

EUROPÄISCHE AKADEMIE

zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen
Bad Neuenahr-Ahrweiler GmbH

Direktor: Professor Dr. Dr.h.c. Carl Friedrich Gethmann

NEWSLETTER

AKADEMIE - BRIEF • NO. 64

AUGUST 2006

EDITORIAL

Der von der Europäischen Akademie GmbH, der Johannes Gutenberg-Universität Mainz und der FernUniversität in Hagen entwickelte Studiengang "Medizinethik" wurde kürzlich als Masterstudiengang akkreditiert. Er wird an der FernUniversität in Hagen als Fernstudium angeboten. Dadurch haben Studierende die Möglichkeit, neben dem Beruf den Grad eines 'Master of Arts' zu erwerben. Eine anschließende Promotion ist möglich. Das viersemestrige Studienangebot umfasst acht Studienmodule, die im ersten Studienabschnitt grundlegende Kenntnisse der angewandten Ethik im Bereich der Medizin und des ärztlichen Handelns vermitteln. Im zweiten Studienabschnitt werden diese Kenntnisse an exemplarischen Problemen vertieft und zugleich auf die spätere berufliche Praxis hin orientiert. Das Studium kann in zwei oder vier Jahren absolviert werden. Weiterhin ist es möglich, pro Semester statt eines ganzen nur ein Teilmodul zu bearbeiten und dies mit einer Prüfungsleistung abzuschließen, die dann im Masterstudiengang anerkannt wird. Als "Schnupperkurs" können Wochenendseminare aus dem Masterstudiengang "Medizinethik" separat belegt werden, soweit jeweils noch Plätze verfügbar bleiben. Der gesamte Studiengang, aber auch die Teilformen des Studiums, sind von den Ärztekammern in der Fortbildung für Ärzte mit einer erheblichen Punktzahl anerkannt. So erwerben die Studierenden durch das Studium eines Moduls zwischen 250 und 270 Fortbildungspunkten, bei Teilmodulen sind es ca. 120 und bei den Seminaren je nach Umfang 10–15 Punkte. Der Newsletter wird regelmäßig über den Fortgang des Master-Studiengangs berichten.

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FOCUS

Assessment of Environmental Noise. The Validity of the Railway Bonus for Day- and Nighttime

Barbara Griefahn¹, Anke Marks¹, Mathias Basner²

Though most information is visually perceived, the auditory system is undoubtedly more important and essential for mental and social development. It does not presuppose directed attention but is designed as a permanently working alarm system. Thus, human beings are able to perceive acoustic stimuli at any time and the human brain is able to analyse these stimuli and to respond adequately even during sleep. The effects of noise concern different functions. Disturbances of communication, of sleep and of autonomous functions (alterations of heart rate, blood flow etc.) occur soon after noise onset and cause in turn annoyance and impair performance. As these effects are non-specific and are evoked by other environmental stressors as well, noise is suspected to contribute to the genesis of chronic multifactorial diseases in the long run. Thus, noise abatement is an essential element of public health care.

1 Assessment of noise

The Directive 2002/49/EC constitutes one step towards this goal of noise abatement. It obliges the larger communities within the member states of the European Union to work out noise maps while using the day-evening-night level (LDEN). The LDEN is an integrated metric where 5 respectively 10 dBA are added to the equivalent noise level for the evening (6 pm–10 pm) or for the night (10 pm–6 am). The LDEN is thought to estimate sufficiently annoyance due to transportation noise which has become the major source of environmental noise. This situation will worsen as traffic density will increase considerably within the next years, more during the night than during the day.

2 Annoyance

Annoyance is the most frequently ascertained effect of noise. It is defined as any feeling of resentment, displeasure, discomfort and irritation when external stimuli intrude into someone's thoughts and moods or interfere with activities and are not considered to fit with current intentions. This is most often the case when people

communicate and when they (try to) sleep. Thus, environmental noise may impair the quality of life seriously.

However, numerous experimental studies and social surveys have shown that annoyance is not only determined by the acoustical load. Instead, annoyance is largely determined by the type of noise as shown by an extensive meta-analysis that based on 55 social surveys with overall about 58 000 interviews of residents living in the vicinity of airports, near busy streets or along railway tracks. Thereafter, aircraft noise annoys more than road traffic noise and rail traffic noise the least. These findings support the bonus-malus regulations that are established in many countries and which allow higher noise levels for rail than for road traffic noise. These regulations do not differentiate between day and night.

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3 Noise-induced sleep disturbances

Due to the undisputed restorative function of sleep, sleep disturbances are regarded as the most deleterious effects of noise. Sleep disturbances are defined as any measurable or subjectively evaluated deviation from usual or from desired sleep behaviour. Awakenings are regarded as most severe as the time awake determines subjectively evaluated sleep quality, mood and even performance the next day.

The ability of the brain to discriminate between various sounds even while asleep has been demonstrated in studies where awakenings occurred more likely in response to meaningful than to neutral acoustic stimuli. It was therefore assumed that human responses to transportation noise during sleep would correspond to daytime annoyance. According to the meta-analysis which concerns annoyance as experienced during the state of consciousness, it was expected that – presupposing the same acoustic load – aircraft noise causes most and railway noise the least awakenings. But where numerous studies support the validity of this rank order for annoyance (concerning the state awake), only a few studies addressed the effects of different traffic noises on sleep.

Studies already performed in the 1970s have shown that road traffic noise disturbs – presupposing the same equivalent noise level – more than rail noise, probably due to the greater number of events. Another field study in the case of which 377 residents exposed to rail or to road traffic noise were observed over a fortnight revealed no differences between rail and road traffic noise concerning body movements, subjective assessment or performance, though extensive interviews have shown that the same persons were less annoyed by rail than by road traffic noise.

Eventually, two limited laboratory experiments revealed the strongest reaction to rail noise, despite even lower maximum levels as compared to aircraft noise, probably due to shorter rise times and longer lasting periods of relatively high levels along with the characteristic temporal structure of rail noise.

4 Experiments on the validity of the railway bonus in the night

The cited studies suggest that the processing of noise might be different during sleep which represents a completely different state of consciousness. A related debate concerns the concept of integrated noise metrics which failed in large-scale studies to predict the effects of transportation noise on sleep sufficiently, whereas the probability of event-related acute reactions such as awakenings and body movements clearly increase with the maximum level of the individual events.

The validity of the railway bonus during the night and the applicability of integrated measures for the prediction of sleep disturbances were examined in 24 subjects who slept during three consecutive weeks a four day sequence each week in the laboratory. With weekly permuted changes they were

exposed to aircraft, rail and road traffic noise with the same equivalent noise levels, the same maximum levels, and the same patterns over night while physiological effects, subjective evaluation of sleep and performance data were recorded.

Prior to each night the subjects rated their actual well-being and mood, and completed performance tests. After waking up they evaluated sleep quality, actual well-being, mood and fatigue and completed again performance tests. During the nights electric brain activity, eye movements and muscle tone were recorded continuously to indicate the depth of sleep.

4.1 Equivalent noise levels

The validity of the LDEN for the prediction of noise-induced sleep disturbances requires a gradual increase of the effects on sleep with increasing noise level that varied between 39 and 50 dBA in this study. A gradual increase was indeed found for subjective assessment of sleep, but only for a few physiological variables. The overall sleep duration, the time spent in deep sleep and in REM-sleep (dream sleep), decreased gradually with the increasing acoustic load in favour of the time awake and in the flattest sleep stage. In this case most physiological variables showed almost the same alteration to both the lower levels, but a considerable stronger response to the highest level. This observation which is supported by other studies leads to the conclusion that integrated noise metrics such as the equivalent noise level and thereby the LDEN are not suitable for the reliable prediction of noise-induced sleep disturbances. The maximum level of the individual noise events is, however, a good predictor of event-related awakenings.

4.2 Type of traffic noise

The hypothesis according to which after the same order was expected for the probability and the extent of sleep disturbances as for annoyance, namely the strongest response to aircraft noise and the least to rail noise, was not verified. In cas-

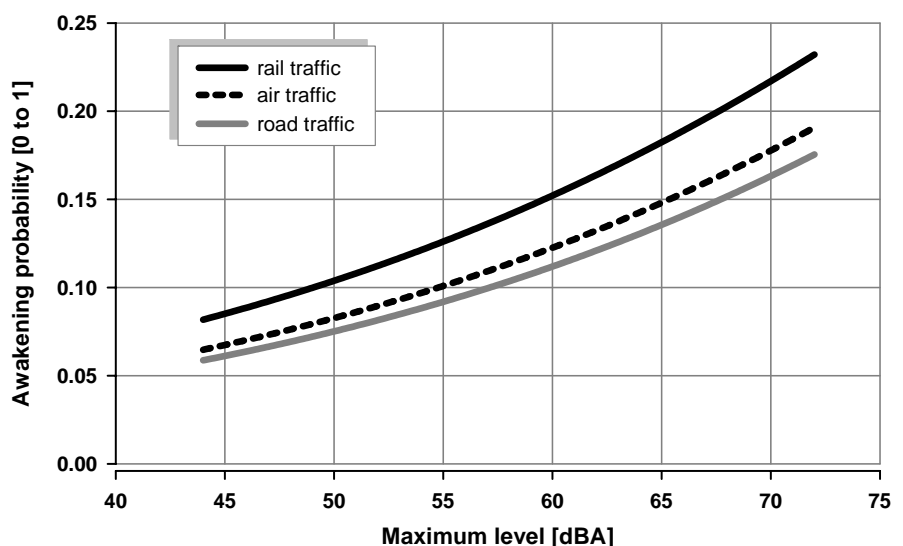
es in which subjective assessment of sleep quality and fatigue were equally impaired irrespective of the type of noise, most physiological sleep parameters (indicating the structure of sleep) were more affected by railway noise than by aircraft and by road traffic noise. When exposed to railway noise, the time to reach deep sleep was prolonged most, the duration of deep sleep was shortest, however, the time awake and in the flattest sleep stage was longest.

This was also found for the event-related probability of awakenings. Figure 1 shows these awakenings in relation to the maximum noise levels and separately for the three traffic modes. Clear dose-response relations which increase with the maximum level of the individual noise were determined for all the three types of noise. The curves are parallel but for railway noise clearly above the effects caused by aircraft and by road traffic noise. Preliminary results of a similar study just completed at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt e.V.) also suggest that the typical traffic mode order seen in annoyance reactions may apply to sleep disturbances.

The slopes of the dose-response curves presented in Figure 1 depend on several acoustic parameters, on personal and on situational factors. These are for all three traffic modes the maximum noise levels and the time within which the maximum levels are reached. The higher the maximum levels and the steeper the increase, the greater is the probability to be awakened. Another decisive factor for the effects evoked by noises from road and from rail traffic is the duration of the single noise events, whereas the intervals between noise events are decisive only for aircraft noise.

Concerning personal factors, gender and self-estimated noise sensitivity concerning sleep had no influence, whereas the percentage of awakenings increased with age. Awakenings are least likely evoked during deep sleep but increasingly more often with the time elapsed between going to bed and the occurrence of the noise.

Figure 1: Awakenings due to aircraft, rail and road traffic noise



5 Conclusions

Several countries, e.g. the Federal Republic of Germany, allow higher noise levels along railway tracks than on roads. This 'bonus' is based on extended social surveys in which the residents were asked to estimate their degree of annoyance related to traffic noise. This is strongly supported by the meta-analysis mentioned above as well as by studies in which performance of children was recorded during exposure to the three traffic noises in which the least impairment were determined under the impact of rail noise. Recently performed studies, however, put the validity of this bonus into question for sleep which represents a completely different stage of consciousness. Nevertheless, despite the clear results presented here it is certainly premature to recommend a modification or a cancellation of the bonus during night time. Such far-reaching decisions require the confirmation on the basis of various more realistic scenarios in the laboratory and in the field.

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Professor Dr. med. Barbara Griefahn is head of the *Institut für Arbeitsphysiologie at the Universität Dortmund* and was a member of the academy's project group "Environmental Noise" which recently presented its results at the *Berlin-Brandenburgische Akademie der Wissenschaften in Berlin*.

WORKING GROUPS

Intervening in the Psyche

■ The last meeting of the project group took place in Ahrweiler from June 29th until July 1st. A time frame for finalising and editing the study report has been agreed upon. The results of the project are scheduled to be presented to the public on January 18th 2007 in the "Berlin-Brandenburgische Akademie der Wissenschaften". Presumably, the title of the study will differ slightly from the project's title: "Intervening in the Brain. Changing Psyche and Society".

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Responsibility for Future Generations – Implementation of Sustainability in Schooling

■ On 26th June in Bad Neuenahr-Ahrweiler the project group working on "Verantwortung für zukünftige Generationen – Schulische Umsetzung von Nachhaltigkeit" met for the first time. It discussed some of the project's main topics in order to make the working program more concise and operable for the two-years period.

In order to enable especially young people to act in accordance with responsibilities for future generations on their own initiative and not only in adherence to governmental directives,

the idea of sustainability is planned to be implemented in schooling. Since any answer on *how* this idea can or should be implemented presupposes a clear concept of *what* exactly it is that should be implemented, the project group will focus on this latter question first.

In doing so, the group has to answer a question that may be a key problem for any environmental education: Since the enlightenment the aim of education is commonly seen in bringing up self-determined students that act on insight and reason. Therefore teachers ought never to be manipulative, not even for aims that are generally accepted as environmentally necessary or morally good. On the other hand it does not seem to be rational, at least not, if the concept of rationality is that of the *homo oeconomicus*, to act in accordance with what is recognised as environmentally necessary as long as the effects will be beneath a certain relevance threshold. Why for example should the individual abandon a tour with his car for fun or comfort just in order to reduce CO₂-emission for a minimal quantum, while most of the others do not – and why should the others do if he does not? Even if it is the individual's own purpose to respire clean air, its contribution to this purpose will be insignificant. But contrariwise the abandonment may be very significant for its purposes of having fun or comfort.

The project group will work on this and other questions connected with its task until summer 2008. Up to now the members of this project group are: Professor Dr. phil. Gerhard de Haan (Berlin), Professor Dr. phil. Anton Leist (Zürich), Professor Dr. rer. nat. Laura Martignon (Ludwigsburg), Professor Dr. rer. pol. Georg Müller-Christ (Bremen), Professor Dr. rer. pol. Hans G. Nutzinger (Kassel), StD. Winfried Sander.

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Electrical Power Grids

■ The project group "Die gesellschaftliche Bedeutung elektrischer Energieversorgungsnetze" held its 'Feedback-meeting' in Düsseldorf on 30th June 2006.

External experts of a different professional background within the domain of energy research were invited: Professor Dr. rer. pol. Dieter Schmitt (chair Energiewirtschaft, Universität Duisburg-Essen), Robert Busch (Director Bundesverband Neuer Energieanbieter), Dr.-Ing. Jochen Kreusel (ABB AG), Dr. jur. Hans-Jürgen Brick and Joachim Vanzetta (RWE AG), and Dr. rer. pol. Gerrit Volk (Bundesnetzagentur).

The experts gave talks which provided interesting insights into their work in the different fields of electrical power supply referring to the study of the project group. In addition to their lectures

the experts were asked to comment on current structuring of the work plan of the emerging survey. There was a substantial agreement on the concept of the study. The identified problems and thus the main topics are: the degradation of the capacities of power stations, the lack of investment in electrical grids due to deregulation, stability problems on account of the upgrading of the European network, and firmness problems because of the increasing amount of renewable energy.

The future direction of the research has now been predefined and the detailed work programme can be amended and completed on the basis of the feedback and comments of the specialists. The focus of the project group's work will be on de/re-regulations of necessary expansion, maintenance and repair of power grids in Germany incorporating the European legislation framework. The next meeting will be held in October. By then, texts of the introducing chapter – giving an overview of the relevant topics – are to be prepared for a detailed discussion.

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New working group Fuel Cells

■ Dr.-Ing. Bert Droste-Franke – who recently joined the Europäische Akademie – will be responsible for the coordination of the newly starting project "Brennstoffzellen und virtuelle Kraftwerke als Elemente einer nachhaltigen Entwicklung. Innovationsbarrieren und Umsetzungsstrategien". The project aims at the design of appropriate realization strategies, taking into account the potentials as well as the barriers of respective innovations. The next steps will be the constitution of a corresponding working group and the specification of the yet preliminary work programme.

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NEWS

Netzwerk TA (NTA)

■ Am 23. Juni traf sich im Anschluss an die Jahrestagung der Europäischen Akademie ("Die Zukunft der Raumfahrt") das Koordinations-Team des deutschsprachigen TA-Netzwerks in Bad Neuenahr zu seiner regulären Stausitzung unter Leitung von Dr. rer. nat. Michael Decker (Forschungszentrum Karlsruhe). Themen waren u.a. eine Vorschau auf die kommenden NTA-Jahrestagungen, Vorschläge für die

Berichterstattung aus den NTA-Arbeitsgruppen sowie die Verbesserung der Kommunikation im TA-Netzwerk.

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Book Presentation on Noise

On 28th June 2006 the Europäische Akademie GmbH presented the newly published study "Leben mit Lärm? Risikobeurteilung und Regulation des Umgebungslärms im Verkehrsbereich" at the Berlin-Brandenburgische Akademie der Wissenschaften in Berlin. The study is the result of the academy's project group "Environmental Noise. Risk Assessment and Regulation for the Case of Traffic Noise" which considered that noise is becoming a problem for ever larger sections of population in industrial countries. The study recommends for example to establish a right for quietness (see also the focus article of this newsletter by Professor Dr. med. Griefahn).

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Publication:

M. Kloepfer, B. Griefahn, A. M. Kaniowski, G. Klepper, S. Lingner, G. Steinebach, H. B. Weyer, P. Wysk: "Leben mit Lärm? Risikobeurteilung und Regulation des Umgebungslärms im Verkehrsbereich" ("Wissenschaftsethik und Technikfolgenbeurteilung", Vol. 28, ed. C. F. Gethmann) Springer-Verlag, Berlin, 2006. ISBN-10 3-540-345 09-4

CONFERENCES

The Future of Space Travel. Use and Value

From 22nd to 23rd June 2006 the Europäische Akademie and the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt e.V.) organized the conference "Die Zukunft der Raumfahrt. Ihr Nutzen und ihr Wert". The speakers analysed the rationale for space travel from an interdisciplinary perspective. Amongst others Professor Dr. rer. nat. Messerschmid (Uni-

versität Stuttgart) gave a lecture about perspectives of manned space travel in general with emphasis on the European contribution. Professor Dr. phil. Eberhard Knobloch (TU Berlin) portrayed Alexander von Humboldt's explorative journey through South America that shows some similarities with explorative space projects. The proceedings of the conference will be published by the academy.

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PUBLICATIONS

Thorsten Galert/Reinhard Merkel

■ "Innovations in Neuroscience: Prospects and Perils", in: *Poiesis & Praxis*, Vol. 4 (2), Berlin Heidelberg, 2006, 77-80

Carl Friedrich Gethmann

■ Einleitung zum Kolloquium "Der 'neue' Mensch. Ethische Probleme der Genforschung und Biotechnologie", in: G. Abel (ed.) *Kreativität. Kolloquiums-Vorträge des XX. Deutschen Kongresses für Philosophie, TU Berlin, September 2005*, Hamburg 2006 (in Druck)

■ "Das abendländische Vernunftprojekt und die Pluralität der Kulturen", in: J. M. Krois/N. Meuter (eds.), *Kulturelle Existenz und Symbolische Form. Philosophische Essays zu Kultur und Medien*. Festschrift für Oswald Schwemmer. Berlin 2006, 17-39

LECTURES

Carl Friedrich Gethmann

5.7.06

■ "Ethos des Heilens vs. Effizienz des Gesundheitssystemes"

Institut für Medizinische Ethik und Geschichte der Medizin der Ruhr-Universität Bochum

14.7.06

■ "Die Krise des Wissenschaftsethos"

Festvortrag zur Eröffnung des Zentralinstituts für Angewandte Ethik und Wissenschaftskommunikation der Friedrich Alexander-Universität Erlangen-Nürnberg

PERSONALITIES



Andrzej Maciej KANIOWSKI, born in 1951, graduated from Uniwersytet Warszawski, where he defended his M.A. in political economy (1974) and gained his Ph.D. in philosophy in 1982 ("Social Philosophy of Jürgen Habermas. In the Search for Unity of Theory and Praxis"). Social philosophy is at the centre of his interest focussing on the critical theory of the Frankfurt School and methodological problems of social research. After starting to work on discourse ethics, communication and problems of normativity in the mid 1980s, his focus turned to ethics. His habilitation on "Supererogation" (published in 1999, defended in 2000) dealt with the question of a possible place of so-called works going "beyond the call of duty" within universalistic concepts of ethics. Continuing his work on the problems of social philosophy and philosophical ethics in the 1990s, he extended his area of interest towards applied ethics (especially bioethics and medical ethics) and to the problems of normative grounds of democratic orders. From 1990 to 1991 he had a research scholarship of the Alexander von Humboldt-Stiftung at the Universität Bonn (Professor Dr. em. H.-M. Baumgartner). In 1996 he worked as a senior fellow at the Institute for Human Sciences in Vienna (translators program), while in 2003 he was awarded a three month scholarship at the Europäische Akademie Bad Neuenahr-Ahrweiler. Since 2001 he has been holding the chair for ethics at the Uniwersytet Łódzki. He has published two books, some readers (on Habermas' philosophy), over 50 papers on social and practical philosophy and translated some of the works of German philosophers (J. Habermas' "Theorie des kommunikativen Handelns", O. Höffe's Kant monography, H.-M. Baumgartner's collection of papers "Endliche Vernunft").

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 Professor nadzw. Dr. hab. Andrzej Kaniowski holds a chair for Ethics at the Uniwersytet Łódzki and has been a member of the academy's project group "Environmental Noise".

Publisher:

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Print:

Warlich Druck Ahrweiler GmbH, Bad Neuenahr-Ahrweiler
 ISSN 1432-0150, frequency of publication: 6-10 times per year, 2.700 copies, reproduction is permitted with reference to the source, please send two voucher copies.