

# Supervisors at work!

Guidance of PhD candidates  
at EEMCS

*“Ultimately, the most important is to ensure you do not leave your PhD candidate to face his or her problem alone. Be pro-active and get to grips with your PhD candidate’s problem!”*

(Quote from one of the EEMCS supervisors)

#### Text

Hans Sonneveld (Consultant Graduate School, TU Delft)

#### Interviews & editorial team

Marcel Reinders and Paula van den Bergh (Graduate School EEMCS, TU Delft)

#### Design and lay-out

Saskia de Been (Media Solutions, TU Delft)

#### Traffic

Dominique Meijer (Media Solutions, TU Delft)

#### Photography

Annelies te Selle (P. 7, 26, 28)  
Marc Blommaert (P. 15, 18)

#### Printing

Edauw en Johanissen

© TU Delft 2014

A digital version of this report is also available on the website:  
[www.graduateschool.eemcs.tudelft.nl](http://www.graduateschool.eemcs.tudelft.nl)

This guide has been based on written and interview contributions from the following EEMCS staff members:

Catholijn Jonker

Jan van Neerven

Kofi Makinwa

Koen Langendoen

Kees Vuik

Kouchi Zhang

Miro Zeman

Ioan E. Lager

Fredrik Creemer

Geert-Jan Houben

Geert Leus

Michiel Pertijs

Henk Polinder

Fred Vermolen

Jos Weber

Henk Schuttelaars

Mathijs de Weerd

Jacob van der Woude

Bert Kooij

Edoardo Charbon

Martin van Gijzen

Frank Redig

Wouter Serdijn

Rob Remis

# Supervisors at work!

Guidance of PhD candidates  
at EEMCS

Graduate School of Electrical Engineering,  
Mathematics and Computer Science



# Contents

Foreword .....	6
The highlights.....	7
Introduction.....	10
<b>1. The pivotal recruitment and selection process.....</b>	<b>13</b>
Is there enough talent around? .....	13
If in doubt, what should you do? .....	13
Do not allow the Go/No Go procedure to be a substitute for proper selection.....	14
Scouting for talent.....	14
Possible stages in the selection procedure .....	14
What do we look out for?.....	15
The value of marks .....	16
Test assignments.....	16
Involve others in the selection process .....	16
Where to hold the interview? .....	16
How to conduct the interview?.....	17
The role of PhD candidates in the selection process .....	17
<b>2. Quality requirements for the PhD programme and learning objectives .....</b>	<b>19</b>
The thesis is not everything.....	19
How do we discuss our expectations?.....	20
Developing an academic attitude. How do you achieve this?.....	20
<b>3. Guidance, increasing autonomy and different styles of supervision .....</b>	<b>23</b>
Teaching independence .....	23
Differences in style... or is there an ideal way of supervising?.....	24
An inherent contradiction?.....	25
Is it possible to apply a standard approach? .....	25
Spotlight on international PhD candidates.....	26
<b>4. The different phases of the learning process .....</b>	<b>29</b>
Focus!.....	29
Analysis of strengths and weaknesses .....	29
Start to experiment in good time .....	30
Learning through publishing – start this in the first year.....	30
Should we opt for a top-level publication?.....	31
Have the PhD candidate take ownership .....	31
Support the candidate’s critical capacities.....	31

<b>5. Planning</b> .....	<b>35</b>
Planning principles .....	35
The first year .....	35
The Go/No Go review .....	36
The third year .....	37
<b>6. The boundary between supervising and taking over</b> .....	<b>39</b>
A development model .....	39
An opposing view: do not become involved in the writing.....	39
Suggesting solutions or stressing the need for independence.....	39
Others can also offer support in writing – other PhD candidates .....	39
Checking the quality of the English.....	39
<b>7. Personal attention and communication</b> .....	<b>43</b>
Supervision is intensive.....	43
How many PhD candidates can you supervise? .....	43
One-to-one supervision is on the decline.....	44
Special focus on the relationship between the principal supervisor and the day-to-day supervisor.....	44
Personal attention.....	44
Give praise and be open about criticism.....	45
Regular basis.....	45
Progress reports.....	45
What you should avoid.....	45
<b>8. Communication and support in a wider perspective</b> .....	<b>47</b>
Peers.....	47
Internal and external courses .....	47
Conferences .....	48
<b>9. When things go wrong</b> .....	<b>51</b>
The nature of the problems .....	51
So what should we do?.....	52
<b>10.The quality of the thesis</b> .....	<b>55</b>
Expectations.....	55
A book or four articles stapled together? .....	55
Structure the thesis as early as possible .....	55
<b>Conclusion</b> .....	<b>57</b>

# Foreword

In 2012, one year after the start of the Graduate School at Delft University of Technology, the Board of Directors asked the Faculties to focus on the professionalization of their Graduate School. Hans Sonneveld, specialist in setting up Graduate Schools and with a lot of experience in guiding en supervising PhD candidates, was invited to coordinate this trajectory at every faculty.

The Electrical Engineering, Mathematics and Computer Science (EEMCS) Graduate School focussed on supervision: getting more insight in the way supervisors act when guiding PhD candidates during their PhD. For that mentors and PhD supervisors were consulted: PhD supervisors were asked to give advice to an imaginary new colleague, and the Director of the Graduate School interviewed eight principal PhD supervisors (*promotors*). The results of both of these exercises have been brought together in this guide. **Consequently, it is a compilation of different point of views about how supervision is given at this Faculty, not a judgement on how to supervise.** As such the text should be read as a nice collection of experiences by colleagues and not as an official standpoint on supervising PhD candidates by the EEMCS faculty. To convey the different views, we chose for a narrative style in which the reader is addressed by an experienced supervisor.

Hans Sonneveld, at the request of the EEMCS Graduate School  
Marcel Reinders  
Paula van den Bergh

March 2014

# The highlights

## Selection

Set high standards when appointing PhD candidates! If in doubt, it is better not to appoint anyone at all as this prevents having to correct a poor selection decision when it comes to the Go/No Go review. Do your best to scout for talent. Look among the Master's students, students you may have met at conferences or who have been recommended by your colleagues. If possible, use a formal, open recruitment process. Never select purely on the basis of written materials, and never recruit on your own. Conduct a personal interview (via Skype or face-to-face) and try to see the candidate at work, by reading their Master's thesis, setting test assignments or asking them to comment on the project they will be working on.

## Learning objectives

Doing a PhD is more than doing research, publish and writing a dissertation. What we are aiming to achieve is increased knowledge in the broadest sense: it is important that PhD candidates develop their academic attitude further. Fundamental competencies include technical skills, presentation skills, writing skills and the ability to formulate a research question. It is vital that we always discuss our expectations with PhD candidates and how we envisage our role and theirs.

## Ever-increasing independence

From the outset, ensure that there is a reasonable level of structure. The direction you provide should decrease as the PhD candidates make progress. Some students take time to become accustomed to the demands we place on their own initiative. Challenge the PhD candidates by asking questions rather than merely providing answers. They have personal responsibility for honing their research question, compiling their plan and taking control of the process. Of course, there will always be research projects with a number of questions, but that usually leaves plenty of room for interpretation and a personal slant.

## Differences in styles of supervision

PhD candidates come from many different countries and from very different cultural backgrounds. But, one size does not always fit all. Tailor the style and degree of supervision you provide to the specific needs and characteristics of the individual PhD candidate. At the start, invest a great deal of time in becoming better acquainted with him or her. Then opt for the style of supervision that is most appropriate. As supervisor you need to be able to switch between different styles of supervision, both 'horizontally' (between different candidates) and 'vertically' (across the four years supervising a single candidate).

## Planning

Planning basically involves three key principles. Firstly, it is not a linear process. Sometimes, a PhD candidate may publish very little in one year and then suddenly issue three publications at the same time. Secondly, structure is important. PhD candidates are usually funded externally, in which case there will be a project proposal. It may be possible to depart slightly from the details in the plan, but the PhD candidate usually needs to stick more or less to the project proposal. Thirdly, we need to incorporate flexibility into the process, although it may seem at odds with the need for structure.

## The different phases of the learning process

Any gaps in knowledge or skills that may be missing need to be rectified as soon as possible. If a PhD candidate has no experience in the field in which he/she is to work, it is advisable to combine a literature survey, culminating in a literature review six months later, with a small assignment. Give the candidate an opportunity to get to grips with the project proposal soon after they arrive. After six months, the original research question needs to be revised as appropriate. Having a clearly-defined research question is crucial for many of the things that will happen from here on in. A PhD candidate must 'get his or her hands dirty' at an early stage: in other words conduct experimental work that enables him or her to become acquainted with the practical challenges, possibilities and limitations. Give the candidate an opportunity to practice writing very early in the process. They should be capable of writing their first article by the end of the first year. Take the Go/No Go review seriously. By that time, the PhD candidate must be able to specify clearly what he or she intends to do, why, when and how. The second and third year are the productive years, involving the writing of around four articles (chapters for the dissertation). This leaves time in the final year for an additional chapter, to conduct a major experiment or something similar. The last six months are for writing the thesis. The substantive part of the work must have been completed by the end of the third year.

## Supervision

Supervising a PhD candidate is an intensive activity: providing occasional tips and meeting once a month is not sufficient. At the start, there will be a lot of contact with the candidate in order to ensure that the topic suits him or her and that he or she does not become bogged down in the details, etc. Have the PhD candidate write a weekly report on what he or she has done. A supervisor should be capable of serving as the principal supervisor for around four PhD candidates. Candidates who come from abroad can often be quite lonely during the first weeks or months. Give praise if he or she does the work well. Be alert to the formation of groups among PhD candidates. Peers can play an important role in supervising each other.

## Problems

Supervisors encounter numerous problems. PhD candidates can find it a major step in



making the transition from conducting research to writing about the results. Some candidates are simply not good enough (despite our selection procedures). It is much more difficult to anticipate whether a PhD candidate will face personal problems, or needs to qualify against a background of difficult private circumstances. Candidates may also lack essential personal qualities or set standards for themselves that are too high. If the odds are stacked against them, they can start to lose motivation. Is day-to-day supervision working well, are there problems with communication? How do we respond to problems? Do we take action or let the issue continue unabated? If we face serious problems with PhD candidates, what options do we have? Talk, talk and more talk. In the case of personal problems, refer the candidate for professional support.

# Introduction

Before taking a look at the key aspects of supervising PhD candidates, I<sup>1</sup> should warn you and at the same time congratulate you: do not expect to find a succinct list of do's and don'ts. Try to be aware of your own style and to build a bridge towards your PhD candidate. Occasionally ask him or her how he or she thinks the process is proceeding so far. Ask what he or she would like to change and how you can help with this. Make clear what your opinion and expectations are. If you are a principal supervisor (*promotor*), make sure you also involve someone else in the supervision process. Some PhD candidates find it difficult to share their PhD-related problems with the boss! They may be more willing to do this with an assistant or associate professor, a post-doctoral researcher, another PhD candidate, or their PhD mentor. Encourage them to stay in contact with their PhD mentor. He or she is there to help, and may be able to assist in seeing things more clearly at times when interaction with the PhD candidate may be difficult.

Being someone's principal supervisor or co-supervisor is a privilege: it enables you to work with people who may be even smarter than you, their only 'disadvantage' being that they are younger and less experienced. With the right supervision from you, they could reach unparalleled heights. Enjoy the experience!

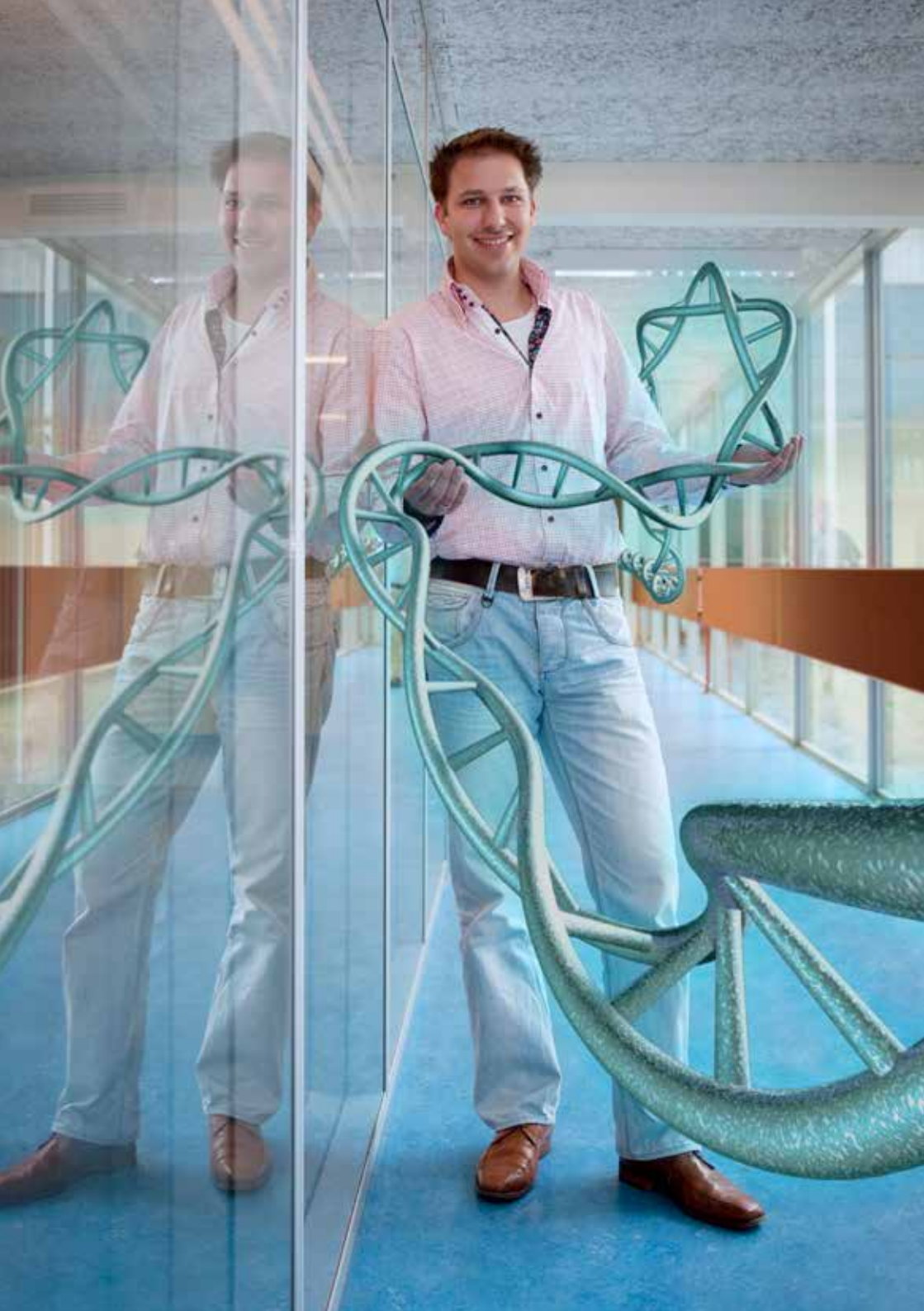
In this overview, I look at the key ingredients for the effective supervision of your PhD candidate. I start by looking at the **selection of the PhD candidate** (Chapter 1). If we do that properly, we can seriously reduce the likelihood of problems. After selecting a PhD candidate, it will be time to discuss what expectations we have of him or her. What is it that makes a PhD programme successful, **what are the learning objectives**? Of course, the PhD thesis takes centre stage, but we expect more than that. That is the subject of Chapter 2. A key aim of the supervision we provide is to ensure that the PhD candidate becomes increasingly independent. This **independence** is not something that I assume to be present from the outset. Chapter 3 is all about how you can nurture that independence. This brings us straight to the question of whether there is a one-size-fits-all model for supervision. In Chapter 4, I will show that, as a supervisor, you need to be able to **adapt** depending on the PhD candidate you are working with. Quickly make your **expectations** clear to your PhD candidate, enable the PhD candidate to **focus** on what matters and carefully **phase** the work. This is covered in Chapter 5.

In Chapter 6, I take a look at a sensitive subject. There will often be occasions when we work with a PhD candidate on a publication. **How far should we go in this?** Should we take over the writing of it? Does that not conflict with the requirements laid down in the

Doctoral Regulations? What happens if a PhD candidate performs poorly once appointed? In Chapters 7 and 8, I look at the **demands** that I place on my **supervision** and the essential **cooperation with colleagues** that this involves. A PhD candidate not only benefits from the support we can offer but can also learn a lot through contacts with **third parties** (Chapter 8). Before concluding with a chapter on the **quality requirements** that we set for **the PhD thesis** (Chapter 10), I examine the **problem scenarios** that PhD candidates may face. What can we do to help them (Chapter 9)?

<sup>1</sup> To put the views of the different contributors together we chose to make use of a narrative style in which an experienced supervisor speaks





# 1. The pivotal recruitment and selection process

## Is there enough talent around?

People sometimes say that the number of good candidates with an interest in a PhD position is on the decline. Increasing numbers of good candidates are opting for life in business and industry. In order to ensure that funded PhD positions can be filled, there can be a tendency not to look too closely at the quality of the candidates or their study results. This can cause all types of issues, such as problems with the quality of research, or issues with the written and oral communication skills. Ultimately, if you admit PhD candidates who are not up to the job you will only end up creating more work.

So the quality of the candidates is extremely important and it is something that you need to identify and measure properly. This is rarely an easy process. I heard one colleague dividing candidates into three different categories: 1) the very good PhD candidate, 2) the middling candidate and 3) the less-than-ideal candidate. In practice you will encounter all three. The less-than-ideal candidates take up a lot of valuable time. Even the very good PhD candidate requires time investing in him or her, but in a positive sense. The middling candidate is often given the least time of all, even though he or she has most to gain from the supervision.

## If in doubt, what should you do?

The reliance on external funding for PhD research can complicate matters. In some projects, there are PhD positions but no good candidates can be found. In the case of an external grant, it is worth considering seriously whether a PhD position definitely needs to be filled if the right candidates are not available. There are other possible alternatives. You can fill the position with a post-doctoral researcher or a researcher/technician with no plans for a PhD in order to deal with the more practical objectives of the project.

Set high standards when appointing PhD candidates! In my experience, it is better not to appoint anyone if in doubt; failure to apply this rule has so far mainly resulted in disappointment. Experience shows that good selection can prevent numerous problems at a later stage.

### **Do not allow the Go/No Go procedure to be a substitute for proper selection**

Of course, there is always a Go/No Go review a year down the line when a decision will be made in consultation as to whether a PhD candidate is allowed to continue, but this must always be an emergency measure only. We must prevent our project being delayed by a No Go decision when part of the budget has already been spent. This means that pre-selection, before arrival, is highly recommended. The same also applies to the PhD candidate who accidentally 'wastes' a year, even though he or she may have learned quite a bit in the process.

### **Scouting for talent**

There are actually three types of candidates. The first of these are former Master's students. Secondly, there are candidates that you met at a conference or during a visit or who have been recommended by a colleague whose judgement you value highly. The third category, which is also the most difficult to judge, are the candidates that you need to assess purely on the basis of written materials.

Previous experiences of a candidate in the Master's programme can prove extremely valuable. In the Master's phase, I teach subjects that many students struggle with. But there are always a few good ones who just love the work and cannot get enough of it. The ones that enjoy it come back for their Master's thesis. If you have supervised someone during graduation for a whole year, you have quite a good idea of someone's strengths and weaknesses and can effectively assess whether you would like to continue with that person for another four years. The Master's results also provide a good impression of the students' qualities, enabling you to screen them for potential PhD talent, which makes these kinds of candidates the safest bet in my experience.

### **Possible stages in the selection procedure**

I have experienced various different types of selection procedures. A key decision to be made is whether to opt for a formal, open recruitment process or something more informal, when we actually know from the outset that we would like to include the candidate in our group. The latter usually happens if we already know the candidate through colleagues or as a Master's student. Despite this, I still prefer a formal procedure. With internal, preferred candidates there is always a risk of persuading someone to take on PhD research without first checking carefully whether he or she really has the motivation and the right knowledge for the specific project. There is also an invitation to come

along and talk and meet other PhD candidates: in other words, a whole programme that needs to be devised and organised.

With external candidates, I try to start by conducting an in-depth interview via Skype. This usually lasts about an hour. I also set them an examination to do by e-mail (“here is the examination, I would like to have the results within two days”). This gives you some kind of impression of what the candidate is capable of now. This is followed by a Skype call in the presence of a few colleagues, in which the PhD candidates give a presentation of the results. All of these different stages (successful individual interview, examination, successful interview together with colleagues) form the basis for the decision of whether or not to invite the candidate. Sometimes a Skype interview will actually be sufficient, but in other cases an invitation is genuinely necessary. Of course, it is important for a candidate to fit well into the team. If one candidate is being invited, several others are often also invited (one, two or three extra) in order to have a range of candidates from which to choose. This may be followed by some kind of vote within the group. But the procedure is not perfect. There can still be surprises, such as a ‘No Go’ a year down the line, even in the case of students who have previously graduated *cum laude*.

### What do we look out for?

Although I try to be selective, it can be difficult. We need to gain an impression of someone’s qualities based on written materials. A degree transcript does not reveal everything (especially if it is from abroad). For me, creativity is very important and this is why I find this personal interview so valuable. In order to judge writing skills, I ask to see the graduation report or publication. References are also requested. I have a particular weakness for people who are pro-active and they also need to be well motivated. You need to discover people’s personal characteristics and this very much depends on your own judgement and feeling. Yet, you may have a very good feeling in a personal interview but you could be completely wrong.

As well as testing specialist knowledge, selection also needs to test writing and presentation skills. Is the candidate able to convey his or her ideas to others or does he or she at least have the potential to learn to do that? Some people are outstanding researchers but have great difficulty in delivering a consistent piece of writing. This is something you need to discover during a selection procedure because it can have a major impact during the writing of articles and the PhD thesis. Of course, being able to work independently is important, but this is something very difficult to measure. Again, this is an area where feeling plays an important role. There needs to be a match of personalities in order to make a healthy and creative communication process possible. When appointing a PhD candidate, alongside academic qualities and knowledge, it matters to me that a good relationship can develop, in other words that we can quickly evolve a rhythm in which we can bounce ideas off each other in a relaxed atmosphere.

### The value of marks

When assessing one's own MSc students, the final mark they achieve is very important (preferably 8 or higher). In the case of PhD candidates from abroad, the marks are not very meaningful unless you have such information as the Grade Point Average (as you do for American candidates).

### Test assignments

I often set some kind of test assignment that reflects the subject of the PhD project and focuses in on a particular area of doubt. This could be writing a commentary on the project including a view on what they can contribute, or, as another example, this could be a programming assignment (short, small, difficult to set up, but something that you think you could write within an hour and that your prospective PhD candidate has a week to complete). This is then followed by an interview about it. This definitely helps in deciding whether a student is capable of taking on a PhD.

### Involve others in the selection process

In my view, you should never do the selection alone. Here, selection almost always takes place together with several colleagues in order to gain a more nuanced impression of the candidates. This will not completely stop you making mistakes, however. Sometimes, certain issues matter more to the principal supervisor than they do to the day-to-day supervisor. Since it is the day-to-day supervisors who will do much of the work with the PhD candidate, I can have a tendency to ignore certain issues only to think later: I would have preferred to have rejected that PhD candidate. I do try to act on my own opinion and feeling about the candidate as far as possible: it is ultimately the principal supervisor who is responsible for the success of the PhD programme.

### Where to hold the interview?

The issue of where and how to interview candidates can be difficult. Of course, with Dutch students this is no problem. With students from abroad, there is always the question of whether to invite candidates to the Netherlands or to interview them via Skype, for example. Some colleagues insist on always seeing candidates in the flesh whereas this does not matter so much for others. Some of them find a Skype interview quite adequate but others do not like that approach at all.

The costs and the time available play an important role in this. The information submitted in the job application can also be decisive. If there is a good CV and references, it is possible to arrange most things by Skype or e-mail and a face-to-face interview may not really be necessary. But, in this case too, there is no general rule: it depends on the candidate. If there are questions about the CV, the candidate will be invited for an interview, since this enables more in-depth questions, for example about the Master's thesis. Personally, meeting candidates is important to me, so that I can experience their



personality. It is not only knowledge that matters, but also who the person is. It is difficult to gain such impression in a Skype interview.

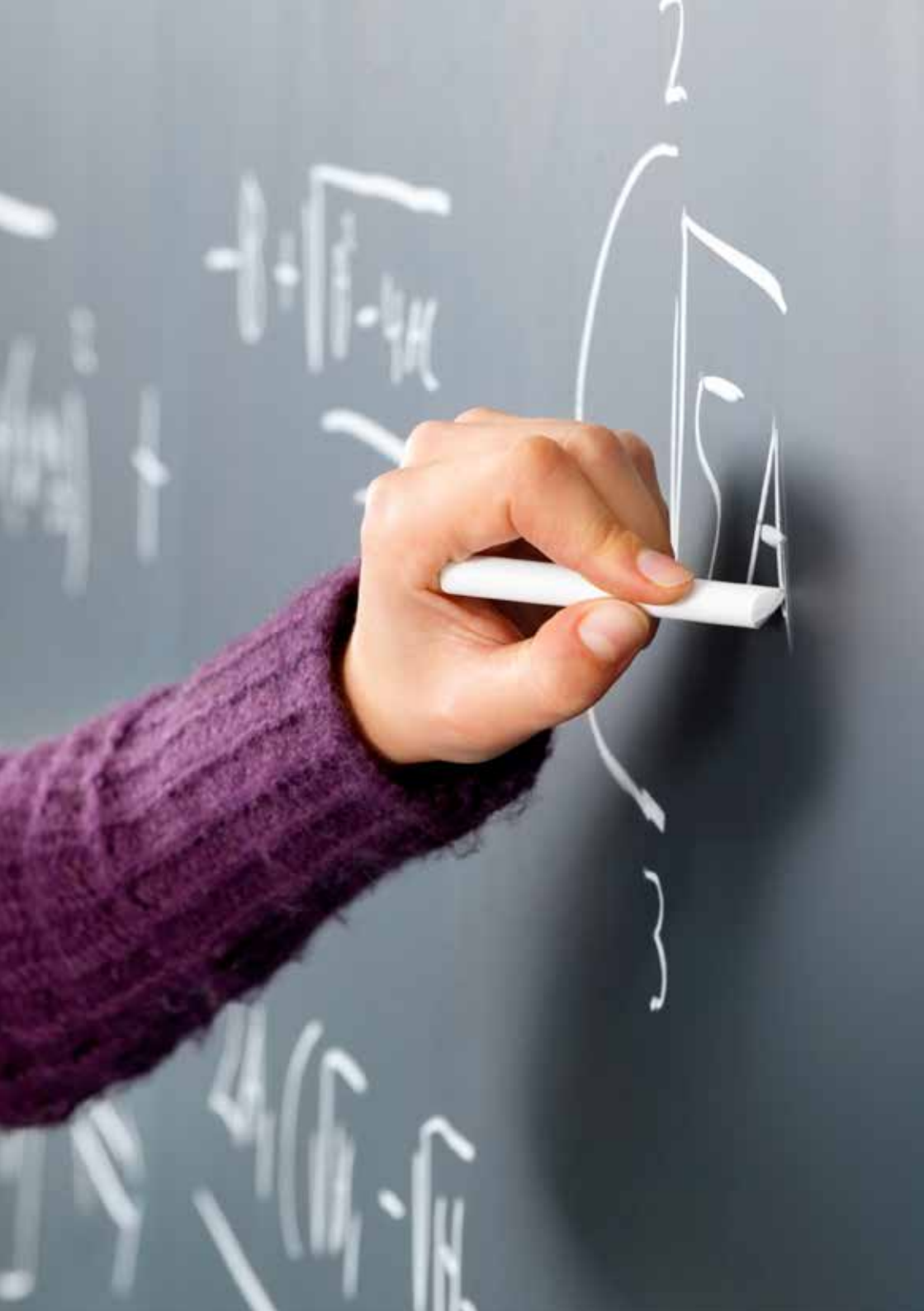
### **How to conduct the interview?**

It is important to go into detail in the interview. What has the candidate done, independently, or as part of a team? What is he or she capable of, how did the graduation process go and what is the quality of the thesis? Does the candidate understand what he or she has done from a theoretical perspective? An in-depth interview is important, because both you and the candidate need to be certain of your choice. The interview helps you to do this by homing in on what matters. Sometimes I suggest that a third person sits in the interview, just observing. Alternatively individual interviews are conducted consecutively by the selection panel: every staff member interviews in his or her own way and then gives feedback on this. Only after all the interviews are people's experiences discussed (in order to avoid influencing each other).

I always prepare interviews carefully in advance. I allow the candidate to speak freely, focusing in on three themes: the substance of the project, the motivation to complete it within four years and perseverance, as well as the 'soft skills'. I try to have an open discussion so that the candidate can feel more relaxed and able to speak.

### **The role of PhD candidates in the selection process**

One colleague tells me that he occasionally involves other PhD candidates in selecting new PhD candidates. He enlists their assistance at the start of the process in scouting for candidates and asks them about the university or the CV. He listens to their opinions and takes them into account in his decision. However, they are not included in the appointment committee. Another colleague goes even further, by asking all of the PhD candidates to hold their own Skype interview in order to give their opinion. Their views on the candidates can sometimes be even harsher than those of staff.



# 2. Quality requirements for the PhD programme and learning objectives

I assume that you have been able to find a good PhD candidate. It is now time to work with him or her and formulate our objectives. What substantive matters need to be addressed, what additional training or teaching does the PhD candidate need and what agreements should be made about supervision? In this section, I would like to look at learning objectives.

## **The thesis is not everything**

In the case of our PhD candidates, it is about more than simply doing research, publicise and compiling the PhD thesis. Unlike in the past, we also focus on increasing knowledge in a broader sense. What other so-called 'products' do we have in mind, in addition to the thesis and the articles that form its basis? I'm thinking of attending conferences, gaining experience abroad and applying for patents. The overarching aim is to ensure that my PhD candidate develops his or her academic attitude. In this context, increasing creativity and independence are key indicators. My PhD candidates increase their knowledge, will know more about the subject than I do, become proficient in the

art of writing a literature review and be able to devise good research questions. Technical skills are also essential in the kinds of projects we work on. You should not automatically assume that your PhD candidate has mastered these. Make sure you check this. Then there are what we call the 'soft skills' which are important for a successful PhD research too, but also for later in their careers.

### **How do we discuss our expectations?**

The process of achieving a PhD has to happen within four years. Fundamental competencies include technical skills, presentation skills, writing skills and the ability to formulate a research question. During the programme, the PhD candidate must make demonstrable progress in all of these areas. For this reason, I discuss these competencies with the PhD candidate. In order to ensure that both sides' expectations are covered, I discuss with the PhD candidate what the minimum requirements will be by the end of the programme. The emphasis here is on the end of the programme, since the PhD candidate does not need to be able to do everything from the outset. We conduct a SWOT analysis together on a regular basis. This enables us to discuss what action to take in the light of any weaknesses identified, as well as strengths. Should the focus be on improving weaknesses or on developing strengths?

As a supervisor, I believe that you should aim to ensure that a PhD candidate takes as much personal responsibility as possible for his or her own PhD (just as an independent entrepreneur takes responsibility for his or her business). The PhD candidate must devise and update his or her own plan, take the initiative, look for assistance where necessary, ensure that discussions with the supervisor are effective and take feedback to heart, etc. Some will take the initiative in doing this, whereas others will need encouragement. Whatever the case, it is essential that you discuss what you expect with your PhD candidate, how you envisage your and his/her role in the research and ascertain exactly what the candidate's own expectations are. Overall objectives, expectations and responsibilities need to be clear from the outset.

### **Developing an academic attitude. How do you achieve this?**

What exactly is an academic attitude and how can you foster this in your candidates? I always aim to ensure that PhD candidates develop an academic attitude, but the question is: how do you achieve it? Personally I think that leading by example can be very effective. Work with your candidates and show them what is and what isn't important. An example of this might be writing an article: the academic attitude is all about which details to include and which to omit in an argument, how you construct your ideas in such a way that they appeal to a wider audience. Ultimately, it is all about the transition from a MSc 'mode' to a PhD 'mode'. I like to see it as shifting one's attitude to study from that of consumer to producer.





# 3. Guidance, increasing autonomy and different styles of supervision

## Teaching independence

At the start of the PhD programme, formal agreements need to be established. These will set down the obligations and freedoms that the candidate and supervisors will have. For example, the supervisors must have a clear impression of the research that the PhD candidate is supposed to be conducting. They need to have this even before the PhD candidate has been appointed and be able to issue the candidate with instructions that enable him or her to make good progress, especially at the start. The supervisors are expected to be able to provide a reasonable amount of structure at the start of the whole programme. The guidance provided should gradually decrease as the PhD candidate makes progress and has completely disappeared by the end.

Once selected, the PhD candidate needs to live up to expectations, for example by successfully completing courses at a research school that is appropriate for the research. He or she also needs to complete the first assignment set by supervisors in accordance with these expectations. At the end of the initial period, the PhD candidate will begin to exhibit a degree of independence, for example by contributing his or her own ideas for a follow-up to the initial assignment. In this process, the candidate will begin to operate more independently, demand less support from his or her supervisors and gradually begin to start guiding his or her supervisors, rather than the other way around. The longer

this process continues, the more I begin to see my PhD candidate as a member of staff and as a colleague. We are in the same boat, so to speak, part of the same endeavour. Of course, in the real world these basic principles will not always be followed to the letter. They exist simply to serve as a guide. The supervisors are responsible for ensuring that an atmosphere and context develops in which it is possible to communicate openly with each other: both the PhD candidate and the principal supervisor will feel at home, accepted and respected in a relaxed atmosphere where freedom of thought prevails. You should also aim to collaborate intensively with your PhD candidate. As far as possible, try to tackle research problems together, since this both challenges and motivates the candidate. Try to create space for the PhD candidate to apply his or her own initiatives. The time available plays a crucial role in your decision to give your PhD candidate room to take the initiative. If the original project is under control and on schedule, you can feel relaxed about allowing the candidate to take the initiative. This means that the amount of freedom and personal initiative that may be possible cannot be pre-scheduled in advance.

### **Differences in style... or is there an ideal way of supervising?**

Together with your PhD candidates, you can reach unparalleled scientific heights, the world becomes a little richer in terms of leaders in the technical sciences and you have a fantastic opportunity to extend your network. But this can only work effectively if you are successful in building a bridge towards the PhD candidate and are alert to his or her talents, skills, personality and cultural background. But which style of supervision is most appropriate? Indeed, are you aware of the style you apply in supervising PhD candidates? I would certainly not describe myself as a style guru, but I do see my style as being quite different from that of my immediate colleagues.

Some colleagues are extremely directive. They tell their PhD candidates exactly what to do and set an assignment that has clearly-defined parameters. Their monitoring of PhD candidates' progress is highly limited and sporadic. There is little discussion of the method chosen, the how and why, only about the result to be achieved. This result needs to be better than anything currently in existence in the world in order to enable it to be reported at a major international conference. Their PhD candidates complain about what they see as a lack of supervision and support, make jokes at the expense of their supervisor, make a great deal of effort and work long days. They rely on each other in order to learn, but they are not a closely-knit group.

There are also colleagues that have an opposite style, more explorative, creating opportunities. They never tell their PhD candidates exactly what they have to do. At the start of the PhD research, they take a look at the field together with the candidate and look for interesting opportunities. They try to identify a relatively empty area in the design space, where there may be possibilities for some good artefacts. The question is how



to identify or invent these, and how to gauge the potential for success in advance. This process of exploration can cause confusion among the PhD candidates because some, although not many, expect the supervisors to have a complete overview of every detail of the field and expect the assignment to have clear-cut parameters. However, this is not the case, especially in totally new areas. These kinds of supervisors believe that PhD candidates should work on areas that are completely new and that involve a new step in terms of methodology. They like their PhD candidates to surprise them.

### **An inherent contradiction?**

At its heart, the role and position of a PhD candidate contains an inherent contradiction. On the one hand, it is a position in which someone has the opportunity to extend his or her knowledge in order to be able to conduct research at a sufficiently high level. On the other hand, it is also expected that someone is able to assist the supervisors scientifically, for example by elaborating on their ideas, or even coming up with their own ideas and developing these independently. Their independence is important because the supervisors often lack the time needed to conduct scientific research. Clearly, it is not possible to fulfil both of these aspects simultaneously, especially not in the early stages as a PhD candidate. Should the training aspects involved in educating a PhD candidate be given greater emphasis? If so, the supervisor can prove useful in setting an example.

### **Is it possible to apply a standard approach?**

PhD candidates come from many different countries and from very different cultural backgrounds. In my experience, there is no 'one size fits all'. It is preferable to tailor the style and degree of supervision provided to fit the specific needs and characteristics of the PhD candidate. I recommend investing a lot of time initially in becoming better acquainted with the PhD candidate (his/her background, current situation, expectations, etc.). And then opting for an appropriate style of supervision, always taking account of the requirements set for PhD candidates at TU Delft, of course.

If my PhD candidate demonstrates independence as well as the capacity to be innovative and a wider understanding, I consider him or her to be a successful candidate. So how do you ensure, as a supervisor, that these three characteristics come to the fore? In my experience, there are various ways of achieving these qualities and these differ for each PhD candidate. Some candidates require little supervision / guidance and just need to be held back from the high-hanging fruit or topics that are scientifically unimportant. These candidates require only high-level supervision. Micromanagement can be dangerous since candidates can feel it inhibits them and pressurises them to apply standards set by others. On the other hand, some PhD candidates find it difficult to cope with too much freedom. Especially at the start, they require strict monitoring, with day-to-day management and regular reports. Most PhD candidates are somewhere in between the two and need a combination of detailed supervision and a more detached approach.

The main challenge is to discover the potential of our candidate and enable him or her to develop it to the full.

As a supervisor, you need to realise that you must adapt between different styles of supervision. Of course, you will need to do this if you have several different PhD candidates, but also in the process of supervising just one candidate. In other words, you need to be able to adapt your style both 'horizontally' (between different candidates) and 'vertically' (across the four years supervising a single candidate).

### **Spotlight on international PhD candidates**

I am also very conscious of the characteristics of what you might call transcultural supervision. Whether any problems actually arise from cultural differences or from the personal characteristics of the candidate, cultural background aside, is an interesting question.

I also acknowledge that this issue is dynamic in nature. Among the more recently-arrived Chinese PhD candidates, I have observed a clear trend. This new generation of Chinese candidates can sometimes be more direct than the Dutch candidates. If you point out that you would like to change something, they will simply say no... So, in the practical world, everything changes all the time. This is why, in practice, I try to strike a balance between adapting to the cultural differences myself and expecting my PhD candidate to adapt to what may be a new style of communication for him or her. I am often quite blunt in making this clear.

One area on which I always work is the development of a more critical attitude. I ask the PhD candidate to review papers. This is a useful strategy. Do they adopt a critical approach to this? If not, this will be something to discuss and work on.

There is another point on which I increasingly focus: it is easy to impose one's own worldview on other people and this is not always advisable. It can lead to major misunderstandings. I always ask questions to make sure everything is clearly understood. One good way of doing this is to ask the PhD candidate to write a brief report on your meeting. This enables you to rule out any misunderstanding.





# 4. The different phases of the learning process

Based on the above, I boil things down into phases and key points within the working process of the PhD candidate.

## **Focus!**

One of the most important issues that PhD candidates need to master is the ability to focus on what really matters: the PhD thesis and the research required for it. There is no shortage of distractions. Firstly, there is the large amount of information that candidates need to process and this can cause the core of the project to become blurred. Secondly, many PhD candidates have to deal with all sorts of different problems simultaneously, because they are involved in different projects. It is highly likely that not all of these projects contribute equally to achieving the final objective of the PhD programme. The thesis can suffer if the candidate faces various different strict deadlines and demands. This can lead to unnecessary delay and negative repercussions in terms of completing the thesis.

## **Analysis of strengths and weaknesses**

Any gaps in knowledge or skills that may be missing need to be rectified as soon as possible. Personally, I always apply a research plan, in principle ensuring that the candidate can achieve the PhD in the space of four years (of course, this plan tends to change during the process). If the PhD candidate has no experience in the field in which he or she is to work, I recommend starting with a combination of a literature study and a small assignment, a project that the candidate can solve with the help of the literature and a little effort of his

or her own (preferably with an extension that is not trivial, since this is important as motivation for the candidate!). The project should lead to a report that is not yet publishable as such but could form a firm basis for a first publication. After six months, also ask the candidate to revise the original research question as appropriate. Having a clearly-defined research question is crucial for many of the things that will happen from here on. The PhD candidate must have a clear idea of what this is. If things go well, you will probably also learn a lot from it yourself. As a supervisor, you have much less time than the PhD candidate to read up on the specific area. The literature study and revised research question will also prove useful for the six-month interview and the Go/No Go review. This also enables you to gain a good impression of the quality of the candidate's research and writing. If the PhD candidate is already at a high enough level to conduct research (which rarely happens in my case), I would tackle one of the research questions straight away, again with a view to gaining an impression of the candidate's ability to conduct research and write reports.

### **Start to experiment in good time**

Many of our PhD candidates conduct research into design techniques and create experimental prototypes. I consider it to be important for a PhD candidate to get his or her hands dirty at an early stage. In other words, carry out experimental work in order to become acquainted with the practical challenges, possibilities and limitations. In this respect, some PhD candidates can be reluctant to take the leap and prefer to spend a long time extensively studying the theory and literature and simulating and optimising their design. But in practice things can be unpredictable. When the first prototype is ultimately tested, an unpredicted problem or effect can emerge that has not been identified at any stage in the preliminary process. Quickly starting with more practical work and then continuing with deeper analysis and optimisation of the design can prevent this. This also proves useful in making a well-considered decision in the Go/No Go review after a year.

### **Learning through publishing – start this in the first year**

There is currently a lot of pressure to publish. Give the PhD candidate an opportunity to practice this very early on in the process. I encourage my candidates to start working on their own thesis from the very beginning. The likelihood of this material ultimately ending up in the thesis is, of course, minimal. But it is an excellent exercise in developing a good style and a good structure in order to ensure that readers fully understand your message. It is also a very good way of encouraging candidates to express their ideas in the English language, which may not be their mother tongue.

So how should we time all of this writing? Personally, I use the following model, which, of course, will always need to be tailored in line with practice. They should be capable of writing their first article by the end of the first year. I like to have received this first paper before the Go/No Go review. The second and third year are the productive years, involv-

ing the writing of around four articles (chapters for the PhD thesis). This leaves time in the final year for an additional chapter, to conduct a major experiment or something similar. This is what we agree in broad outline. The last six months are for writing the thesis.

### **Should we opt for a top-level publication?**

At times it can be tempting to aim extremely high, but it is actually a case of all or nothing since it involves an investment of several years and it is questionable whether it is something worth taking on. For assistant professors this is a good option (better one good publication than ten mediocre ones). However, this is not the message that I convey to my PhD candidates.

The level of the publication will also depend on the subject. Sometimes it is possible to publish at a higher impact factor, but certain subjects do not allow for this. It is something that we discuss in the team. If we can achieve a high impact factor, we will aim to do that, but what really matters for the PhD candidate is to ensure that the thesis is complete within four years.

### **Have the PhD candidate take ownership**

I find it necessary to challenge the PhD candidate by asking questions rather than merely providing answers. They have personal responsibility for honing their research question, compiling their own plan, finding their own way and taking control of the process. It is up to them to demonstrate the relevance of the research. Of course, there will always be a research proposal with a number of questions, but that usually tends to leave plenty of room for interpretation and a personal slant. Additionally, I sometimes deliberately ask questions that I know are more likely to confuse the candidate than help them, because I think that they need to learn to think independently and critically. Place trust in the PhD candidate, but also make sure you give him or her responsibility too. The aim of the PhD programme is to educate someone to become an independent researcher: this is why I think it is so important to allow the candidate to grow in independence, in order to discover and experience his or her own scientific personality. This happens faster or slower depending on the person, but it is always in this direction that my supervision process is heading. The results achieved are their results, able to come to fruition thanks to my help. This is why I believe you should give a PhD candidate a lot of freedom, whilst making sure you have regular meetings in order to discuss progress and provide feedback.

### **Support the candidate's critical capacities**

Try to conduct an intellectual debate with the PhD candidate at a high academic level. Encourage a sceptical and critical attitude (also with regard to one's own work). A PhD candidate should take nothing at face value or on the basis of someone's authority. You should therefore promote critical thinking. With all of the bibliographical sources

available electronically, there is a temptation for PhD candidates to be satisfied with the information that is most readily available. We really must prevent PhD candidates basing their work on sources that have not been subjected to a thorough peer review. My PhD candidates must develop a critical attitude towards their sources and check information using independent sources. I have also observed a negative trend in recent years: PhD candidates are using books less and less. But the authors of books have more space in which to describe their results and the different stages of their research, which encourages PhD candidates to value the information more.







# 5. Planning

I know from experience that the time factor can seriously knock my PhD candidates off balance. What may seem under control to us, can lead to great uncertainty for them. The book by Gosling and Noordam places this issue firmly on the agenda. The book is issued to all PhD candidates at TU Delft and it is used in their doctoral education. Of course, in the world of science, it is never possible to completely set things in stone for three to four years. Nevertheless, it is not too much to ask for a global, feasible plan. And, bear in mind: there is no time to lose as completing a manuscript in four years is tough enough. Below, I take a look at some of the principles that I apply when drawing up a plan. I then look more specifically at two parts of the PhD process: the decisive first and third years.

## Planning principles

Over the course of the years, I've noticed that three principles take centre stage when I am planning with my PhD candidates. First of all I explain that planning is not a linear process. Sometimes, you may publish very little in one year and then suddenly issue three publications at the same time. Secondly, I set great store by structure. My PhD candidates enter the four years with a lot of structure in place. They are generally externally funded and everything is already more or less set in stone in the project proposal. It may be possible to depart slightly from the details in the plan, but we usually stay relatively close to the project proposal. Although it may seem to contradict the need for structure, you also need to build in flexibility. There are deliverables, but in practice things often go slightly differently because research is partly unpredictable (you start with an idea, but in doing so you already develop other ideas.). These changes might have repercussions for the phasing of the programme. Yet as the principal supervisor, you need to manage the progress of the project, albeit you need to do this together with your PhD candidate.

## The first year

Give your candidate an opportunity to get to grips with the project proposal soon after he or she arrives. This encourages your PhD candidate to become part owner of the project.

Earlier, I said that it is good to have your PhD candidate conduct a literature study during the first year. You should always check whether your candidate knows how to tackle

a literature review. If there are any gaps in his or her knowledge, the candidate can catch up on these in the training that PhD candidates have to take. During this kind of trial period, you may think you have explained things clearly and then notice that the candidate has understood things completely differently. This is why it makes sense to get feedback.

It is important for the first three months to be clearly defined, since this enables you to gain a better impression of what the candidate is capable of. You get the first results and then it is time for the fine-tuning. The PhD candidate is then sent off to come up with a working plan. This itself serves as a form of assessment. Is the PhD candidate capable of devising a concrete plan on the basis of an idea, including a month-by-month schedule? When will the first papers be written? So we carefully plan the first three months and then the next nine follow. This then brings us to the Go/No Go review.

In the first three months, I also draw up a Gantt chart with my PhD candidates. All activities are listed in a planning matrix, with the times when things need to be done and when they have to be completed. This immediately reveals when problems can arise as a result of various activities coinciding. After the first year, I start planning on a six-monthly basis. We always look back and then look further ahead. Drawing up this kind of plan or schedule has various advantages. The process also involves examining your strengths and weaknesses, so these schedules will always need adjusting.

Finally, I recommend that you have your PhD candidates write a draft table of contents for the thesis at an early stage. It may seem a bold move having your candidate do this so early on in the process, but the practice increases their ability to see the bigger picture. You should see the first-year version as a working hypothesis, rather than a template set in concrete.

### The Go/No Go review

You must take the Go/No Go review at the end of the first year seriously. By that time, the PhD candidate must be able to specify clearly what he or she intends to do, why, when and how. If that is not possible, because of a lack of planning, presentation or other skills, this will be a good indication of what is likely to happen during the rest of the PhD programme. This is something you need to make clear to your PhD candidate and do so in good time.

Draw a distinction between the project and the PhD candidate. If a PhD candidate is not capable of seeing it through, you may still be able to save the project by enlisting the services of a post-doctoral researcher. But that does signal the exit for the PhD candidate. Despite this, he or she will have learned from the experience. It need not be a wasted year for PhD candidates: they have learned something, received supervision,

improve their writing skills, making it potentially a worthwhile year.

In order to prevent the conclusion of the Go/No Go review coming as a complete surprise (and we really must prevent that), I conduct monthly evaluations of progress. These result in plans to be acted on and some very straightforward feedback. The six-month interview also plays an important role in this.

### The third year

I would like to focus in particular on the third year. I often try to arrange for PhD candidates to spend some months gaining experience abroad during the third year. By then, you will know whether everything is on track for the thesis. I advise candidates to go off and work on something together with their new colleagues abroad and to explore everything around them. This is beneficial for their academic development. Spending time elsewhere can give your PhD candidate an all-important nudge and also help them in preparing for the labour market. I always encourage candidates to do this and they regularly take my advice, usually for around two to three months. I leave the final decision on whether or not to do it to my PhD candidates, since some are more willing than others.

The third year is also extremely important with regard to the fact that PhD candidates sometimes leave with no thesis. This is asking for big problems because they then need to complete a thesis alongside what may be a busy job. Pugh and Phillips, the authors of a great book for PhD supervisors and PhD candidates – *How to Get a PhD* – argue that this is one of the best ways of messing up the thesis. This is why I always try to ensure that my PhD candidates have completed the substantive part of the thesis before the end of the third year. I have become much stricter about this and focus much more on progress. The bulk of the work really must have been completed after three years.



# 6. The boundary between supervising and taking over

PhD supervisors set great store by developing the PhD candidate into an independent scientist or academic. At the same time, as co-authors, we are intensively involved in the writing of articles and papers by the PhD candidate. If everything goes as we hope, this involvement will diminish the longer the PhD candidate has been working on the research. In staff consultations, we rarely talk about this complicated relationship between the independence that we expect from a PhD candidate and the sometimes major contribution we have made to their publications. It is an area that deserves closer attention.

## A development model

Personally, I work on the basis of a development model. At the start, I may go quite far in contributing to the first article. After that my aim is to gradually minimise the role I play. It is important for the PhD candidate to become more independent. Initially I work more at a micro-level (sometimes discussing every single sentence), before moving to a meso-level. There are two models: taking over the writing (the master/pupil model) and merely continuing to make comments (supervisor model). If you take over the writing, it is important to structure it in such a way that the PhD candidate shows progress. The point at which the supervisor becomes involved in the writing will then gradually become later in the process. If they really (still) cannot do it on their own, you will need to help by sending your candidate on a course and sitting down to discuss things. Because the thesis should be an independent scientific contribution, you will ultimately need to take on the supervisory role. It may take longer to write the article, but the reward will be much greater.

### **An opposing view: do not become involved in the writing**

Another colleague of mine has different views on contributing to the writing and explicitly opposes it. If a particular section is poorly written, it will be sent straight back to the candidate, complete with comments, and the text will have to be rewritten. You should be able to expect a PhD candidate to do this without your help. On the other hand, you should help a MSc student. Another colleague deliberately focuses in on who is listed as the first author of the article. If the PhD candidate has not contributed enough, he or she cannot be the first author.

### **Suggesting solutions or stressing the need for independence**

There are various ways of emphasising the importance that we place on the contribution made by the PhD candidate to a publication. I once asked colleagues how they provide comments. Some of them use the 'Track Changes' feature in Word. They make corrections and ask the candidate to study them and confirm that they agree. Of course, we can emphasise the candidate's contribution much more if we use the 'Comments' feature in Word. We make comments, or ask questions and it is up to the PhD candidate to incorporate these into a revised text.

### **Others can also offer support in writing – other PhD candidates**

There is no doubt that the supervisors play an important role in the publications of their PhD candidates. But are they the only ones to do so? We sometimes underestimate how much help PhD candidates can give each other. Examples of this include running a 'writing lab', in which PhD candidates comment on each other's texts and make suggestions. At times, a piece of text may be unreadable and I do not have time to comment on it in detail. In such cases, I advise candidates to have 'friends' assess what they have written. A PhD candidate writes an article, followed by several rewritten versions, until the group is satisfied. On other occasions, different members of staff may be involved in looking at the text.

### **Checking the quality of the English**

Because we almost always publish internationally and PhD candidates may not be especially proficient in the English language, it is essential to check the quality of the English. Although I check papers for the quality of the English myself, for the thesis itself and official reports we will use an editor. This is funded by our research group.







# 7. Personal attention and communication

## **Supervision is intensive**

Supervising a PhD candidate is an intensive activity: providing occasional tips and meeting once a month is not sufficient. At the start, you need to have a lot of contact with the PhD candidate in order to ensure that the topic suits him or her and that he or she does not become bogged down in the details, etc. A verbal explanation can be very useful for a PhD candidate at this stage. Personally, I also find it important to check out how the PhD candidate is doing more generally and whether he or she is comfortable socially (both within and outside the University). A fortnightly meeting lasting one hour is acceptable as an average. If they need to, candidates can always make an appointment in the meantime or drop by for a quick consultation.

## **How many PhD candidates can you supervise?**

I tend to draw a distinction between PhD candidates for whom you serve as the principal supervisor and those who have another day-to-day supervisor. In general, it is possible to say that you can act as principal supervisor for around four PhD candidates, although I have known exceptional cases in which someone had as many as seven. But that is really only possible if someone does not have other major (teaching) commitments.

Principal supervisors may also often be responsible for PhD candidates whose day-to-day supervision is in the hands of a colleague in the research group. If the team works well together and the expertise of the day-to-day supervisor is trusted, this can be a workable solution. But do you sometimes wonder what your PhD candidates feel about it? Some of them have come to TU Delft especially to work with a particular principal supervisor and may become disappointed by the lack of contact. Group meetings with PhD candidates can make up for that to some extent, since PhD candidates then at least see their principal supervisor 'in action', so to speak.

### **One-to-one supervision is on the decline**

Compared with the old days, it is remarkable the extent to which supervision has become a shared responsibility. Supervision by a single person only is now a relatively rare occurrence. It is gratifying to see how we can take collective responsibility and work together in an open and friendly atmosphere between colleagues. The fear and arrogance are something we need to overcome. Everyone struggles with certain problems and it is important to be able to talk about this. Remember, it is all about people and so you should work together towards peer-to-peer learning.

Things can sometimes go so far that I occasionally involve external parties if I can no longer solve a particular problem scenario. These may be other academics and scientists, or possibly psychologists and physicians. You could call it an open and friendly atmosphere between colleagues.

Increasingly, our management team meeting also regularly discusses all of the PhD candidates. You talk about the PhD candidates and discuss what is going well and not so well. You then have half an hours' discussion and then decide with your colleagues how best to tackle the issue.

### **Special focus on the relationship between the principal supervisor and the day-to-day supervisor**

We need to be aware that tensions can always arise when several people are involved in supervising a single PhD candidate. In terms of the subject matter, I always remain very closely involved in what happens, even if someone else is acting as day-to-day supervisor. If something is not going well, I need to know about it immediately as the principal PhD supervisor responsible. We talk about it and agree on what to do. Some projects allow more freedom and space for the PhD candidates and the day-to-day supervisor may be in favour of giving the candidates that freedom. However, I tend to exercise caution in allowing this. It is important that PhDs work in areas that we are familiar with, but there is also the PhD candidate's knowledge to take into account. If there are differences of opinion, it is important to agree on a policy before involving the PhD candidate in the matter.

In this respect, the difference between younger and more experienced day-to-day supervisors (assistant and associate professors) is quite interesting. Senior associate professors supervise independently and there is often a formal progress meeting every 3 to 6 months that I attend in my capacity as principal supervisor. On the other hand, with new assistant professors, there are fortnightly group consultations.

### **Personal attention**

Make sure you have a good relationship with the PhD candidates. Candidates who

come from far in particular can often be quite lonely during the first weeks or months. I have noticed that they will continue to appreciate the additional attention in these early weeks during the whole of the PhD programme. I usually also invite them to my house in order to become acquainted with them in a completely different way.

### **Give praise and be open about criticism**

When the PhD candidate delivers good work, you must give praise: a researcher who intensively focuses on a specialised subject will at some point become insecure about the quality of his or her work. On the other hand, you also need to make it clear to the PhD candidate if certain things are not going well.

### **Regular basis**

Speak to each other on a regular basis. Listen and provide support where possible. Provide direction and correction where appropriate. If things go well, the PhD candidate will learn a lot, including in terms of working methods. The amount and type of supervision that you provide will change a lot during the process.

### **Progress reports**

Have the PhD write a weekly report on what he or she has done. It need not be particularly long: one paragraph should be enough.

### **What you should avoid**

Ultimately, the most important thing is to ensure you do not leave your PhD candidate alone with his or her problems. Be pro-active and get to grips with your PhD candidate's problem!



# 8. Communication and support in a wider perspective

Other people are also important for my PhD candidates. It is not only from me that they receive feedback on their work. Fellow PhD candidates can play an important role because they are often much closer to my PhD candidates. For areas that I consider being self-explanatory, they can count on their immediate colleagues for understanding and support.

## Peers

I would like to emphasise how important it is that my PhD candidates are part of a group. This group exerts peer pressure that brings out the best in my PhD candidates. This peer pressure takes many forms, ranging from encouragement to write scientific papers to assistance in using equipment, understanding theory and solving practical problems. It is essential that all of this be based on mutual respect, since an atmosphere of trust is otherwise impossible. Occasionally a colleague's PhD candidate will join in at a group event and is very much welcome.

## Internal and external courses

In addition to coming to grips with their own research themes, it is also important for my PhD candidates to become well-informed scientists in my field. They need to be people who know what is happening in the discipline. For this, I send them on courses, such as a summer school. We also form reading groups, where we read recent books or articles together and become inspired to devise new research questions and techniques. The Graduate School also offers several useful courses and I encourage my PhD candidates to take full advantage of these.

## Conferences

Attending conferences is good for marketing and is also something we encourage: selling expertise and looking for partners. This is something we teach our candidates. Some PhD candidates will attend conferences several times in a year. My PhD candidates always go with a contribution of their own. Presentations are also regularly practised in-house in order to ensure success at conferences.







# 9. When things go wrong

## The nature of the problems

It is almost unimaginable that your PhD candidate will not encounter any problems during a four-year PhD programme. However, the types of problems can vary widely. Let's take a look at some of the types of problems there may be. Assuming that we define problems as being directly related to the PhD candidate, I would like to begin with problems that actually relate to the content of the project itself. For example, a project may prove to be much tougher than anticipated; the results may be disappointing or slow. If someone achieves a few successes and everything works, as it should, there may not be any issues with motivation problems. But with tough projects that aren't really working and offer few opportunities for success, motivational chats may take up a lot of your time. I always make it clear that a result is a result, even if it is not a successful one. You can also learn something from a chip that does not work particularly well or not at all. The chip that works straight away actually teaches you nothing and merely confirms your hypothesis. The chip that does not work is interesting, but this is often not what PhD candidates think. "That can wait until later in my career..." is what they tend to say.

Secondly, we need to look at the type of supervision we offer. Is the day-to-day supervision working well? How do we respond to any problems highlighted? Do we take action or let the issue continue unabated? Sometimes things are brought to a dramatic halt and it is no longer feasible to change course. It may not be a frequent occurrence, but it does happen. But before we make that decision, we discuss together what the cause was, whether it was down to the skills of the PhD candidate or the supervision. At one point, I arranged for a PhD candidate to continue the work with another principal supervisor.

We work in disciplines in which our PhD candidates may have received less training in writing in the earlier phases of study. PhD candidates can find it a major step in making the transition from conducting research to writing about the results. Other PhD candidates simply find writing difficult. This means that writing deserves our particular attention.

If the odds are stacked against them, a PhD candidate can start to lose motivation. But not only setbacks or disappointments may lead to that. Conversations with PhD candidates who have abandoned their PhD research at an early stage have taught us that we may be so enthusiastic about candidates taking on PhD positions that we do not carefully investigate whether they themselves are truly motivated. PhD candidates can also lose motivation if they set themselves unrealistic demands and are bogged down by perfectionism, never really being satisfied with their results. If a PhD candidate has great difficulty with experiments that are unsuccessful, this can also undermine his or her self-confidence.

Many of these issues can be successfully solved by discussion between PhD candidates and their supervisors. This also shows the importance of a good communication between the supervisor and the PhD candidate. If someone is in difficulty and unable to talk about it with the supervisor, motivation can quickly start to plummet.

Not all of our PhD candidates are at the high level we would like. If our selection procedures are not good and we do not gain a good understanding of the qualities of the PhD candidate, we can of course face some nasty surprises later down the line.

In terms of substance, we can always test the PhD candidate's qualities in a good selection procedure. It is much more difficult to anticipate whether our PhD candidates will face personal problems, will need to work against a background of difficult private circumstances, or be lacking essential personal qualities. Examples might be the ability to deal with setbacks, perseverance, or the capacity to handle contradictory advice or results. These kinds of problems virtually always come to light during the work itself. This is another good reason for the Go/No Go review moment as we then have working experience with the PhD candidate.

Another issue is whether problems are predictable. I must confess that I often do not see problems coming and potential issues are not always obvious during the selection procedure.

### **So what should we do?**

If we face serious problems with our PhD candidate, what options do we have? Talk, talk and more talk. There may be several underlying causes. It may be down to the day-to-day supervisor, the unrealistic demands set by the PhD candidates themselves, or problems with communication. Occasionally I refer candidates for professional support, in order to attempt to solve things by means of counselling, for example. But more often I anticipate the issue. It is something you develop a feel for. I have become assertive in these types of discussions and ensure it is possible to talk about everything. Yet, it is generally possible to identify the problem but the solution may not always be so easy.

Nevertheless, the most important is that supervisors address the problem. Ultimately it is about ensuring that the PhD candidate regains motivation. There is also the question of whether the PhD candidate can actually achieve the solution. The art is to find out what it is that makes a PhD candidate happy or not. This can be quite a challenge.

PhD candidates can become disillusioned: they may feel they are not up to the job or become frustrated with the lack of progress. In my experience, showing patience and confidence in your candidate proves most effective in such cases. Confidence is a (soft) strength that eventually sets things back on track. If talking no longer works or if there is a deeper problem, there is no choice but to call in the experts. Occasionally this kind of problem will resurface in the later years. In this case, you need to exercise slightly more caution with the PhD candidate in order to encourage him or her to reach the finishing line. It is also important never to forget that every individual demands a different approach even though they may sometimes have the same problems.

Ultimately, the strategy that I apply to all these problems is to adopt a positive approach! And invest time in them. Give examples, discuss the details, give advice and check that it is being followed up on. Revise certain parts of the candidate's text. Look for possibilities for maintaining or improving the candidate's motivation. Setting achievable short-term goals is a good way of doing this. I also work to intensify social activities in order to ensure that everyone is involved and a group mentality develops. Time spent studying abroad can also work wonders.



# 10. The quality of the thesis

## Expectations

As supervisors, we have quite clearly-defined expectations when it comes to the requirements that a thesis must meet. However, this does not mean that we adhere to them at all costs. At times we will need to be more modest in our expectations. This can be caused both by what a PhD candidate turns out to be capable of during the project itself, as well as the substantive aspects of the project. Occasionally there may be a lot of implementation work, which takes up a great deal of time. As a result, a PhD candidate will not have time to complete the requisite number of publications. As the principal supervisor, you may opt for a journal with a high citation score, as a result of which the number of publications is lower. Sometimes the subject is extremely complicated and so the number of publications is kept low.

In conclusion, it is not possible to set the same demands for everyone. This therefore means striking a balance in practice.

## A book or four articles stapled together?

Opinions among supervisors vary somewhat with regard to how the thesis should be structured. Is it little more than a collection of four/five articles 'stapled together'? Or should we aim for a cohesive whole, with a solid introduction and an appealing conclusion, something more along the lines of a book? Surprisingly, the book is still very much in vogue in my area. The aim is not so much to write a thesis that is a monograph but rather a publication that has cohesion. In doing this, we follow a two-track policy. The ultimate decision depends on the ambitions and capabilities of the PhD candidate. His or her career prospects are also an important factor. If an academic career is the aim, a book is worth recommending, as it can serve as an excellent calling card.

Personally, I am torn between two ideas. A PhD programme need not necessarily culminate in a nice book. I increasingly tend towards the stapled-articles method. Writing a book takes an awful lot of effort. It also depends on the quality of the papers

that precede it. If top-level publications have been delivered every time, it is simply a question of ‘writing an introduction, providing a theoretical background and stapling everything together’. But I have still not yet decided on a definitive stance on this issue. Both options need to be possible and it will always depend both on the PhD candidate and the work itself.

### **Structure the thesis as early as possible**

I always encourage my PhD candidates to start thinking about the structure of the whole project and the links between the underlying parts as early as possible. Here, I am following the advice of Umberto Eco who, in a handbook for thesis writers published in 1975, argued for a table of contents as a working hypothesis, that is, of course, adjusted in the process of writing.

Barbara Lovitts’ *Making the Implicit Explicit. Creating Performance Expectations for the Dissertation* should also be recommended reading. The chapters on the Physics Dissertation, the Electrical and Computer Engineering Dissertation and Mathematics Dissertation are almost second nature to us.



# Conclusion

This brings us to the end of the suggestions. Is there a core message that I have tried to convey? I think that I already captured this in the motto at the start of this guide. “Ultimately, the most important thing is to ensure you do not leave your PhD candidate alone with his or her problems. Be pro-active and get to grips with your PhD candidate’s problem!”

I would like to add one more thing. It can sometimes be a major challenge for a PhD candidate to make it clear that a piece of advice he or she has received is unclear or difficult to apply as a solution to a problem. You should therefore not only be pro-active, not only give good advice, but always check that what you have said has been fully understood.

Finally, bear in mind that the gulf between you and your PhD candidates will increasingly widen. Things that become increasingly obvious to you will remain a challenge for every PhD candidate just starting out. A colleague from another discipline, Law, put it quite nicely:

*Remember, although your knowledge and skills are constantly improving, the skills of the new first-year PhD candidates are the same as those of a new first-year PhD candidate from the year before, and the year before that. Therefore, each year the gap between you and the position of a new first-year PhD candidate will be greater. Make sure you realise that!” (Ian Curry-Sumner).*





