How to Write a Good Research Proposal

Prof. Vincent Lepetit

Different Agencies Have Different Expectations

- FFW: Scientific development (put some neat formulas);
- Bilateral projects: ~FFW, but with a foreign partner (mostly with European countries but not only);
- DACH projects: ~FFW, with a German, a Swiss, and an Austrian partner;
- ERC junior grant: Scientific development, focused on promising junior researchers (also "consolidator" and "senior" grants), should be "different from what you have done, and for developments you cannot fund otherwise";
- FET: Long-term ambitious/risky scientific development, with several (~5) European partners;
- H2020: Several (~10) partners, including academic and industrial partners. Needs potential economic and social developments;
- Marie Skłodowska-Curie Innovative Training Networks: Scientific development, focused on PhD students, with visits at the other partners;
- …

- FFG: Applied development, need a company as a partner;
- Christian Doppler Laboratory: Long-term project, in collaboration with 1 (or 2) company(ies);
- Google research award;
- Some companies are willing to pay for research [and development]
- …

When should you write a proposal? (beside external constraints)

- When you have a good story to tell:

a poor proposal might hurt your credibility.

Your proposal should have a single, simple theme. All parts of the proposal should be consistent with that.

An Opportunity to Think

- A research proposal typically spans 2 to 5 years;
- It is a crucial part of the research process.
- Opportunity to think:
  - more broadly about a research agenda, and
  - about what problems are really important.

Proposal writing is the hardest part of the job,
but also should be the most interesting one.

Getting Started

- Developing a research proposal takes time: It is important to start the process at least 4-6 months in advance.

- Carefully read over the guidelines of whatever agency you are submitting it to. These guidelines will give the deadlines for submission and instructions for the length, structure and format of the proposal.

- Try to put your hands on a previous (successful) proposal, and the form the reviewers have to fill;

- Develop a focused research direction.

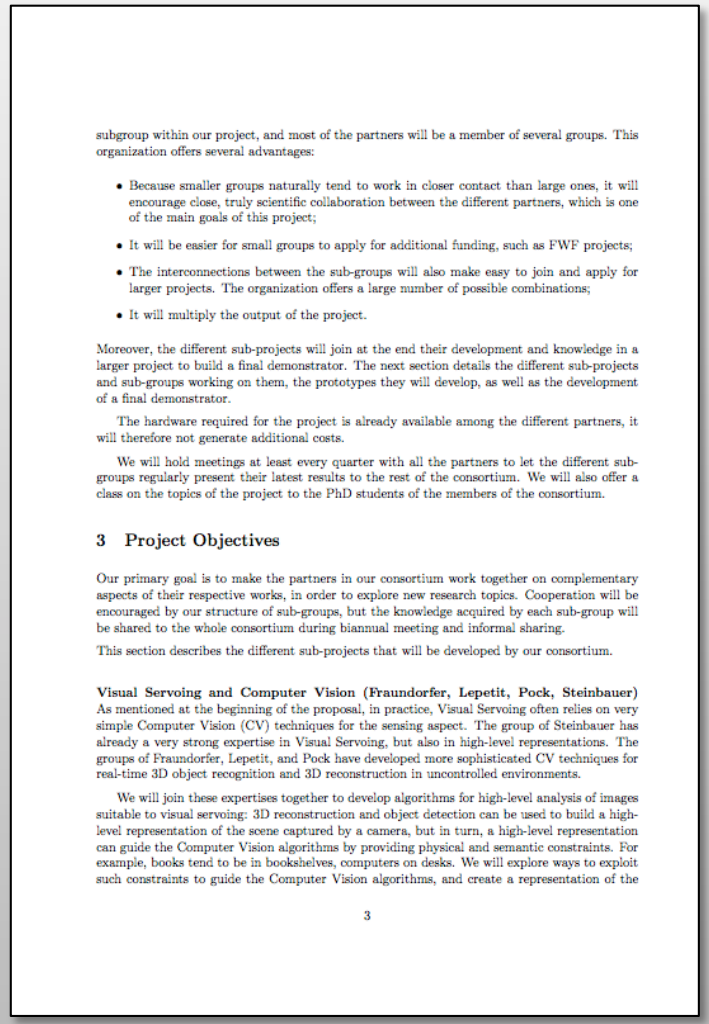
- Develop a method feasible in time and resources.

Structure of the Proposal

Usually imposed by the funding agency, but the general structure is:

- Introduction: a clear statement about what you want to do and why it is important, interesting, relevant and realistic;
- Some background knowledge and context;
- Description of your approach;
- Timetable and Risk Management;
- The budget;
- Dissemination.

Human Context



subgroup within our project, and most of the partners will be a member of several groups. This organization offers several advantages:

- Because smaller groups naturally tend to work in closer contact than large ones, it will encourage close, truly scientific collaboration between the different partners, which is one of the main goals of this project;
- It will be easier for small groups to apply for additional funding, such as FWF projects;
- The interconnections between the sub-groups will also make easy to join and apply for larger projects. The organization offers a large number of possible combinations;
- It will multiply the output of the project.

Moreover, the different sub-projects will join at the end their development and knowledge in a larger project to build a final demonstrator. The next section details the different sub-projects and sub-groups working on them, the prototypes they will develop, as well as the development of a final demonstrator.

The hardware required for the project is already available among the different partners, it will therefore not generate additional costs.

We will hold meetings at least every quarter with all the partners to let the different sub-groups regularly present their latest results to the rest of the consortium. We will also offer a class on the topics of the project to the PhD students of the members of the consortium.

3 Project Objectives

Our primary goal is to make the partners in our consortium work together on complementary aspects of their respective works, in order to explore new research topics. Cooperation will be encouraged by our structure of sub-groups, but the knowledge acquired by each sub-group will be shared to the whole consortium during biannual meeting and informal sharing.

This section describes the different sub-projects that will be developed by our consortium.

Visual Servoing and Computer Vision (Fraundorfer, Lepetit, Pock, Steinbauer) As mentioned at the beginning of the proposal, in practice, Visual Servoing often relies on very simple Computer Vision (CV) techniques for the sensing aspect. The group of Steinbauer has already a very strong expertise in Visual Servoing, but also in high-level representations. The groups of Fraundorfer, Lepetit, and Pock have developed more sophisticated CV techniques for real-time 3D object recognition and 3D reconstruction in uncontrolled environments.

We will join these expertises together to develop algorithms for high-level analysis of images suitable to visual servoing: 3D reconstruction and object detection can be used to build a high-level representation of the scene captured by a camera, but in turn, a high-level representation can guide the Computer Vision algorithms by providing physical and semantic constraints. For example, books tend to be in bookshelves, computers on desks. We will explore ways to exploit such constraints to guide the Computer Vision algorithms, and create a representation of the

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- Be aware that the reviewers have limited time;
- Use reasonable font and margins, provide figures;
- Tell a consistent story;
- Make sure you communicate your excitement! Don't assume the reader has the same interests you do.

Remember Who You Are Writing For

- Committee is smart and knowledgeable about many things, but
- it is highly unlikely they are experts in what you are doing
- They do not know *a priori* what others are doing, and why what you propose is novel and important

Have an Easy-to-Remember Acronym

- **STAR**: Service Training through Augmented Reality
- **PEGASE**: helicoPter and aEronef naviGation Airborne System Experimentations

Introduction / Statement

- You must convince the committee this is an exciting topic and that you will accomplish what you propose;
- You must convey the "big picture": the context, and importance of the research you propose;
- *Tailor your proposal to the funding agency and the specific program.*

the Four “Whys”

- Why is the problem important?

- Why is the problem hard?

Is it possible that industry could solve your problem with an army of engineers?

- Why now?

In many cases, however, problems are longstanding: you should aim to convince the reader that “things are different this time” because of recent advances, changes, etc.,

- Why you?

Convince the reader that you are qualified (and, ideally, uniquely qualified) to carry out the work that you have proposed.

This is not the time to be modest!

Description of the Approach

- Don't go into too much technical detail, especially about steps that are fairly trivial.

- Depending on the call: Split the work into Workpackages

The Plan is Non-Binding

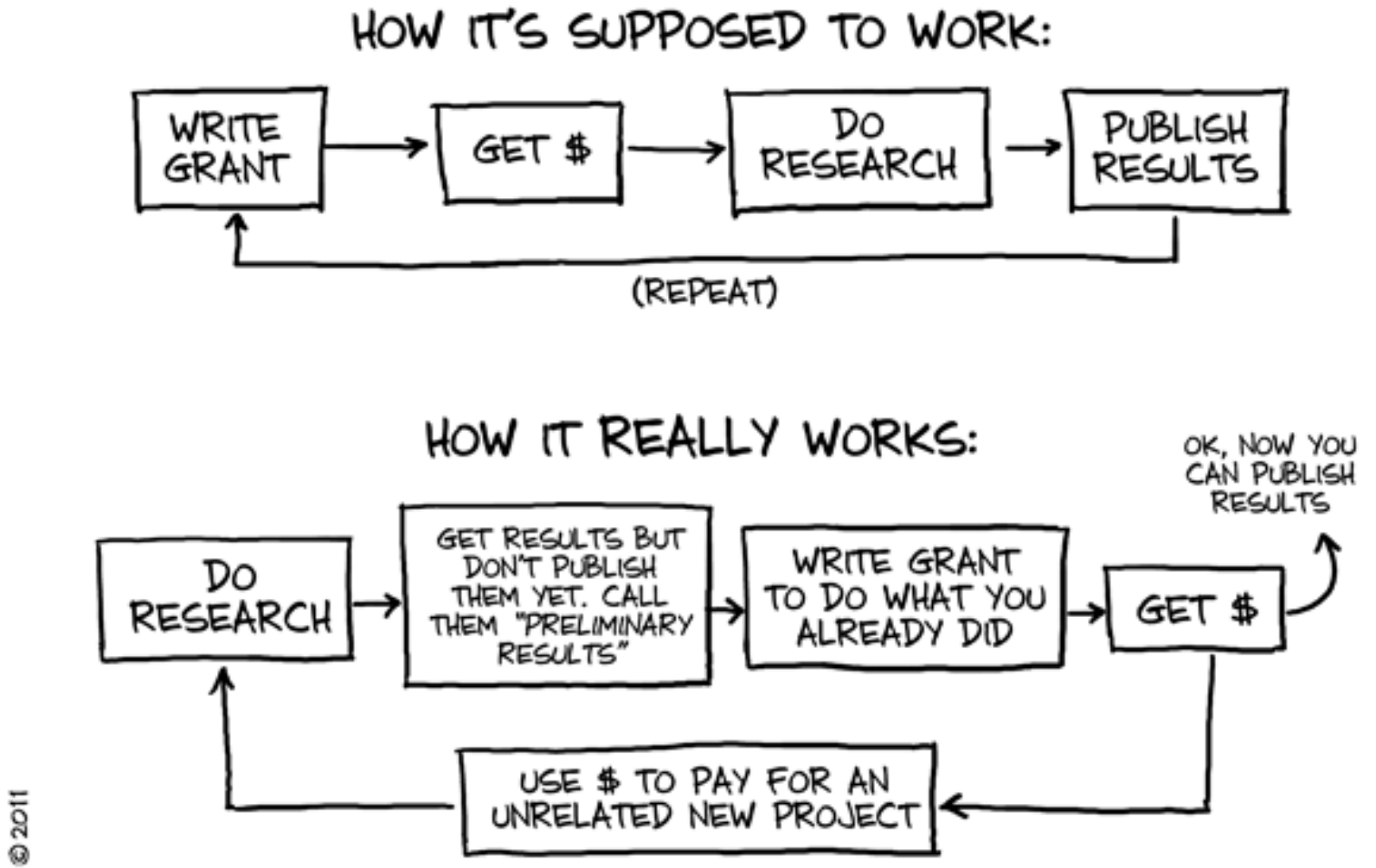
- You need a plan before you start, but
- you can (and probably should) update it as you go.

Have Preliminary Data

It is important to establish credibility

- If you have published, you can say "as we have done before"
- otherwise, preliminary data shows you can accomplish your goals
- you can also discuss what can go wrong, and what you will do in that case

THE GRANT CYCLE



Who Should Read your Draft?

- The best reader is someone smart and critical, but unfamiliar with the field.

- All readers' concerns are valid even if they are completely wrong: If the reader missed or misunderstood something in your proposal, it is because you did not explain your point well enough.

Budget

- Read instructions
- Be aware of the *overheads*. If in doubt call the person in charge of the grants;
- Itemization of costs:
  - Personnel (salary)
  - Equipment
  - Supplies (be complete, include cost per item)
  - Travel costs
  - Other expenses
- Justify the budget;
- Don't be too greedy, but be realistic.

Time Table / Work Plan

Timeline (6 | 12 | 18 | 24 | 30 | 36)	Description and Milestones
WP1.1(1)	Error detection algorithms given *a priori* statistical information.
WP1.1(2)	Error detection algorithms without *a priori* statistical information.
WP1.2(1)	Error correction algorithms based on topology changes.
WP1.2(2)	Error correction algorithms based on labeling information.
WP2.1(1)	First version of the gesture capture implementation.
WP2.1(2)	Second version of the gesture capture implementation.
WP2.2(1)	First version of the occlusion handling implementation.
WP2.2(2)	Second version of the occlusion handling implementation.
WP3.1(1)	Global navigation.
WP3.1(2)	Local exploration and maneuvering based on WP2.1 and 2.2(1).
(3)	- based on WP2.1(2) and WP2.2(2).
	POI selection:
WP3.2(1)	- using algorithms from WP2.1(1) and WP2.2(1).
(2)	- using algorithms from WP2.1(2) and WP2.2(2).
	Tree editing:
WP3.3(1)	- based on WP1.2(1), WP2.1(1), and WP2.2(1).
(2)	- based on WP1.2(2), WP2.1(2) and WP2.2(2).
WP3.4	System integration and evaluations.

} 1 WorkPackage

How to Have a Good Career

Prof. Vincent Lepetit

What To Do After a PhD?

→ Academic career;

→ Industry;

→ Take your own direction.

Academic Career

What People Look for

- Academic brilliance:
  - Great PhD and postdoc work;
  - Your name is known in the community;
  - A theme that is associated with your name;
  - Papers with an impact.
- Ability to raise funds (as Principal Investigator)
- You raised good PhD students;
- Ability to fend for yourself;
- Have a clear career plan.

What is Expected on a Personal Level

- Academic life is not just a job, it should be an important part of your life;
- You will have to move around several times.

What About your Family?

- Will your partner move around with you? And will (s)he find a job?
- When will you have children?

Grants

- FWF - Schroedinger
- FWF - Hirnberg (women)
- EU - Marie Curie

...

Recommendations

- Publish quality, not quantity;
- Give excellent talks;
- Network;
- Find several people that will write you letters of recommendation;
- Develop your own topic.

Recommendations

- Leave Graz!
- Find a top institution with a top professor for a postdoc;
- Be prepared for the two-body problem.

Once You Have a Job

- Seek out problems that will make people remember your name;
- Get a mentor. Your boss is not always a good mentor;
- Get yourself a research group:
  - Write proposals, fund PhD students;
  - Beware of continuity of funding;
  - Don’t run the risk of getting lonely.

Once You Have a Job

- Learn to enjoy the process of writing and presenting papers, building projects;
- Take risks;
- Enjoy your work!
- Learn to say "no";
- See the big picture and keep it in mind.

Industry

- Big IT companies: Google, Amazon, Microsoft, Amazon, Facebook, Qualcomm, etc. and
- smaller ones.
- Consulting companies: McKinsey, etc.
- Startup companies;

- Create your own startup company?

Many opportunities out there. Remember that you are smart and adaptive!

Useful Websites

- Next Scientist: http://www.nextscientist.com
- PhD Comics: http://phdcomics.com