Scientific Writing and Presentation:
A beginner's guide for students starting the bachelor thesis

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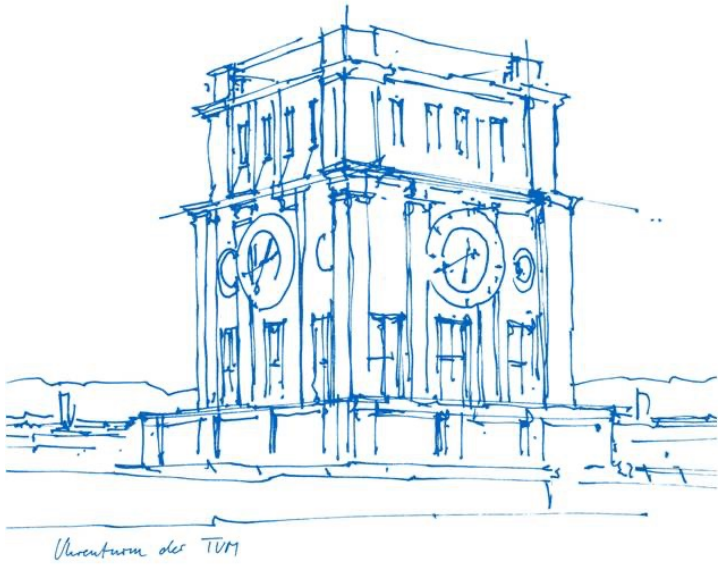

Success in Thesis Project Determined by …

Ability to Speak

Ability to Write

Quality of your Ideas

From: MIT OpenCourseWare “How to Speak” (https://www.youtube.com/watch?v=Unzc731iCUY)

Outline of this Talk - Phases of a Scientific Project

Phase 1: Literature Research
Phase 2: Project Work
Phase 3: Scientific Writing
Phase 4: Slide Preparation
Phase 5: Scientific Presentation

Phases of a Scientific Project

Phase 1: Literature Research

Phase 2: Project Work

Phase 3: Scientific Writing

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Phase 5: Scientific Presentation

Literature Research

Use all Possible Resources!

- Ask supervisor for initial pointers to relevant literature (publications, previous bachelor or master thesis, dissertations, etc.)
- Consider references in these initial pointers
- Search for relevant scientific literature using search engines (keywords, authors, …)

How to Find and Access?

- Google Scholar (http://scholar.google.com)
- IEEE Xplore Digital Library, ACM Digital Library (TUM subscriptions)
- TUM Library (https://www.ub.tum.de)

Learn More

- Courses from TUM Library (https://www.ub.tum.de/kurse)

Phases of a Scientific Project

Phase 1: Literature Research

Phase 2: Project Work

Phase 3: Scientific Writing

Phase 4: Slide Preparation

Phase 5: Scientific Presentation

Project Plan

When?

- More than one task / more the one contributor
- Deadlines

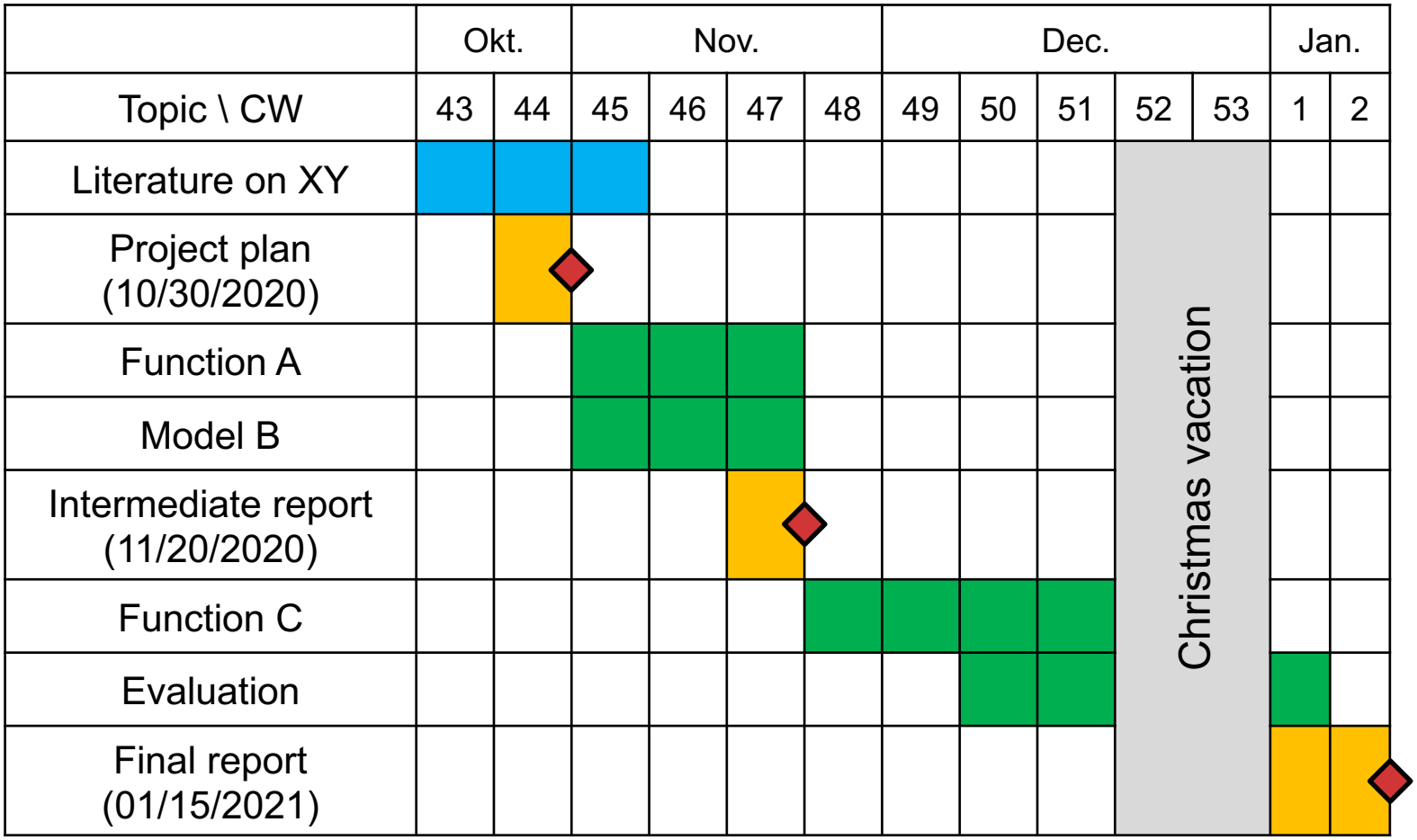
How?

- Divide problem into subtasks
- Detect dependencies between subtasks

Why?

- Enforcing progress
- Monitoring of deadlines
- Early detection of delays

Project Plan: Example



Mismatch Project Plan → Reality

Do not be discouraged, this is normal!

Preventive Measure

- Schedule Buffer Weeks

Revise in Work Phase

- Differentiate between must-have and nice-to-have
- Reconsider required effort based on personal skills
- Discuss revised project plan with supervisor

Phases of a Scientific Project

Phase 1: Literature Research

Phase 2: Project Work

Phase 3: Scientific Writing

- Structure of Report
- Structure of Text - Content
- Style and Layout

Phase 4: Slide Preparation

Phase 5: Scientific Presentation

Structure of Report

Abstract

Introduction

- Motivation, Problem Statement, State of the Art

Main Part (typically more than one chapter)

- Required Theory / Methods / Tools, Main Result, Examples, Applications, Discussion

Summary and Conclusion

Bibliography

Before you start writing: Is there a report template at the professorship?

Structure of Report - Introduction

Orientation

Problem Statement

- Generic formulation

State of the Art

- What did others dealing with the problem already propose?
- Why do these approaches not fulfill our requirements?
- What is the gap in the State-of-the-Art?
- Why does the proposed approach fill this gap?

Structure of Report – Main Part

Main Part 1 – Preparation for Main Contribution

- Provide reader with an understanding of required theory, methods and/or tools
- Motivate why you introduce this
- This is not your work and has to be cleary distinguished!

Main Part 2 – Your contribution

- Objective presentation of your approach

Structure of Report – Main Part (contd.)

Main Part 3 – Experiments / Simulations / Examples

- Show that your approach works in application
- Compare performance of your approach to performance of state of the art approaches

Main Part 4 – Discussion

- Compare approach to state of the art
- Better? Worse? Limitations?

Structure of Report – Summary and Conclusion

Summary

- Short version of approach and main results

Conclusion

- Final assessment
- Open issues and future work

Structure of Report – Bibliography

Book

C. Wickens and J. Hollands. *Engineering psychology and human performance*. Prentice-Hall Inc., Upper Saddle River, New Jersey, 2000.

Journal

R. A. Ruddle, J. C. Savage, and D. M. Jones. Symmetric and asymmetric action integration during cooperative object manipulation in virtual environments. *ACM Transactions on Computer-Human Interaction*, 9(4):285–308, March 2002.

Structure of Text

Levels

- Chapters
- Sections
- Subsections
- ...
- Paragraphs

At all levels

- Heading
- Motivate

  (What will be done and why?)
- Contents
- Summarize

  (What was done, where are we now?)

Structure of Text

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- ...
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Controller Design

„In the following the controller parameters will be determined that result in closed loop stability. Therefore ..... Controller parameters K and T have been determined. They will later be used to ensure desired stable closed loop behavior.“

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Goal: Easy to read!

Style and Layout

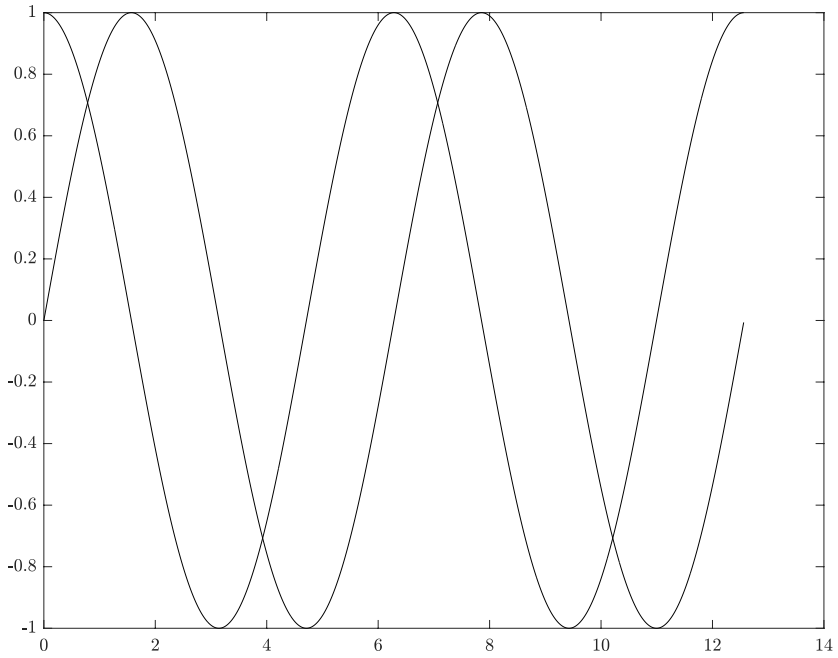
Style

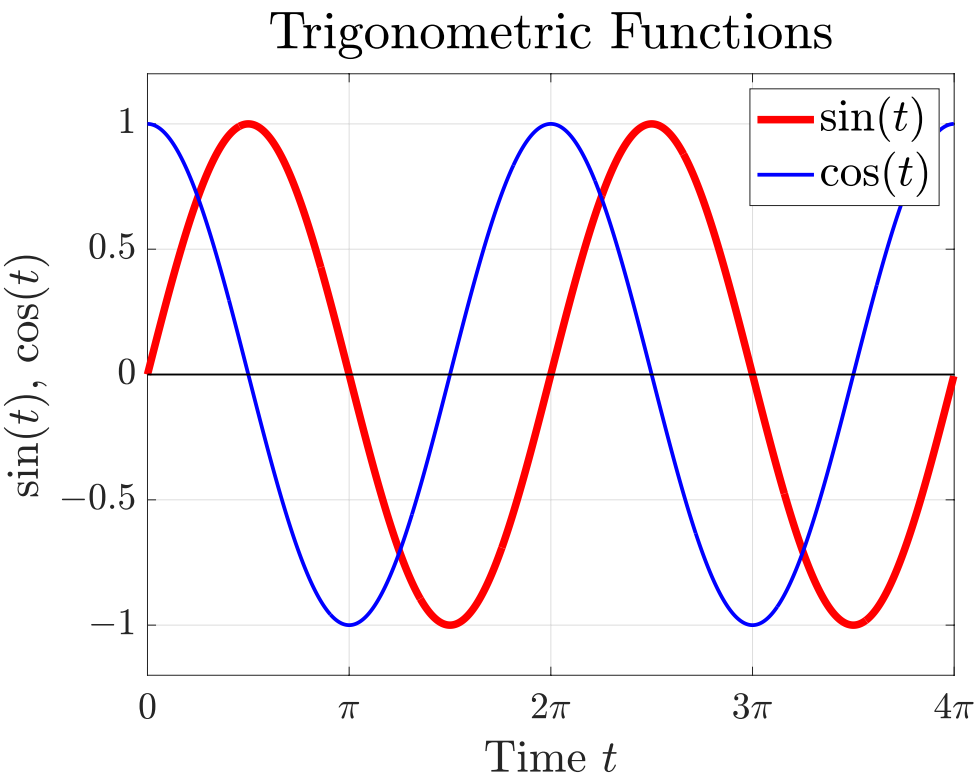
- Neutral and technical style
- Keep it simple: short sentences, simple grammar
- Figures to illustrate the text, but not to replace text

Layout

- Often: Layout is given by template of professorship
- At least for title page: check TUM template
- Figures: your layout skills are required!

Which Figure do you Prefer?





Finally: Never ...

- … submit without spell checking and careful proof-reading
- … copy from other sources (ideas, text, pictures, …) without giving reference

Example:

„In the following, method XY is summarized that was introduced by Author et al., see [1]. Here, the presentation of the method is adapted from Author et al. [2].“

More Details: TUM Citation Guide (https://mediatum.ub.tum.de/1225458)

Phases of a Scientific Project

Phase 1: Literature Research

Phase 2: Project Work

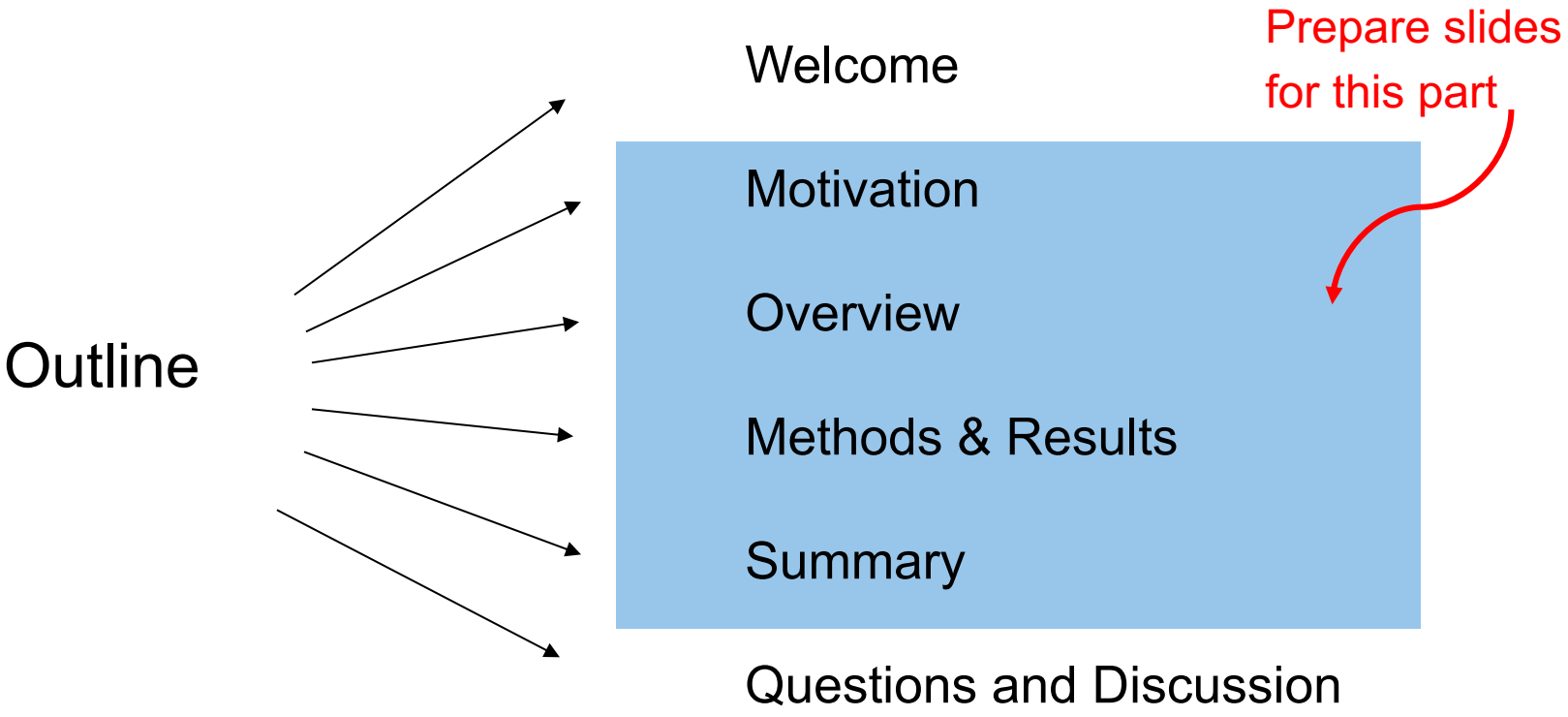
Phase 3: Scientific Writing

Phase 4: Slide Preparation

- Structure
- Content
- Style and Layout

Phase 5: Scientific Presentation

Structure



Content

Content of Presentation:

Orient on Knowledge and Expectation of Audience

- For other students: bachelor level students are able to follow
- For examiners: demonstrate your competence
- Really essential for all: clear problem statement!

Content per Slide:

- Just one main message and appropriate heading
- Slide content supports your speech
- Next: How can layout further support your speech?

Slide Layout: Elements

To structure a slide you can e.g. use:

Boldface , Underline, Colors, Different Font Sizes

- Enumeration Item 1
- Enumeration Item 2

Columns: First column

Second column

Blocks, Shapes, etc.

Slide Layout: Negative Example

Your slide should not look like this

- This is an example for a slide with too much text.
- Avoid to have long sentences and text paragraphs, keywords are better.
- Too many nested ennumerations are confusing.
  - **The audience is busy with reading the text and not listening any more to your speech.**
    - Figures are much better for illustration
  - You will also start reading the slides instead of giving a free speech

- *Too many layout elements lead to CHAOS on your slide.*

Slide Layout: Positive Example

- Do not overload slides
- Keywords and short sentences
- Max. 2 levels in bullet lists
- Max. 3 font sizes / 3 colors
- Frugal use of text emphases
- Only sans-serif fonts
- Comfortable contrast

Better two sparse slides than one overloaded!

Slide Layout: Font Size

Normal font size level 1: 30pt

Normal fontsize level 2: 24pt

Normal fontsize level 3: 18pt

Stay with 18pt in further levels

This is 16pt

This is 14pt

12pt is really tiny

Style: Video, Sound, Animation, Effects, …

Appropriate illustration/effects improve your presentation!

Though:

- No redundant elements, e.g. slide transitions
- Maybe helpful: let contents of a slide appear one-by-one
- Video / animation only if necessary or helpful for comprehension!
- Evaluate „consumption of time“ versus „delivered insight“
- Definitely check: is video / animation / sound running as expected

Phases of a Scientific Project

Phase 1: Literature Research

Phase 2: Project Work

Phase 3: Scientific Writing

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Phase 5: Scientific Presentation

- Style
- Troubleshooting

Style

From: https://www.youtube.com/watch?v=8S0FDjFBj8o

Ability to Speak

Ability to Write

Quality of your Ideas

From: MIT OpenCourseWare “How to Speak” (https://www.youtube.com/watch?v=Unzc731iCUY)

Style: Structure your Speech

- (Slides and slide layout)
- Verbally: Transitions

  “In the following, I will summarize …”

  “This concludes the methods part. Next I will discuss the results”

- Verbally: Rhetoric questions

  “What is the next step?”

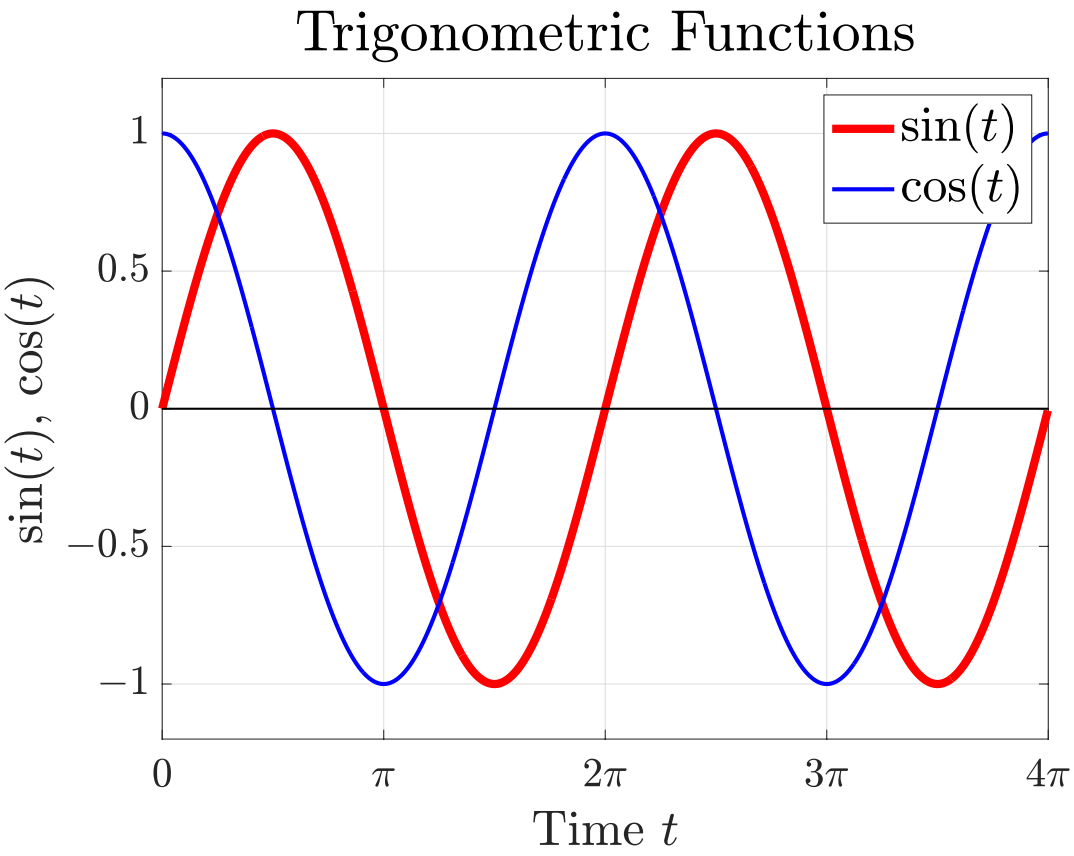
  „Can that be generalized?“

- Take a breath, hold on!

Style: Clarity

- Keep central theme in mind (roter Faden)
- Go through all the content (text / figures) of the slides
- Explain equations in detail (output, input, variables, constants...)
- Explain figures in detail (axes, legend, ...)
- Use a (laser-) pointer!

How to Discuss a Figure / Plot



Style: Language, Speech and Voice

- Simple and short sentences
- Avoid passive formulations
- Avoid unnecessary technical terms

- Talk slowly
- Free speech with natural speech melody
- Appropriate volume

Style: Body Language

- Turn to the audience
- Take an upright posture
- Controlled gestures
- Open-minded facial expression
- Eye-contact with audience

And beyond …

- Better a little overdressed than underdressed, though decent

Style: Reaction on Questions

- Listen carefully, wait until question is finished
- Respectful reaction
- If necessary to clarify, repeat question in own words
- Give concise and objective answer and do not wander from subject
- Confess if you do not know the answer

Troubleshooting: Stage Fright is Normal!

Preparation

- Prepare notes
- Learn opening by heart
- Train difficult passages more often

Practice

- Rehearsal alone and with selected audience
- Video rehearsal

On-Site

- Check room and technical equipment in advance
- Be there early enough

Blackout

- Summarize what you have just said
- Repeat what you have just said
- Go to next part

→ Admit that you got lost

Finally: Never ...

- … give an (important) presentation without intensive practice!

- … run over time!

This presentation: 46 slides in ?? Minutes?

General advice: 1 slide/minute

Try to get feedback on your report and presentation!

How to find a suitable bachelor thesis topic?

- Webpage chair/professorship
- Blackboard

- Approach lecturer of interesting courses
- Attend poster sessions, lab tours etc. of chairs
- Hands-on projects e.g. lab courses of chairs

- TUM job and internship events
- Job portals of companies (TUM examiner needed for industry theses)

Am I ready to start ?

- I am interested in the topic
- I have attended relevant lectures
- I understand the topic description
- I discussed the expectations with the supervisor
- I have enough credits
- I have sufficient time to work on the project for 9 - 20 weeks
- I have a TUM examiner
- I attended this presentation ☺
- I read all information on the department homepage

Information on Department Hompage (mostly in german)

Information Elektrotechnik und Informationstechnik – Bachelor of Science
https://www.cit.tum.de/cit/studium/studiengaenge/bachelor-elektrotechnik-informationstechnik/

Information on Theses in Elektrotechnik und Informationstechnik
https://www.cit.tum.de/cit/studium/studierende/abschlussarbeit-abschluss/elektrotechnik-informationstechnik/#c5053

Studienführer Elektrotechnik und Informationstechnik – Bachelor of Science :
https://www.cit.tum.de/fileadmin/w00byx/cit/Studium/Studiengaenge/Bachelor_Elektrotechnik_Informationstechnik/Studienfuehrer_BSEI_WS2023-24.pdf

Even more questions: bachelor@ei.tum.de