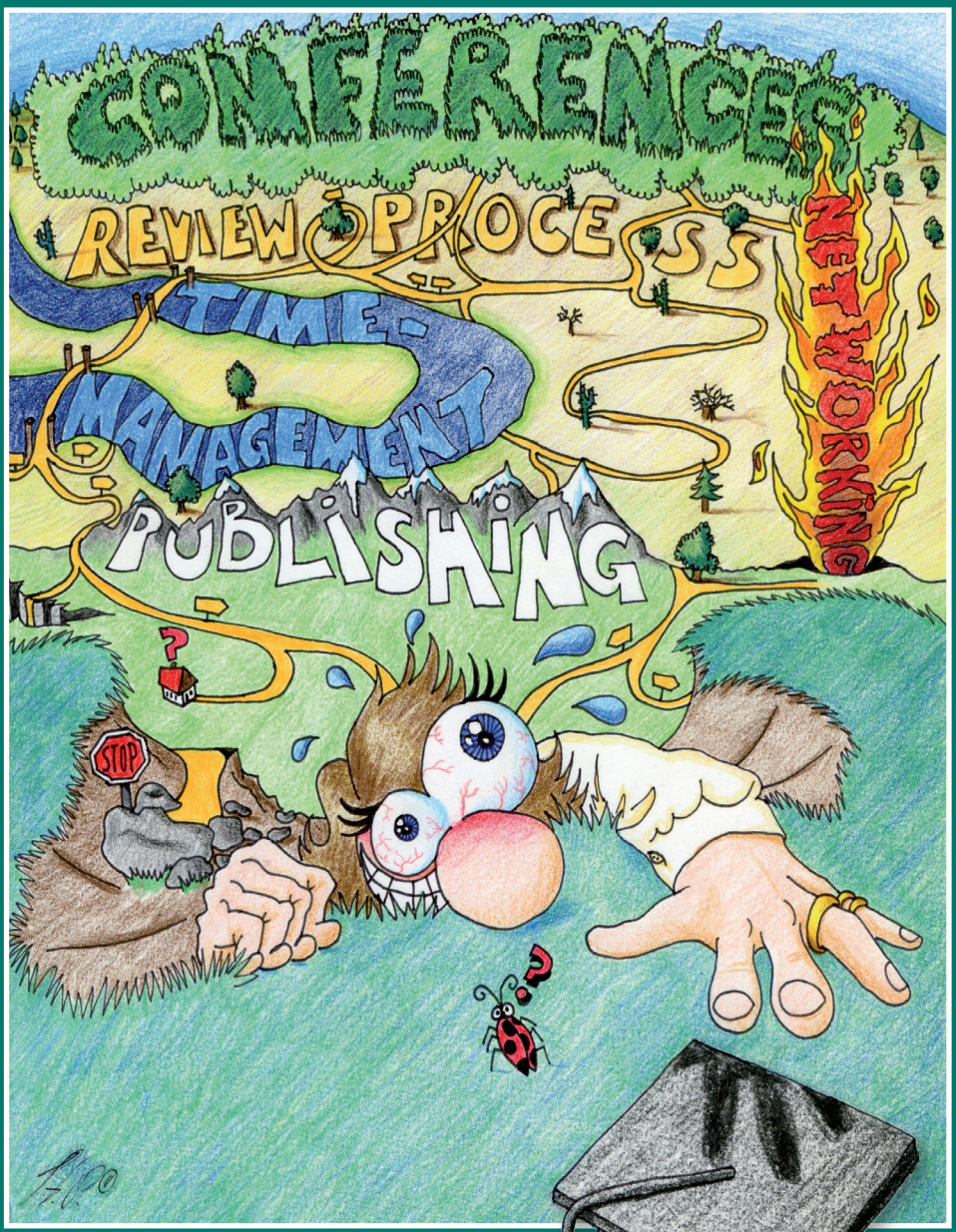
How to survive your PhD



Essays from KlimaCampus graduate students

Dear new graduate student,

The handbook you are holding has been written for you. 11 PhD students and 3 MSc students wrote about their own grad school experience thus far. They put themselves in your shoes, the shoes of someone starting out on the PhD endeavor. So, what you find here is not an all-embracing manual written by someone with 20+ years experience[1]. But, what you will find here are essays written by students who still vividly remember what it was like when everything was new, the amount of information just overwhelming, and writing – let alone publishing – a scientific article seemed a big myth.

The essays presented here are based on a semester-long 'research-skills' course. At the outset, the topics of interest to the students were chosen by popular vote. Throughout the semester, these topics were discussed one-by-one in separate lectures. Now, 14 students put their own perspective on these topics into writing – based to a varying degree on their personal experience, the research-skills course, and their discussions with other people etc.

The essays also benefited from a writing workshop co-taught with Dallas Murphy[2] (writer from NYC, USA). While the workshop was at its core directed at scientific writing, we took the essays as a starting point to discuss the process of writing.

In summary, the authors wrote down the pieces of advice that – in retrospect – they would have found useful when starting out with their graduate studies a year or two ago. You may therefore enjoy reading the handbook from cover to cover, but we also hope that you might find it useful to come back to the appropriate essay when you later find yourself faced directly with one of the topics discussed.

Enjoy reading,
Johanna

Johanna Baehr *is a Juniorprofessor for "Climate System Data Assimilation" at the Institute of Oceanography. She designed and led the course to help junior graduate students develop the research skills needed for a successful completion of their thesis. She also co-taught the writing workshop with Dallas Murphy, and coordinated the compilation of the essays in this handbook.*

[1] This kind of scholarly advice you can (and possibly should) read elsewhere. We put some suggestions for this kind of literature at the end of the handbook.
[2] dallasmurphy.com

Contents

Communicating with your advisor

Janpeter Schilling

Advisor: "Hey, I just realized that the abstract for the World Science Congress is due this Wednesday. Could you write that? I'm gone until the end of the week and it's very important."
Student: "Wednesday, that's tomorrow! I am not sure..."
Advisor: "Great, you can send it directly to Mike or upload it to the platform."
Student (to himself): "What platform, what Mike, what conference?!"
Advisor (to himself): "I am sure... whatever his name is will do fine."
Dialogues like this can be witnessed everyday at universities all over the world. The communication between a PhD student and his advisor is often difficult. In this essay I will discuss why that is (the root causes) and what can be done about it (strategies). An ineffective, unbalanced or somehow else dysfunctional communication between student and advisor can have many causes. However, I think that (a) different and unclear expectations and (b) a lack of understanding for the other person can be seen as root causes of miscommunication.

In the dialog above the advisor expects the student to write an abstract for a conference. The student does not expect to be asked to write the abstract, otherwise he would have known about the deadline, or at least the conference that his advisor was referring to. One could further assume from the student's confused reaction that he would expect some more information and guidance from his advisor before writing such a "very important" abstract. There is a clear discrepancy between the advisor's and the student's expectations which leads to miscommunication. The discrepancy in expectations can take multiple forms, but it is always the result of at least two people interacting. The advisor may expect his student to win a Nobel Prize while the student just wants to have a warm shelter where he can check his private email. Or the student pressures himself to write one paper per month while the supervisor is already happy when the student shows up for lunch once in a while. It also works the other way around. The student may expect the supervisor to take his hand and guide him through the 'dark woods of science' right to the 'bright glade', where the student's PhD title is already waiting for him, while the advisor thinks it is ok to meet his student only twice (once to discuss the outline of the thesis, and again when the student hands it in).

Closely related to this first root cause of miscommunication is a second one: a lack of understanding for the other person. Again referring to the introductory dialog, the advisor lacks even a minimum level of understanding of his student; otherwise

he would have noticed the student's reluctance to take over the task. But the same is true for the student; if he had known about his advisor's full schedule and habit of doing everything at the eleventh hour, the student could have anticipated and prepared for the situation (for example by collecting some ideas for the abstract ahead of time). This argument should not be misinterpreted as a general appeal to find out everything about your advisor. It is not necessary to marry your advisor (in most cases this causes trouble elsewhere). However, the student should have a basic understanding of his advisor and vice versa. Where does he (academically) come from? What is important to him? What are his weaknesses and fears? Where does he want to go and where is he actually heading?

Now that we have identified two root causes of miscommunication, we can think of strategies to tackle them. To avoid or to reduce major discrepancies in expectations, it is important to know what the other person expects. Expectations need to be clearly communicated. The interview for the PhD position should give a first hint as to where the other person wants to go. At the beginning of the PhD period there should be a more informal meeting where the student and the advisor sit down to tell each other what they expect from the upcoming years working on the PhD. The meeting will show where differences in expectations already exist or where they could potentially develop. A prerequisite for such a meeting is, of course, that you know what to expect from your PhD studies. It makes sense to take a moment and to write down everything that comes to mind. From "becoming a lead author of the next IPCC report" to "just getting that bloody title," anything is possible. For some people it is useful to assign these thoughts to categories such as 'has to be achieved', 'could be achieved', 'is desirable', or 'welcome to utopia'.

Once you are aware of your own and your advisor's expectations, you can then try to match them. At first some of your advisor's expectations might seem ridiculously low ("show up for lunch") or disproportionately high ("win a Nobel Prize"). But keep in mind that your knowledge and skills will advance over the PhD period. This means that objectives which seem to overwhelm you at first could become pretty manageable at a later point in time. If there is really something that your advisor expects from you, for example drilling for ice cores in the Arctic though you hate the cold, it is important to inform your advisor about your concerns right away. Otherwise the Arctic will circle as the sword of Damocles above your head until your highly disappointed advisor finds out.

Again, a categorization of your advisor's expectation from 'I will do that' to 'not in a thousand years' could be helpful. At the same time you will discover skills, for

example by organizing an Arctic excursion (without actually attending it) that your advisor did not expect you to have. If you on the other hand have the feeling that your advisor cannot provide the assistance that you desire (guidance through the dark woods of science), you will always be able to turn to your second advisor, or another person whom you trust. For that purpose it is useful to have a fellow PhD student or postdoc acting as a 'shadow advisor' who can answer your 'stupid' questions and who supports you without judging.

In general, it seems more practical to meet your advisor's expectations (or to argue why you absolutely cannot) than make your advisor meet yours. Sharing a common set of expectations with your advisor is likely to make both of you more comfortable with one another, and ease up communication between you.
Communication can be further improved by deepening your understanding of your advisor. The question is how exactly? You are likely to find basic information such as your advisor's prior institutions, affiliations or even a full CV on the web. To gain an understanding of his scientific views it is a good idea to read his publications (and especially his conclusions). Or, if you attend his speeches (which he is likely to appreciate anyways) you will win a sense of his style of communication, his responses to questions, and his preferences. Lunch, after work activities, or a shared trip to a conference is good opportunity to gain some personal insights (political opinion, family status, current worries). Experienced coworkers who have worked with your advisor for a longer period of time are often a good source to learn about his habits and routines.

This may sound like a manual on stalking, but some of the advice might actually make communication with your advisor a little easier. In any case, it at least helps the advisor to remember his student's name. Maybe if the student in the introductory dialog had known his advisor a little better, the student would have viewed his advisor's request as a sign of trust and appreciation. A better understanding of how your advisor "works" will also help you to improve the timing of your conversations. A well-chosen moment allows for a smooth start of a conversation while a rushed atmosphere (one day before the deadline) can sabotage a conversation right from the beginning.

Every advisor is different. Some are available for an easy chat early in the morning, after lunch or late in the evening, others will only talk to their students on the weekend (in this case: good luck with that). If you want to talk to your advisor about something important that needs more time, send him an email with bullet points listing what you want to discuss with him and a timeframe for the meeting. This shows your advisor that you are prepared and that it is important to you.
Of course, all arguments presented here are to a certain extent theoretical. Some advisors may not appreciate any personal contact with their PhD student while others want to marry you. You yourself might think that a deeper understanding of your advisor is not necessary – or even counterproductive. That is absolutely legitimate. The given advice may be unsuitable for some, while it will work for others. From my perspective, a common ground of expectations in combination with the ability to put yourself in your advisor's shoes once in awhile is essential for a healthy and productive communication.

Recommended Readings

An advisor who writes about the communication with her students:
FemaleScienceProfessor (2009): BAs (Bad Advisors). Blog (01/09/2009), http://science-professor.blogspot.com/2009/09/bas.html.

FemaleScienceProfessor (2010): Try, try, try to understand. Blog (31/03/2010), http://science-professor.blogspot.com/2010/03/try-try-try-to-understand.html.

A helpful scientific book for everyone who wants to dig deeper into the subject:
Mortensen, David (1997): Miscommunication. Sage. London.

A fun website that collects comics on student's life is at: www.phdcomics.com

Janpeter Schilling *is in his 2nd PhD year at SICSS. He received his graduate degree in Geography. In his PhD thesis he focuses on the interrelations between climate change and conflict in Africa.*

Communicating with your advisor

Kostas Bonatsos

Introduction

I strongly believe that the subject in question is of paramount importance for a young scientist. Conflicts and miscommunication between students and the supervising head could lead to both scientific ineffectiveness and unpleasant situations. On the other hand, in those fortunate cases where such pitfalls are overcome, goals are achieved and cooperation flourishes.

Having spent some time in academic communities as a student myself, I have met a lot of academics, both students and professors. I was always interested in enriching my point of view with diverse and fresh ideas. Discussions, interviews and debates with students and professors helped me shape a personal view on the issue of communication between students and advisors.

I've frequently observed that the student-advisor relationship illustrates some specific attributes. The main objective of an academic institution always was scientific progress. For that reason, the typical employer-employee stratification, as seen in other working environments, is quite weak here. Unlike the typical, strict, free-market hierarchy, in the academic realm the two parties treat each other more as equal colleagues. This nourishes mutual respect and understanding. As expected, common scientific background is always present, practically serving as the "internal language" of each working group. Unfortunately, I notice some of the usual communication barricades as well.

Most of the complaints you hear about have to do with the ease of approaching a supervisor and their time management capabilities, or the seeming complete lack of both. The same applies for perception conflicts. "He has no time for me," "I'm stuck and don't know how to approach him," or "I'm afraid he will be harsh on me," are some of the phrases I have often heard from PhD and even Master students.

The way I see it, there is no obvious all-in-one solution when concerned with interpersonal communication. A helpful starting point could be a personal question, and so each person involved in scientific work should ask themself, "What do I expect from my supervisor in the first place?" It is pretty irrational for someone to complain about what they have, when not being able to define what they want. Nevertheless, this issue is strictly too personal and is a subject for introspective individual thought.

Defining common grounds

After clarifying your own personal goals you could try to see things from your supervisor's point of view.

Let's take a look at an advisor's typical job description. According to the formalities, an advisor is a PhD student's mentor on their way to becoming an independent scientist. Independence is a quality that an advisor has to encourage and reinforce in his students. Independence is a tricky feature for an advisor to influence, since it incorporates strict guidance while at the same time leaving some room for the student to make their own choices. To put it simply, I reckon that inspiring independence is a product of an advisor's ability to maintain a balanced distance from his student. Maximizing that distance leads to alienation, and minimizing it leads to overprotection. Any failure in such a process is not only a student's but also an advisor's as well. With that in mind, we as students more or less know what to expect.

So what is next? The very next step is to determine what a supervisor is actually asking of you. From an advisor's point of view the answer to that question may look straight forward. It makes perfect sense that an advisor expects a motivated and proactive student that is eager to deepen his scientific expertise. Advisors like to work with self-motivated young scientists who do their own background research, avoid or solve problems, and deliver questions throughout this very process. Matching that description seems like a beautiful goal to set, I can say for myself at the least.

Problem spectrum

As a rule of thumb, I find it helpful to separate communication problems between PhD candidates and supervisors into two interlinked categories: Complaints related either to science or resulting from personal discord. One could argue that personality manifests itself in every possible way, in every possible issue; that you can't just get rid of it. I totally agree! However, even though personality always interferes with everything, I distinguish science-oriented problems simply because they are too strictly defined to be altered by personal beliefs.

Given the distinction, problems such as "which method should I use," or "I need more material input," could be included in the science-oriented list. Correspondingly, complaints like "my supervisor does not have enough time for me or interest in me," fall into the personal conflicts category. Science-oriented problems can be approached with a more strict and logical manner, whereas the second class of problems calls for flexibility in communication.

Hard advice

In this section, I will try to give information based on input from fellow students and my personal experience up until now.

Regarding cases where you as a PhD student do not have enough time with your advisor or need more scientific input, setting an agenda could do the trick. Make a list of topics you need to discuss, set a timeframe for the discussion, and arrange regular meetings. Then, just communicate your intentions to your advisor. Meeting

frequency is related to your individual needs and your personal way of working. Each advisor is different, so it is highly likely that you have to identify your advisor's normative way of working or socializing.

When in the meetings, you could have a confident and direct way of explaining your agenda's topics. Don't worry if you maybe sound simplistic. Confidence comes when one knows he did his best and is satisfied with that. Until you reach that point, you could find comfort in asking your 'silly' questions to your fellow students or someone you trust.

It is more than probable that at one point or another you will find yourself with a piece of not so pleasant news to communicate. This may seem frightening but there are ways to tackle your concerns. Be direct and don't wait for the 'right' time. Usually, postponing the time to approach your advisor only makes things worse. Being straightforward without dodging the issue also helps to build confidence in your relationship with your advisor. Feeling confident with your advisor and vice-versa is a quality that solves many problems, sometimes before they even develop.

Timing is also important. All people have good and bad moments, so you could first try to observe your advisor's working patterns and how he responds to your calls. It may also be helpful to keep in mind that not everyone perceives the same piece of news in exactly the same way. Reviewing criticism of a paper, for instance, may seem like terrifying information to receive for a student, but a challenge and an opportunity for evolution in the eyes of an advisor.

In case you feel like your advisor wants you to work in a different way than you usually prefer to, make sure you let him know. Propose your own way of carrying out your workload. Even if your proposal is rejected, you will have made your point clear. There is no need to stress yourself without expressing your thoughts. After all, working the way your advisor proposes is one thing and working in your individual pattern in addition is another. Those two are not self-excluding scenarios. Usually after discussing such topics with your advisor, a solution or a working equilibrium if you wish, is reached.

I have observed that advisors do not tend to interfere with a student's time management and usage, especially when the job is done correctly within the time frame given. Your advisor probably will not care whether you work for six or fifteen hours per day as long as your results are sound and on time. Cases where students work remotely from home also fall under this category. Also, have in mind that no matter how many working hours your contract specifies, an advisor always expects your full-time devotion and sometimes even more (background research, literature reading and extra curricular activities).

Carrying out a PhD thesis seems to me to be an interactive process that incorporates mutual benefits for you and your advisor. Remember to show your appreciation. Just as you would wish for yourself, your advisor also cherishes a word of acknowledgment. Express your gratitude without a second thought. It is always nice to couple information with a note of appreciation towards your advisor from time to time.

Epilogue

It is important to understand that each of the matters addressed here call for a specific, flexible approach. Not all scientists are on the same level of expertise and not all personalities bear the same characteristics. Regardless of whether the conflict lies in science or in personality, in the end it is usually the case that problems between students and the respective advisors are, more than anything else, communication failures. Your best allies in tackling those failures are your hard work, your honesty and your good intentions.

Kostas Bonatsos *is a 3rd semester MSc student in the SICSS program. His first BSc degree is in Maritime Studies at the University of Piraeus, Greece. He is currently interested in approaching climate-related issues in a more holistic way, combining physical, economic, and social aspects.*

Time and self-management

Bente Tiedje

Once you've figured out your scientific goals for your PhD, and what you have to do to accomplish these tasks, there is no way to avoid planning when to do all this stuff, either on a short term scale or in the long run. Good advice is manifold and different strategies work for different people. Only you know the time when you work most creatively and concentratedly. So in the end you have to figure out which strategy works for you. The fact that an average office worker loses 1–2 hours a day due to a lack of planning shows that you need a plan to work more effectively. You won't find time, you have to make it!
Is failing to plan planning to fail, or is a deadline junkie condemned to be a deadline junkie? Is Parkinson's Law really true in saying that "work expands so as to fill the time available for its completion?" In the next few paragraphs you won't find answers to these questions, but they will point out some advice, tricks, and suggestions on how you could cope better with the limited time you have in each day or over your years of PhD study.
Because, as mentioned above, everyone has to find his own strategy, this essay is naturally based on my own experience. I've found out what works for me (mostly by trial and error), but I am always open to new tricks that can help me stick to my to-do list. The discussions we've had during the research-skills course made me realize how important time and self-management is and will be for my future career and, in the end, for my work-life balance as well. This became especially clear to me while listening to Randy Pausch's talk about time management, available at http://www.cs.cmu.edu/~pausch (September 2010). So a lot of good advice you will find in this essay is inspired by his talk.

At the very beginning, before you start making plans or tidying up your desk, you have to look properly into yourself and find out your creative time. It's up to you if you spend this time alone, maybe at home, or in your office – although you might have a couple of office mates – but you should defend this time ruthlessly. In contrast, you probably have some hours during the day when you can't focus at all. In this dead time it is probably more effective to schedule meetings, phone calls, surfing for new literature, and/or dull stuff, than think about the same formula over and over again.

Generally, successful planning starts with organizing three basics things: a calendar, a master list, and a daily or weekly to-do-list. You should try to stick to only having one of these things for each category. The master list should contain specific objectives and milestones of your work on a multi-monthly basis. Although it covers a rather long time period, it has to be reviewed and reorganized regularly, for example before advisory panel meetings or whenever your scientific objectives change directions. In contrast, the items on your daily or weekly to-do list should be as specific as you can express them. Breaking your tasks down into small things has the advantage that the single points or small goals of your list can be achieved easily or in a rather short time span. That way, when you check your list the next time, you'll have a good feeling when looking at all the accomplished missions, and you can build enthusiasm for the next tasks. If you can't remove any point of your list at the end of the day, you have probably overscheduled your day. It is helpful to review the day or week in the evening, or to plan the next week on Friday. For the daily list it is also helpful to write down precisely what to start with in the morning in the evening before. A common and often recommended strategy for organizing your day/week and prioritize your tasks is the Eisenhower method. With this method you sort your tasks as the following table suggests:

	Due soon	Not due soon
Important	1	2
Not important	3	4

Be especially aware of the 'Due soon but not important' tasks. They can be time sinks. In the end it does not matter if you write down your to-do tasks in an Eisenhower list or in a simple column. The idea behind it is that you have to sort your to-do list by importance. The last important thing to mention for to-do lists is that you need to be flexible: do not expect that you will always get everything done. You can always reorganize and reprioritize. You can always change your plan as long as you have one!

By making these lists and being serious about them, you more or less set deadlines for yourself. If you cannot manage to stick to them in any way, you might take the opportunity to tell others about them, for example your advisor or office mates, so you have some kind of loose control and motivation to get things done. If you give deadlines to others, for example in a team project, include 1–2 extra days to make sure you and they can really meet the deadline. All the advice above should help you to avoid doing things at the last minute, so you can avoid stress and being a deadline junkie every time.

Of course there can be a lot of things that delay your work apart from simple laziness. Time sinks can be, for example, coping with all the emails, phone calls, and

additional tasks or requests coming in. Reading and answering emails and phone calls is part of your work, but if you don't want to spend precious hours of your working day you have to keep it short and effective. Instead of checking your inbox every time you hear the 'incoming email' sound, you can try to set regular email times, for example 15 minutes twice a day. To make sure your inbox is not your to-do-list, clear it, but also make sure you save all the emails. If you have read an email and have gathered all the information to answer it, do it immediately. To touch every email only once helps you to avoid procrastination and keeps your head clear of thinking about the email traffic all the time.

Phone calls or interruptions in person can be kept short, first of all by standing up and starting the conversation with phrases like "I only have five minutes," or "I'm in the middle of something now." For additional tasks and requests by people other than your advisor, you should review why you would say yes. Do you have the need to please or are you afraid to offend someone by not doing it? You could try with a gentle 'no' by saying, "If no one else is willing to do it, you can come back to me." For requests from your advisor another rule applies: Don't say no to your advisor! Let him re-think the task by explaining to him what else you have to do and what you've planned for the future (probably what you've planned together) and discussing with him whether or how this new tasks would fit in the original plan.

In the end, and after all the good advice, you have to realize that effectiveness also depends on appropriate self-assessment in respect to your personal stress level and physical well-being. So make sure you set your own pace and enjoy your private life besides. And remember: There is always time to eat and sleep!

Bente Tiedje *is a 2nd year PhD student at SICSS. Her graduate degree is in physical oceanography. In her PhD, she investigates the potential predictability of the ocean circulation on decadal timescales.*

Managing and organizing information

Hyung Sik Choi

Trouble with overwhelming amounts of material

Did you ever think that if you had collected and organized material well since the beginning, your work would be much easier? I have had this thought so many times during my past years of university life. While I did my master's degree, I couldn't resolve this problem. All of the files and papers were scattered all around my hard disk and desk. It resulted in an inefficient working process.

When I started my PhD, I first made up my mind to establish an efficient information and material management method to survive in PhD life. I thought that this could play a vital role in doing good research, or at least being a competitive researcher. I seriously pondered over my problems in handling research material. I realized that I tended to be somewhat impetuous in finishing my tasks, because I am obsessed with the notion that I should produce many good results. Thus I didn't pay much attention to organizing materials. As a result, files and papers were mixed readily without proper naming and order. Many useful reports were not accessible when I needed. It made my working process sluggish. I concluded that my bad habits should be changed and effective methods and rules must be devised.

I tried to search for established methods on the Internet, but there was not much useful information available. Therefore, I tried to discuss this challenge with my colleagues. But I could not ask them every detail of their methods because it is a matter of personal preference. About 8 months have passed since I started my PhD. I still struggle with abundant materials, like reports, scientific papers, models, books, online articles, and data. But I dare to say that I seem to have succeeded in making my own effective rules. I would like to tell you about my experience of learning to manage and organize information.

Some rules I have learned

First of all, I realized there is no magic solution. Certain amounts of time need to be spent on organizing your materials. I used to regard this time as wasteful, and was only concerned with time for researching, reading, and programming. I decided to change this attitude. Now I spend 10 minutes every day to arrange documents on my PC, and file research papers on my desk into folders before I leave my office. Whenever I start working the next day, documents and computer files are well organized and it makes me feel settled. Sometimes I find this all very troublesome and fall back into my old habits. My materials become disordered again. However, I reorganize them once a week (usually on Friday): my knowledge system is organized again and I feel like I'm conducting an orchestra.

You may have more questions about how to organize materials in an effective manner. I generally classify everything in two ways – according to topic and to purpose. For instance, research papers can be categorized into their topics, i.e. extreme event science, extreme impacts and adaptation policy, in the case of my research. This is a generally accepted method. When I have to prepare for presentations or write a paper, I create a new folder. This is a new branch of data systems from my original one. I can just select the ones necessary for my purpose and start to work. This rearrangement of your materials is a reprocessing of your raw data. From this, you can extract important information and work more efficiently.

However, the most difficult part of this process is determining how to easily extract information that I need for writing papers and presentations. I decided to take notes and keep them in notebooks and word files corresponding to their topics. Whenever I read research papers, reports, and data, I think about how this information could be used and decide to keep or discard it. This became a very important moment, which can affect my research. In addition, I also decided to make another set of notes for seminars and discussions. During PhD studies, students attend many seminars and conferences. I also decided to keep that valuable information. Ultimately, I realized that daily reading and research activity end up with certain products, such as good research papers and good presentations. Lastly, I found that the proper naming of files is important in classifying materials. I name each file with publication year, the first author's name, and the work's title. This rule makes it easier to search for them again with only author's name and title.

So far I haven't utilized any reference manager software. I keep document files and papers without any software, apart from information on them available online. When I discover useful articles and information, I save it using Firefox Zotero. I might use a reference manager to write a research paper. There are many software tools that you can use for data management, and you should decide whether to use it or not after trying it. Such software is merely a tool, which is able to facilitate your work process. Your concern and effort for managing your materials are more essential than the use of tools.

You can apply the same rules to collecting materials and organizing not only your research, but also other materials. I like to gather plenty of information on many kinds of topics such as climate economics, renewable energy cost, climate change,

and so on. It is my personal aspiration to be an intellectual in this field. I hope that my concerns over material management systems will make a big difference in the end.

On occasion, I reorganize my database of materials. After a panel meeting, conference presentation, or before writing a paper, I rearrange all of my information and renew my system according to the new research objective. Once in a while, I try to search through my files and the papers in my folders and remind myself of what I have learned and have struggled with.

Making your own good habits

I try to bear in mind that whenever I read and think, I should keep my objectives and their utility in mind. I believe that my PhD thesis is made up of the routine work I carry out everyday. My good habits in data management make my work more efficient. I encourage you to develop your own ways to organize research material, which fit with your style and stick to them all the time. I hope that your own methods will work out and help you finish your thesis as you expected.

Hyung Sik Choi *is a 1st year PhD student at the IMPRS-ESM. His graduate degree is in mechanical engineering (South Korea). In his PhD, he investigates decision-making in climate policy under climate uncertainty.*

Work-life balance

Pavan Kumar Siligam

When talking about Work-life balance, what is the very first thought that comes to your mind? One way to define it is as the efficient management of work and personal-life to strike a harmony between the two. In my opinion, work-life balance is reached when neither work nor life blurs out the other. The desired harmony comes when both are carried out effortlessly, both bringing out productive and satisfactory outcomes.

Though work and personal life are different facets of one's life, they significantly influence each other. One common attribute the two share is that they are both very time intensive. For someone who is pursuing a Master's or a Doctoral degree, the major portion of the day is spent at the University, leaving the lesser portion of the day for your personal life. Often more time is required to complete study/university related tasks. Considering this uneven distribution of time for work and personal life, trying to accommodate by allocating more time to your personal life may not be a good approach. I would recommend a 'task oriented time allocation for the day' approach. These tasks can be related to both work and personal-life. I enjoy a sense of satisfaction as long as I can keep up with this kind of schedule.

Importance

I have understood that it is important to find a balance between work and life in order to be satisfied, productive, innovative, and creative. At the same time, this balance has helped me to improve my organizational and managerial skills regarding both studies and personal activities. Lack of balance can lead to dissatisfaction with work, thereby decreasing performance and possibly leading to medical conditions, both psychological and physiological. For example, only an individual would be able to understand what he has had to sacrifice in order to achieve his goals. And so, if for some reason he is not successful in his career goals, he might fall into a downward mental spiral, from which it might be very difficult to recover.

Work-life balance can be achieved at work and in your personal-life by making good use of tools such as prioritizing, time management, strategic planning and communication with family.

Prioritizing helps me to organize activities according to the urgency that is demanded by them. At the University, sorting tasks according to their importance and approaching deadlines helps in completing tasks as planned. In personal life, the concept of prioritizing is also very useful, whether it means taking time for hobbies, travel, shopping or family.

Time management is also an important part of achieving balance. The way to go about this is to evaluate how to use one's time productively. It can be done by focusing on the important tasks at hand, finishing them within the time set aside for them. From my personal experience, having a to-do list is very useful to achieving as much out of a day as possible. One critical aspect of striking a balance is not to crowd up too many activities in a short time span. According to Thomas Fuller (1732), "A stitch in time saves nine."

Strategic planning is another great way to get organized, and be productive. For a start, it is good to find a work place that encourages a work-life balance for its employees. Finding possible resources/facilities in the vicinity of the work place makes life convenient for the family of the employee. For example, when a person finds a workplace where superiors are understanding and offer flexible working hours, he can easily fulfill his family and personal needs. For employees with working life-partners, it is better to find work in the same organization (Dual-career option) or at least the same city. This leads to higher concentration and efficiency on the part of the employees, since they can focus completely on their tasks at hand.

Communicating with family about work related issues is very important. The same applies for organizing home activities. A good way to go about this is to assess the total amount of time available, and then divide the various responsibilities among one another. It is a fortunate situation when each individual is able to find the ease and space to do the shared activities, without actually compromising his individual goals and interests. For instance, for a couple who are both career oriented, it may be difficult to find the right time to have children. But, there could never be a right time for childbearing if one considers their career as priority. There will always be some pressing career issue that could hinder having children. Again, communication is very important for decision-making.

Apart from the tools mentioned so far, I have found that it is also important to know when to take a break from stressful activities – whether at work or in one's personal life, so that there is no 'burn out'. Such situations demotivate the individual and raise obstacles to regain focus and concentration. This is crucial, because a person's mental stability gives him the ability to use the tools discussed above.

The very idea of creating a balance between work and life can be different for dif-

ferent individuals depending upon their lifestyles and career lines. For example: for a scientist, there is always the need to research and experiment, meet grant deadlines, attend meetings, build relationships, and so on. Unless the scientist is well organized, and has his priorities set, it is very difficult for him to cope with these high work demands and personal life.

All-in-all, in order to achieve a balance, setting priorities, saying no to non-productive and time-consuming activities, and investing in family communication is very important. It is good to accept help and assistance, when things might get too overwhelming to handle, and also ask people around you with similar lifestyles for their advice.

Pavan Kumar Siligam *is pursuing his Master's at SICSS. His first graduate's degree is in 'Spatial Information Technology and Remote Sensing'.*

Work-life balance in academia

Jana Peters

Work-life balance is a broad concept concerned with the proper division between time spent working and with the family and at leisure.
There is no accurate definition. It is not clear what 'proper' means in this context. In addition, the division between the two in the concept is fuzzy. The concept only implies two things: Work and free time are two totally different parts of life, and second, it is important to divide the 24-hour day into two parts, one labeled 'work time' and the other labeled 'free time' and then somehow find a balance. This does not really seem to fit into a PhD student's lifestyle. For example, most do not shut down their brains when they leave the office and go home. On the contrary, oftentimes good ideas and solutions to difficult problems are to be found away from the desk.
Work-life balance also seems to be a quite fashionable concept. There is a huge amount of guides and online content on how to find the perfect balance. Many people try to sell their solutions and concepts for finding the perfect balance. In my opinion, work-life balance is more or less a modern phrase for the old question of how to find happiness. By asking "how can we become happy PhD students," instead of "how can we find a perfect work-life balance," we can rid ourselves of the puzzle as to which part of life belongs to working time and which to free time. We don't have to divide up the day, and the imperative to balance is also relaxed.
Unfortunately, this question on happiness is not only very old, but is also difficult to answer. Frankly, I do not think there is a general answer: everyone has to find his or her own way to live a happy life as a doctoral student.
A Chinese proverb says "to know the road ahead, ask those coming back." As I am still on my way, I cannot really give perfect advice, but I want to address a few points, which may help you to become a happy PhD student. First, let me start with the opposite.

Reasons why we may not be happy

There are many reasons for not being happy. Many PhD students feel guilty about not working enough, or leaving the office too early. This guilt sometimes results from comparing yourself to other people, but it also results from expectations that other people, like your supervisor, might have. Also your own expectations, or expectations you think other people might have, can impose a burden. It is not that easy to rid yourself of guilt, as it is not easy to dispose of any other feeling. For some, it helps to know that office-hours are not a good measurement, and that research is never 'done'. Often, important ideas are found during a walk along the river, and a difficult problem may always turn out to be very easy to solve after a proper amount of sleep.

How much should a PhD student work?

This question is strongly related to the problem of feeling guilty about not working enough. Especially for PhD students, this question is impossible to answer, in general because we are result-oriented. It does not matter how long we work on a paper or the next chapter of our thesis. It has to be good, and it must be finished at a certain point. No one checks whether we are in the office or not. It also often does not matter if we are working at the office or at home.
Most of us can decide where and when we work, as long as we are making progress and getting things done. Given the limited time-span of 3 to 4 years for our projects though, this often means we work a lot, even on weekends. We have the weighty responsibility of organizing ourselves in such a way that we are getting things done. This can fail in two ways. First, the freedom we have can result in not working enough. If no one checks whether we are in the office, no one will notice that we are drinking coffee in the sun instead of working on a paper or the thesis. The freedom can lead to procrastination, which in turn can result in a lot of stress or in the worst case, in failure at the end of the project. But secondly, the freedom we have and the lack of a fixed working structure can also result in working too much, in guilt and a nagging belief that we don't work enough, and consequently in the neglect of our children, friends and hobbies. The answer to the question of how much we should work, lies somewhere in between.
In my opinion, it is important to keep both extremes in mind: Do not forget the paper or thesis chapter that has to be written, but also think of your family and friends, your hobbies and always include some time to relax.

Family and friends

To find the right amount of work also includes thinking about family-life and maintaining time for friends. How much time would we like to spend with our partner, how much time do we want for ourselves, and how much for our friends? Maybe some also like to think about starting a family. For some people, the special structure and the freedom of academia is the perfect environment for having a baby, but on the other hand, having a baby is a time consuming (albeit wonderful) additional 'research project', and as such needs an extra amount of organization.
Whether being a PhD student is a good time to have a baby or not is a decision every couple, and not only the woman, has to make on their own. The advice I can give here is: Discuss it with your partner and see if both of you are ready for it.
In conclusion, an important aspect of becoming a happy PhD student is finding the

optimal amount of work. Think about the three points above, and may they help you to find your personal optimum, or at least lead you to a better approximation. Just be aware that you shouldn't spend too much time optimizing.

Jana Peters *is a 2nd year PhD student at SICSS. Her graduate degree is in mathematics. In her PhD, she investigates how the concern for model uncertainty can alter environmental policies.*

A (not so) serious guide to an excellent oral presentation

Oliver Kunst

Scientific presentations are the backbone of every conference, workshop, etc. These events are relevant for researchers, and even more relevant for junior researchers, as they are an opportunity to establish new contacts – to network.
Networking is good for your scientific career because you generally have a time-limited contract with your university. Therefore, it is important to have contacts to potential employers. Getting in touch with potential employers is a hard task, even when you are at a conference. There, the best way to get attention and filter the big shots from the rest is by giving an oral presentation. Since you are looking for business contacts, the maxim is: 'Every talk is an application!' Therefore, you have to be aware of some important rules for any presentation!
Once you have established a good presentation, you can use it over and over again, making only minor revisions. So you have to spend the most effort on your first presentation. In following, I will explain how to prepare it.

You have to choose the proper media for presenting your results. In fact, there is only one kind of relevant presentation media: PowerPoint! Using PowerPoint shows that you are familiar with a computer, and even more importantly, it shows everybody that you have prepared your presentation ahead of time. Doing a blackboard or flip chart presentation is like typing your keywords into a text processor in front of the audience. People will think, "hey, this speaker is too lazy to do the work in advance." Showing that you are prepared is also possible with other presentation software besides PowerPoint, even with old-fashioned slides and a projector. But using a tool most people don't use makes you seem lika a maverick, a geek, or just old-fashioned. It will show that you are not ready to work in a group, because you are not willing to adapt yourself to the group. To put it shortly: If you don't use PowerPoint you will never get a post-doc position!

Since you are using PowerPoint, you have to choose the matching template for your slides. This is a very easy task! In general, your institute or university provides you with such a template. Of course there is one available from the KlimaCampus, too. Just use it! If you do, you will show both that you are not a lone wolf and that you are loyal to your institution. Any organization puts a lot of money and effort into designing its template. Every single design property is carefully chosen and optimized, so do not modify the template, you can't do better! There is exactly one exception: If you have a lot of important text that you want to pack onto a single slide, it is acceptable that you decrease the font size.

Before starting your preparation, you should think about the question: "Whom do I want to address with this presentation?" As stated earlier, you are networking. Since you like your job and the research you are doing, it is best not to change your research area during your scientific career. Hence, you should only address people who are really interested in your work and doing stuff that belongs to the same field of research. This could include many people, so you have to filter carefully. Who might be important for your career? In general, research positions are not offered by junior scientists, so forget about them. You have to address the more experienced scientists. There is only one reason why you should network with junior scientists: A really clever junior scientist can provide valuable input to your work. A further advantage is that nobody knows the names of junior scientists, and therefore, it does not matter if you don't cite your contributor. Whew, we are totally off-topic, now. In summary: Your presentation has to reach the experienced and smart people in your field. Anyone else is useless for your career! Bearing this in mind, you can prepare your basic presentation.

To allow yourself an easy start, prepare the last slide first. It is an unwritten rule, but your last slide should contain only one sentence: "Thank you for your attention!" If you don't have this slide, people will think that you are impolite – no, they will think that you are rude. When you think that people should judge your science and not your character, here are some more reasons why it is bad to end your presentation with a different slide. The last slide is as important as the first one! Even people day dreaming during your talk will recognize your first and your last slide. You should use this moment of their attention carefully. Do you like it when people pay attention to someone else's work while you are presenting? No? So don't end with your references. Even worse is to have a set of conclusions as your last slide. If you do, the people who have been day-dreaming will not recognize that your presentation is coming to an end, and they will not applaud you at the right moment. During the applause, everybody focuses on you and your last slide. Some people will focus on your presentation for the first time. They will take your conclusions and form some trivial questions from it. They don't do it out of interest! Those people will use the discussion to pretend they have understood your talk and impress the audience with how smart they are. In general, these are not the brilliant researchers looking for a position, but are rather those who have messed up their own presentation and will use yours to compensate. Avoiding stupid questions is made easier by the 'thank you' slide.

The first slide of your presentation should contain your name and the title of your talk. Since the title announces your presentation, it should be very catchy. Keep

the title general, but use a bunch of buzzwords: buzzwords attract people. The more people listen to your talk, the better the chance that there are experts in the audience. Also, if the title is very general and cleverly chosen, you won't have to change it for every new presentation. At the beginning,you should present a short introduction. This should not be longer than one slide. Keep the spoken introduction short, and put a lot of additional text on the slide. Interested and smart people can read it quickly while you are talking.
Since a presentation has the same structure as a journal article, the most convenient way to add content is to copy important parts from your last paper over to the presentation slides. Since your last paper was excellently written, it could even be understood by non-experts. Keep in mind that only the experts are valuable for networking. Smart people can focus on the whole talk. If you repeat things you will offend the smart people, so don't bother with the dumb pseudo-scientists, and avoid summaries and recapitulations! Okay, maybe that's too hard. People who don't understand your presentation should get a second chance. Give them the opportunity to study your presentation. Often, you can download the presentations after a conference from the Internet. On the world wide web, your presentation will be saved for years; your talk lasts 15 to 30 minutes.
After the talk, the downloadable presentation becomes your business card. Understanding the downloaded presentation without having listened to your talk is only possible when your presentation contains a lot of text. At the least, your talk should be written completely on the slides. A very basic rule is to put as much text on your slides as possible! If necessary, reduce the font size in your presentation template. A small font is a good way to attract the audience's attention to your spoken words, and away from your written text. The written text should be easy to read when you are standing in front of the projected slides. It is convenient when you can read the text directly from the slides. Doing so, you can easily finish your presentation within the announced time limit. If you can not talk fast enough, you can skip unnecessary words. Just make sure that you use the most important keywords. But be careful! Even for a really sophisticated listener, it will be hard to follow your talk unless you are using an appropriate pointing device.

Basically there are two kinds of pointing devices: A really cool laser pointer or an ordinary stick. Sticks have proved to be reliable for thousands of years. Of course it will do its job, for sure, but it will prevent you from looking young, energetic and smart. Another very embarrassing moment can come about when you are standing in front of the big screen and realize that your stick is too short to reach the important parts of your slide. If you try to point to those areas with the shadow of the stick, you will look like a conductor, or a five year old playing with his own shadow. You can easily avoid such inconveniences by using a laser pointer. A laser pointer has even more advantages! You can get rid of a really annoying type of person. Some members of the audience might show their good will by following your talk, but they will not be able to understand your brilliant ideas. With such people, you often have to explain your ideas to them during the discussion after the presentation. They block valuable discussion time, which could be filled with fruitful questions. How does one get rid of them? If they cannot understand your brilliant ideas, it will be even harder for them to focus on your presentation. So, give these people the opportunity to deal with things they can understand. The trick is to point constantly with the laser to the sentence you are reading. While you are reading, allow your hand to shake normally; don't even try to hold the dot perfectly steady. Instead let the red dot jiggle around the words you are trying to point at. This jumping dot will become the focus for everyone in the audience who is not able to focus on your brilliant ideas. They will be distracted like a cat focusing on an insect. These cat people will immediately stop trying to understand your presentation. Therefore, they won't degrade your discussion any more.

After your presentation, you have to impress the audience with a genius discussion. Using the previous tricks should leave you with a very good selection of people who will ask questions. Congratulations, now only the best scientists are still talking to you! But how should you answer? First of all, discussion time is very limited. Even if it is called a 'discussion', it is simply a short answering of questions. Clearly, a short answer can not cope with your presentation. Nonetheless, before you answer any question, pause a while and try to stare smartly into space. After one to three seconds, praise the questioner for asking such an interesting question and invite him to have a real discussion during the coffee break. It could be that only the chairman is asking you. Answer his trivial questions shortly, and don't invite him to further discussion. He is not really interested, but he thinks that it is more polite to ask something than enjoy the silence following your storm of sophisticated scientific ideas. If nobody else replies to your talk, then you have been really great. The whole audience is impressed, especially those members who could offer you a job.

Good luck with your next presentation.
May it be very impressive!

Oliver Kunst *is a 2nd year PhD student at KlimaCampus, University of Hamburg. He has a graduate degree in applied mathematics (Technomathematik). In his PhD, he develops a three dimensional adaptive Discontinuous Galerkin Method for atmospheric moist convection.*

Oral Presentations

Ralph Rösner

Communication and the exchange of information, whether intra- or interdisciplinary, is crucial for successful and progressing science. Presenting your own work gives you the opportunity to share your results with colleagues and fellow scientists. Furthermore, you get feedback on your work, which can both help you to improve it, and think about it from a different point of view so that you are able to develop new ideas.

But there is another advantage, which should not be underestimated: Conference meetings, talks and oral presentations will make your work public. Certainly you have already experienced good and bad presentations, and everything in between. But only the good and the bad talks will be remembered later, while the others will be forgotten very quickly. The bad presentations will only be kept in mind because of all the mistakes that were made. On the contrary, the good presentations will impress the audience and your face will be positively related not only to the presentation itself, but also to your results, which will be more easily kept in mind. If you do a good job, you will be remembered by some scientists, which could even lead to a future collaboration. There are a lot of reasons why you should be eager to present your own work as well as possible.

In the following, I will give you some advice on how to prepare a good scientific presentation. These hints are based on personal experience and on the research-skills course. I would have found these hints very valuable at the beginning of my scientific career, and I hope that they will serve you well!

How should I start?

Watching as many presentations as possible can be very useful, because this can help you to identify which way you want to build up your presentation. Write down during each presentation precisely what you like or dislike the most about it and use this information to design your own presentation. This will help you to avoid the same mistakes and to prepare a presentation with all the benefits of previously seen presentations.

Before you begin with your presentation you should also know who your audience will be. Will you present your work to scientists of the same or a familiar research area or will the audience barely have any idea what you are working on? If your audience consists of both groups, a useful technique is to start quite generally at first, and then narrow the presentation down towards the end.

It is also quite helpful for the preparation of your talk to know how large your audience will be: for a larger audience your presentation should be more formal and entertaining, while for a smaller audience a relaxed and conversational presentation seems to be more adequate.

Therefore, it is essential to adjust every presentation to your audience!

If two-thirds of your audience is pleased at the end of your presentation you surely did a great job!

How should I design my presentation?

One of the most common mistakes among presenters is that they put up way too much information on one slide. One problem that arises from this is that most people in the audience will try to read the text on the slide, and hardly anybody will pay attention to the speech of the presenter anymore. A helpful hint might be that you should show only those passages on your slide, which you are addressing at that very moment as you move on through your speech. This will help the audience to follow your presentation more attentively.

Another common mistake, which often occurs in line with the above-mentioned problem, is the small font size of the text on the slides. Use at least a font size of 24, not only for your text but also for the description of your graphics, and you can be quite sure that even the last row of the audience will be able to read your text. The secondary effect of using a larger font size is that you are forced to reduce your text to a minimum so that it fits on one slide.

Further problems concerning visibility that might arise can be due to the contrast of the slides. Be sure that all content is visible! You can use bright colors for important content and duller colors for less important content. When choosing colors, be aware of the fact that many people (about 9% of men and 1% of women) suffer from red-green color blindness, which means that they cannot distinguish between those two colors. Try to eliminate this color-combination in your graphics!

How should I present my talk?

Many people feel very uncomfortable if they have to present their own work and results in front of a group of people whom they don't know. They are afraid that they could make a fool of themselves, if they make a mistake, or even worse, that their work will be criticized and they will not be able to explain the facts properly.

Stage fright is a very common phenomenon among presenters. Nearly everybody suffers from stage fright, and so did I during my first presentations at the university. I believed that the expected standard was really high and the self-made pressure for giving a "perfect presentation" increased my nervousness even more. There is not much you can do about your nervousness when standing in front of an au-

dience, the most important person in the room at that very moment.
The symptoms of stage fright will be reduced after several presentations, because you get used to the conditions when talking in front of an audience. But these symptoms probably never vanish completely. Just keep in mind that everyone started as a nervous wreck at the beginning and you can be quite sure that no one in the audience will make fun of you. All of them have had the same experience as you.
The only helpful advice on reducing your nervousness before a presentation is reasonable preparation. Practicing your speech over and over again until you have internalized the whole presentation is essential for a successful talk.
During your talk, you should stand in a relaxed position or move around calmly a little bit from time to time. This gives the impression that you are not only confident about yourself, but even more importantly, about your work.
Smiling occasionally and making eye-contact can help as well to keep the audience engage in your presentation.
Even a little humor can lighten up the stiffness of a scientific talk, though that doesn't mean your presentation should be like a performance in a comedy club. If you are very nervous during your speech however, it surely isn't a good idea to force a joke, because it wouldn't seem honest. It could make the predominant atmosphere in the room turn even tenser, and your nervousness could become even worse. It doesn't make sense to be funny because you believe that this is expected from you – it is not!
If you don't feel relaxed on stage, you should stick to your prepared presentation; you shouldn't start thinking about experimenting with new presentation techniques or start improvising.

How should I deal with the discussion?
After you have finished your talk, you will have to face the next part of your presentation, which many people feel uncomfortable with: the question and discussion section. Within a short time-span the audience is encouraged to ask questions on your presentation. To a certain extent, you can prepare some answers to questions that are likely to come up. Just think of some aspects that might not be quite clear to the audience or gaps that there could be in your work. During your presentation you can also include some phrases like, "unfortunately, I don't have time to talk about this in detail," if you want to lead the discussion in a certain direction.
It is also quite important to mention that you should remember to repeat and summarize an asked question from the audience again before answering, so that everyone in the room is able to hear it (you are the only person in the room with a microphone!).
If there is an insistent questioner or a person who asks off-topic questions, you can ask him to come to you after the presentation, by saying something like, "I would really like to discuss this point with you, maybe we could do so afterwards?" This is not rude at all, and the audience will be thankful to you for avoiding off-topic questions that are not of general interest.
Questions might even come up that you are not able to answer, simply because you don't know the answer. The worst thing you could do is to make something up! Just admit that you don't know the answer and that you will have to look it up. There is nothing wrong with that! It is quite obvious that you can't know everything on the topic.

Although giving presentations in front of an audience may sound intimidating, you shouldn't worry about making mistakes. Quite the contrary! You should seize every opportunity to present your work to colleagues and fellow scientists. Practice makes perfect! In the course of time you will become more confident and you will find out how the audience's reaction to your presentation evolves. According to this reaction, you can adjust the presentation slightly until you are fully satisfied.

Ralph Rösner *is a 2nd year PhD student at SICSS. He received his graduate degree in biology from the Ludwig-Maximilians University (LMU) in Munich. In his PhD, he investigates the impact of climate change on Lake Plußsee and its zooplankton community.*

Scientific writing and summarizing scientific information

Maria Koon

Introduction

Throughout high school and while completing my bachelor's degree, I naturally had to write essays and research papers. Usually these papers were about historical events or literary topics, not scientifically based. During my bachelors, I began to write more scientific papers on experiments that I had personally conducted. I felt that my scientific writing was not perfect, but at least clear and, most importantly, followed grammatical and scientific writing rules. Writing always took me an exceptional amount of time, but was not extremely hard because I was able to reflect upon the work I had done and the steps I took to complete projects or experiments. During the past year of my master's, I have had several assignments in which I was to make a presentation and write an essay summarizing scientific articles. At first, it did not seem very challenging. Then I realized that it is very hard to write about a topic that is difficult to comprehend and is something on which you have not personally worked. The assignments also raised my awareness on the differences between good articles and overly complicated and incoherent writing. I recognized that I did not want to make the same mistakes in my writing and needed advice on how to write scientific summaries. Apart from attending a research-skills course in which one discussion session was about scientific writing, I browsed the Internet for tips and consulted a few books to refresh upon the basic rules of writing.

Writing scientific summaries

In my search, I found the following statement regarding professors' perspectives on student writing: "They agree that the first step is to have a solid understanding of the science. Therefore, reading comprehension is one key factor in effective writing" (Department of Biology, GMU). It is very obvious to professors when students do not understand the topic on which they are writing; therefore, it is important to begin conducting your research as early as possible, and conduct further research on subtopics that you do not fully understand. Do not try to simply extract sentences from the article you are summarizing. Maintain and build a large vocabulary, use a systematic reading technique, and re-read information when you notice you have not fully understood (Martin, 1991). Verbally explain what you have read to someone before you begin writing (Department of Biology, GMU). Whether you have to give an oral presentation on the topic or not, talking about it with others helps to assess whether you have truly understood it. I think it is also important to read other articles relating to the topic, even if you do not include them in your summary, just to be sure that you have a firm grasp on the material. Basically, do not procrastinate, and even if you do not begin writing well before the deadline, at least begin your research.

General writing tips

After searching for advice on how to read and prepare to write a scientific summary, I consulted writing handbooks for general writing guidelines. Tim Skern (2009) offers eight guidelines for improving your writing technique – make a plan, use a legible layout, use paragraphs, write simple sentences, write positive sentences, write active sentences, omit needless words, and read and think about your work. I found these tips helpful, but as usual, easier said than done. It is important to find a good website or book to consult in case you have questions about specific grammatical or punctuation rules. The MLA Handbook for Writers of Research Papers offers extensive content on the mechanics of writing.

The book also includes advice on citing sources, an issue with which I often found myself struggling. As it can vary from course to professor to topic, I was never certain which style to use for citations. However, it is typically acceptable to use inline citations. A few examples are as follows (Department of Biology, GMU):

- „Smith (1983) found that N-fixing plants could be infected by several different species of Rhizobium."
- „Walnut trees are known to be allelopathic (Smith 1949, Bond et al. 1955, Jones and Green 1963)."
- „Although the presence of Rhizobium normally increases the growth of legumes (Nguyen 1987), the opposite effect has been observed (Washington 1999)."

Speaking of citations, this is probably a good time to mention that it is very important to learn a program to assist with keeping a digital bibliography and composing your report. One such writing program is LaTex, which can be downloaded from the Internet. Once you learn how to use it, it eases the pain of formatting documents and can also store citation information from scientific works.

Lessons learned from the scientific writing discussion

As mentioned, some of this research was done while preparing topics for discussion in a research-skills course. During the session, we also discussed some other important tips for writing and went through some examples of how to improve sentences. To clarify, the focus of the session was mainly about writing scientific articles on your own work, not writing scientific summaries. To overcome your writer's block, start with the figures that you want to include (or think you want to include) in your report. Think about how they are connected and what you want to convey; however, do not describe them in detail in your writing. After considering your figures, tell a story about your work, but do not write a crime story in which you wait until

the very end to convey the main information. Ensure that your story makes one point. Perhaps it is better to consider the title of your work even before the main content in order to confirm what point it is that you truly want to make.
In writing your story, always remember where you are and remember to keep the emphasis at the end of sentences or paragraphs. Stick with one tense in your report and ensure symmetry in writing.

Ready to start writing?

I cannot say whether or not this essay will really assist in your scientific writing skills, but sometimes it is helpful to read about writing before actually doing it, to overcome initial barriers of where to start. Read many scientific articles as well as other documents to build your vocabulary, but keep sentences simple and do not use big words simply for the sake of sounding intelligent. Keep a writing workbook on hand in case you do not know if you need a comma or a semicolon. Finally, learn to use a writing program because when you have a deadline, you do not want to spend hours trying to format your figures so that they are all aligned perfectly and numbered correctly. In summary, my advice for surviving your masters is to learn the scientific jargon and learn to talk to people about scientific topics. If you are able to express yourself in speaking, then you can certainly achieve the same in your writing.

Works Cited

Department of Biology, GMU. (n.d.). A Guide to Writing in the Biological Sciences – Practical Tips for Scientific Writing. (G. M. University, Producer) Retrieved September 5, 2010, from Department of Biology: http://classweb.gmu.edu/biologyresources/writingguide/PracticalTips.htm

Martin, D. (1991). How to Improve Reading Comprehension. Retrieved September 4, 2010, from How to be a Successful Student: http://www.marin.edu/~don/study/7read.html

Skern, T. (2009). Writing Scientific English – A Workbook. Vienna, Austria: Facultas Verlags- und Buchhandels AG.

The Modern Language Association of America. (2009). New York, New York, USA: The Modern Language Association of America.

Maria Koon *is a 2nd year master's student in the SICSS program. She completed her bachelor's degree in Mechanical Engineering at Clemson University in Clemson, SC USA. She will begin her master's thesis in March 2011 on "The Characterization of the Hydrothermal Carbonization Process for Biochar Production."*

Publishing

Wenke Wegner

One of the first things that I was told when I started my PhD was that an important part of it is having my findings published. At that point, publishing felt like it was ages away. Still, I had all these questions in my mind: Why exactly should I publish? Where and how could and should I publish?
To help answer these questions, I talked to my colleagues and supervisor. They gave me reasonable answers, for example on why I should publish my results. They first of all mentioned that the publication of scientific results in refereed journals is an essential part of the scientific process and a scientific career. One can say that publication is the researches final payoff. Publishing gives you the chance to get critical comments from members of the scientific community other than your advisor. In addition, most thesis regulations call for at least one published paper. My supervisor said that one of the most appropriate reasons for publishing the research results is to tell others about it. You may have important things to say, or to teach others, and scientists may build their ideas upon your methods or results. The next step is to then think about how and where to publish. I again talked to some colleagues and others who where more experienced than I. I summarize the answers in the following as a kind of manual. It will slightly differ from research area to research area (my knowledge is based on the economics literature), but the main steps will be the same.

Write

The first thing to do is to start writing. It will not be perfect in the beginning but it is a start. You should also remember to focus on the reader, because the reason for writing is to communicate with other people. Keeping that in mind will help you avoid becoming too concerned with an abstract discussion of your topic. To learn more about this specific topic, you should read the essay on 'Scientific Writing' included in this handbook.

Choose the journal

The objective is to find a journal that fits the topic of your paper best (and not the other way around). This choice depends on the length of the paper, the audience you would like to reach, the money you are willing to spend, how interdisciplinary the paper is, and so on. If your paper has to be published swiftly, then you should look for journals that do so. When you read the table of contents of the journal you will get a feeling for who has published there and what the main topics are. It would also be a good idea to check the mission statement or the goal of a journal.

It is furthermore wise to submit your paper to the journal that inspired you to pursue the research you are trying to publish.

Formatting and submitting

It is common for each journal to have its own format for papers (at least in the field of economics). You should therefore keep your writing in a manuscript style so that it is easy to adjust to the journal's request or their given style file. You should then submit your work to the journal that you think would be most appropriate for your paper. Usually, journals want you to sign that you have not submitted your paper elsewhere.
CHOOSE AN EDITOR: Choosing an editor for your manuscript is important because the right editor can make a crucial difference in whether or not your paper will be published.
The managing editor is normally a full-time paid professional, whereas editors are usually unpaid volunteer scientists. The managing editor is normally not involved in the acceptance-rejection decision.

Submit the paper

When submitting your paper you should often include a cover letter. Write this letter with great care, as it will form the basis for the editor's first impression of you and your work. Be sure you spell the editor's name correctly. In the letter, name the journal and say something nice about why it is the appropriate place to publish your paper. You should include your postal and email address, as well as your phone number.
When your paper arrives at the journal's office, the managing editor makes some preliminary decisions. He checks if the manuscript is concerned with a subject area that meets the main topics of the journal. He examines if the form of the manuscript is suitable to the editorial style of the journal. He then selects and asks the reviewers if they will take the paper for peer review.

Response from the editor/reviewer

„The first thing to remember is that submission of a serious scientific paper to a scientific journal establishes the author as a citizen of the scientific community with all the rights and privileges thereof. So hold your head high and refuse to be executed without a fair trial in which the evidence against you is clearly presented and you have the opportunity to state your case on an equal level with the referee's indictment."(Parker 1997)

Remember that a harsh reviewer's criticism means that your paper most likely contains something nontrivial. There are four possibilities when receiving your

paper back. One possibility is that it has been 'accepted'. In that case, take a day off and reward yourself with some ice cream. Unfortunately your receiving this answer is highly unlikely. The other possibility is that 'minor revisions' are requested. In this case, the reviewer points out some small mistakes, which can be easily corrected. The third option is that 'major revision' is required. In that case you have to revise your paper. You should then take a deep breath, and calmly evaluate the comments made by the reviewers. Go through the review report point by point. Start with the comments and suggested changes that make the most sense to you and adjust your paper accordingly. If a reviewer misunderstood you, try to determine why he did so and think about whether you can make it easier for readers to understand. Did the reviewer misunderstand you because he is a blockhead, or did you not make it clear enough? In most cases, reviewers have positive intentions; they actually want to critique the paper in a constructive manner, to improve it. The last possible answer is a 'rejection'. If that happens you should consider submitting the paper to another journal.

Resubmit

In your letter to the editor you should respond to each of the reviewer's comments and indicate acceptance of the suggestions. If you choose not to accept one of a reviewer's comments, you should indicate why not. Try to avoid anger in your responses.

How often can one resubmit the paper to a certain journal? Some journals do not have a limit on resubmitting papers. However, if you rewrite it over and over again, it will at some point no longer be your own work. Another crucial point is that your paper will not be up-to-date anymore, once you have resubmitted it a couple of times. At some point, you may want to think about choosing a different journal.

These are the most important steps in the process of publishing. As these steps vary between research fields, always ask your fellow PhD students in your field of research who have already published papers, or your supervisor for more specific help. This definitely helped me in the beginning, and the goal of getting my findings published does not seem so far away anymore.

Recommended Readings

E. N. Parker (1997), The Martial Art of Scientific Publication, Eos 78, 393–395.

Robert A. Day (1979), How to write and publish a scientific paper,
Cambridge University Press.

Ann M. Körner (2008), Guide to Publishing a Scientific Paper, Routledge.

Wenke Wegner *is a 3rd year PhD student at SICSS. Her graduate degree is in mathematics and economics. In her PhD, she investigates power and responsibility in environmental policy making.*

Paper reviews

Oliver Krüger

This text is inspired by "The Martial Art of Scientific Publication" by E.N. Parker and the discussion in the research-skills course. I merely write about the things that I have experienced, and the text is thus biased. I do not intend to give objective advice. Instead, I write about the lessons that I have learned and that readers can probably learn from.

Paper reviews can be pure pain – if you're not prepared. I still remember the first review I received. Back then I was a very inexperienced student and in the process of writing my diploma thesis. My supervisor and I summarized the early content of the thesis and submitted it to a journal. Four weeks later, the reviews were in my mailbox. At that moment, I shouldn't have read the reviews. They upset me. Honestly, I wasn't prepared and didn't know what to expect from the reviews. Funnily, the two reviews held completely different opinions of my work. One recommended a publication with minor revisions; the other rejected the paper. Also, while the first review was quite objective, the second was not. Instead, his or her comments made me wonder whether the reviewer had actually read the manuscript. At that time, which was stressful anyway due to my thesis, I did not expect such condensed criticism of my work at all, and the reviews put me in a bad mood. After several talks with my advisor, and one final call not to allow myself to be deeply affected by these reviews, I revised the paper. Later on, we resubmitted it to the same journal. I did not expect the paper to be accepted. In the end, it was rejected due to space limitations, although the reviews were more positive than before.

Unfortunately, some reviewers keep forgetting how their reviews affect the actual writers. In that sense, both authors and reviewers need some rough advice to cope with reviews. In the following, I first seek to give some advice to authors of manuscripts. Afterwards, I address some of the issues that reviewers face.

Handling reviews is fairly easy, although my experience above seems to state otherwise. Authors should understand reviews as one part of a discussion. Reviewers raise points to which authors need to respond.
The author might then admit that a particular fact has simply been forgotten, or that certain issues were underrepresented in the manuscript. Rejecting suggestions can also be an option. However, authors always need to describe changes, and discuss and justify their points. I find it easier to handle reviews if I see the points raised as suggestions for an improvement, even if the review is just a series of criticisms. Such critiques must not be taken personally. It is always hard to be criticized. It is even harder when you identify with your work. But a review should never be so overwhelming that it may spoil your mood – a lesson I had to learn in the beginning.

Addressing reviews and revising the manuscript will consume a fair amount of time. Nevertheless, sometimes all the effort and time seems to be pointless when the paper is completely rejected in the end. Then, authors are still free to submit to a different journal, or perhaps even need to reconsider whether that particular publication is worth the time and continued struggle.

When you review a paper, there are some important questions you need to ask yourself, namely: How can you help the authors to make the paper better? How would you improve the manuscript, and what advice would you give the authors? That is to say, the focus should lie on the evaluation of the article, and on putting it into a scientific context. Both strengths and weaknesses should be pointed out and a conclusion should be reached. Based on this conclusion, the reviewer eventually judges the manuscript whether or not it is publishable. Does the article tell a complete story? Does it contribute to the knowledge on a specific field? Is it scientifically sound? Are the right references cited?

These questions can only be addressed after the article has been carefully read. I once received a response where one reviewer raised a point that had already been discussed in my article. If he had read the manuscript carefully he could have saved the time needed to discuss this point extensively. He even came to the same conclusions as we did. I was quite amused by his advice that we should include this in our paper. Nevertheless, we revised the sentences that dealt with this point. When a reviewer is not able to grasp the whole meaning, a revision is beneficial and seems unavoidable, if only to further clarify specific points. Doing so will hopefully prevent other readers from misunderstanding the manuscript.

Reading carefully does not necessarily mean that a reviewer should take as much time as wanted. In fact, a reviewer usually faces a deadline by which an article should be read and evaluated. Reviewing is work that consumes time beyond one's normal workload. In that sense it might be handy to get the review done quickly. Furthermore, if the review is done in a timely manner, it will help you to build a reputation as a good reviewer. Reviewing speedily can only be achieved if the reviewer always keeps the previously mentioned tasks in mind. The question of how the paper could be improved cannot be addressed when the reviewer starts to nitpick.

Does it make sense to reproduce results to the fourth decimal place? Maybe. Even when the estimated uncertainty associated with the datasets used is much higher? Maybe not. Does the reviewer need to address points like "in line 4, 'their' should be 'there'"? Definitely not. There are other people that tackle spellcheck issues. Something of that kind should only be mentioned if the readability of the manuscript is seriously affected. The authors and editors will also be grateful if the review is brief. It is easier to address points as an author or to come to a decision as an editor if the review doesn't stretch for 16 pages. A condensed conclusion with a precise recommendation is the ideal review.

Of course, a reviewer is free to write and recommend anything wanted, even further experimentation or more citations. A recommendation for further research is always useful, however it is often not necessary. For instance, one reviewer wanted me to compare my results to those of a different method. I believe that the suggestion would have been very useful, if I had been able to do so. The problem was that the other method was only roughly, moreover imprecisely described in a paper, and relied on numerical models that were specifically designed for that analysis. In my reply to the review I mentioned that I was unable to carry out the same analysis with my model for the above-mentioned reasons. The reviewer was satisfied and admitted that it would not have been possible to carry out such an analysis, which was beyond the scope of the presented paper.

Besides recommendations, I strongly suggest reviewers to be positively minded and to watch the tone of their language. First, every serious manuscript has strengths besides weaknesses. Even if the paper cannot be recommended for publication, the strengths should be emphasized to encourage authors to continue their work – not to discourage them. It does not help to just give a series of criticisms. Second, every disapproval can be expressed in a polite way. Instead of writing that reading has been "a waste of time," the reviewer should give some advice on how to improve the manuscript and do so in a friendly manner.

By the way, I used both rounds of reviews written about in the beginning to improve my thesis, which we later again condensed into a new paper. We submitted this version to a different journal, from which we soon afterwards received the reviews. The reviews were surprisingly constructive and positive. I do not want to emphasize this point, but it makes a difference: Constructive reviews make it easier to motivate yourself in your continued work on a subject. In my case, these reviews helped me to get through the publication process – the paper has since been published.

Oliver Krüger *is currently a 2nd year PhD student at the Helmholtz-Zentrum Geesthacht and a member of SICSS. He graduated in Meteorology from the University of Hamburg in 2009. Oliver's research mainly deals with pressure-based proxies for storm activity. In particular, he evaluates the informational value of these proxies for assessing past storminess.*

What is networking and what role does it have in a scientific career?

Laura Niederdrenk

While thinking about the question of why having a network is important, I had to ask myself what exactly networking means. It is obvious that a network is important not only for your scientific career, but also on a daily scientific working basis. You can network during conferences, workshops, or summer schools, and find contacts in many meetings, but what precisely does a network imply? Does a network always have to be built around you? Or could you simply adopt an already existing one, for example, that of your supervisor? Is it even the task of your supervisor to network for you? It depends on your definition. However, everyone is supposed to have his or her own network. This might mean basically that one should have contacts to different scientists, who can be other students, post-docs, or senior scientists from your own institute and from others, in Germany or abroad. In any case, they should all have in common one thing: their work should somehow be related to yours.
When I started my PhD one and a half years ago, I was completely new to the field, which meant basically that I did not know anyone from this community, where everyone seems to know everyone else. Now, I already have the feeling that not only do I know some of these scientists, but that they also know me.

But why is having a network important? The answer is simple: It makes things easier. When you try to find a job or a project, it is necessary that you know people to ask for advice. If you do not know anyone, it is much more difficult to find an expert when needed. You can start collaborations with other scientists, either by joining projects and working closely together with others, or by discussing your results with someone not directly involved in your research. Such an external point of view can be helpful in many situations. Furthermore, you might receive new input for your work as well as broaden your mind in different fields. It is obvious that you can find and keep such contacts during conferences or workshops, etc. At the beginning, when you are new to a field, it might be easier to open the door to a specific community while presenting on small specialized workshops or informal meetings, rather than while participating in one of the big conferences. Last month, for example, I participated in a small workshop with a very specific topic. I had the chance to have interesting discussions with experts in my field, which probably would not have been possible at a big conference with a more strict and dense timetable.
However, you can also contact authors of interesting papers or go to talks and seminars. The crucial point is that networking is an active process. One cannot say, "Today I will network," but writing an email, asking for an opinion, or sending your results to someone are proactive decisions you make. Although there is no golden way to foster useful contacts, it is helpful to think about the profitability and potential advantages of contact before putting too much effort in maintaining a connection to a specific person.

Certainly, such a network is necessary for finding future positions. If nobody knows you and you do not know anyone, it is not only more difficult to find interesting positions; it is also more difficult to successfully complete the application process. This does not mean that you cannot find a job without knowing someone, but, as mentioned before, it can make things easier. If people remember you from a conference and if they know about your publications before receiving an application, they might know in advance whether you are promising for this or that position. Additionally, you can tell people before finishing your PhD thesis what type of position you are interested in, or more precisely, in which field you plan to work afterwards. Often, people keep you in mind and if they have or hear about a position, they might contact you before it is announced.
Telling people what you plan to do after your Ph.D. implies that you are thinking about your future scientific career now, while writing your thesis.
Do not start with that too late, because in the last months before handing in your thesis you will surely be too busy with other things. About one year before you plan to have finished your thesis seems to be a good point in time to start finding out where you see yourself afterwards, and begin talking to other people about it. Open your eyes to new opportunities and reflect what a future position should bring with it.

Is there the perfect scientific career? And what does that mean: what is a "perfect scientific career?" The path, at least in Germany, and at least in the first steps, seem to be clear: Master of Science or Diploma, PhD, post-doc and then after that it becomes unclear. There follows somehow an 'academic career'. You have to figure out on your own if you see yourself on that track. If so, you need to take a closer look at your interests. Do you want to specialize in a field closely related to that of your PhD work? What parts of your work do you like most? What would you like to learn more about and what would you like to avoid if possible? It is also possible to change your scientific field of interest with the first post-doc position. There are plausible arguments for and against changing your field. Insisting on a specific topic means increasing your specialization with time. Changing to a new field can broaden your knowledge and allows you to gain insight into different perspectives on a scientific problem. Either way, be aware of your personal and scientific advancement! It is not enough to answer the same research questions as before, with more detail. Something new must begin.

The university structure as an employer for scientists in Germany is changing rapidly, and there remain possibilities for a scientific career outside the university, in non-university research institutes, for example. There are numerous governmental and inter-governmental research institutes searching for young researchers. Do not forget to keep your mind open to such possibilities as well. Until now, the positions at universities often imply a teaching role, which is very nice with respect to getting new and fresh input from motivated young people, but can be long-lasting in the sense that you have less time to do research. In the U.S., there are permanent positions for researchers, called principal investigators, as an alternative track to the traditional professorship.

Think about your interests in detail, for example, whether you would like to teach or not, and do not postpone this planning on your personal way finding the perfect scientific career, which definitely looks different for each of us! Talk to your colleagues and other scientists about their experiences and use your network to find out what you would like to do. And last but not least, besides all this thinking about career plans, do not forget to trust your gut.

Laura Niederdrenk *is a 2nd year PhD student at the Max Planck Institute for Meteorology and a member of SICSS. She has studied mathematics and psychology in Freiburg and Madrid. After her university studies, she changed to oceanography and is now concerned with the Arctic hydrologic cycle and its variability.*

Interdisciplinarity

Alexandra Kroll

Why work across disciplines?

Because the core research within the disciplines is already done; Because questions which involve more than one discipline and which interact between traditional disciplines have become more pressing; Because fundamental concerns like environmental issues, sustainability, or poverty cannot be answered by disciplinary work, and we need a common interdisciplinary strategy. As the philosopher Karl Popper put it, "We are not students of some subject matter but students of problems."

What is interdisciplinarity?

Interdisciplinarity crosses traditional borders among academic disciplines or schools of thought. It addresses questions and issues that cannot be answered by one of the traditional disciplines. In contrast to multidisciplinarity, interdisciplinarity is not additive, but is instead incorporative. Therefore, during interdisciplinary work, the disciplines work together and intertwine with each other. The aim of interdisciplinary efforts is the connection of knowledge and methods from which synergies arise, and in turn answer a scientific question at hand.

Following this definition, interdisciplinary work could be done by one individual who is familiar with at least two disciplines, or by a team of people of different disciplines. Probably, the cooperation of different people more efficiently results in synergetic effects than the work of one individual. This means that completing interdisciplinary work as a single person is possible, but not as efficient as working together with other researchers.

What are the basic prerequisites for interdisciplinary work?

Interdisciplinarity requires critical reflection on one's discipline. In particular, the power and the boundaries of the own discipline must be formulated and must be related to the strategies of the cooperating disciplines. Implicit assumptions about one's own discipline must be made explicit. Through this process, it becomes possible to familiarize other people – who have no background in the field – with the basic concepts of the discipline. Some might say that a critical reflection on one's own discipline is time consuming and annoying, but it is necessary to relate and classify the interdisciplinary research topic within the cooperating disciplines. A critical reflection reveals the abilities, the differences, the similarities, and the boundaries of the cooperating fields. Even the explanation of one's own discipline and the learning of other disciplines could stimulate further research.

How to become a good interdisciplinary researcher.

A good interdisciplinary researcher needs adequate and profound knowledge in his discipline, and also a broad understanding of other disciplines. How can we archieve this? Is it better to have a multidisciplinary education (for example, via a liberal arts education), which combines different research disciplines, and become a specialist afterwards? Or is it better to have a traditional education in a specific discipline (chemistry or physics) to achieve a deep-reaching knowledge in one field and get in touch with other disciplines afterwards?

I don't know what is better. I had a multidisciplinary education, and thus I came into contact with the different disciplines of natural sciences very early. During my studies, I learned that when physicists and biologists use exactly the same word they might mean something very different. There are even differences within one discipline: for example, the time for adding the "internal standard" to a sample in organic and inorganic chemistry is different.

Moreover, I learned that (1) it is necessary to have broad interests in adjacent disciplines and (2) it is easier to communicate with people who are right at the beginning of their research life. With enthusiasm and interest for different disciplines, it becomes much more easy to get in contact with people from other disciplines than thinking one's own discipline is the one and only true study. If you do think along these lines, people become incommunicative and uncooperative and any cooperation becomes impossible. Communication with people right at the beginning of their research life is something different than the communication with senior researchers: the 'beginners' are not that deep into their field and they can still imagine what the problems are for outsiders. Senior researchers, who are not used to interdisciplinary work and have worked on one specific issue a long time, may suppose too much expert knowledge and don't have the holistic view needed for interdisciplinary communication.

What are the challenges of interdisciplinary work?

Working across disciplines in a team can easily lead to misunderstandings or miscommunication. For example, the interpretation of research questions could be different or definitions and terms could be used differently. Maybe two disciplines have different definitions for one and the same issue. I have experienced this type of misunderstanding when using the same terms despite meaning something different several times during my studies. Sometimes it takes a while to recognize.

Not only can communication be a challenge, prejudices may also exist. Prejudices might concern the methods, the procedures, or the basic competence of the foreign

discipline. These prejudices should be corrected as far as possible, because otherwise there is no chance for successful cooperate and interdisciplinary work!

Also, there could be a lack of the theoretical and methodological knowledge necessary, and which must be communicated – very likely more than once. For example, imagine the following problem: you are working together with someone who measures something during an experiment. For your work, you need his results but in a different unit than measured. You cannot properly convert the measured unit into the one you need, because you need additional information about conditions during the experiment, which were not measured and cannot be reconstructed afterwards. Therefore, the results are useless for your work. Imagine further you explained the problem to your team partner in advance and he appreciated the problem. In the future, you can be sure that you will have to communicate this issue more than once with him, because the experimenter has measured this same way for a long time. In essence, keep communicating and don't get tired of it!

Also, the usual group challenges can occur, which appear in the course of cooperation, like problems with team coordination and planning.

For individuals, the challenge can be fully comprehending the other field. For example, some may be unable to judge the quality of results due to a lack of familiarity with the other disciplines, or they may not recognize the relevance of the knowledge from other disciplines. This could be overcome by work based in interest in the other field and, again, by communicating with the working partner.

What does it all mean?

Overall, I would like to mention the most important requirements for people who would like to complete interdisciplinary work, and those are: (1) broad interests in other disciplines, and (2) proper communication within the team (that also implies the willingness to explain a lot, most likely more than once).

If these requirements are fulfilled, one can gain a lot from interdisciplinary work: one can learn techniques and methods from other fields, achieve broader knowledge, develop new opinions, and appreciate different points of view. Thereby, one has new ideas and it stimulates research in its whole and raises new research questions. Moreover, you become able to achieve results by working in an interdisciplinary field: results which you could not achieve by working in one discipline.

Besides that, working across disciplines is often only a transient phenomenon: with time, interdisciplinary issues tend to become a new field of their own or even replace an existing field. For example, biotechnology is now accepted as a discipline on its own, resulting from interdisciplinary work in biology and engineering. In such a case, the interdisciplinary researchers become the specialists in this new field.

Alexandra Kroll *is a 2nd year PhD student at the Institute for Hydrobiology and Fisheries Science and a member of SICSS. She studied at the Institute for Chemistry and Biology of the Marine Environment (ICBM) at the University of Oldenburg, where she received a Diplom in Marine Environmental Sciences. In her PhD, she investigates the regulation of phytoplankton blooms by life cycle events by implementing numerical models.*

Interdisciplinary work

Christine Radermacher

Interdisciplinary research seeks to combine different scientific fields to solve problems that single disciplines fail to handle by themselves. In my PhD studies, I am concentrating on the climate modeling of extreme precipitation events. Moreover, I am working in a project that focuses on the assessment of landslide risks at present and in the future. Climate scientists (like myself) and geologists are working together across our disciplines. Through my project work, I have already earned some knowledge about interdisciplinary research that enables me to share my experiences.

Although the disciplines that are involved in this project represent different aspects of the geosciences, the scientific knowledge of people working in these fields hardly overlaps. On my first project meetings, for instance, I faced the real challenge that is communication. Just imagine the word 'model'! Different communities use this expression for very different things, with very different requirements and possibilities. Not communicating accurately about such terms can lead to misunderstandings that may have far-ranging consequences for the outcomes of the project. But why is communication so difficult for scientists nowadays? Has it always been like that?

When I think about the history of natural science, great names like Nicolas Copernicus, Alexander von Humboldt, or Alfred Wegener come to mind – discoverers, for whom interdisciplinary work was a logical consequence of trying to understand the world as a whole. Despite the interdisciplinary nature of their research, their findings were the basis for specialized research. Specialized scientists of later generations understood more and more about astrophysics and meteorology, about the nature of plate tectonics and the constitution of the earth. Today, many of the world's biggest riddles have been solved, but hundreds of puzzle pieces still keep falling into place, contributing to a better understanding of our world and the universe. During the 20th century, science underwent a shift away from the pure understanding of the laws of nature towards a better understanding of changes within the earth's system, the role of humanity, and most recently, the impacts of climate change on human life.

As a consequence of this shift, people realized that scientists working in only one single field of research couldn't tackle today's scientific problems. Instead, various disciplines need to be connected with one another. Besides aiming at the very central questions of one field, researchers are now confronted with problems that cross the borders of their fields. Specifically, the need for a growing socioeconomic component in earth system sciences arises due to changes in the climate system – whether or not induced anthropogenically – and their impacts on society. Unlike the old discoverers, we not only see our earth and the universe as a whole, but we face ourselves interacting with the climate system. These shifts in scientific thinking make it necessary to find a way to communicate efficiently across the fields.

But how can we achieve efficient communication? During my first project meetings, I sometimes felt uncomfortable communicating my work. I had the feeling that I was still very inexperienced, and was thus afraid that I would be unable to give the right answers to questions from senior experts, although they were from different fields. This feeling might seem familiar to many PhD students, especially in the beginning of their doctoral studies. Just remember: When you work in an interdisciplinary project and explain something from your field to people from a different field, you are likely the most experienced person in the room. In this situation you are the expert on the topic.

In giving oral presentations about my work at project meetings, I realized that it is worth the time to explain even the simplest facts about the model, or the methods I used. Otherwise, misunderstandings and mislead expectations about each other's work appeared very quickly. In order to prepare for a project meeting, it can be helpful to ask yourself some questions: For which purposes are other people using my results? Which additional information do they need to use my results successfully? What are the aims of their contribution to the project? When you present your scientific results, it is important to prepare them in a way that people from the other disciplines can understand the essence of the results. Nevertheless, make sure not to lose important information due to oversimplification. Obviously, this is a fine line. Ideally, people from each field would have some prior knowledge in the fields they are cooperating with. Of course this is not easily achievable if the involved fields differ greatly.

In my opinion, the greatest danger of interdisciplinary research is a loss of quality due to a lack of careful communication. In the ideal case, interdisciplinary research would be synergetic, but if people are not able to find a common language, interdisciplinary research can easily become a step backwards. It seems important to me that knowledge is aggregated at a high level to maintain the credibility of the completed research, especially when information is passed on to policy makers.

If people accept the challenge of communication across fields, interdisciplinary science can be a great success. For diverse scientific problems like climate change, different perspectives and the connection of specialized knowledge can build the basis for innovative solutions.

Christine Radermacher *is a 2nd year PhD student at the Max Planck Institute for Meteorology in Hamburg and a member of the IMPRS-ESM. She obtained her graduate degree in meteorology at the University of Bonn. In her PhD, she investigates changes in extreme precipitation over Europe.*

Literature List just a few examples in essay form, by no means comprehensive

Academic careers & time-/self-management, work-life balance

- **A Scientist by Choice,** Edward N. Lorenz (1991). Kyoto award lecture. http://eapsweb.mit.edu/research/Lorenz/publications.htm
- **Advice for a Young Investigator,** Santiago Ramon Y Cajal (1999). MIT Press. 172 pp. His advice originally appeared in Spanish in 1897.
- **Advice to a Young Scientist,** Peter B. Medawar (1981). Basic Books. 128 pp.
- **The Last Lecture,** Randy Pausch (2008). Hodder & Stoughton. 206 pp.
- **An Open Letter to the Next Generation,** James D. Patterson (2004, Jul.). Physics Today, p. 56–57.
- **Scientist: Four Golden Lessons,** Steven Weinberg (2003, Nov., 23rd). Nature, 426, 389.
- Tough Lessons for Survival in Hard Academic Times, John A. Duley (2004, Jan., 1st). Nature, 427, 13. ('Correspondence' to 'Concepts' essay by Weinberg).
- **Stop Trying to Get Tenure and Start Trying to Enjoy Yourself,** Gary W. Lewandowski Jr. (2008, Sep. 22nd). Inside Higher Education. http://www.insidehighered.com/views/2008/09/22/lewandowski (Substitute 'getting tenure' for 'getting a PhD').
- **Triaging the Behindedness,** Kim A. Kastens (2010, May, 5th). Blog. http://blogs.ei.columbia.edu/blog/2010/05/05/triaging-the-behindedness/
- **Solving a Work Problem,** Virginia Valian (1985). In M. F. Fox (editor), Scholarly writing and publishing: Issues, problems, and solutions (pp. 99–110). Boulder, CO: Westview Press. Available from her website: http://maxweber.hunter.cuny.edu/psych/faculty/valian/valian.htm.
- **Impostors Everywhere,** Richard Felder (1988). Chemical Engineering Education, 22(4), 168–169. http://www4.ncsu.edu/unity/lockers/users/f/felder/public/Columns/Impostor.html

Communicating with your advisor

- **BAs (Bad Advisors),** FemaleScienceProfessor, (2009, Sep., 1st). Blog. http://science-professor.blogspot.com/2009/09/bas.html
- **Try, Try, Try to Understand,** FemaleScienceProfessor, (2010, Mar., 31st). Blog. http://science-professor.blogspot.com/2010/03/try-try-try-to-understand.html

Oral presentations

- **Ten Secrets to Giving a Good Scientific Talk,** Mark Schoeberl and Brian Toon: http://www.cgd.ucar.edu/cms/agu/scientific_talk.html

Paper reviews

- **The Martial Art of Scientific Publication,** E. N. Parker (1997, Sep., 16th), Eos, 78 (31). Also available at: http://aas.org/career/ArtofSciPub.php

Careers outside academia

- **Finding Nonacademic Work Overseas,** Robin Moriarty (2004, Feb., 16th), Chronicle of higher education. http://chronicle.com/article/Finding-Nonacademic-Work-Ov/44765/
- **Quasi-Academic Careers,** Susan B. May (2009 Jul., 12th), Chronicle of higher education. http://chronicle.com/article/Quasi-Academic-Careers/47054/
  Susan B. May is the author, with Maggie Debelius, of „'So What Are You Going to Do With That?': Finding Careers Outside Academia".

Interdisciplinary work

- **Interdisciplinary Research and Your Scientific Career,** Richard M. Reis (2000, Sep., 29th), Chronicle of higher education. http://chronicle.com/article/Interdisciplinary-Research-/46386/
  Richard M. Reis is author of "Tomorrow's Professor: Preparing for Academic Careers in Science and Engineering". He is also the moderator the biweekly Tomorrow's Professor Listserve, which anyone can subscribe to.

Working Mother

- **Mama, PhD**: Women Write about Motherhood and Academic Life, Elrena Evans, Caroline Grant (2008). Rutgers University Press. 288 pp.
- **Motherhood, the Elephant in the Laboratory**: Women Scientists Speak Out, Emily Monosson (editor; 2008). Cornell University Press. 219 pp.
- **Karriere und Kind:** Erfahrungsberichte von Wissenschaftlerinnen Nikola Biller-Andorno et al. (editors; 2005). Campus Verlag. 328 pp.

Literature on scientific writing (not in essay form)

- **Scrutiny of the Abstract,** Kenneth K. Landes (1952, Jul.). Geophysics, 17 (3), 645. Previously in AAPG Bulletin (1951), 35 (7).
  Also available at: http://sepwww.stanford.edu/sep/prof/abscrut.html
- **The Elements of Style,** William Strunk Jr. & E. B. White (1918). Longman. 105 pp.
- **Style: Toward Clarity and Grace** (Chicago Guides to Writing, Editing, and Publishing), Joseph M. Williams (1995). University Of Chicago Press. 226 pp.

Call for submissions: The Wladimir Peter Köppen Award

The Cluster of Excellence CliSAP, KlimaCampus, University of Hamburg honors outstanding PhD theses in climate and earth system research with the Wladimir Peter Köppen Award. The award grants 5000 Euros and is presented annually to talented young academics who have completed their PhD work in the German-speaking area.

The award

The dissertations can be in German or in English and should not date back more than two years at the time of nomination. The candidates should not have yet reached their 30th birthday at the time of completion. Supervisors, professors or heads of the working groups can nominate appropriate dissertations and submit them together with a letter of recommendation to the KlimaCampus. The CliSAP Steering Committee selects the awardees on the basis of the recommendation of a scientific jury. The date for submission is the 31st of March of each year.

Contact

Dr. Ingo Harms
University of Hamburg
KlimaCampus, CliSAP Office
Grindelberg 5
D-20144 Hamburg, Germany

Tel. +49 (0)40 42838-4206
Fax +49 (0)40 42838-4938
ingo.harms@zmaw.de

Publisher
KlimaCampus, University of Hamburg
Cluster of Excellence CliSAP

Editors
Johanna Baehr, Ute Kreis
Cluster of Excellence CliSAP

Project coordination
Tiziana Maneljuk

Layout
medien&mehr, Wittorf

Illustration
Stephanie Poschmann, Hamburg

Print run: 300
CO_2 neutral printing

Hamburg 2011

This handbook has been written by PhD and MSc students studying at the School of Integrated Climate System Sciences (SICSS) and the International Max Planck Research School on Earth System Modelling (IMPRS-ESM). The schools offer PhD programs in climate sciences and earth system sciences, respectively, and are committed to promoting young academics.

SICSS is part of the Hamburg Cluster of Excellence "Integrated Climate System Analysis and Prediction". It links climate system sciences such as meteorology, physical oceanography and biogeochemistry in one curriculum. The school integrates also social and economic sciences as well as peace and conflict research and offers a Master`s and a PhD program.
IMPRS-ESM provides a high quality, modern and structured graduate education as well as an active exchange program and networking opportunities to students pursuing a doctoral degree in the emerging discipline of earth system modelling.

www.sicss.de
www.earthsystemschool.mpg.de

www.klimacampus.de

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

KlimaCampus