Research guidelines

Jan van Gemert, j.c.vangemert@tudelft.nl

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The goal of this document is to give structure to doing research with me. Benefit for you: avoid my comments by following these guidelines.

Organization	**Process**	**Mentality**
O1 Full Responsibility	P1 One main Q	M1 Be critical
O2 No dependencies	P2 Min. 3rd party	M2 Find ToDos together
O3 Meet supervisor	P3 Validate	M3 Consistency
O4 Focus supervisor	P4 First break it	M4 Question everything
O5 Take critique	P5 Breadth first	M5 Simple is strong
	P6 Exps answer Q	M6 Limitations
	P7 Proof of concept	M7 Write early and often
	P8 Exps max 1 night	
	P9 Change 1 var	
	P10 Debug science	

Research organization

O1. Take full responsibility. This is your project. Not your supervisor's. You are in charge of everything, including: planning, progress, direction, meeting topics, bureaucratic formalities, etc. Your supervisor's role is to help you as best as possible, yet the final responsibility remains yours.

O2. No dependencies. Avoid dependencies on third parties. Such parties intend well, yet reality is often different from expectations. Do not become the victim of this and make sure you have full control. E.g.: Promised datasets, experts, constraints, or other agreements have to be there *before* you start.

O3. Meet your supervisor. Try to see your supervisor at least once every 2 weeks; once per week is better.

O4. Focus your supervisor. Meeting time is limited. It is your responsibility to choose to discuss what benefits you most.

O5. Do not take criticism personal. All feedback is meant to improve and benefit you. Do not fight the feedback, even if you think it is wrong: Make a note, and think about why your supervisor gave this feedback.

The research process

P1. Only one main research question / problem statement. It may change over time but explicitly pursue a single topic: Write it down.

P2. Minimal effort for 3rd party building blocks. If you build on top of existing work (e.g. an optimizer, object detector, pose estimator) start with the *least effort* approach to obtain this building block. It should not matter which building block you take, so start with the easiest available implementation. If you work modularity, you can always add another one later.

P3. Validate published work. It is not obvious that a published work generalizes to your problem. There may be subtleties: Validate this.

P4. Prioritize idea breaking. Start by investigating the greatest risk to your main research question. Do not invest heavily on the foundations, only to find out months later that the main idea did not work.

P5. Breadth-first instead of depth-first. Do not explore sub-topics too deep. Identify the minimum requirement per sub-topics and get to this minimum as soon as possible. The next iteration can go deeper into sub-topics.

P6. Experiments answer a single question. Write down before you do an experiment what your expected answer to the question is. Validate.

P7. Show proof of concept. Start with a fully controlled (possibly toy) dataset of 'the simplest case possible' which should only vary in the relevant manner. Its goal is to validate that the problem occurs and/or that your model can solve it.

P8. Experiments take max 1 night. If it takes 1 week, you can only do 24 in 6 months. Minimize experimental time so you can answer more questions.

P9. Change only one variable. If more than one variable is changed, it is not possible to determine the cause of an effect.

P10. Debug your scientific ideas and your code. Test ideas and test code every time you make a change. Start with the assumption you made a mistake somewhere, gather independent proof that it is correct.

Research mentality

M1. The critical reviewer. Often switch roles to a savage reviewer (Mr Hyde) who is looking for any excuse to say: *'I do not believe X; Reject.'* Try to identify X yourself and think about which evidence argues for X.

M2. Your supervisor does not have the answer. We are doing research. By definition, this research has not been done before. Thus, it is impossible for your supervisor to give you a list of ToDos: We'll find them together.

M3. Be consistent. Assumptions you make in one part of your research should not suddenly change in another part.

M4. Question everything. Take a step back, and think about what you are really doing. Does the story logically make sense? Try to see the things you take for granted: Is everything justified?

M5. Simple is strong. Simple is more powerful than complex. Explain the core of your topic to a layman (your mother?) without using math/jargon. If you cannot explain it, it is probably too complex.

M6. Limitations. What are the limitations of your method. No method will always be the best. Showing insight where it fails is strong. The goal of research is understanding.

M7. Write early and often. Writing is important. It helps to make thoughts concrete and it is the interface to your work. Writing always takes longer than you think and it benefits from iterations.