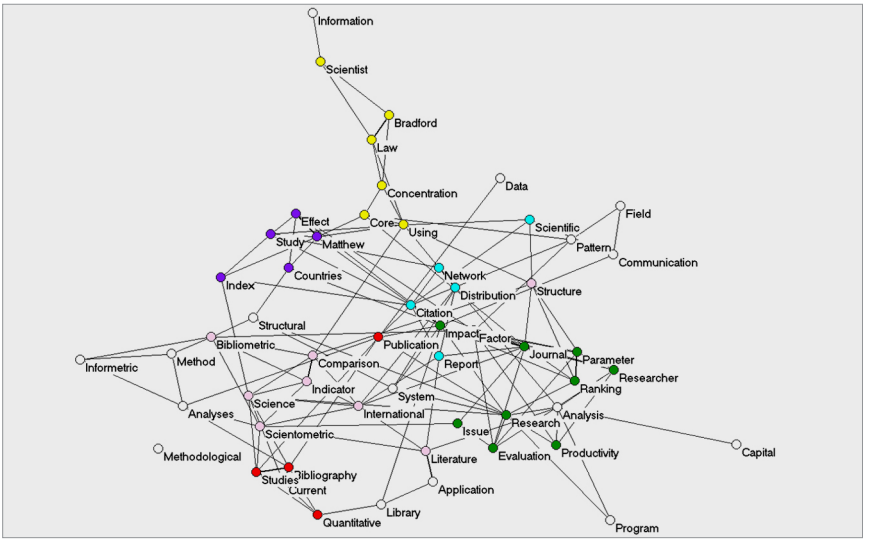

Figure 4: Cosine-normalized map of the observed/expected values of 55 co-words in 113 titles of citing documents; six factors; cosine > 0.1; Kamada & Kawai (1989).

In Figure 4 – coloured on the basis of the six-factor solution – the two groups colored pink and orange in Figure 1 are now clearly distinguished as a a group of words related to the study of the Matthew Effect as an "index" for "countries" (violet) versus a group (in yellow) focusing on the shape of the distribution. The fine-structure of Factor 6 is resolved in Figure 4.

The advantage of Figure 4 is that the coloring of different areas is more contingent than in Figure 1. Exceptions such as the word "Publication" are caused by differences between the use of the cosine for the normalization in the vector space and the Pearson correlation underlying the factor analysis. This problem can be circumvented by using the Pearson correlation also for the mapping (cf. Ahlgren *et al.*, 2003) or by using the factor matrix directly as input to Pajek. The (Varimax) rotated factor matrix is visualized as a 2-mode matrix in Figure 5.

Distances in Figure 5 are based on factor loadings. Factor loadings are equal to the Pearson correlation coefficients between the variable vector and the latent eigenvector or factor. Negative factor loadings are dashed, but also used in the spanning of the map. This is a major advantage over the representations in Figures 1 and 4. However, this representation may be more difficult to explain to a lay audience.

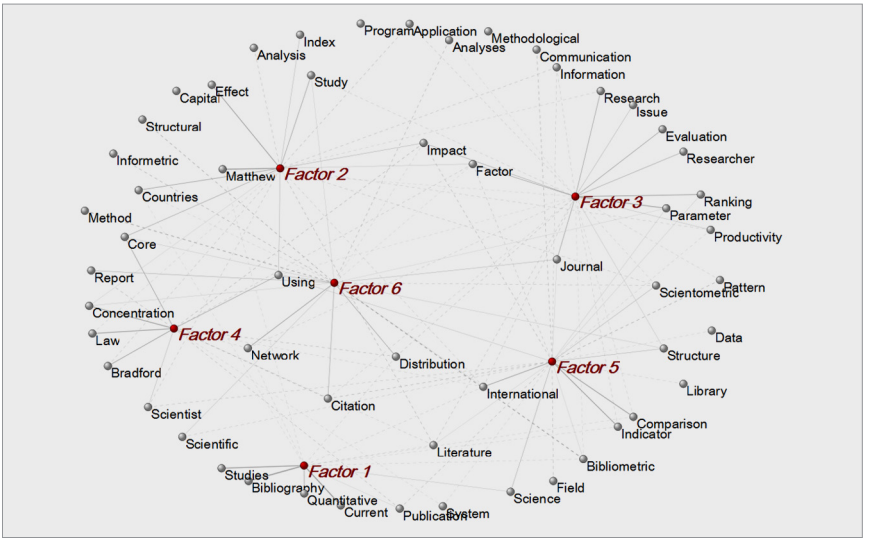

Figure 5: Visualization of the six-factor solution of observed/expected values in the word-document matrix of 55 title words in 113 citing documents; factor loadings > 0.1 or < −0.1 included; Fruchterman & Rheingold (1991).

Conclusion

Using different co-word maps, I explored the fruitfulness of Manfred Bonitz' scientometric contribution for the social sciences and the further development of theorizing about the Matthew Effect. This research question provided me with an opportunity to demonstrate some recent advances in quantitative content analysis (Danowski, 2009). These techniques and methods, among other things, enable us to objectify and automate citation context analysis (Amsterdamska & Leydesdorff, 1989; Chubin & Moitra, 1975; Moravcsik & Murugesan, 1975; Small, 1982).

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From physics over information science to philosophy of science

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Trajectories of scientists in the academic landscape are hardly ever straight lines, but few researchers have the capacity and ability to contribute to the academic endeavor at very different places and from very different perspectives. As Goethe described in *Wilhelm Meister's Lehr- und Wanderjahren*[1], it is as if during the journey through different disciplines, at different institutions dealing with different research questions and epistemic cultures, the researcher has the possibility to enhance his competences, skills, insights and abilities to create new knowledge. However, such enrichment will only occur if the researcher in question is curious enough to explore new areas and is open for lessons he might encounter along the way.

Manfred Bonitz clearly belongs to the *long distance sailors across the ocean of knowl-*

1 Johann Wolfgang von Goethe, Wilhelm Meister's Apprenticeship and Wilhelm Meister's Journeyman Years. *See: Goethe's Wilhelm Meister's Travels: Translation of the First Edition by Thomas Carlyle.* Columbia, SC: Camden House, 1991.

edge (a circumnavigator).[2] Manfred departed from nuclear physics as an experimentalist. He shaped the newly emerging information sciences after WW II in the German Democratic Republic[3], and contributed to the international emerging field of scientometrics. In the last few years he has returned to the philosophical roots of scientometrics in a very practical sense, by devoting time and energy to translate fundamental writings of Nalimov, the name giver of our field, and to co-organize conferences to further disseminate Nalimov's ideas in the field of philosophy of the sciences[4].

I got to know Manfred more personally in the turbulent years after 1989, when I was privileged to collaborate in different projects with him. In the setting of (scientific) ABM's (*Arbeits-Beschaffungs-Massnahmen)*[5] allocated at the former Academy of the Sciences of GDR (1990-1992) and the WIP[6], these strange constructions offered us a niche to freely explore ideas –sometimes hampered however by uncertain institutional and financial frames. But Manfred is never afraid of restricted material conditions, as long as he can do science. He is very resourceful, can always improvise around conditions and has great pleasure to be really hands-on. This being hands-on reaches from computer programs (e.g., the macros written for the *Matthew effect of countries*), crafting posters (with glue, scissors, papers and laying at the floor in a youth hostel in Leiden 1991) to crafting own archive boxes on rolls in his home from plastic boxes as offered at supermarkets and IKEA wheels. I learned a lot from Manfred during these years and we – and our families - became friends.

One aspect of Manfred's personality which I find very special, is his ability to enjoy new things he comes across when traveling. Manfred has a specific eye for how things in daily life are organized differently in another culture, and he enjoys the differences. Being an academic, he is able to articulate these

2 For a bibliography of the oeuvre of Manfred Bonitz on the occasion of his 70th birthday see: Heinrich Parthey, Walther Umstätter (eds) Wissenschaftliche Zeitschrift und Digitale Bibliothek: Wissenschaftsforschung Jahrbuch 2002. Berlin: GeWiF 2003. http://www.wissenschaftsforschung.de/pbuch2002.html

3 Manfred Bonitz (1986) Wissenschaftliche Information und wissenschaftliches Verhalten. Berlin: Zentralinstitut für Information und Dokumentation d. DDR.

4 Nalimov, V.V. (2009) Spontaneität des Bewusstseins. Wahrscheinlichkeitstheorie der Bedeutungen und Bedeutungsarchitektonik der Persönlichkeit. Translated from Russian by Manfred Bonitz. Berlin: Trafo Verlag

5 Job Creation Programme in Germany

6 Wissenschaftler Integration Programme (Integration programme for scientists) was a special funding stream for East-German researchers.

differences very well and reflects on them in order to give new impressions a place. If you are in the company of Manfred Bonitz - *open your eyes, look up to the skies and see*[7] – is what will happen naturally and joyfully to you.

Academically I learned from Manfred to be careful and clear. No grand confusing ideas and visions – at least not when it comes to writing a paper. Concentrate on the essence, present it clearly, do not give too many links, but only when necessary, formulate your message clearly, and concentrate on new things. What I also learned is that acknowledging the work of others does not necessarily undermine your originality. Re-inventing the wheel is not what counts, but how to go forward by standing on the shoulders of giants who have gone before.

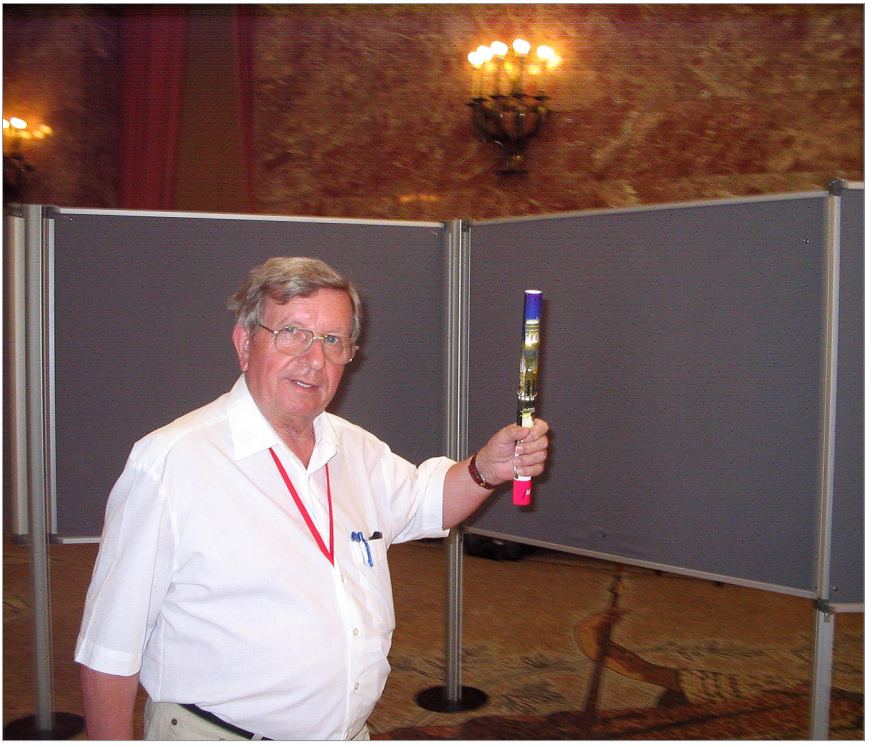
One of the scientific findings we have published together is about the so-called *Matthew effect of countries*[8]. In this case, the ingredients were already there for quite some time. The Budapest group had already introduced the idea to compare expectations for citations with actual citation numbers. Trained as mathematicians and natural scientists, researchers of this group were of course familiar with concepts of expected values as common in probability theory since centuries. The so-called relational chart for countries compares expectations with observations and allows visualizing "over-" and " under-" performance. With the small but important step to display a difference between expected and observed values instead of dividing them, one additional feature in the skew distributions of scientific performance became immediately visible: a systematic and increasing deviation between expectation and observation when ranking countries according to their expected performance. Countries expecting a lot of citations get even more citations and countries with lower expectations get even less than they expect.

Manfred explored this systematic deviation with respect to different aspects: field-dependency, time-dependency, size effects and so one. Maybe it would be useful in the current debate for "right indicators" also to look back to those papers. However, Manfred's interest was not only primarily driven by academic curiosity, but there is also a deeper humanistic motivation behind the different indicators that he himself has proposed.

This can best be illustrated by looking back at a meeting in 1990 at the University of Bielefeld, where scientometricians from East and West were

7 A line from the lyrics of the *Bohemian Rhapsody*, Queen

8 Manfred Bonitz, Eberhard Bruckner, Andrea Scharnhorst (1997): Characteristics and impact of the Matthew effect for countries. *Scientometrics* 40(3)407 - 422.



Manfred Bonitz in 2007. ISSI Conference, Madrid.

brought together to develop concepts and write a report on the best way to evaluate the sciences in the former socialist countries.[9] Aside from not unexpected occurring political controversies, Manfred's take on the task was to choose indicators which show both the potential and the actual performance of the science system in the former socialist countries. While not wanting to polish the results, he did want to compare scientific production on the background of the means to produce – even being aware of how limited tools of scientometrics are for such a task. He knew very well of the dangers of scientometrics becoming instrumentalised in political debates. He experienced

9 Peter Weingart (Ed.) Die Wissenschaft osteuropäischer Länder im internationalen Vergleich - eine quantitative Analyse auf der Grundlage wissenschaftsmetrischer Indikatoren [The Science System of Eastern European Countries in an International Comparison - a Quantitative Analysis Based on Scientometric Indicators]. Kleine Verlag, Bielefeld, 1991

Manfred Bonitz in 2007. ISSI Conference, Madrid.

this in the debate on his short paper on "Sage mir, wo Du publizierst …"[10] (Tell me where you publish ..) in the science magazine "Wissenschaft und Fortschritt" (Science and Progress) in the GDR.

But despite criticism, Manfred would never ever give up further developing quantitative methods. He was a great admirer and promoter of the innovative invention of citation indexing and the SCI as product in its early years. He was and still is a constant and important factor in the international growing community of scientometrics - advising, promoting and caring for the further development of scientometrics. But in his work one can also see an attitude that scientometrics has to support the sciences, it has to be applied to make science better, and has to detect weaknesses and hidden potentials in a research system. I think this attitude explains why Manfred, when delving

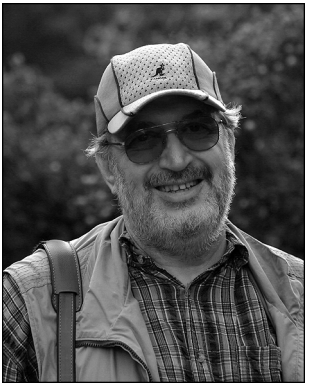
10 Manfred Bonitz (1985) Sage mir, wo du publizierst... *Wissenschaft & Fortschritt* 35(1), p. 23-24.

into the Matthew effect always underlined that this effect in science is less about injustice, but about the best use of talents[11] and should be read in this way. An interpretation which he shared with Robert Merton's view on it. This does not take away the need to create conditions in which talents can be used!

I started picturing Manfred as a *circumnavigator*. There are many different types of these sailors. Some do it on their own and for their own content, some do it for fame, and some do it together with others aiming to find passages that others can make use of. All of them have an important role to play in knowledge discovery. Manfred clearly does it with an understanding of the privilege to be able to sail, not only with gratitude and modesty for being a scientist, but also with a clear feeling for the duty to bring back from his *knowledge travels* as much as he can for the greater good, and with the pleasure to do it in a team with others sharing as much as he can. This makes him such a good colleague and friend.

11 Manfred Bonitz (1997) The scientific talents of nations. *Libri* 47(4)206 - 213.

An Ostwaldian greeting to Manfred Bonitz on the occasion of his 80th Geburtstag



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It is certainly not merely accidental that the German word *Festschrift* has been adopted in English as "a book honoring a respected person, especially an academic, and presented during his or her lifetime" [1]. I wonder why *Geburtstag* did not become accepted as an academic variant of birthday. In my personal interpretation, at least, birthdays are about colored balloons, chocolate cakes, infantile rhymes, and the likes. No doubt, these are absolutely appropriate requisites for a family event, particularly with several happy children, but a decent and honorable academic – however cheerful and colorful personality he or she might be – deserves somewhat more. So, let's sing it together: Happy Geburtstag to Manfred / Happy Geburtstag to you!

And now for something completely different [2].

Manfred Bonitz turned the attention to the fact that Wilhelm Ostwald was a pioneer, among so many others, also of scientometrics [3–6]. Namely, the idea of an Atlas of Science, as it was much later realized by Garfield and the Institute for Scientific Information [7], can be traced back to Ostwald's 1919 classic [8].

Much wider known than his information science activity, are Ostwald's efforts to build a unified Weltanschauung (another irreplaceable German word) on the basis of energetics [9–12]. Although it soon turned out that – like all similar overambitious attempts – it was condemned to failure, it served well as inspiration in various areas of science, social science and humanities. An early example is connected with scientometrics through the person of its author: Alfred J. Lotka [13].

Recently, Gangan Prathap published a set of papers [14–16], in which Hirsch's ubiquitous h-index [17] is reinterpreted in an energy-related framework. He made use of the formula theoretically derived by Glänzel [18] and empirically supported by Schubert & Glänzel [19], which connects the h-index, h, with the number of publications, n, and the mean citation rate, x:

$$h \approx n^{1/3} x^{2/3} \quad . \qquad (1)$$

The proportionality factor, according to a wide range of empirical evidences, proved to be close to unity. He argued that this composite indicator, which he aptly named "mock h-index" [14] is a useful measure on its own right. It may complement or even substitute the original h-index overcoming some of the deficiencies of the original. A somewhat reformulated version of Eq. (1)

$$h^3 \approx n(z/n)^2 = z^2/n \quad , \qquad (2)$$

(z denotes the total number of citations) can be interpreted as an "energy-like" quantity, analogous to several similar formulae well known in physics. Maybe the most plausible analogy proposed by present author (as kindly acknowledged as a "personal communication" reference by Prathap) is that of electrostatics, where the formula for energy, E, is

$$E = Q^2/2C \quad ,$$

Q being the charge, C the capacity.

In scientometric context, the publications may be thought to represent a kind of scientometric "capacity", which is able to store the scientometric "charge": the citations. The h-index has a physical "dimension" of the cubic root of energy.

Prathap went even further, and extended the mock h-index concept to non-scientometric models. He used the index for ranking cricket batsmen, thereby giving, to my knowledge, the only sports example of the h-index concept after its first historical occurrence as a measure of cycling proneness [20].

To take a minor step further, the mock h-index can be generalized even for cases, when the determination of the original h-index is not simply difficult, but when it cannot be defined at all. For example, in the case of the most widely used pair of econometric indicators, GDP and population, it seems rather pointless to try to measure the contribution of individual persons to the production of the GDP, or its distribution over individuals. We may know, however, (at least, in some approximation) the total GDP and the total population, and experience also taught us that the distribution, similarly to that of income, wealth, etc., might be rather skew, presumably of Pareto-type.

On the basis of this knowledge, we can easily define and calculate an econometric mock h-index as

$$\eta_{(eco)} = \sqrt[3]{(G^2/P)} \quad , \qquad (3)$$

where G stands for GDP, P for population. Together with its bibliometric version

$$\eta_{(bib)} = \sqrt[3]{(z^2/n)} \quad , \qquad (4)$$

(cf. Eq. (2)), they form a pair of indicators usefully characterizing the economic and the scientific potential of countries, respectively.

The results presented in Table 1 and Figure 1 are based on data from references [21–23].

Rank	Country	η(eco)
1	United States	7987.75
2	Japan	4999.15
3	Germany	4154.66
4	People's Republic of China	3891.01
5	England	3779.41
6	France	3765.06
7	Italy	3615.93
8	Canada	3279.22
9	Spain	3135.10
10	South Korea	2863.10
11	Australia	2709.57
12	Netherlands	2589.27
13	Russia	2566.41
14	Brazil	2359.04
15	India	2303.11
16	Mexico	2282.71
17	Belgium	2212.63
18	Sweden	2111.59
19	Switzerland	2109.25
20	Austria	2095.94

Rank	Country	η(bib)
1	United States	824.93
2	England	462.76
3	Germany	442.18
4	Japan	384.95
5	France	384.72
6	Canada	371.19
7	Netherlands	332.83
8	Italy	327.70
9	Switzerland	323.38
10	Sweden	295.53
11	Australia	288.66
12	Spain	263.91
13	Scotland	253.61
14	Denmark	244.14
15	Belgium	242.57
16	Israel	226.28
17	Finland	223.15
18	Austria	206.65
19	People's Republic of China	185.76
20	Norway	182.86

Table 1. The top 20 countries by the econometric and bibliometric η*-indices*

The top 20 lists of Table 1 show very reasonable ranking, reflecting the balanced way h-type indices represent quantity and quality. There is no need for any pre-filtering, extremely small countries, however wealthy, like Iceland or Luxembourg, do not have measurable moment either in econometric or in bibliometric terms; P. R. China loses its pre-eminent status when it comes to scientific rather than economic production; small Scandinavian countries (Denmark, Finland, Norway) reach the top 20 in science, but not in economy.

The scatter plot of Figure 1 shows a rather strong correlation between the two indices. (Actually, it is stronger than that between any "traditional" econometric–bibliometric pairs.) It can also be clearly seen that among the major countries England, Canada, the Netherlands and Switzerland has a definitely

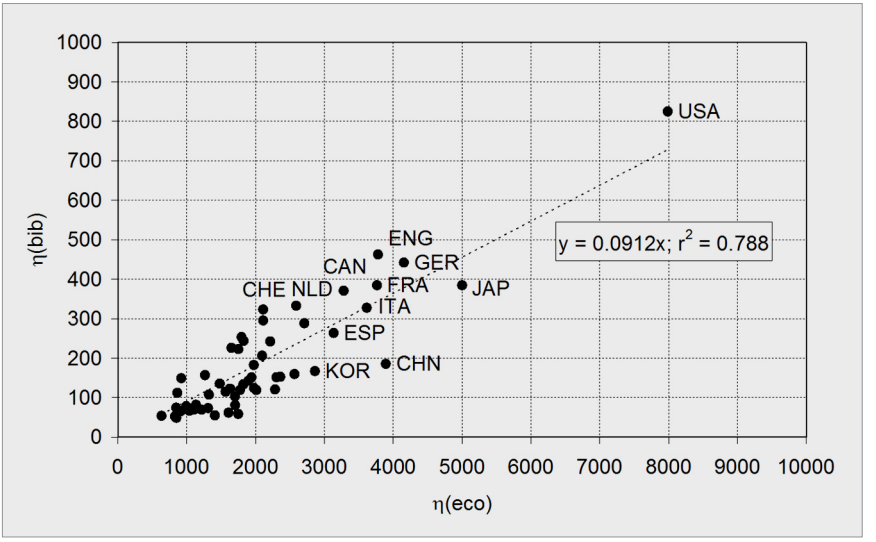

Figure 1. Bibliometric vs econometric η*-indices of the world's 56 major countries*

higher weight in scientific research than in economic production, while in the Far-East countries (Japan, P. R. China, South Korea) the situation is reverse.

Within this short essay, quite a long distance has been covered from Ostwald's inaugural address to a novel econometric indicator. It was only to prove that Ostwald's oeuvre has a far reaching influence in a variety of research areas, and that Manfred Bonitz served well the interests of the scientometric community by directing spotlight to the wide spectrum of works of this immortal genius.

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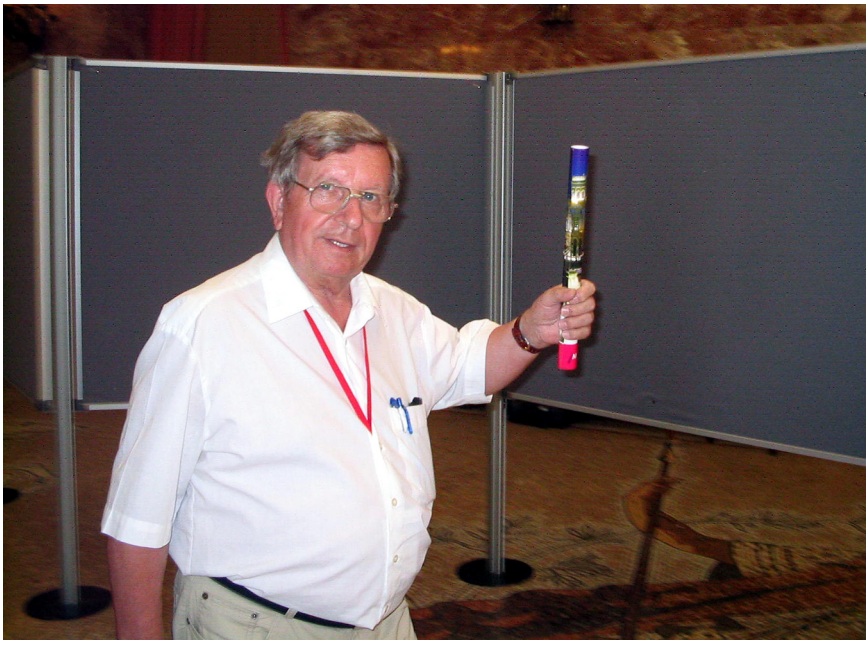
Addendum

Diverse Photos Sent by the Authors

Manfred Bonitz in 2007 – ISSI Conference, Madrid, Spain. Photo courtesy of Andrea Scharnhorst.

Manfred Bonitz in 2007 – ISSI Conference, Madrid, Spain. Photo courtesy of Andrea Scharnhorst.



Manfred Bonitz in 2007 – ISSI Conference, Madrid, Spain. Photo courtesy of Andrea Scharnhorst.

Manfred in Wolfgang & Zsuzsanna Glänzel's home in Perbál, Hungary. Photo courtesy of Zs. Glänzel.

Manfred in good company in 1987. Budapest, Hungary. Photo courtesy of Wolfgang Glänzel.

Addendum

Finally, it is our pleasant duty to announce the names of those colleagues and friends of Manfred who were, because of the extremely tight deadline, not able to contribute to this volume, but who have expressed their wish to congratulate Manfred Bonitz on the occasion of his birthday. Herewith, we kindly acknowledge best wishes expressed by

Abraham Bookstein
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Nieuwegein (Netherlands)
Former director of Technology Foundation STW

Ed Rinia
NWO, Den Haag, (Netherlands)

Ronald Rousseau
KHBO, Oostende (Belgium)

Balázs Schlemmer
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currently freelancer, Budapest (Hungary)

Péter Vinkler
Chemical Research Center, HAS, Budapest (Hungary)

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