How to do a Successful PhD (in Visual Computing)

Eduard Gröller

Institute of Visual Computing & Human-Centered Technology,
TU Wien, Austria
Research Topics in the Vis-Group

- Medical Visualization
- Mathematical Visualization
- Visual Modelitics of DNA Nanostructures
- Molecular Visualization
- Graph Visualization
- Perception in Visualization
- AI explainability
Interactive Visualization of Simulation Data for Geospatial Decision Support

Daniel Cornel

VRVis Forschungs-GmbH
Vienna, Austria
Instant Construction of Atomistic Models for Visualization in Integrative Cell Biology

Tobias Klein

Institute of Visual Computing and Human-Centered Technology
TU Wien
Tight Integration of Visual Analysis and 3D Real-Time Rendering

Thomas Ortner
VRVis Research Center, Vienna, Austria
Before You Get Started

- Why to do a PhD?
  - Money
  - Reputation
  - Job opportunities
  - Scientific curiosity

- How to get a PhD? [Peter Eades]
  - Find a good topic
  - Find a good supervisor
  - Use a good research method
  - Give lots of good talks
  - Write lots of good papers
  - Write a good thesis
How to do Research?

"If we knew what it was we were doing, it would not be called research, would it?"

[Albert Einstein]

- Doing a PhD is a
  - highly unstructured process
  - underspecified task

- Structuring
  - Divide and conquer
  - Anchor your work in a local research group
  - Get connected in international research community
Divide and Conquer

- Subdivide your three-year PhD endeavour
  - State-of-the-art (6 months)
  - 4-5 research subprojects (6 months each)
  - Write-up thesis, wrap-up results (6 months)

- For each subproject define
  - Problem
  - Goal
  - Approach
  - Outcome
  - Cost

- Define Milestones
To steal ideas from one person is plagiarism – to steal from many is research [Steven Wright]

- Regular meetings with advisor
- Expose your ideas early on to your local peers
- Attend scientific meetings from early on
  - Local conferences
  - International conferences
- Attend talks, tutorials
- Try to give many talks
- Use every opportunity to talk to your (international) colleagues
Reflection and Transparency

\[ \alpha = \beta \]
\[ \gamma = \delta \]
Transparency

- Clearly know what you are doing
- Clearly communicate to others

Reflection

- By yourself
- Get feedback from others
Reflection and Transparency

- Internally, externally
- Everything is peer based
  - Peer reviewing
  - Peer learning
  - Supervisor learns as much as you do
- Be sincere to yourself and to others
- Evaluation is key [Peter Eades]
  - Effectiveness
  - Efficiency
  - Elegance
Reflection and Transparency

- Internally, externally
- Everything is peer based
  - Peer reviewing
  - Peer learning
  - Supervisor learns as much as you do
- Be sincere to yourself and to others
- Evaluation is key [Peter Eades]
  - Effectiveness
  - Efficiency
  - Elegance

“When you’re screwing up and nobody says anything to you anymore that means they’ve given up on you…you may not want to hear it but your critics are often the ones telling you they still love you and care about you and want to make you better.” [Randy Pausch]
Failure is the Key to your Success ??

If you can look into the seeds of time,
And say which grain will grow and which will not,
Speak then to me …  

[William Shakespeare]

- The landscape of the known is convoluted
- In hindsight everything looks straightforward and simple
- The path to scientific discovery is tangled
- Learn from errors (from your own, from others)
- If you cannot fail you cannot succeed

And sometimes you fail because it is your fault !!!

Eduard Gröller
Three Failure Stories from the Vis-Group

- Project proposal on dynamical systems

- Depth-of-Field for Volume Rendering

- Semantic layers for Illustrative Vol. Rend.
Three Failure Stories from the Vis-Group

- Project proposal on dynamical systems

  „In my opinion this work is a significant step backwards“  
  [anonymous reviewer]

- Semantic layers for Illustrative Vol. Rend.
Three Failure Stories from the Vis-Group

- Project proposal on dynamical systems

„In my opinion this work is a significant step backwards“  
[anonymous reviewer]

I have not failed.  
I've just found 10,000 ways that won't work.  

Thomas A. Edison
The Most Valuable Resource for your PhD?

It's you
The Most Valuable Resource for your PhD?

- Stay focused and dedicated
- Act as problem solver
- The result not the amount of work counts
- Solutions: trivial – complicated – simple
- Cost/benefit curve
The Most Valuable Resource for your PhD?

- Stay focused and dedicated
- Act as problem solver
- The result not the amount of work counts
- Solutions: trivial – complicated – simple
- Cost/benefit curve

Genius is one percent inspiration and ninety-nine percent perspiration. [Thomas A. Edison]
The Pareto Principle (80-20 rule)

- With 20% effort you achieve 80% of a goal
- The Pareto principle is a **blessing**
  - Structured reading of papers
  - Keep a record of your research activities and ideas
- The Pareto principle is a **curse**
  - Sometimes you have to care for the smallest details (110% is barely enough)

**Make everything as simple as possible, but not simpler.**  
[Albert Einstein]
Learn to Write Good Scientific Papers

- Your papers have to tell a story
  - Something to tell
  - Somebody to address
- Hierarchical top down approach
  - Define section headings first
- Illustrative figures
  - Overview figure (as pictorial table of content)
  - Figures by themselves should tell the story
- Paper writing as a collaborative effort
- Review papers from others
PhD Student – PhD Advisor

- What is a good PhD student?
  - Curiosity and playful thinking
  - Know your tools
  - Analytic reasoning, abstracting
  - Creativity
  - Learning on the job
  - Stay focused and dedicated
  - Resilience, Frustration Tolerance

- What is a good PhD advisor?
  - Interested in your research work
  - Scientifically well connected
  - Provides continuous support, stimulating environment
  - Supports the runners-if (self-runners, runners-if, never-runners)
PhD Student – PhD Advisor

- What is a good PhD student?
  - Curiosity and playful thinking
  - Know your tools
  - Analytic reasoning, abstracting
  - Creativity
  - Learning on the job
  - Persistence
- What is a good PhD advisor?
  - Interested in your research work
  - Scientifically well connected
  - Provides continuous support, stimulating environment
  - Supports the runners-if (self-runners, runners-if, never-runners)

First class people hire first class people, second class people hire third class people, and third class people hire fifth class people.
Trinities - How to Run a Successful Research Group?

https://www.cg.tuwien.ac.at/research/publications/2021/wu-2021-vi/
Vis-Group Specifics

- Group has distinct identity
- Tight professional interaction
  - Weekly meetings in the group
  - Regular meetings with supervisor
  - Yearly closed meeting
  - Joint deadline frenzies
- Tight social interaction
  - Joint lunches
  - Going for a fast beer
  - Rejection parties
- Senior PhD students act as role models
- International composition
Solve relevant problems and enjoy your work

References

- Wu et al.: Visualization working group at TU Wien: Visible Facimus Quod Ceteri Non Possunt; doi.org/10.1016/j.visinf.2021.02.003
- Patel et al.: PhD Education Through Apprenticeship; doi.org/10.2312/EG2011/education/023-028

I never did a day's work in my life. It was all fun. [Thomas A. Edison]