



Responsibility of Science

RESULTS

Germany, Darmstadt

04.08. - 11.08.2007



Dear reader,

welcome and thank you for showing interest in the results of this year's International Summer and Science Camp (ISSC) on the topic of "Responsibility of Science". In this pamphlet you will find a documentation of one week of intercultural and interdisciplinary work and life in Darmstadt as well as of the results from the workshop on responsibility.

First of all, a few words on the ISSC in general: The ISSC was launched in 2006 by juFORUM e.V. and FUF (Swedish federation of young scientists) in order to support the buildup of a pan-European federation of young scientists. It is held in a different country every year with the country's organisation team taking its own national concept for a basic structure. This enhances the diversity and leads to an organisation optimally fitting the programme of the according ISSC. The idea is to bring young people from different countries together and to provide them with an inspiring frame of activities such as workshops or lectures, enabling them to start discussions and to establish national and international friendship. This is one major step in order to start an international dialogue that will prolong for long after the ISSC.

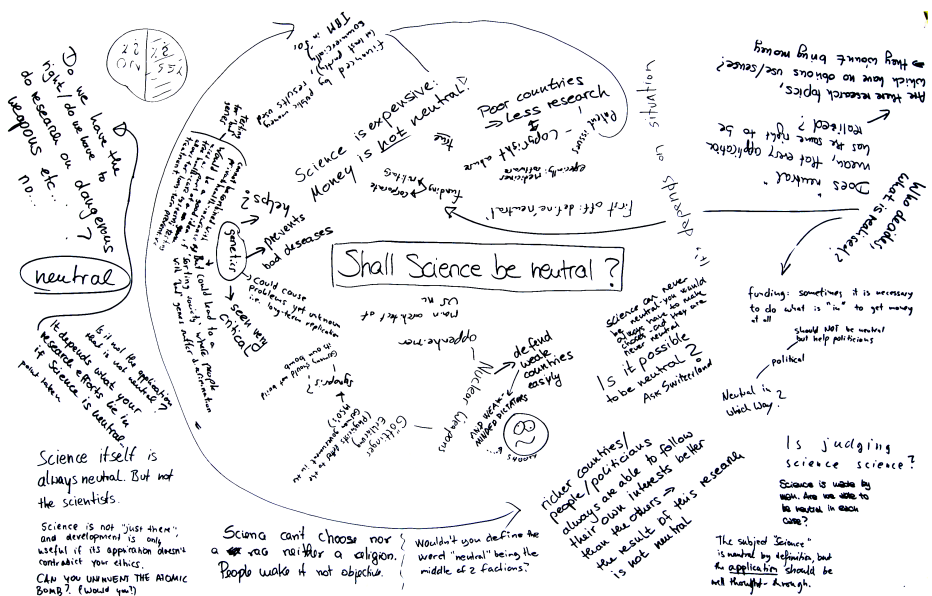
For curiosity is one of the main abilities of scientists, this chance to communicate with people from other cultures and scientific fields is taken almost instantly by the participants; a constant process of explaining and learning from others is started. However this process is not restricted to the mere gathering of knowledge about "the different" but helps to assess own opinions and perspectives and therefore to enhance the own arguments.

The corporate life for one week in a relaxed atmosphere makes international approaches inevitable as various similarities and differences in culture can especially be found in normal day-to-day life. The explanation of customs and manners as well as the discussions about such seemingly natural topics as food contribute to this process of getting to know "the different".

This year's ISSC was organised by juFORUM e.V. and held in Darmstadt; however, the organisation started one and a half years ago. The idea was to bring together people of various scientific disciplines, countries and backgrounds. All in all the ISSC counted 62 participants aged between 14 and 29 who came from ten different countries and 16 different sciences from Molecular Biology over Physics to Media Technology.

As all participants took part in all activities, the main topic of the ISSC had

to be a meta-topic referring to all sciences, so that everyone was able to enrich the intercultural and interdisciplinary discussions depending on his or her background knowledge. Due to the mixture of cultures and sciences there are multiple perspectives and opinions expressed about one single topic by the group which leads the single person to reflect his or her own arguments and to enhance his or her position.



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A diary of the ISSC

First day: Saturday, August 4th, 2007

As we expected participants from all over the world, the programme of the first day scheduled the arrival till five o'clock in the afternoon. But this definitely did not mean a loss of time for the early birds, as the great weather offered perfect conditions for a first get-together. However, even those who had used the opportunity to intensify the first new contacts while refreshing in the nearby lake Woog, looked as curious and expectant as any other participant in the evening. The faces appeared to ask many unspoken questions: "Who is who?" and "How will this camp turn out to be?"

Actually, you could already see the doubts fading away during the dinner at the Braustüb'l. This typical German meal could be regarded as the first part of the subsequent "Night of Nationalities", during which all participants presented their home countries and rectified some common misconceptions about them. As a kind of warm-up, each of us positioned him- or herself on an imagenary worldmap in the luckily large seminar room of the TU Darmstadt to get a rough grasp, from which parts of the world the other participants came from. Still in this warm-up phase, we shared informations about the fields of science everyone is interested in or the individual language skills again by positioning oneself in the room according to certain rules.

Afterwards, we formed casual, but international groups of six or seven. Each of these groups was given the name of one of the ten countries, which were represented by the participants, and the task to draw a new flag for this country, including all ideas, stereotypes and anything else anyone in each group believed to know about this country. The true challenge of this task was to work out a design of the flag including - if possible - all ideas of the group and nevertheless to compose a complete something which looked like some kind of flag for only the very country each group worked on. To make it even more difficult, the material was limited, each group had only one sheet of paper to draw the flag, thus one had at most one of the two sides of this sheet to make scetches. This forced each group to communicate and to discuss anything in detail. Like that, many different interesting ideas were collected in each group, not only on the country they had to work on, but also on the countries the members of each group came from, as the ideas of a certain country varied from person to person,

depending on the individual origin. At the end of this task, each group had to present their flag to all other participants with an explanation for their design. These presentations, which were, of course, full of quite funny misconceptions and prejudices about the country presented, were the basis for the representatives of each country to present their homeland themselves. Like that, many of those misconceptions and prejudices could be revised, whilst others were confirmed. It was everyone's very own decision to present his or her country the way he or she considered best. That means, we did not only hear some kind of report on every country, but we also listened to the Slovakian hymn or a Finnish folksong and also saw some performances of traditional dances.

Second day: Sunday, August 5th, 2007

Well rested after the first night in Darmstadt, we split up into eight smaller groups, in which as many nationalities as possible were represented. Each of these groups explored the most important cultural sights of Darmstadt's inner city guided by the various tasks of a city rally. Due to this competition atmosphere of the rally, each group was keen on working together as good as possible. Like that, we experienced the different cultures in our groups not as an obstacle but as an advantage when it came to such tasks as writing a poem about the ISSC and our expectations of the following week. All the tasks offered touched different fields of knowledge, so that everyone had the chance to bring in his or her special abilities, no matter if in pantomimics, in botanics or, more technical, in constructing paperplane. The group always had to discuss the solutions to the given task and needed to employ the skills of everyone. Teamwork was essential, especially when the whole group should bridge a distance of several meters without touching the ground by not using anything else than two pages of a newspaper. The rally found its end in a common picnic in the park at Rosenhöhe.

Afterwards, we started the first part of our workshop "Responsibility of Science". Therefore, casual groups of five people were formed; each group was given a topic related to the political, social, or economic impact of scientific research, such as the question whether science must or must not make money. In a first phase, these topics should be discussed by writing down thoughts and ideas onto a poster as to create a first mind map. This made the given topic more accessible for those who dealt with another question, as everyone was meant to examine

and discuss all other posters in the second phase. Finally, we had to decide on the basis of these discussions which topic we would like best to work on for the rest of the week.

At the end of the day, each group working on one of the workshop's topics was supposed to create a protection device to protect an egg from every damage afflicted by means of a free fall out of the university-building. As both, the given material and the given time were limited, it was essential to cooperate efficiently.



Third day: Monday, August 6th, 2007

Monday started with an official welcome at the City Hall of Darmstadt by the city representatives and the Technical University (TU). Both, city councillor and chancellor of university emphasized the importance to involve young and interested people in the field of science. Besides the participants of the ISSC, the media attended this welcome taking the chance to interview the organisation of the ISSC.

We spent the following hours at the European Space Operations Centre (ESOC) where we had a guided tour through the facilities: After a video clip about ESA and ESOC in general, we were shown the main control room and the control rooms for some satellites currently supervised by the ESOC. We also had the chance to take a closer look on the engineering model of Rosetta. A lecture on today's and tomorrow's space missions to Mars was held the following hour in which we not only learned about the mission objectives, but also about the interest in Mars and other planets of the solar system in general.

After lunch, we visited the Fraunhofer Institute for Computer Graphics where we were introduced to some of the latest developments in computer graphics and their application in day-to-day life. These include the best computer algorithms to recognize 3D-CAD-modells in pictures which are used for building an augmented reality, a software to virtually try on clothes before actually producing them or another software rendering 3D modells in such a way that they fit into the background-environment in which they are put.



During the next lecture at the TU Darmstadt about the RoboCup, we were presented robots playing soccer autonomously. What started as a student's project out of pure fun and curiosity is today a field of study and helps to optimize software and hardware in robotics.

In order to introduce our foreign guests to German food, dinner was held in a Bavarian Biergarten.

This was followed by a bat excursion where we learnt about the most common bats in Germany and actually listened to their sounds which were made audible by using special devices. The bat's way to orientate itself was asked about in great detail and examined with scientific knowledge.

Fourth day: Tuesday, August 7th, 2007

Today we went to Heidelberg in order to visit the Max-Planck-Institute for Astronomy (MPIA). Having arrived at the Königstuhl Mountain we were welcomed and led to a lecture hall. There we were informed about the basic research methods in astronomy as well as about the special research done at the MPIA.

After the lecture, the group was divided into two parts which were separately guided through the MPIA-facilities. One of the two 70cm telescopes was demonstrated to us and we were explained that - although 70cm seem very small compared to the 7m of the most modern telescopes - they are still useful for current research within our solar system. Moreover, MPIA's involvement in the development of the James Webb Space Telescope, which is to be launched in 2013 by the NASA as the successor of Hubble, was shown to us: at the MPIA the grating wheels and the filter wheel are developed and built, as the MPIA has gained extensive experience in building such mechanisms which have to fulfil highest demands.



Having been introduced to the latest research performed at the MPIA, we gathered again in the lecture hall to attend a lecture by a publisher of the German magazine "Sterne und Weltraum". This magazine is meant to deliver various information on all fields of astronomy for both, laymen and scientists.

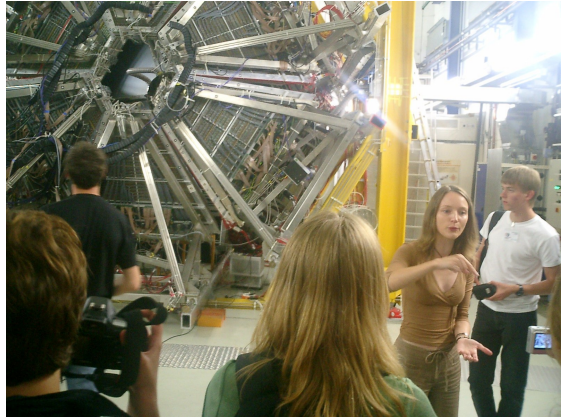
Afterwards we went to Heidelberg and had some spare time to explore the city on our own, guided by helpful tips in our programme. We met again for dinner in the Mensa Marstall. Due to the bad weather conditions, the guided city tour planned for the evening was cancelled so that we went home to the youth hostel directly after dinner.

Fifth day: Wednesday, August 8th, 2007

Today's activities took place in Darmstadt again. After breakfast at the youth hostel, we went to the TU where we worked in the workshops on the topic of the ISSC 2007, "Responsibility of Science", again. In order to gain some thought-provoking impulses we first attended a lecture on responsibility by Richard Finckh, member of the "Interdisziplinäre Arbeitsgruppe Naturwissenschaft, Technik und Sicherheit" (IANUS) at the TU Darmstadt. He talked about the historical background, the impact and the leading role of the so-called "Göttiger Erklärung", as well as about the research performed by IANUS. His lecture started some prolific discussions which highly contributed to our work in the workshops.

After the work in the workshop, which will be described further later on, we had lunch.

This was followed by a trip to the GSI, the “Gesellschaft für Schwerionenforschung mbH”. In a first lecture we were told about the research performed at the GSI with particle accelerators: discovering the structure of particles, building new heavy elements and developing a cancer therapy. We were also taught that an even bigger particle accelerator, the so-called FAIR, is currently developed and that the building phase will soon be started.



Thereafter, we were shown the facilities of the GSI where we were able to take a closer look at some of the particle-detectors. The guided tour was followed by another lecture, Physics of Star Trek, where Professor Roth explained to us in great detail the technical background of the Enterprise and whether the technologies are theoretical reality or mere fiction. We also learnt about some “tiny” software-failures in space missions which had quite serious consequences and some bizarre NASA projects.

Having heard a lot about physics, we went to the Museum of the state Hessen to learn about the regional archaeological research, another branch of science not to be neglected.

Sixth day: Thursday, August 9th, 2007

Having visited many of the facilities in Darmstadt and Heidelberg, we spent Thursday in Frankfurt. In the morning, we went to the university where we had two lectures: one on NMR (Nuclear Magnetic Resonance), a method to determine the structure of proteins, and the other one about various techniques used by viruses in order to stay hidden from the immune system of an organism. In between those two lectures, a guided tour through the NMR-facilities was organized for us where we could see the NMR equipment.

Lunch was held in the cafeteria of the university. In the afternoon, we visited the Palmengarten where we spent most of the time in the numerous beautiful greenhouses due to the bad weather conditions. There we learnt about culture in China, saw tropical plants as well as various cacti and encountered very rare blooms in the horticultural Blütenhaus. We left the Palmengarten in small groups to explore Frankfurt on our own. Again, the information provided in our programme was very helpful. For those who were interested, a trip onto the Helaba skyscraper was organized; however, a good view was not to be expected as it was very foggy so that many of us preferred to have early dinner instead.



Final day: Friday, August 10th, 2007

Our final day began with the transfer to the facilities of one of our main sponsors, the chemicals and pharmaceutical company Merck KGaA. There we were divided into four groups as there would be two guided tours through a chemical plant and another two through a biochemical plant. Before the guided tours started, there was a brief presentation of the history and the products of Merck as well as of the fields of current research in pharmacy and chemistry.

As Merck is the world market leader in the production of liquid crystals the chemistry-groups were led through the new and highly automated plant for liquid crystals.

Meanwhile, the biochemistry-groups visited the production facilities for agars as well as the plant, where Dihydroxyacetone is produced, the main ingredient for self-tanning lotions.

All of us visited the tablet production plant where our guides told us about the clean rooms in which all the manufacturing-steps are performed. We were also shown the storage and shipping department and were informed about the fully

automated management-system for all the products.

Throughout the entire tour, we were repeatedly elucidated about various safety arrangements in all the facilities.

After a grandiose lunch at Merck, we attended a lecture about the efforts undertaken by the company to protect the environment as much as possible. We also learnt about the waste water treatment plant, the chemistry-vessel's re-use and some of the international projects to help other countries to develop environmentally friendly ways to dispose chemical waste.

Afterwards, we went to the TU where we rounded off our work about the different facets of the "Responsibility of Science" and formulated the results for each topic, which can be found a few pages further on.

In the evening, we gathered in and around a small house near lake Woog for a barbecue to enjoy one last time for this week the international community. This opportunity was warmly welcomed by everyone to have a first look back on the ISSC, to plan ways to stay in contact in the future, or simply to have fun one with another; not even the rainy weather could derogate the great atmosphere.



Departure: Saturday, August 11th, 2007

This last morning was probably the most quiet one during the entire camp, not only because last night's barbecue hardly found an end, but also because it was time to say goodbye. A first group departed from the central station at seven in the morning already. The others followed from then on bit by bit, sealing the end of a fantastic week full of new ideas, new experiences and new friendships.

ISSC workshop “Responsibility of Science”

The intention of the workshop was to motivate students and pupils from different countries to think about responsibility of science and its consequences for society, politics, individuals and the scientific communities. Thereby we hope that the consciousness of the relevant topic will spread not only within the group but also over their universities and schools leading to a sharpened sensibility in future.

Due to the multicultural and interdisciplinary background of the participants a wide spectrum of solutions as well as arising questions and an inspiring atmosphere were to expect.

Realisation

The workshop was composed of three major parts. The first part was intended to offer the participants a kind of starting point. For that reason, table-clothes with a provocative statement or question in the centre provided the basis for a non-vocal discussion which was achieved in a writing manner. The used statements and questions were:

1. It's too much effort to explain that to people who don't understand it anyway.
2. Shall we judge the way or does only the goal count?
3. Research for sustainability or sustainable research?
4. Science without borders – Science without limits
5. Science must (not) make money.
6. Research is neutral, application is political.
7. Science means to sacrifice.
8. Science forms society? – Society forms science?
 - Research for eternity
 - Science is egoistic.

- Responsibility societal or individual?
- Shall science be neutral?

Because of the special form of the debate everybody was enabled to participate the discussion, which was appreciated by all students. The method proved to be a solid basis for deriving central questions. The second and third part of the workshop which took place within the following week offered the opportunity to formulate possible solutions or more advanced questions employing the impressions gained during the lectures and visits in between. Finally, all results were collected and presented to the other groups.



Results

1. It's too much effort to explain that to people who don't understand it anyway.

The responsibility to explain science to society – How much effort should you put into explaining science?

We all know that there are a lot of scientific discoveries every day, which heavily influence our daily life. In order to make reasonable decisions, for example in political referenda, people need to be informed about the subject on which they decide. Today this is not often the case, as obviously not everyone is able to keep track on the latest research. Furthermore, we think that scientists have the responsibility to inform the public about the results of the research funded by the state. Additionally, people who understand (at least parts of) these results are willing to contribute further into research. This means on the one hand to pay more money and on the other hand to participate by becoming a scientist (especially as a pupil/student).

In general, there are two different ways to gain knowledge on a certain topic: It can be pushed upon somebody acting passively by force or pulled by somebody who acts actively. An example for the first is the school system of today, where basics are taught. Pushing is (almost) impossible once a person has finished school; afterwards people need to pull information from somewhere, i.e. media or research facilities. In order to be able to pull, people must first be pushed as otherwise they are not able to ask the right questions. This as said above is done at school where not only information is pushed into people but also curiosity is excited. To affect adults curiosity today (as they can not be pushed at school anymore) other steps must be taken. This could be achieved by means of interesting events (similar to Life Earth) increasing peoples curiosity. During our discussions the following ideas arose:

- Record podcasts
- TV-shows or short clips (similar to commercials) about scientific topics broadcasted during prime times
- Museums and exhibition where science can be touched

- Free lectures accessible by the public
- Free scientific newsletters delivered to every household

In general, different categories for different ages and levels of understanding are reasonable.

At this point, the question Who is paying for all this? automatically arises; there are different models of funding. On the one side the people who use these new sources of information could pay for that. However, people tend not to pay for information as they are not physical / touchable. On the other side the state (or organisations of states such as the EU) could pay for that, such as the research companies themselves. As this area is very complex it can not be discussed further at this point.

Another question in this context is: Who decides what is necessary to know? Usually, people like being independent and want to decide for themselves. However, do people always know what they should know? In many cases this might not be the case. There might be people who are experts or simply more competent in a certain subject, who could judge much better what the public should know. And how much do people need to know to form their own opinion? If a scientist believes that publishing his results would not benefit the general public, this might not be the case after putting more effort into a good, understandable explanation. Another question is, if it could be wise in some cases to not publish research results in order to prevent them from being misused? A possible solution for these kinds of problems would be to found an interdisciplinary committee, much alike the Nationaler Ethikrat (National Ethics Committee), consisting of scientists, experts in ethics as well as pedagogues, etc.. These people should be informed about the recent progresses in scientific research, they should be aware of recent political discussions concerning scientific topics, and they should use their personal knowledge and experience to decide what the public needs to know and how people should get to know it. Another task these experts should accomplish is to condition the information into different levels for different target groups (e.g. kids, the general public, the interested public (and probably stupid adults)). Such a committee could not only be a national institution, but it would probably make sense to establish it EU-wide or in an even larger scale. There must be a close collaboration with the media who should be informing in an objective way including both sides of the coin.

Knowledge is in general said to be very powerful. The progress in research influences our daily life. We cannot and must not stop it, because we can benefit from it. But we also have to keep in mind that new technology and findings hold great danger. As a conclusion we think it is important for everyone to be interested in science in order to be able to keep tabs on the development of latest research!

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2. Shall we judge the way or does only the goal count?

In ethical discussions about scientific experiments, one has to compare the costs of the way or the side effects with the (possible) benefits of the experiment. If we take two extreme examples, we can see that the problem is not simply resolved. If only the goal was considered, the Nazi experiments on people could be seen as justifiable because medical advance was achieved through means of killing and torturing human beings. If only the way was taken into account, we could not possibly gain any advanced progress in medicine, as testing on animals would not be possible. A well-balanced compromise has to be found in order to assure ethical and responsible research and progress.

In our essay, we have considered three controversial debates in which it is important to consider both the way and the goal.

Genetic engineering is one highly discussed topic. It could solve important problems like lack of proper food and pollution of the environment caused by pesticides. Pesticides are not only harmful to agricultural pests but can also harm the ecosystem and humans for example by groundwater contamination. Genetic engineering involves the change of the organisms genome, for example the plant becomes resistant to a kind of pests without the use of pesticides. On the other hand, big problems can arise, since the sideeffects cannot be predicted. The modified plants might spread into nature and have a severe impact on the ecosystem. The modified plant might have an evolutionary advantage, therefore suppress unmodified plants and thus remove the food source of other organisms. Also, the plant could cause unpredicted health problems for animals or humans who eat it.

Animal testing is mostly considered unavoidable. Medication which is not tested on animals before starting human trials might be a serious health hazard. Many life-saving medications could only be developed this way. The alternative would have been a high human death toll, which no one is willing to accept. The EU rules for animal testing are quite strict. Animals can not be harmed or killed unless there is a good reason and pain is avoided when possible. To avoid animal suffering, animals are killed as soon as possible. The problem arises about the value of an animal life. Animals are obviously sacrificed for human benefit. The question is if that is to be considered ethically justifiable or not.

Modern scientists mostly agree that animals are not conscious of the fact that they are going to die, so that they do not suffer psychologically as humans do when they are confronted with death. The controversy is mostly about whether the experiment is worthwhile of the sacrifice of the animal lives and the value that is attributed to different forms of animal life.

In order to find a compromise, a well thought-through cost-benefit analysis has to be done. The costs and the benefits have to be compared and the risks evaluated. However, sometimes the benefits are not assured and the probability of discovering something worthwhile has to be considered instead. Also, the cultural or religious influence might affect the final compromise greatly. For example, in Israel stem cell research is considered ethical - and is legal - whereas in Germany it is frowned upon and forbidden.

In such debates, it is important to inform oneself in detail about the topic. Uninformed people may judge out of spontaneous emotions like fear, instinct or the prospect of huge benefits instead of considering the more hidden aspects of the topic. Even for experts, the huge complexity of the issue can make it difficult to obtain an "optimal" judgement.

In conclusion to the title "Shall we judge the way or does only the goal count?", the way and the goal have to be carefully analysed to obtain an opinion which is based on information due to the complexity of the themes.

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3. Research for sustainability or sustainable research?

This concept supports a wide area, as the concept itself can be understood in two different ways; one of which the research is for a sustainable purpose, like securing a nuclear power plant as much as possible, or one of which the research itself has to be sustainable/trustable. An example for such understanding of the concept could be the climate changes, of which scientists have divided themselves into several “camps”, having widely different conclusions on the same subject.

The different fields:

So, by having defined the concept itself – sustainable research – we can specify its importance of research fields. For an example, would it be needed researching in increased quality-standard of now-a-days houses if our world is heating up similar to an oven? (a harsh example, although extremity supports understanding) But for being serious, the fields being researched in have a large timescale and usually does not only have local (by local meaning country-based), but also global relevance. When it comes to research on global scale, like the research of the global warming, we need trustable results. As things are now, we do not have such; otherwise the scientists would not divide themselves into camps. Sitting in this situation, what can the population do? We know that there are changes of the weather – or more specified the climate – on global scale, but we cannot agree whether it’s human mankind being the reason, or if it has nothing to do with us. And as things are now, the scientist camps simply try convincing the population of their theory, as well as fighting against the other theories. And even the global science has turned into politics. But for the part of research being for vitality, the timescales are somehow the same, although the relevance is mostly local. For an example, if we take the nuclear power plant again, one country would have most interest in money going for research of their own safety of their power plants, rather than another country’s. This does not mean the research is not important, for it is. The nuclear power plants have a huge deliverable amount of energy, but the process for gaining this energy can turn out being devastating, if anything should go wrong. Also the radioactive garbage have long lifetimes, making it necessary locking them away in a bunker underground or it would result in damage on both humans and nature. Also these “bunkers” will have to withstand 100,000 of years, and most important of all, they have to be secure against any kind of terrorist activity.

Should we take a step back?

Summing up what we have – the concept sustainable research can be either research for vitality, or research which can be trusted. This kind of research usually has timescales on more than generations, whether the effect first will take place in a long time or the research itself taking such time, and the research is not for purpose of a single company, but at least for one country. For this it would be wise going back to the question about climate changes and take part of the camp of scientists and non-scientists having the opinion that it is the human made CO₂ being the reason for global warming. If this is the case, we should shut down major parts of coal- and gas power plants all over the world, as well as either inventing new fuel for cars or making traffic illegal (a weird thought), etc., just in order to survive the following generations. Now the harsh question comes – should we invest a ton of money for research in new technology being environmentally friendly, or should we take a step back? It leaves mankind in a dilemma, but the dilemma itself is so surrealistic that it can become more than it seems like. Some people call the question about climate changes the age mankind lost against itself, although the research we have today cannot assure whether we can do something about it, or whether we can not. As you can see, the climate changes are a perfect example showing how confusing non-convincing research can be. At the moment we stand at a point whether to act or not act, based on research we cannot completely trust.

A question of “sponsoring”:

When it comes to these large scales with huge (possible) impacts on humanity, you stand with the problem – where will the money come from? Most likely it would be the government supporting a bunch of scientists with the required money, or big companies, although the money required for such research might be of such scale that it will make them lose interest. So where should the money come from? People of an organisation? People of a nation? Or all the people of the world? One can always say it is a worldwide problem, but making mankind financing it can be more valuable than finding gold.

By so I would like to end this text with a small “conclusion”, if one can call it so. Mankind today is able to see into the future, although we might not agree how it is going to look like. Based on this forecasting, we need to act in order shaping the world the way we would like it being shaped, and if the first forecast about the future was incorrect, mankind can always reshape it again – if it still exists.

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4. Science without borders – Science without limits

In any case science should have borders – but some parts should have more freedom and the others should have stricter “rules”.

Science should be limited and unlimited at the same time. We should only carry out science that would benefit our societies – not from an economical point of view or the political but from the progress point of view of the human kind as a whole. In other words, science is only right if it serves good for the human kind.

But on the other hand science should be without borders in the case of global cooperation concerning global issues such as global warming. So there should be less limits to research programmes which have the aim of helping a majority of human beings and with visible and positive effects and without negative effects.

Should politics limit science?

Politicians have to limit science because scientists won't put limits on their own in the way that they want to make more and more researches. So politicians have to make the laws that should apply around the world and contain such aspects like research limits, the sum of the money which is spent on science programmes and education systems. Furthermore there should be a commission made up of scientists and non-scientists from other parts of the society for contributing a different perspective to the politicians.

Would it be possible to have science without borders in connection with payment for the studies? Yes, perhaps it would be possible if every country paid a certain amount of money e.g. to an organisation which is founded for all science studies in the world. This question can't be solved quickly because the economical situation is different in each country. The fee could be counted according to the number of people (students), area of the country and other parameters.

Is ethics a limitation for the development of science?

Limitation sounds too strict in this situation. There should be a certain sense of responsibility of human rights and environmental impacts. The aim of research and science is to protect and develop our world, but not to destroy it.

Are there still borders for Science? Doesn't the Internet break all the borders?

The Internet breaks many borders but of course, some still exist: For example people can better share their thoughts and communicate worldwide. For example you can find many different thoughts. However, there are still problems in visualizing them because lack of money and knowledge. As the Internet is easily accessible to everyone, it's not assumable that all material is suitable for everyone looking at it.

Different laws in different countries – how can we manage to have science without borders?

The best thing would be to have the same laws all over the world. But of course there are lots of differences, e.g. religious aspects, which cannot be united. That means that it is difficult to make the same laws for the whole world. Problems which concern the whole world should be solved by international laws. It might take a long time until that aim is reached. There should be held more international congresses, conferences, meetings and discussions because that is a good way to come to an agreement.

Should we neglect ethical and cultural issues in order to have science without borders?

Actually we should not. Our aim is to protect our world and therefore ethical and cultural issues are very important because we need these borders. Human rights must be guaranteed and we have to take responsibility in order to achieve this goal. People can build nuclear bombs and destroy themselves, but e.g. a mouse will never build a mouse pad. **Science without borders: Does it save money?**

As you can improve the accessibility at knowledge and through the scientific community. This will ease up sharing of discoveries which should both save time and money.

Louisa Mosemann, Daniela Edler, Natalie Schindler, Eva McBride, Per Grundström, Hena Sandhu, Tobias Mattsson, Austė Cijunelyte, Salomé Pereira de Matos

5. Science must (not) make money.

As science becomes more and more important for our economy, one can recognize that science also becomes increasingly dependent on money. This can be said in regard to the enormous costs of modern research as well as to definition of the aims of science. In the question if science must or must not make money one has to consider both, the perspective of the investors and of the scientists which often differ from each other.

First some arguments why science must make money. Many companies and institutions are only willing to invest such amounts if they expect profit in the foreseeable future. The risk of "losing" money often stops investors from giving money to research projects without any sellable application. Another aspect why science has to make money is the public opinion that non-profitable science is a squandering of public money. Society is more likely to accept and understand a research project if the result is a usable product or could improve the quality of live. Furthermore, profitable science has the advantage that the money earned can be used for further and even more research in the future. Maybe financially self-sufficient science could be a solution. From the economical view, every value - also knowledge - is directly connected to money. So if science does not lead to financial success, it destroys values by wasting money and thereby wealth.

On the other hand, science has more freedom if it is independent from financial interests. A lot of interesting scientific research, like cosmology, is only possible because of the researcher's freedom to choose his or her own topics and create projects without the concern of money. Besides, science is in danger to be exposed to egoistic interests. These interests could lead to science, which does not care about ethical impacts. For example the invention of new bombs would be preferred instead of the invention of new medicine. If large investments are involved in private scientific research, the results can be distorted to fit certain wishes of the investors. For example, large scale environmental pollution could be obscured by manipulated scientific data. Furthermore, scientific data should not be proprietary but published to the scientific community. The simple reason is that other research projects can get hindered by a lack of knowledge and have to do research again, which has already been done. Creative energy is lost by the need to replicate already successfully done experiments in order to get data. Besides, the need to buy knowledge from companies involuntarily increases the budget of the projects.

Both, science which is financially oriented and science which is not demanded to make profit have the right to exist and will surely increase in their importance. As the economy and especially the industry is depending on the science stronger than ever before, the policy of industrial countries are willing to invest more and more efforts in both kinds of scientific orientation. This is a tendency that has societal and political reasons. Especially since the globalisation, state of the art science and technology has become an essential status symbol and a challenge to keep up with the rise of wealth and political power of other industrial countries. To stay competitive both scientific orientations have to be invigorated.

Dominik Lammering, Magnus Anselm, Sebastian Glasl, Marcus Unger, Christian Brødstrup, Lutz Gruber

6. Research is neutral, application is political.

Before we could validate the claim, we had to determine what it meant. First, we tried to define “politics”:

Wikipedia: “Politics is the process by which groups of people make decisions. Although the term is generally applied to behavior within civil governments, politics is observed in all human group interactions, including corporate, academic, and religious institutions... Max Weber defined power as the ability to impose one’s will ”even in the face of opposition from others”,^[4] while Hannah Arendt states that ”political power corresponds to the human ability not just to act but to act in concert.”^[5]

Then we tried to define “neutral”:

OED.com: B. adj.I. Senses relating to partiality, determinacy, etc. 1.orig. Sc. Esp. of persons: not taking sides in a controversy, dispute, disagreement, etc.; not inclining toward any party, view, etc.; impartial, unbiased.

“Neutral” is a hypothetical position that does not take sides. However, it is extremely difficult to know when something is “neutral”, we have come to decide that it is not possible for humans to be involved in something neutral.

Neither of the explanations we obtained were fully satisfactory, as we, after group discussions, were able to detect several flaws and find incompatible situations. However we used these definitions to visualize a general idea and public conception.

It is often argued that science/knowledge and mankind's devotion to learning is pure and therefore unsoiled by the cynical business of politics. This might hold true for research that requires very limited expenses. However, a great majority of the research that is conducted today is extremely costly, and thus research is forced to obey and conform to the reigning economic paradigm.

Research today is a very expensive ordeal. As a result, increasingly larger organisations, or often governments, are required to provide the funding. Politics is defined as the exercise of power, and as corporations control most of the world's resources, it is fair to say that their actions represent politics. This holds true even though governments hypothetically have the power to legislate and thus exercise control, because in practice, that power is severely limited by international financial markets and free trade agreements.

Concerning the effects of politically influenced research, it is often feared that the integrity of the results reached have been compromised to suit the intentions of the funder. Where this holds true it has, obviously, a considerable impact on scientific progress. Numerous examples abound, but this one should suffice: Thalidomide was a "wonder drug" developed in the mid fifties in West Germany, which was supposed to alleviate morning sickness. "Before its release inadequate tests were performed to assess the drug's safety, with catastrophic results for the children of women who had taken thalidomide during their pregnancies." Between 10,000 and 12,000 babies were born with deformities, and countless others were stillborn. Because pharmaceutical research is subject to constant demands for profitable results, the drug was not tested adequately, and was rushed onto the market.

There are two main ways in which science is affected by the market. Firstly, corporate science can publish and act on false results, as in the case of thalidomide, cigarettes, and global warming. Secondly, research that is funded by corporations must focus on potentially profitable applications, as opposed to "neutral" science. This means that research into, for example, consumer electronics, will get a very large share of corporate research funds, while research into developing cheap water purification facilities or cheap Tuberculosis drugs tends to receive much less corporate funding, even though this research has the potential to do much more good for humanity than the development of super-wide television screens.

This sort of research must instead be funded by NGOs and governments. Governments are primarily accountable to taxpayers, so the amount of public money available for non-profit research is naturally limited.

In conclusion, the political economy decides what can and can't be funded. Because we have a capitalist economy in most of the world, this means that research into consumer goods, with a high potential for profit, receive more funding than non-profit research. Discoveries that are made by corporate-sponsored research tend to be applied to areas where it can be profitable, instead of areas where they may serve humanity optimally. Although success in the market may coincide with a benefit for mankind, that is not always the case.

Karl Larsson, Amelia Travers, Peter Jebsen, Aman Steinberg, Meike Müller

7. Science means to sacrifice.

International council for ethical science applications

1. Would it be a good idea to develop an international council for ethical science applications which could unify national rules? How much knowledge would be sacrifice in order to achieve that goal? - No!(individual) . We should create specific organizations for every different kind of project or investigation
2. Should there be a disciplinary way to teach young pupils about ethical uses of scientific results? - Yes. We should teach the younger people, but not in a specific way, we should talk about responsibility in science in every area and discipline from physics to biology.
3. How much (knowledge) would you sacrifice in order to science development? - Just think about it. Some hints: Family, money, social life, opinions, politics, time
4. Does it worth to sacrifice opinions, in order to achieve a common goal for the whole scientific community? This means that some times we have limits in our scientific work because of rules or restrictions. - So its necessary to compromise if we want to work

Gurajada Deepthi, Gonçalo Pimentel, João Cortes, Sofie - Amalie Rasmussen, Vladimír Smataník, Tomáš Klunda, Michal Greguš, Jorin Pang

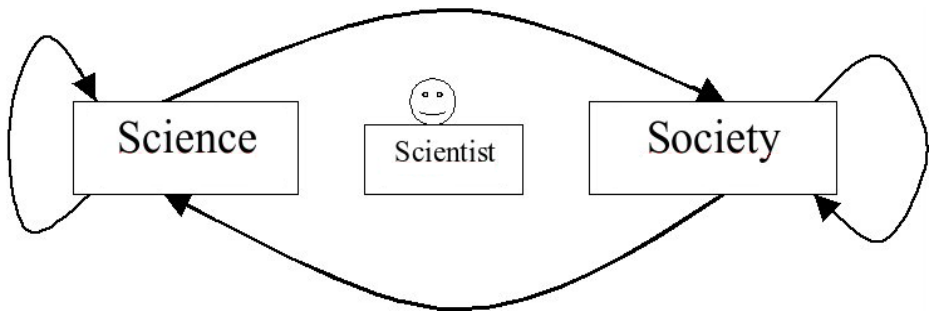
8. Science forms society? – Society forms science?

Our topic was to discuss if science forms society or/and if society forms science.

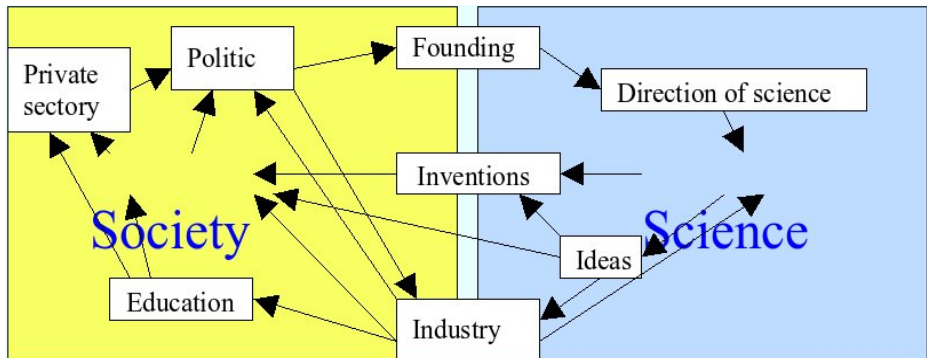
The main question was:

What are the concrete ways how science forms society and how society forms science?

After some discussions in our group, we all agreed that there is an influence on both sides. It works like a circle, which means, that every "action" induces a response. In other words, there is always a feedback of an influence. In general it can be seen as the following graphic shows:



At the next steps we analyzed the two sides, science and society. We found that society should be divided in different groups, as politicians, scientists, Childs and "average" citizens. In the following graphic we show the relationship between science and society.



Some other questions we asked ourselves were:

1. Does society use science as an instrument to form itself?
2. Is the influence of science to society predictable?

Answers:

to 1.

In general we think society can use science as an instrument to form itself, but we don't think this is a "conscious" decision. In most cases it is for sure that a scientific invention will change the way of life of the society. But we don't think that a society can really say: In 2050 we want to live exactly like this... and therefore we need these special scientific inventions.

to 2.

We think the outcome of a scientific idea in general is not predictable. Mainly it can be understood as action and reaction in a random way. For example, the techniques which are the basis for mobile phones were firstly invented for military use. Nowadays nearly everybody is using a mobile phone. On the other hand, in some cases the society has a need for an improvement and scientists are trying to offer solutions. For example the traffic vehicles have become safer, because lots of terrible traffic accidents in the past showed that there is a need for more safety. Here, the outcome was totally predictable.

The conclusion is that the forming process of science and society is a network that interacts in both directions, which has no specific borderlines.

For example, politics and industry uses funding as is a very efficient way to influence science. Due to the fact that the interactions between science and society are a network, sciences use education and inventions as an instrument to influence society, too.

So the conclusion of our group is, at least that everybody is part of a network, where science plays a significant role.

Thomas Berndt, Susanne Kreßner, Daniel Schröder, Max Bigelmayr, Dalia Vitkutė

Conclusion



Besides the results of the workshops described on the last pages, many more conclusions can be drawn from this year's ISSC. There were many inspiring and productive discussions closely connected to the work in groups everywhere throughout the entire camp. However, many discussions were not restricted to the times and topics of the workshop but were held to an even larger extent on various subjects such as personal experiences and culture, own scientific work and projects, school and university career or scientific problems. This was a gainful and inspiring experience for all participants as they were enabled to share their personal and professional knowledge, as well as their culture for the benefits of everybody; especially the pupils were able to learn from older participants. Furthermore an intercultural dialogue was started; the contact with other cultures sparked interest in them with the effect that many participants want to extend their knowledge and learn a foreign language.

Moreover – and this aspect must not be forgotten to be mentioned as the importance of team-work still increases – many new international friendships were established which might be the foundation for future scientific projects.

The participants were able to develop a more holistic view on a field of study by working on the meta-topic “Responsibility of Science” as well as on their own culture. In course of the discussions between people from different countries the firsthand accounts on various cultures lead to the discovery of differences and similarities in one another's cultural background. Consequently, the participants were able to enhance their own perspective and their opinions. In addition, prejudices were dispelled and the reservation against other cultures was resolved.

The participants also learnt that there is not solely one “correct” opinion about one topic but many different equally “correct” points of view. It was of great importance to discuss those differences by means of enhancing own arguments and by means of gaining several perspectives on the same problem. Even further thought-provoking impulses were provided by the numerous lectures and guided tours which gave young people an overview of many fields of study as well as of the ways of performing scientific research. In addition, the concept of the ISSC will spread to further countries (namely Denmark and Lithuania) so that it grows in importance and effectivity. Besides, many new ideas for workshops and topics for future years were developed, partly as a side-effect of the discussions, partly as a response to the positive feedback from the participants in the evaluation at the end of the camp.



Introducing: juFORUM e.V.

Who we are and what we do

juFORUM e.V. is a registered non-profit association founded in 2000 by twelve former participants of the Jugend forscht contest, a German science fair for students aged 15 to 21. juFORUM's founders wanted to keep in touch with each other beyond the science fair itself and also wanted to create a network of like-minded young researchers.

Currently the association has approximately 200 members. The majority of our members are students aged from 18 to 25, including some PhD students and young professionals.

Creating an opportunity to peek inside science and research related industries, fostering innovation, expanding members' current knowledge, developing a contact pool and building a young researchers' network - these are the goals and challenges we pursue.

Our members come together at the JufoCongress which is held annually in alternating cities throughout Germany. The participants visit research facilities and companies involved in research & development and enjoy a multi-faceted cultural program. Furthermore, the JufoCongress provides a platform to discuss recent scientific developments, cultivate old friendships and make new friends.

Aside from regular face-to-face meetings, networking inside of juFORUM is supported by our internet platform.

As well as national activities, we organize a variety of meetings and events which support young people committed to science. Representatives of juFORUM visit most of the science fairs throughout Germany to interact with participants and organizers, and to experience the unique atmosphere of these events.

In our mentoring program, we conduct seminars for highschool teachers and interested students to provide first-hand information about scientific contests from the perspectives of participants, supervisors and organizers. Thus, we tear down stereotypes and encourage scholars to start their own science project.

Why become a member and what does a membership stand for?

As many of juFORUM's activities are open for the public, a membership does obviously mean more than just attending juFORUM's events. This "more" is mainly about full access to our network based on our internet platform with our own messenger-server, our own small magazine "Zahnrad" and a news service. However, as all this needs to be organised, we also offer various fields of activity, e.g. press and public relations, membership issues, cash auditing, sponsoring, design of our webpage, IT support etc. Each of these activities provides the opportunity to dive deeper into juFORUM's matters as well as to develop your own personal skills. Besides, you might find that it's a lot of fun to help us actively building a young researcher's network. Be part of it, help us to propagate the concept of a young researcher's network, instantiate your own ideas and sozialize with like-minded young researchers!

How to become a member?

The only prerequisite is commitment to science and scientific curiosity. There are three different types of membership:

As a regular member you can take part in all the activities juFORUM has to offer. You are eligible to vote and to be elected at the general annual meeting. You pay an annual membership fee of 15 EUR.

The supporting membership, valid for one year, enables you to take part in most of our activities without paying a membership fee, but lacking the right to vote and to be elected at the general meeting.

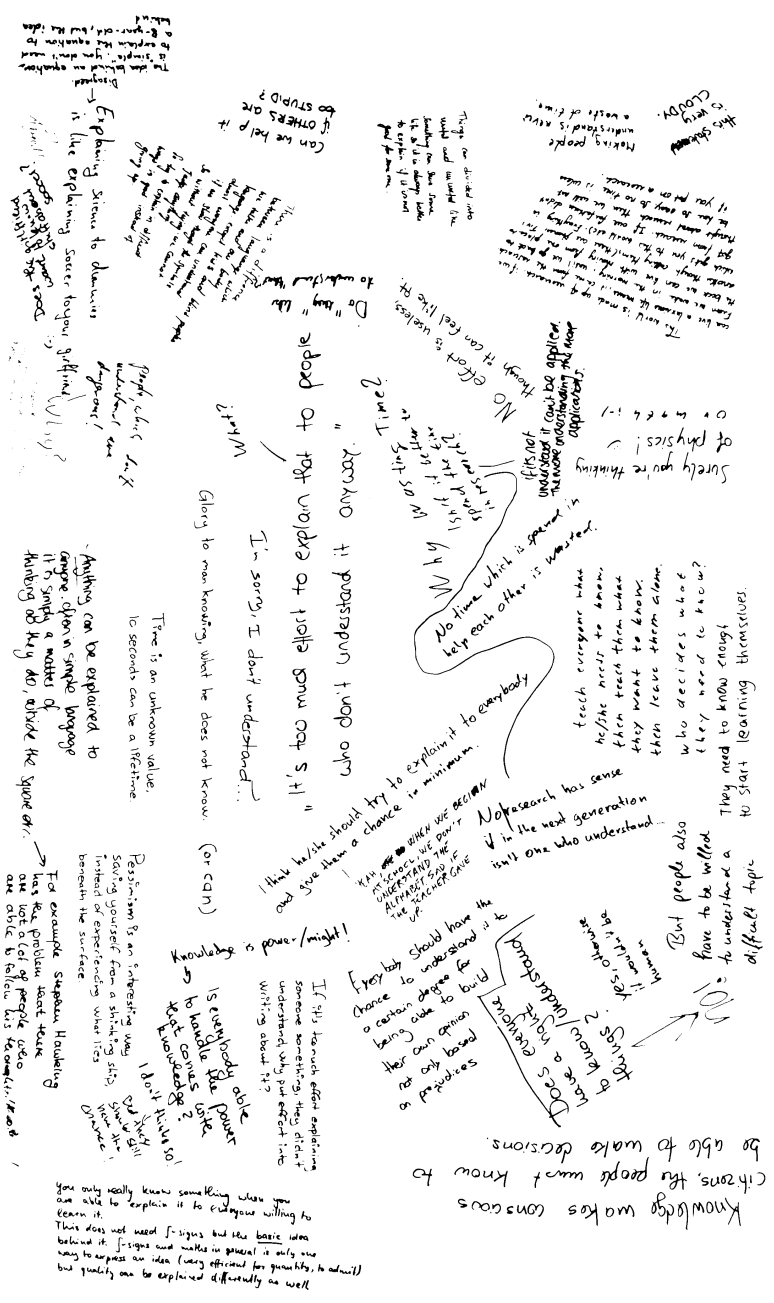
For our senior members/young professionals we offer an advisory membership.

Let's go!

Contact us! Feel free to approach us any time during the ISSC or send an e-Mail to mitgliedschaft@juforum.de. More information about juFORUM e.V., recent news and current activities can be found on our webpage:

[http : //www.juforum.de](http://www.juforum.de)

We hope to welcome you as a new member of juFORUM e.V. soon!



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Host of the 2nd ISSC 2007 was juFORUM e.V. – Das Jungforschernetzwerk. juFORUM e.V. is a registered non-profit organisation in Germany.

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