

# 4TH SEMESTER: THESIS RESEARCH

*“LIFE AFTER DRESDEN...”*

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Cartography M.Sc.



Technical University  
Munich



TECHNISCHE  
UNIVERSITÄT  
WIEN  
Vienna University of Technology

TECHNISCHE  
UNIVERSITÄT  
DRESDEN



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[www.cartographymaster.eu](http://www.cartographymaster.eu)

# Agenda



- Why a thesis and what is it?
- Thesis Topics
- The research semester
- Q & A



# Why an MSc Thesis, and what is it...?

# The MSc Thesis

In the 4<sup>th</sup> semester you have to prove that you have gained the competencies to become an **independent researcher**

Our website says "*The Master's Thesis is a scientific elaboration within a time period of six months.*"

- **six months** = 1 full semester (30 EC)
- **elaboration** = writing a  $\pm 50$  page thesis, guided (not instructed!) by a supervisor, plus presenting & defending it in public
- **scientific** = .....?

## Scientific =

- based on, and embedded in existing research (literature review, prior work, existing theory and research frameworks)
- looking into well-contemplated research questions and/or hypotheses
- conclusions and recommendations that take the field of **cartographic science** further  
    *↪ more than "science with some maps"...*
- using **proper scientific methodology** to answer said questions

# Science defined

	ACTUALLY PRETTY EASY TO FIND OUT	VERY HARD, BUT THERE HAVE BEEN RECENT BREAKTHROUGHS	EXTREMELY HARD, CURRENTLY UNSOLVED
SOUNDS BORDERLINE UNSOLVABLE	HOW MUCH DOES THE EIFFEL TOWER'S GRAVITY DEFLECT BASEBALLS IN BOSTON?	WHAT TIME OF YEAR DID THE CRETACEOUS IMPACT HAPPEN?	HOW CAN RELATIVITY BE RECONCILED WITH QUANTUM MECHANICS?
SOUNDS PRETTY HARD, BUT YOU'D ASSUME THAT SOMEONE KNOWS	WHERE WAS MARS IN THE SKY FROM PARIS ON THE DAY THE EIFFEL TOWER OPENED?	HOW MANY ANTS ARE THERE?	HOW DOES TYLENOL WORK?
SOUNDS LIKE IT WOULD BE EASY TO LOOK UP	HOW TALL IS THE EIFFEL TOWER?	HOW DOES GENERAL ANESTHESIA WORK?	WHY DOES YOUR HAIR GET A STATIC CHARGE WHEN YOU RUB IT WITH A BALLOON?

Neither approach is perfect. See e.g. [Langstons Ant](https://xkcd.com/2682/) for an example of how reductionism fails...

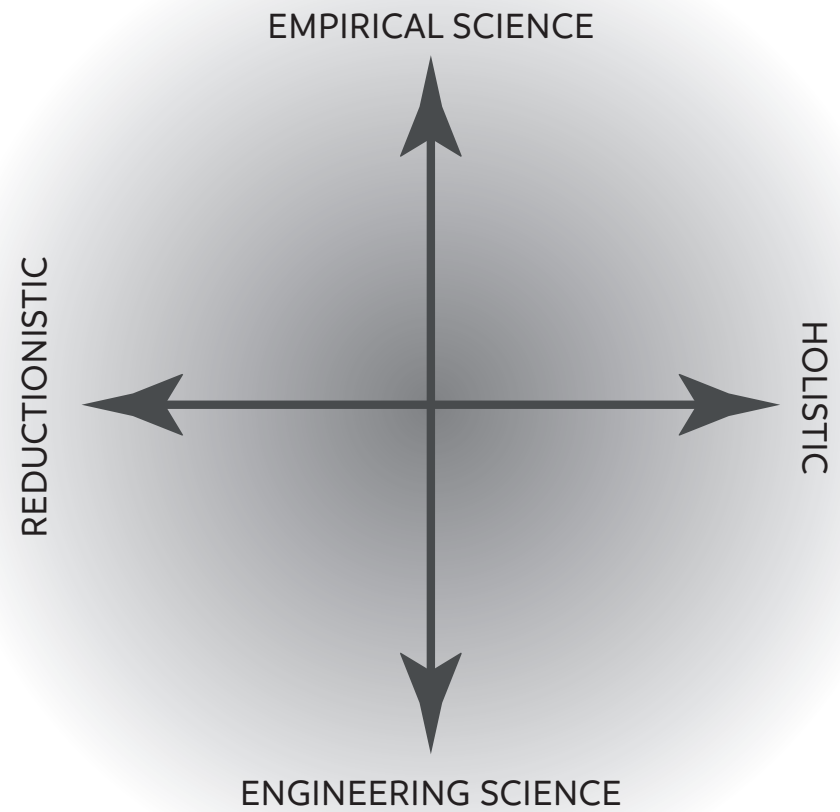


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# Scientific method in Cartography?

- Can be based in/on different methodologies, as the discipline is on the interface between many sciences
- Thus, your method can be somewhere in the “research space”, between empirical or engineering oriented, reductionist or holistic...

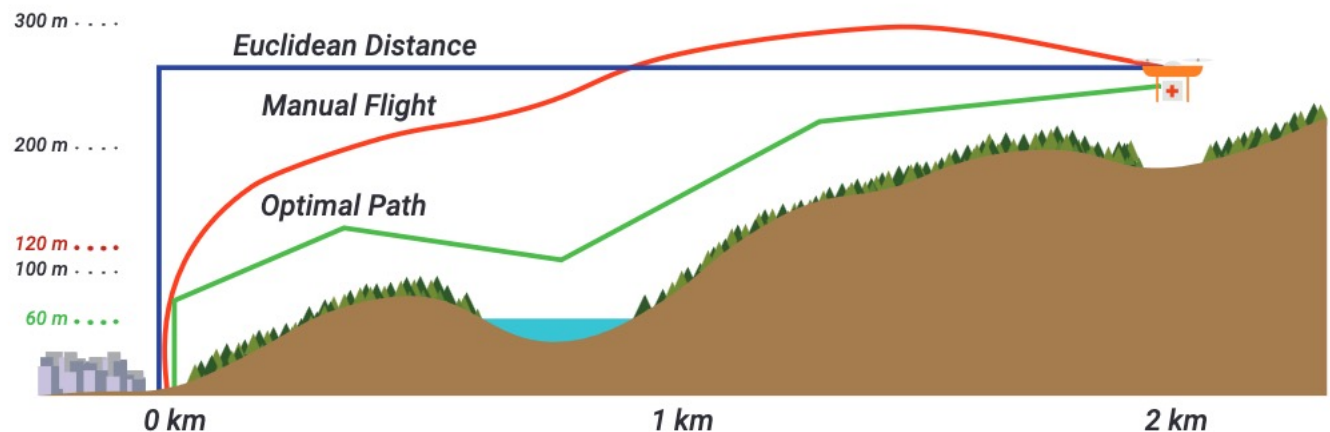




# Scientific method in Cartography?

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Towards an automatic UAS-based mapping tool for first responders



# Scientific method in Cartography?

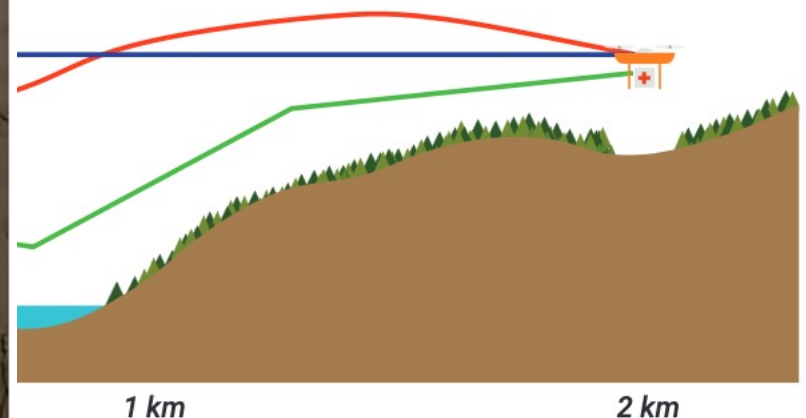
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## Materiality in Cartography, A First Attempt to Evaluate its Usefulness



Fig. 2. Unconventional media map of the degradation in the Amazonia. Materials: Cow bones and coins.

Towards an automatic UAS-based mapping tool for first responders



*So what will **you** research...?*

Thesis Topics

# Topics Examples – Completed Theses









Cartography M.Sc. HOME ABOUT A PROGRAMME FOR ME? HOW TO APPLY STUDYING STUDENTS & ALUMNI NEWS

Home → Theses

## Theses

A list of all theses completed in the programme. The colors indicate the university of the main supervisor.

### 2017

-  **Extraction and Visual Analysis of Negative Traffic Events from Weibo Data**  
Chenyu Zuo | [Presentation](#)  
[DOWNLOAD THESIS](#)
-  **Spatial Optimization of Wind Farm Allocation**  
Dragana Subotic | [Presentation](#)  
[DOWNLOAD THESIS](#)
-  **Legend-less Maps**  
Md. Marufur Rahman | [Presentation](#)  
[DOWNLOAD THESIS](#)
-  **Do Taxi Drivers Choose the Shortest Routes?**  
Junyan Li | [Presentation](#)  
[DOWNLOAD THESIS](#)
-  **Combining Open-Source Programming Languages with GIS for Spatial Data Science**  
Maja Kalinic | [Presentation](#)  
[DOWNLOAD THESIS](#)
-  **Glacier Extents of the Greater Caucasus mountain range derived from manual interpretation and digital classification of Landsat satellite data**  
Kate Doyle | [Presentation](#)

[cartographymaster.eu/theses/](http://cartographymaster.eu/theses/)




# Proposed Thesis Topics

- Research topics are proposed by all 4 members of the consortium: [kartoweb.itc.nl/msc-carto-thesis/topics/](http://kartoweb.itc.nl/msc-carto-thesis/topics/)
- Selecting a topic determines your supervisor and thus where you will write your thesis: TUM, TUW, TUD or UT-ITC
- Note that:
  - The programme strives for an even distribution of thesis students over the 4 partner universities
  - Mobility rules make that German and Austrian students with EM scholarship **must** write their thesis at UT-ITC

## Cartography – MSc Topics


**Effectiveness of 2D and 3D symbols on virtual globes**



Understand the usefulness of 3d symbols on a 3d globe

**Domain(s):**  
Geovisualization

**Topics at the Environmental Remote Sensing group**



[depending on the topic considered]

**Domain(s):**  
TU Dresden


**Creation of an artistic 3D cross-media**



For cross-media use a derivation of an artistic 3D

**Domain(s):**  
TU Dresden


**Gaze-directed Flow Map Explosions in AR/VR**



To build an AR or VR application that allows users to explore a generalized 3D origin-

**Domain(s):**  
Big Geodata Management | Geovisualization | Analytics

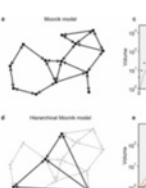
**Developing a location-based "CartoGame" for learning the main concepts of**



Academic education of the fundamental concepts and methods of cartography is

**Domain(s):**  
TU Vienna

**Dimension of Geograph**




Developing and implementing detecting subnetworks th

**Domain(s):**  
Modelling & GeoAI | Big Geo  
Geovisualiza

**Visualizing Places**

fault/node/1316

**Improving Users' Depth Perception in Mixed Reality**



**Inclusive Web Mapping Learning and Cogniti**



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## Cartography – MSc Topics

Topic Title	Description	Domain(s)
Effectiveness of 2D and 3D symbols on virtual globes	Understand the usefulness of 3d symbols on a 3d globe	Geovisualization
Topics at the Environmental Remote Sensing group	[dependent on what is considered]	Remote Sensing
Creation of an artistic 3D cross-media	Use a virtual globe to create an artistic 3D cross-media	Remote Sensing, TU Dresden
Gaze-directed Flow Map Explosions in AR	To build an AR or VR application that allows users to explore geospatialized 3D origin-destination networks	Big Geodata Management   Geovisualization   Analytics
Developing a location-based 'Cartography' for learning the main concepts of cartography	Development of the fundamental concepts and methods of cartography is	TU Vienna
Dimension of Geographical Networks	Developing and implementing methods for detecting subnetworks in geographical networks	Modelling & GeoAI   Big Geospatial Data   Geovisualization
Visualizing Place		
Improving Users' Depth Perception in Mixed Reality		
Inclusive Web Mapping: Learning and Cognition		

# Where do these topics come from?



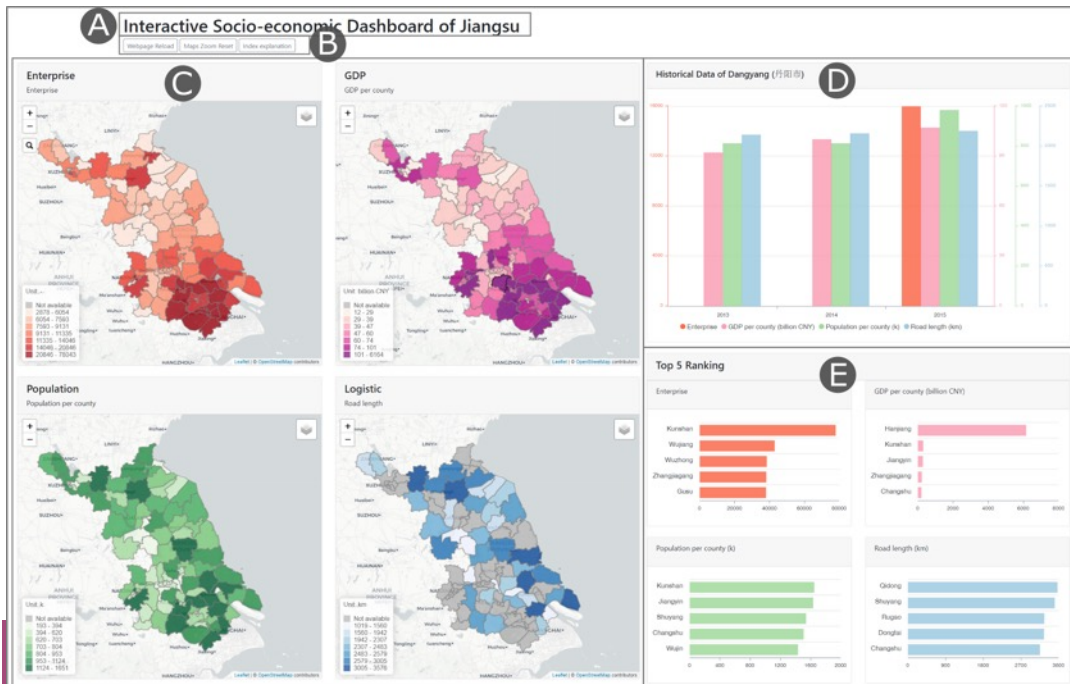
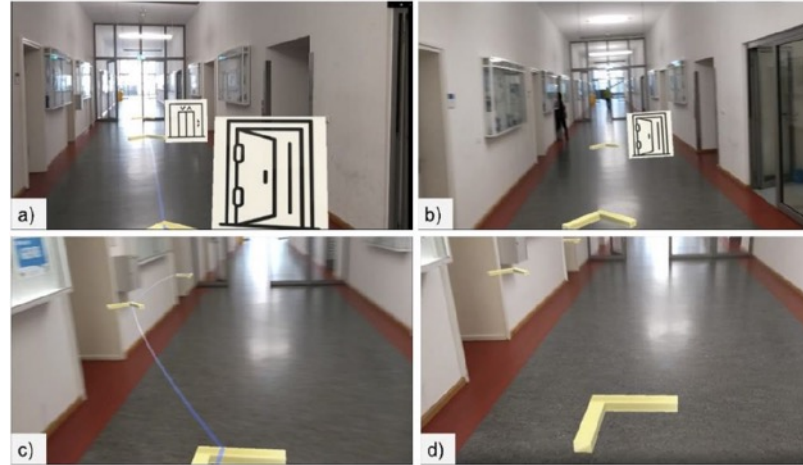
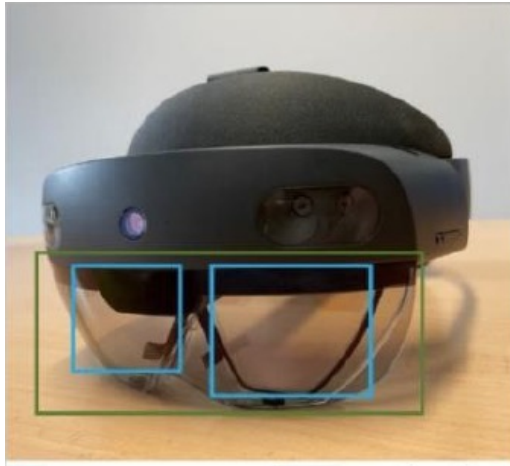
The groups at the 4 partners have a focus on particular research fields:

- **TUM:** Dashboard design, mixed-reality, spatial learning, map-based storytelling, HD mapping
- **TUW:** Location-based services, cartographic storytelling, theoretical cartography, knowledge networks
- **TUD:** Geovisual Analytics (of Location-based Social Media), Artistic Map Design, Automated Generalisation and Multiple Representation
- **UT-ITC:** Atlases/Dashboards, Map Ethics, Mapping time, Place & Space, Webmapping, Visualization of automated workflows, General Data visualization



# RESEARCH FIELDS IN MUNICH

- Mixed Reality based indoor navigation and spatial learning

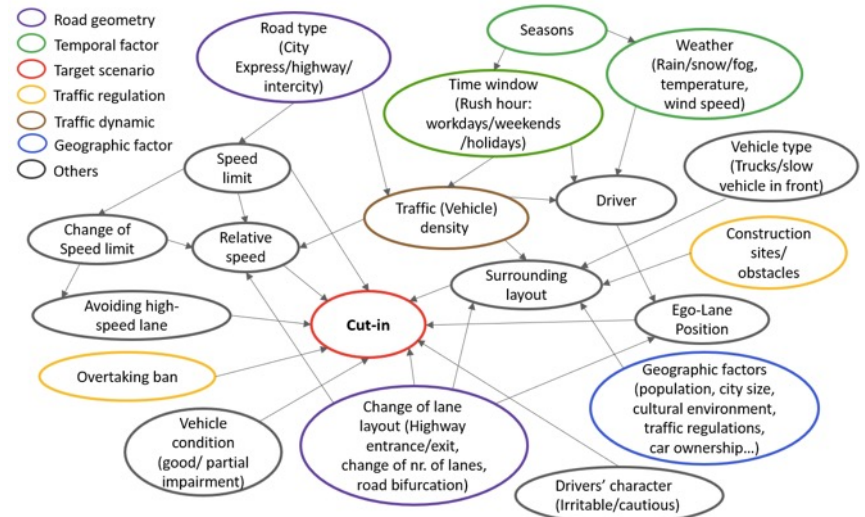
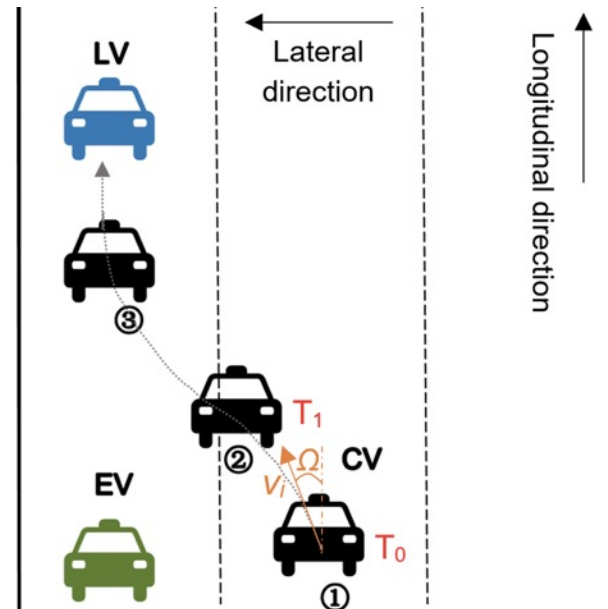
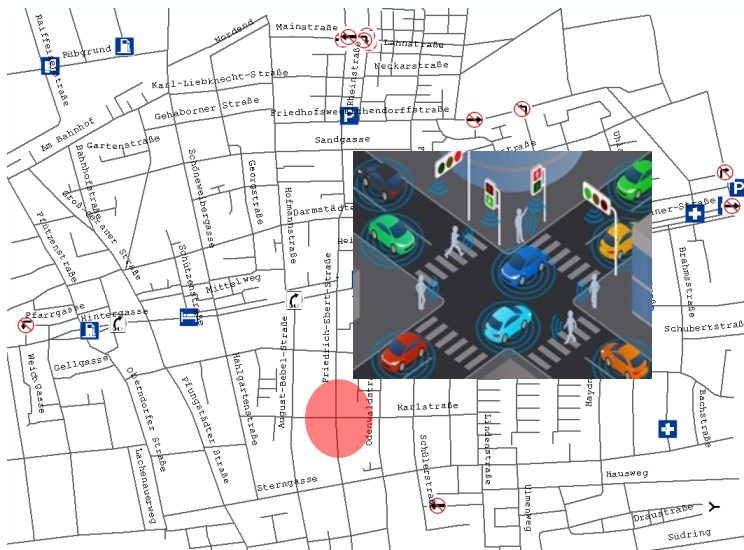
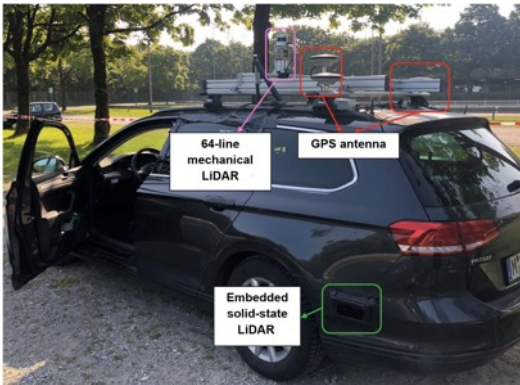


- Map-based dashboard



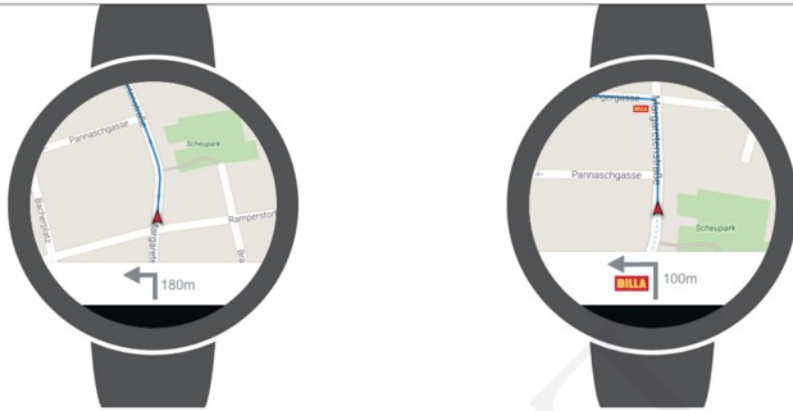
# RESEARCH FIELDS IN MUNICH

- HD Mapping



# RESEARCH FIELDS IN VIENNA

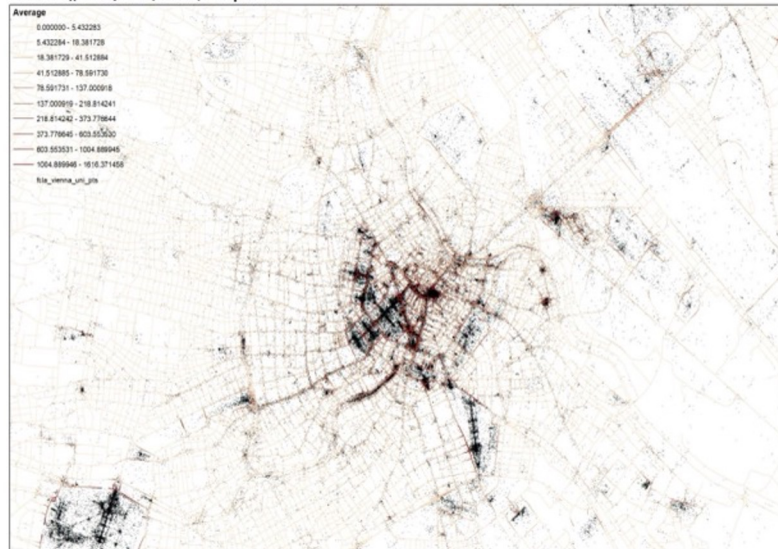
- Location-based services



(a) User is far away - Landmark is not shown

(b) User is close - Landmark is shown.

VIENNA || Footprint (NKDE): All points



Network Kernel Density Estimation.  
10 Intervals. Natural Breaks (Jenks).  
(Notice: Intervals and color scheme to be adjusted)

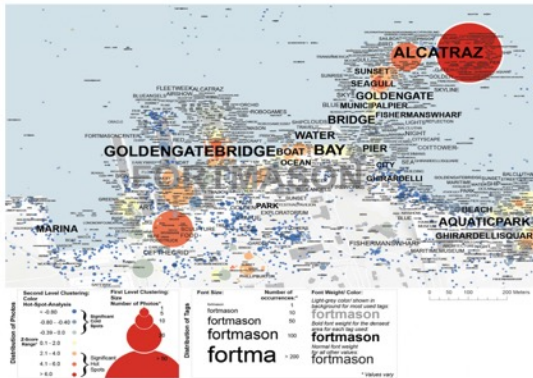
**Was Sie auf gendertlas.at erwartet ...**

- Visualisierung zeitlicher Entwicklungen und räumlicher Clusterung**  
hier: Bürgermeisterinnen in Niederösterreich
- Flexible Diagrammtypen**  
hier: Studienwahl österreichweit
- Geschlechter- und altersspezifische Differenzierung**  
hier: Hochqualifizierte österreichweit
- Interaktionsmöglichkeiten zur Visualisierung räumlicher Vernetzung**  
hier: PendlerInnen im Burgenland
- Lebensweltliche Darstellungen**  
hier: Straßennamen in Wien

- Cartographic storytelling
- Knowledge networks
- Theoretical cartography

# RESEARCH FIELDS IN DRESDEN

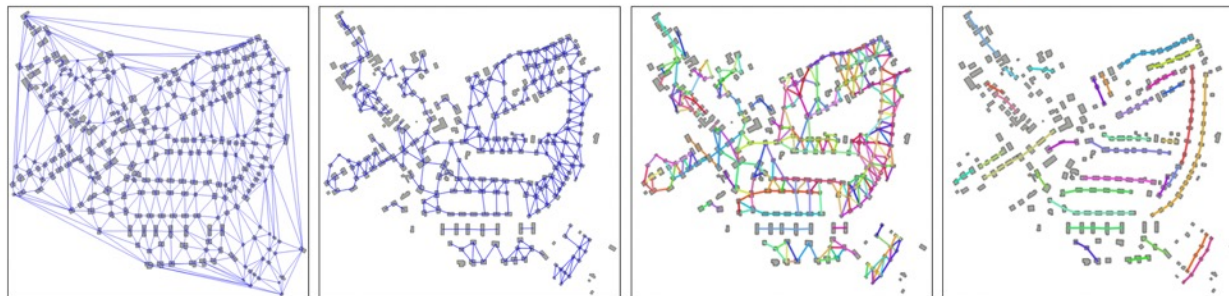
## A) Geovisual Analytics (of Location-based Social Media)



## B) Artistic Map Design



## C) Automated Generalisation and Multiple Representation



## Cartographic interests in Twente



**Atlases / Dashboards**



**Map AI & Map Ethics**



**Mapping time**



**Place & Space**



**Visualization of automated workflows**



**Data visualization**



mixed-reality

Artistic Map Design

spatial learning  
HD mapping

Automated Generalisation and  
Multiple Representation

Atlas /  
Dashboard design

Geovisual Analytics

Cartographic storytelling

Mapping  
Time

Location-  
based services

Map AI &  
Map Ethics

Dataviz

Place & Space

Theoretical cartography

Visualization of automated workflows

Knowledge networks

**This is our partners "research space"....**

# Break-out

1. make one or more Post-Its with your name on it
2. place them in the “research fields” overview near research areas where *you NOW can “see yourself” doing your thesis...*

BREAK-OUT



mixed-reality maryam

juan luis stef marcel

joselyn spatial learning  
athina HD mapping pia  
keying ridwan  
qianyi

Artistic Map Design  
qianyi marcel

Automated Generalisation and  
Multiple Representation ??

joselyn Atlas /  
Dashboard design

Geovisual Analytics  
irene nargiz brenda bella keying  
ridwan yuxuan

juan luis yuxuan bo-yuan  
qianyi will madeleine rica  
Cartographic storytelling

Mapping Time  
Location-based services  
jakub  
will brenda nacho

juan luis tatiana marcel stef nacho  
Map AI & pia  
Map Ethics stef  
kсениia

Dataviz  
jakub nargiz itay  
bo-yan mahyar athina

Place & Space  
juliette athina

Theoretical cartography

Visualization of automated workflows itay

Knowledge networks  
juliette

**THIS WERE YOUR CHOICES LAST YEAR IN MUNICH....**

# Is that all the choice I have....?

- The topics on the list are **suggestions and ideas**. The staff proposing these ideas considered them interesting, relevant and do-able. They are **not a finished proposal**





# Is that all the choice I have....?

- The topics on the list are **suggestions and ideas**. The staff proposing these ideas considered them interesting, relevant and do-able. They are **not a finished proposal**
- You are **very welcome** to propose **your own** cartographic topic!
- Talk with us, we'll help determine if a topic is viable, and who could supervise it.
- There is another workshop (**12 December**) helping you shape your topic (from the list or your own)

*Topic determined, what then...?*

# The research semester

# Sources of information

- Thesis semester website: [kartoweb.itc.nl/msc-carto-thesis/](http://kartoweb.itc.nl/msc-carto-thesis/)
- Procedural handbook

Cartography M.Sc. THESIS ADMIN (PW NEEDED) HOME WEBSITE CARTOGRAPHY M.Sc.

## Semester 4: Thesis (cohort 2021)

On these pages we will publish information relevant for the Thesis phase (the 4th Semester) of the Cartography M.Sc.

To do in the coming time [\[complete timeline here\]](#):

- All theses of (except of the 3 people with an extension) have been submitted and the defenses are ongoing...

MORE INFORMATION: MORE THESIS RESEARCH INFORMATION: SPECIFIC INFORMATION PER UNIVERSITY:

- [A complete timeline](#)
- [The topics of the current cohort](#)
- [Thesis introduction slides](#)
- [Browse the Theses written by earlier cohorts](#)
- [The Procedural Handbook for Students](#)
- [More info on the ERP](#)
- [More info on the midterm presentation](#)
- [About thesis hand-in and defence](#)
- [For those writing the thesis @ UT](#)
- [For those writing the thesis @ TUW](#)
- [The cloudstore for those writing the thesis @ TUD](#)
- [The Moodle pages for those writing the thesis @ TUM](#)

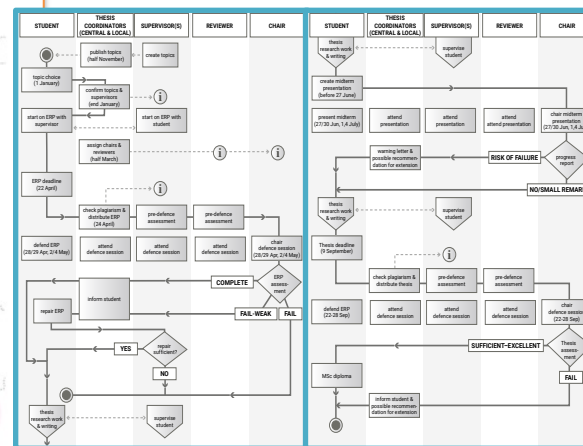
Contact the thesis coordinator, Barend Kobben, by email [b.j.kobben@utwente.nl](mailto:b.j.kobben@utwente.nl) or phone [+31 53 4874253]

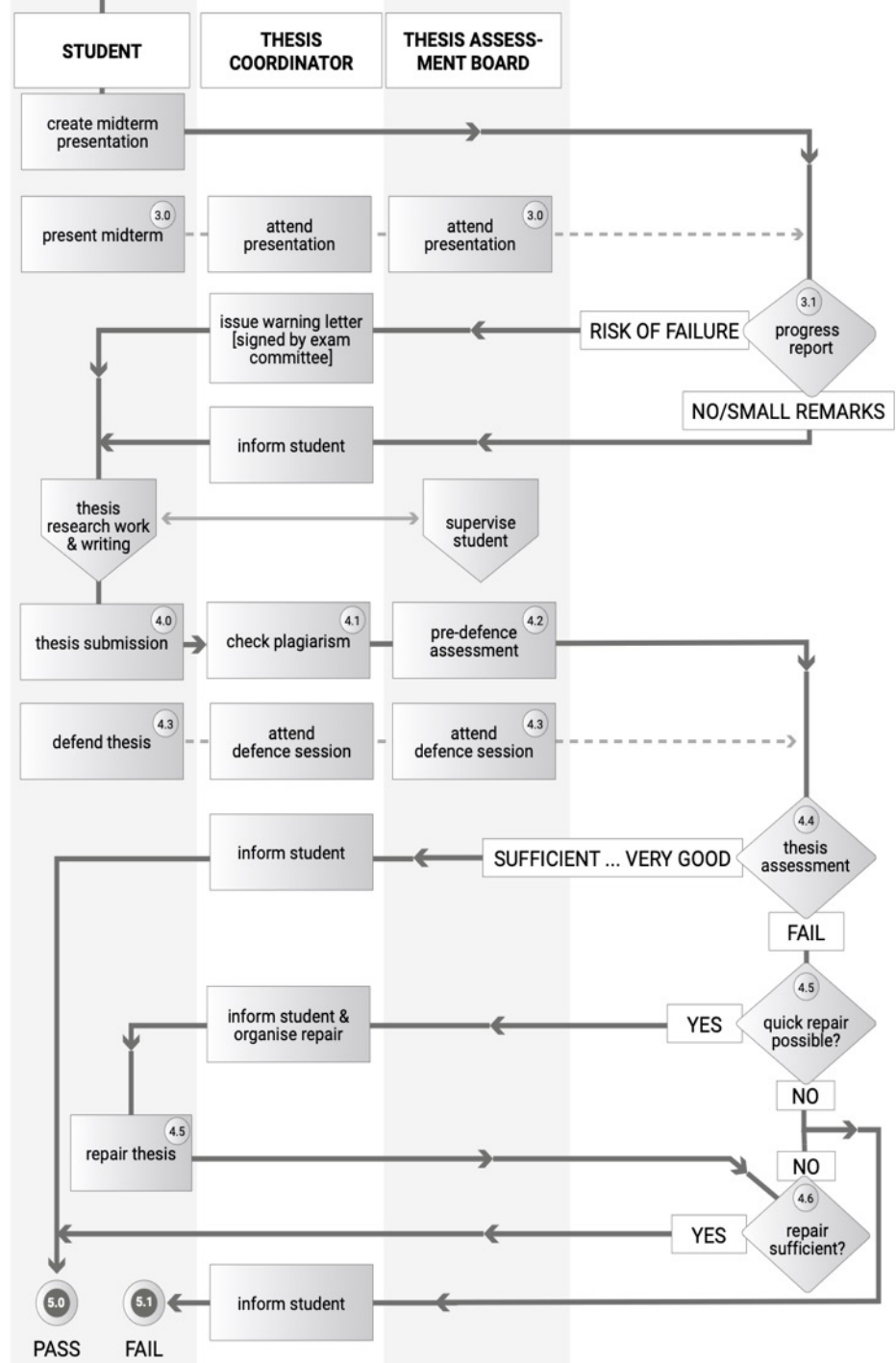
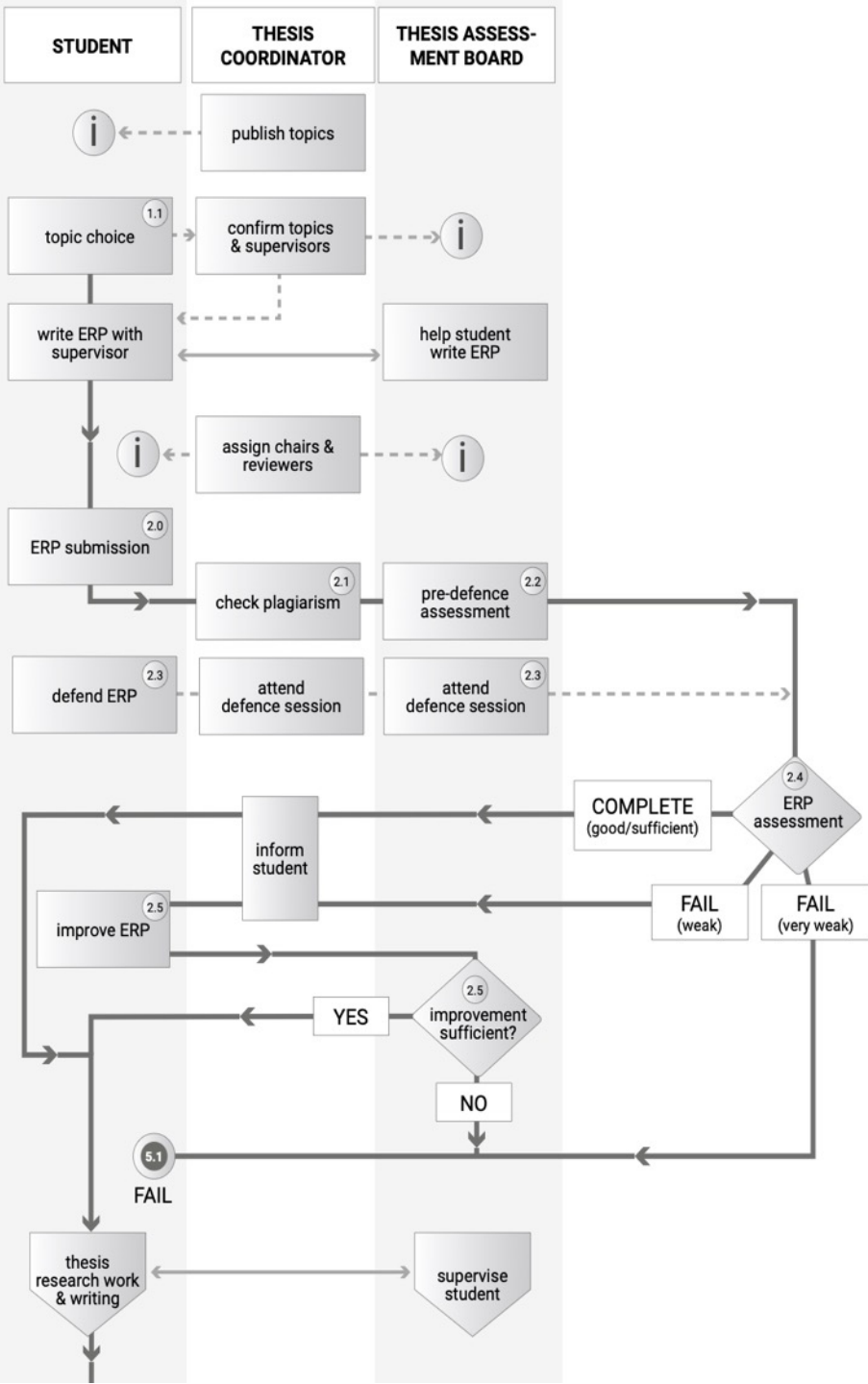
## Thesis Research PROCEDURAL HANDBOOK for student

### MSc Cartography

4th Semester: Master thesis (30 ECTS)

Version 1.0 (February 2023)





# Start Requirements

- If you have obtained **at least 90 credits** in the first three semesters, you **have permission** to start with thesis research
- If you have collected between 80 and 89 credits, you ***may obtain*** permission to start, from the Exam Committee:

write a special request for starting your thesis – addressed to Juliane Cron as secretary of the Exam Committee; final decision on your request will be made by the Committee by the start of Semester 4.

- For the 4th semester you need to **enrol and pay** the **registration** fees at the partner university that employs your primary supervisor  
*[also at TUM as administrating university]*
- beware that for UT-ITC registration fees are high compared to TUM, TUD and TUW (ca. €6.200) !
- for EM Scholarship students fees will be paid by the consortium  
*[additional limited grants might be available]*

# Extended Research Proposal (ERP)



- You will start with the topic ideas and mould them them into your own Extended Research Proposal (ERP)
- **Your supervisors will help you write your ERP**
  - Your primary supervisor is assigned to you based on your topic choice
  - In most (not all) cases they are the person that proposed the topic
  - Your supervisor's university will be where you write your thesis
- Depending on the topic, there may be further supervisors, also from other research institutes or companies



# Primary Supervisor's role

- Your supervisor is your research *coach* – you are in charge & responsible for the research!
- Consider what the supervisor proposes.  
Be *teachable* and learn
- Plan your time (e.g., use Gantt charts, Kanban boards, etc), and check whether you are on schedule. If not, adjust plans and inform your supervisor when necessary
- Ask for feedback on important decisions
- Discuss (intermediate) results
- Note that your supervisor will **not** be available 24/7.  
They have other things on their agenda (unlike you ;-)



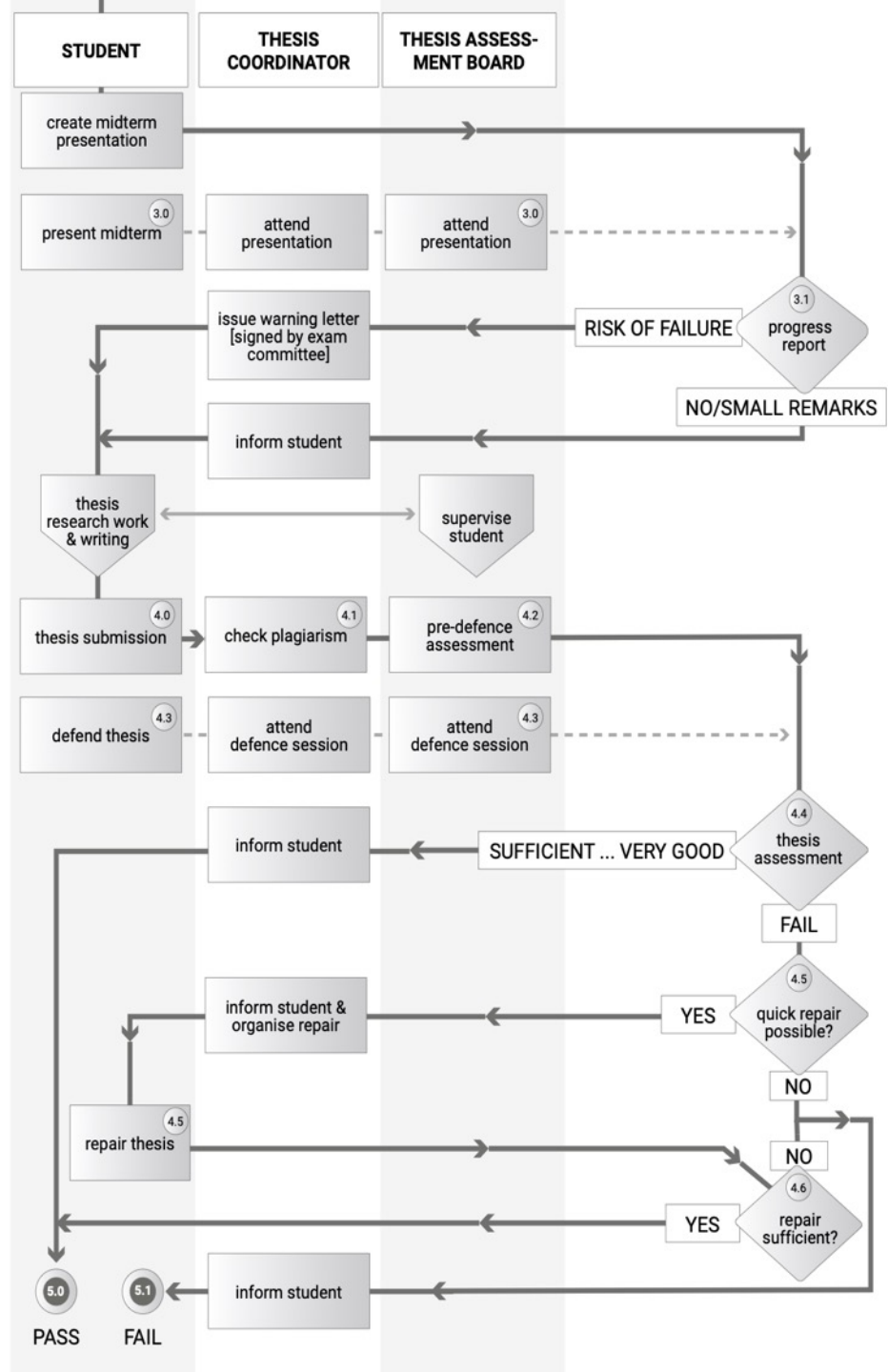
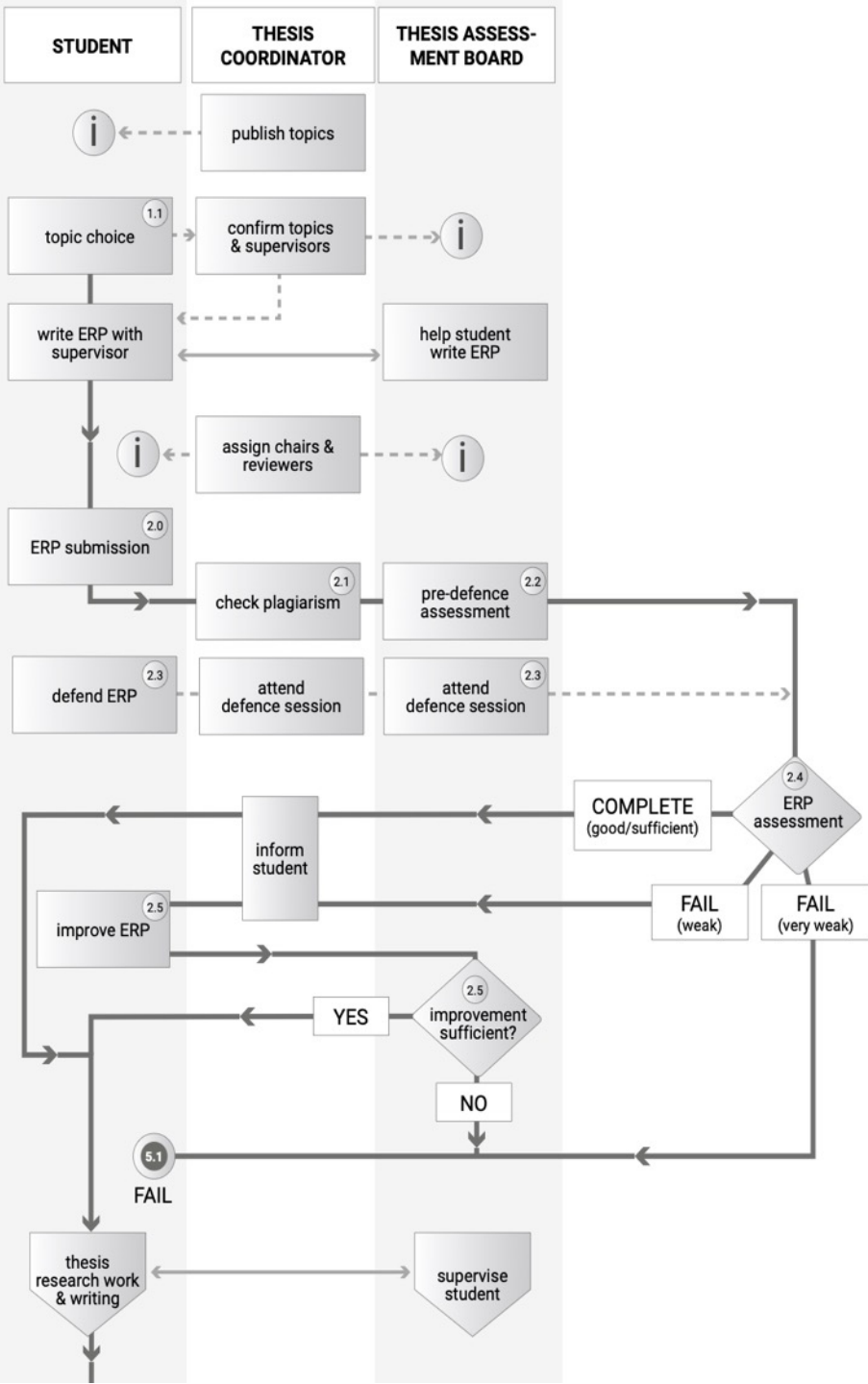
# The Thesis Assessment Board

The TAB consists of at least 3 members:

- The **chair** is a full or associate professor (of the university where you write)
- The second member is your **primary supervisor**,
- The third member is an **external reviewer**, from a university other than your supervisor's.
- other supervisors can be additional members

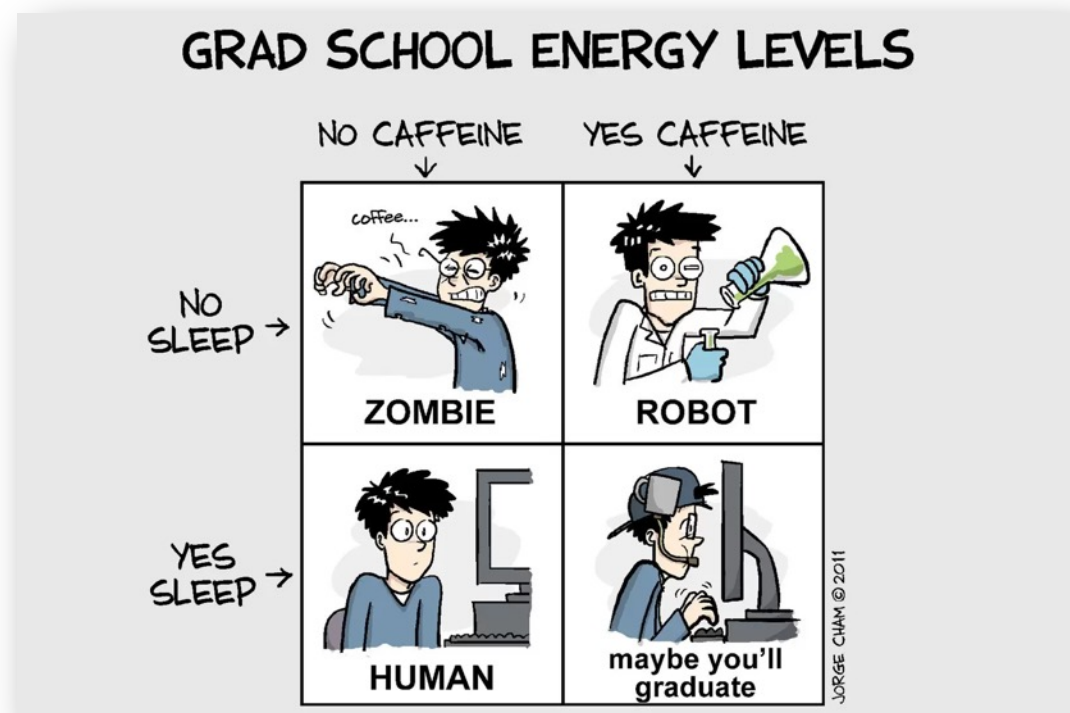
The TAB **assesses** your work:

- In the beginning: your ERP (Extended Research Proposal), at the proposal defence – you can't start until it's approved!
- At the end: your finalised thesis, at the Thesis Defence – your final mark will be determined by the TAB



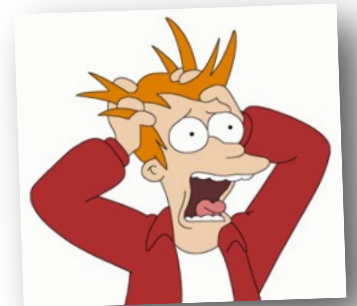
# Planning the stages

- Stage 1: Propose research questions, design of methodology; present & defend proposal (1st month)
- Stage 2: Literature review, finalizing methodology, setting up experiment/prototyping/user requirements; writing first chapters ( $\pm 2$  months).
- Stage 3: Data collection/prototyping/user tests, analysis, conclusions; presentation of results ( $\pm 2.5$  months).



# Timing in a Nutshell:

1 Dec	thesis topics list finalised
12 Dec	<i>topic choice &amp; definition workshop</i>
1 January	topic selection by students
during Jan	approval of thesis topic & supervisor
Jan-Feb	<i>academic writing workshops</i>
...	<i>...work on proposal...</i>
1 April	official start of semester 4
18 Apr	Extended Research Proposal (ERP)
end Apr	ERP defence
...	<i>....working....</i>
end June	midterm presentation
...	<i>....working....</i>
5 Sep	deadline for submission
end Sep	thesis defences



# Q&A

For further information & questions regarding your thesis semester, we have a dedicated website:

[kartoweb.itc.nl/msc-carto-thesis](https://kartoweb.itc.nl/msc-carto-thesis)

<https://xkcd.com/2268/>

Barend Köbben

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Coordinator of the

Master's thesis semester

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We believe this resolves all remaining questions on this topic. No further research is needed.

## References

1. [Illegible]
2. [Illegible]
3. [Illegible]
4. [Illegible]

JUST ONCE, I WANT TO SEE A RESEARCH PAPER WITH THE GUTS TO END THIS WAY.

