Europäische Akademie

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

Direktor:
Professor Dr. Carl Friedrich Gethmann

Newsletter

Akademie-Brief ▪ No. 30 (Februar 2002)

Editorial

On 15th November 2001 the constituent meeting of the Society of Friends and Promoters of the Europäische Akademie GmbH took place. The first board meeting of the society's committee and the first general meeting were summoned for 14th January 2002.

The society´s object and function are to support the European Academy for the Study of the Consequences of Scientific and Technological Advance Bad Neuenahr-Ahrweiler GmbH in the realisation of its projects. Furthermore the society´s target is to promote and support science and research in the field of scientific ethics and the evaluation of consequences of technology implementation.

Last but not least the society is to take care for the relations between science and practice by expert discussions by paying particular attention to the interchange between companies, institutions and natural persons in the district of Ahrweiler.

During the above mentioned meetings the society´s statutes were established and approved on and the first board of the Society was elected. Members of the board are Dr. Hans Ulrich Tappe (deputy mayor of the town of Bad Neuenahr-Ahrweiler), Mr Hans Joachim Brogsitter (businessman), and Professor Dr. Carl Friedrich Gethmann (ex officio as the Director and Chairman of the Europäische Akademie GmbH).

The Newsletter will report about the work of the Society of Friends and Promoters of the Europäische Akademie at regular intervals. PH

Focus

Interaction between Robots and Humans

Michael Decker

Industrial robots are well established in the field of industrial production. They are used in manufacturing plants in which typically only those human operators are employed that are well acquainted with the way robots function and with the pertinent of work safety regulations and who know how to apply the relevant safety precautions. These persons are experts in the application of robotic systems. Robotic systems, however, are increasingly being used outside of industrial manufacturing facilities. This article is a summary of the recommendations concerning modes of operation with regard to the various different forms of interaction between robots and human operators that was compiled by a working group of the Europäische Akademie[1]. The different types of interaction are sub-divided, beginning with "experts in the sense of industrial robot systems", continuing with "unconcerned third parties" and finally "robot users". In the following article, these different categories are elucidated by means of examples.

Deutsche Fassung dieses Texts: ***www.europaeische–akademie-aw.de.***

1. Experts

So-called expansion robots increase the range of action of the human operator in so far as they enable the human to overcome barriers and to be "remotely present", i.e. to perform actions at places that are not accessible directly. In this there may be "insufficiency" on the basis of various criteria:

– Great Distance

With the help of a robot, for example, it is possible to perform actions in space. In view of the considerable time needed for receiving and sending signals in some cases, space robots are only operated partially by remote control. Certain pre-programmed tasks are performed (semi)autonomously.

– Size Relationships

By means of robots, human operators are able to perform actions also in the micro and nanometer sphere. In this field, the robot takes over the transformation of the amplitude of movement of the human hand to the corresponding miniature sphere. In this sense, also a sewer inspection robot would expand the spectrum of human action since the sewer pipes, in some cases, are too narrow to be inspected or cleaned by a human being himself.

– Physical Barriers

Robots may serve to perform actions behind a physical barrier. Thus the concepts of remote presence can be used in minimal invasive surgery to transform the hand movements of the operator intuitively, controllably and commensurately to the instruments applied. In this way, the barrier itself, in this case human skin, need only be penetrated as little as possible.

– Danger for the Human Operator

Danger for the human operator may also constitute a barrier which remote presence may help to overcome. Robots, for example, can be applied to defuse explosives (e.g. anti-personnel mines) or for the inspection or dismantling of nuclear power stations, or for actions performed at great depth in the ocean.

With regard to interaction with humans, these robots may be considered to be industrial robots in the sense of the introduction to this article, with the difference that they are used outside of industrial manufacturing plants. These robot systems have been developed for specific, concrete applications and are used within action contexts in which, though on the one hand, an expert operator is familiar with the application of that particular type of robot, on the other hand however, it may not be expected that other persons could come into contact with the robot "by chance", as it were. Therefore, analogous to the industrial robots, it may be assumed that the only persons that interact with these robots are experts who are familiar with the relevant safety precautions, accident prevention regulations, etc.

This also applies to the minimal invasive operation in surgery, albeit that in this context a further person in the shape of the patient is represented who is, of necessity, not a robot expert. In this case, it is important that the patient should be told beforehand that it is intended to use a robot in the operation and that he should be enlightened as to the dangers involved for the patient himself.

2. Experts and Unconcerned Third Parties

Service robots include, for example, vacuum cleaner, lawn mower and window cleaning robots. They are used for the benefit of a person (typically the "owner" of the robot, analogous to the "car owner"), beyond that there is no need for interaction with other humans. It cannot be excluded, however, that while performing certain actions, other humans are encountered. For these encounters the robot must be equipped with a repertoire of functions that enables the simultaneous action of the robot and the person in the same environment. This can be realised by relatively simple control functions. For example, the robot should come to a halt when a person enters its immediate radius of action in order to avoid collision. It may also be useful for the robot to transmit a warning signal. The subsequent actions of the robot should also be recognizable from outside by an unconcerned third party: a change of direction may be recognized by flashing indicators, concrete actions can be announced by a simple speech module, etc. The decisive point in this interaction is that once the robot has received the initial instructions from the owner, typically at the beginning of the operation, no further input from outside is necessary for the completion of its task.

Concerning interaction with humans, the owner of the robot (expert) must know enough about the robot to enable him to effect maintenance, operation and organisation. Over and above this, it may come to encounters with so-called unconcerned third parties, for which the robot must be adequately equipped. The decisive aspect in this connection is the prevention of accidents. Should it happen, that in spite of this, an accident is caused by the robot, the question must be examined as to who bears the liability for any damage or injury caused.

3. Experts, Unconcerned Third Parties, Users

In the case of robots of this type the interaction with human operators is focal to the purpose of the application, that means that, in contrast to point 2., the communication between human and robot is central to the execution of the task involved. Examples of this type are waiter robots that must be able to receive orders and to serve beverages and food to tables, or robots used in the care of persons needing help, i.e. sick or elderly people. Over and above the capabilities of the service robots mentioned under point 2., – for example collision-free operation, warning signals for changes of direction – a far more complex control module must be integrated into these robots. It means that they must be prepared for a wide variety of situations. The robot must be equipped to adapt its actions to the task on hand in the best way possible. This technical requirement is typically fulfilled by the integration of a cognitive learning algorithm. The adaptive orientation to new surroundings and to a concrete action context would then be able to and, in fact, have to take place "on site".

With regard to the interaction with humans, analogous to point 2., the robot owner (operator of a restaurant, a hospital care service provider) has to be familiar with the maintenance, organisation and operation of the robot. It is he that will lay down the basic parameters for the robot system if these are necessary for the programming. Also analogous to point 2., unconcerned third parties are involved (for instance visitors in the hospital). Additionally the robot will have to interact with the users who will not be familiar – or will only be partially familiar with the operation of the robot (as in the case of the restaurant customer or the patient under care, respectively). In contrast to the so-called "unconcerned third parties" under point 2., the former are explicitly dependent upon the correct functioning of the robot.

In the underlying study[1] operational recommendations resulting from the interdisciplinary expert discussions are set out according to categories, e.g. "Robots and the Law", "Technology", "Utopia" etc. At this point, some of the operational recommendations shall be ordered according to the three categories of "inter-actors". Expansion robots, according to the study, are to be recommended without reservation for promotion in the research field. Here the chief consideration is the fact that precisely in the case of these robots, the pure ends-means relationship is of decisive importance. It may be assumed that the strived for ends will be met and that the task on hand is to find the optimum means to achieve these ends. For this it is initially necessary to ascertain whether the robot is technically capable of performing the operations required to meet the ends. If this is so, the question arises, from the economical point of view, as to whether the robot constitutes the most economical way, among all other possible ways, of achieving the ends (cost-benefit analysis).

Expansion robots, in view of their characteristics as tools, give rise neither to ethical questions nor does their application involve new legal regulation ("business as usual"). In this connection, however, a problem could arise from the point of view of the national economy if, as a result of their wide-scale application, large numbers of the workforce are replaced by robot systems. Since it may be expected that the framework conditions for human labour will be considerably altered by the widespread application of robot systems.

Service robots, in view of their confrontation with "unconcerned third parties", require new legal regulation. Though robots, from the legal perspective, must still be regarded as things. This involves making the manufacturer of robots liable for claims ensuing from faulty construction, instruction and design within the product warranty regulations. It is recommended that the technical aspects under point 2. should be integrated into the robot systems. Also the robot owner will be placed under legal liability, if it can be proved that he neglected his duty in regard to maintenance, organisation and operation. In view of the complexity of modern robot systems, however, the injured party cannot be expected to be able to trace and prove the fault in the robot system. Therefore it is recommended that there should be an amendment to the legal regulation in the sense that the defendant of the claim should bear the burden of proof. In this way claims for dam-

ages on the part of unconcerned third parties will be facilitated. The increased cost liability for the robot owner could then be covered by a kind of third party liability insurance for robot owners.

Service robots equipped with algorithmic learning modules for adapting to the applications of a specific user develop within their prescribed technical control systems their own action plans and save certain plans in their memory as "learned" so as to use them again in similar situations. This learning process must be made correspondingly transparent so that the robot owner is aware that the robot now has the "intention" to learn something. This could be accomplished by means of a kind of "black box" in the learning system (analogous to the "black box" in aircraft). In this way it could be guaranteed at all times that in the event of "wrong behaviour" on the part of the robot it would be possible to ascertain whether this was due to a fault in the control system from the manufacturer or whether it was the result of the robot owner accepting a certain "self-learned" process. This differentiation is important for deciding the question, "Who is liable?".

In the study the operational recommendations for political advisory consultation have been optimized in the wide sense. This includes the detailed rationale for each of the recommendations, which cannot be dealt with in this article. By referring to the various forms of interaction between robots and humans, it is possible for the potential robot developer to operationalize these recommendations. It is possible to determine from the analysis of the action contexts which categories of interaction between humans and robots: experts and/or unconcerned third parties and/or users have to be considered, and from this therefore which recommendations are relevant for the development of a particular robot system.

[1] The recently published study "Robotik. Perspektiven für menschliches Handeln in der zukünftigen Gesellschaft" (Springer Verlag, ISBN 3-540-42779-1) assesses the technical, socio-political, economic and philosophical consequences of modern robots from the interdisciplinary, scientific perspective.

Dr. Michael Decker is staff member of the Europäische Akademie. He is project coordinator of the sudy group "Robotics" and co-author of the study.

Working groups

Environmental standards. Dose-effect relations in the low dose range and their risk evaluation

The project group welcomes two new members Professor Dr. Dr. Hermann Bolt from Universität Dortmund (Inst. For Occupational Physiology) and Priv.-Doz. Dr. Jan-Georg Hengstler from Universität Mainz (Inst. for Toxicology) who will together work on the problems of standard setting in toxicology.
The group had two meetings on December 4, 2001 and on January 10./11.2002, where further drafts had been discussed. Presentations by the new members were given: "In vitro human hepatocytes. A model for the assessment of cancerogenic compounds" (J.-G. Hengstler) and "A novel concept – the hygiene-based margin of safety (HBMOS) – for the assessment of the impact of potential endocrine disruptors like environmental estrogens)." (H. Bolt) This concept integrates exposure scenarios and potency data for industrial chemicals and naturally occurring dietary compounds with estrogenic activity (phytoestrogens).

Chair: Professor Dr Dr. Christian Streffer

Project coordinator: Dr. Kathrin Prieß
Phone: +49 (0) 2641-973 309
Kathrin.Priess@dlr.de

Embryo Experimentation in Europe

The fifth meeting of the project group took place on 8./9. December at the Berlin-Brandenburgische Akademie der Wissenschaften in Berlin. As a guest Professor Dr. Barbara Knowles, Director of Research of The Jackson Laboratory, Maine USA, gave a comment on the current debate on research involving the human embryo in the USA.

Chair: Professor Dr Davor Solter (MPI for Immunobiology, Freiburg)

Project coordinator: Minou Bernadette Friele, M.A.
Phone: +49 (0) 2641-973 305
m-b.friele@dlr.de

Conferences

Frühjahrstagung 2002: Nachhaltige Entwicklung und Innovation. Globale Perspektiven wirtschaftlichen Handelns

Die Schlagwörter ‚nachhaltige Entwicklung' und ‚Innovation' als Leitbegriffe zeitgemäßer Umwelt- bzw. Wirtschaftspolitik scheinen auf den ersten Blick einen Gegensatz darzustellen: Die Forderung nach nachhaltiger Entwicklung verhindert Innovationen; Innovationen – als Motor wirtschaftlicher Weiterentwicklung – verhindern eine nachhaltige Entwicklung.
Bei näherer Betrachtung wird jedoch deutlich, dass die Begriffe vielmehr als gegenseitige Ergänzung verstanden werden müssen: Ohne Innovationen ist an eine nachhaltige Entwicklung nicht zu denken; die Ausrichtung von Innovationen auf eine nachhaltige Entwicklung verbessert deren Wertschöpfungspotential.
Diese komplementäre Sichtweise ist heute zwar weitgehend akzeptiert. Über das Zusammenspiel von Innovation und nachhaltiger Entwicklung in spezifischen Anwendungsfeldern herrscht jedoch keineswegs Klarheit.
Die Frühjahrstagung der Europäischen Akademie 2002 soll Perspektiven von Wissenschaft und Wirtschaft zu dieser Konkretisierungsaufgabe zusammenführen und einen Dialog über das Potential von Innovationen im Hinblick auf eine nachhaltige Entwicklung sowie die Vorteile des Leitbildes einer nachhaltigen Entwicklung für die Ausrichtung von Innovationen anstoßen.
Anmeldung und Anfragen an Europäische Akademie, Tel. 02641-973-300, Fax 02641-973-320, Email: europaeische.akademie@dlr.de.

News

Wissenschaftsregion Bonn

On 3 December 2001 the members of the „Transferkreis Bonn" – a regional network of institutions engaged in the transfer and assessment of technology developments – held its regular meeting at the „Siegwerk Druckfarben GmbH & Co. KG" in Siegburg. Main topics were the demonstration and discussion of actual innovation potentials in the print and packaging branches.

Expert Discussion

On January 10th, 11th and 12th, the Europäische Akademie in cooperation with the FernUniversität, Hagen conducted an expert discussion with the title *Sterbehilfe. Rechtswissenschaftliche, philosophische und Praxis-Aspekte* (Euthanasia/ Physician Assisted Suicide – Juridical, Philosophical and Practical Aspects).

Modern medico-technical developments are bringing dying and death increasingly into the sphere of human intervention. In cases where prolonging the life of a person concerned is perceived merely as the prolongation of suffering without any hope of recovery, the demand is made to pay more respect to the right of self-determination of the patient with regard to the time point of death.

Controversies flare up for one thing when the question is posed whether assisted suicide should ever be permitted at all. This question is frequently seen in connection with the possibilities of palliative pain treatment. Furthermore, fears exist with regard to the possible difficulties involved in containing the consequences of the practical implementation of regulations concerning assisted suicide. Finally, the question arises as to whether there should be a differentiation, from the moral and (juridical) practical point of view, between active and passive euthanasia. This question is of particular relevance in regard to the role of the physician.

The aim of the expert discussion was to make a contribution to the rational assessment of active and passive suicide assistance and its possible practical implementation.

Lectures were presented by Jeantine Lunshof, Hans-Ludwig Schreiber, Klaus Kutzer, Reinhard Merkel, Dietrich Kettler, Dieter Birnbacher.

The organisation was undertaken by Professor Annemarie Gethmann-Siefert, Dr. Felix Thiele and Minou Bernadette Friele, M.A. A publication of the results of the expert discussion is foreseen within the regular series of publications issued by the Europäische Akademie.

Book Series

The following volumes of the Europäische Akademie's book series "Wissenschaftsethik und Technikfolgenbeurteilung" were published recently:

F. Breyer, H. Kliemt, F. Thiele (Eds): *Rationing in Medicine. Ethical, Legal and Practical Aspects*. Band 13, Springer-Verlag, Berlin 2002, ISBN 3-540-42782-1.

T. Christaller et al.: *Robotik. Perspektiven für menschliches Handeln in der zukünftigen Gesellschaft*. Band 14, Springer-Verlag, Berlin 2001, ISBN 3-540-42779-1.

A. Grunwald, M. Gutmann, E.M. Neumann-Held (Eds): *On Human Nature. Anthropological, Biological, and Philosophical Foundations*. Band 15, Springer-Verlag, Berlin 2002, ISBN 3-540-42905-0.

Lectures

Felix Thiele:

28.10.2001 "Predictive Medicine", Symposium, Bio-Policy and the Place of Professional Ethics in Political Decision Marking, GSK-Stiftung, Seeon

7.11.2001 "Humangenetische Diagnostik", Wissenschaftliche Grundlagen und gesellschaftliche Konsequenzen, Vertretung des Landes Rheinland-Pfalz, Brüssel

14.11.2001 Lebenswissenschaften Leit/d-wissenschaften des 21. Jahrhunderts?, Podiumsdisskussion, Urania, Berlin

17.11.2001 "From Genomes to Cures", Gene therapy: progress and prospects, Statement und Panel, Joint EMBO/EMBL conference on Science& Society, Heidelberg

23.11.2001 "How far may science be allowed to go?", Roundtable, 10th Anniversary Ernst Schering Research Foundation, Berlin

New Publications

M. Decker:

(with K. Lauterbach, M. Lindlar) "Cost-Benefit-Analysis of Telemedicine. First Steps to an Interdisciplinary Technology Assessment"; In: *Innovations for an e-Society. Challenges for Technology Assessment*. Congress Preprints. Teltow, 2001.

C. F. Gethmann:

"Ethische Argumente gegen das Klonieren von Menschen", in: D. Jakovljevic, *Angewandte Ethik*, Podgorica 1999, 87-191

(mit L. Honnefelder, O. Schwemmer, L. Siep (Hrsg)) "Die Natürlichkeit der Natur und die Zumutbarkeit von Risiken", Abschlussbericht (Ethik in den Biowissenschaften und Medizin, Band 1), Institut für Wissenschaft und Ethik, Bonn, 2001

"Hermeneutische Phänomenologie und Logischer Intutionismus", in: J. Mittelstraß, A. Gethmann-Siefert (Hrsg), *Die Philosophie und die Wissenschaften. Zum Werk Oskar Beckers*, München, 2001, 109-128

"Arend Heyting und die phänomenologische Erkenntnistheorie", in: J. Mittelstraß, A. Gethmann-Siefert (Hrsg), *Die Philosophie und die Wissenschaften. Zum Werk Oskar Beckers*, München, 2001, 149-159

(mit G. H. Fey) "Wir dürfen unsere Evolution nicht dem Zufall überlassen", in: J. Nida-Rümelin (Hrsg), *Ethische Essays*, Frankfurt/M., 2002, 442-448

F. Thiele:

"Moralische Probleme der Grünen Gentechnik", in: Fulda E. et al. (Hrsg) *Gemachte Natur. Orientierung zur grünen Gentechnik*, Braun Verlag, Karlsruhe, 104-116

Personalities

Ruth Chadwick is Professor of Bioethics at Lancaster University, UK, where she is chairing the Istitute for Philosophy, Environment and Public Policy. She held positions in Liverpool, Cardiff and Preston before joining Lancaster University in 2000. She co-ordinated the Euroscreen projects (1994-6; 1996-9) funded by the European Commission and co-edits the journal Bioethics. She is Vice-Chair of the Human Genome Organisation (HUGO) Ethics Committee and a member of the Food Ethics Council, the National Committee for Philosophy, the Research Development Grant Assessment Panel of the Scottish Higher Education Council, the research Assessment Exercise (2001) assessment panel for Philosophy and the Medical Research Council Advisory Committeee on Scientific Advances in Genetics. She has published 16 books as author or editor, including the award-winning Encyclopedia of Applied Ethics (San Diego: Academic Press, 1998). Ruth Chadwick is a member of the advisory board of the Encyclopedia of the Human Genome.

Professor Ruth Chadwick is the chair of the Europäische Akademie's project group "Functional Foods".

Publisher: Europäische Akademie zur Erforschung von Folgen wissenschaftlich-technischer Entwicklungen Bad Neuenahr-Ahrweiler GmbH, Wilhelmstraße 56, D-53474 Bad Neuenahr-Ahrweiler
e-mail: europaeische.akademie@dlr.de, Internet: www.europaeische-akademie-aw.de

Director: Professor Dr. phil. Carl Friedrich Gethmann (V.i.S.d.P.)

Editing: Friederike Wütscher, Phone +49 (0) 2641-973 313, Fax 973 320, friederike.wuetscher@dlr.de

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