

# Design Thinking and Advanced Prototyping

ELEC-C9821 - Introduction



Aalto University  
School of Electrical  
Engineering

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# Today's agenda

1. Introductions & expectations
2. Practicalities
3. Teaming up
4. Project Launch

# Dr. Salu Ylirisku

- **Doctor of Arts / Concept Design / Aalto University / Department of Design**
- **Master of Science / Interaction Design / Univ. of Helsinki / Department of Computer Science**
- **Over 20 years experience in human-centred design and concept design & prototyping**



# Learning goals

- **Improving practical design thinking project skills and teamwork skills**
- **Learn advanced prototyping techniques in the context of IoT product design**



# Practicalities

The course has two variants

- **V5** = 5 ECTS → 135 h
- **V8** = 8 ECTS → 216 h (recommended option)



# Completely redesigned course

- I have completely redesigned DTAP for 2023 to make it more relevant and more effective learning experience
- **Course prerequisites:**
  - Basic understandings of electronic prototyping and programming makes your life in the course a lot easier

# Differences between V5 & V8

## V8

- Full project
- 3 learning diaries (periodical)
- Own custom topic session

## V5

- Reduced project
- 2 learning diaries (periodical)
- No custom topic sessions
- No activity in period V –  
except for Final Presentation  
(31<sup>th</sup> of May)

# Grading V5

**The course is graded on the 6-point scale: 0-5**

**Grade is based on:**

- 1) Learning diaries, 40%
- 2) Project work (weekly deliverables), 30%
- 3) Concept presentation, final presentation, demo + poster, 20%
- 4) Project documentation, 10%

**Teacher's overall evaluation of your active performance (+/-)**





# Grading V8

**The course is graded on the 6-point scale: 0-5**

**Grade is based on:**

- 1) Learning diaries, 30%
- 2) Project work (weekly deliverables), 30%
- 3) Custom topic session, 10%
- 4) Concept presentation, final presentation, demo + poster, 20%
- 5) Project documentation, 10%

**Teacher's overall evaluation of your active performance (+/-)**



# Custom topic session (V8)

**A V8 student team is expected to run a 20-minute introduction to a course-relevant topic, and plan a 20-40 minute related activity for other students. The session needs to be based on research.**

**A topic may be as simple as “why is the steering wheel so popular?” or “what are the most interesting ways to use AI with IoT products?”**

# Learning Diary

- **Reflective & reflexive writing**
- **400-600 words weekly to keep up the rhythm (deliverable periodically, 2400-3600 words)**
- **Show your exercises & project work**
- **Be visual (+ integrate images to body text)**
- **Read and cite academically (=IEEE or APA format)**

# Learning Diary Tips

**Start today, submit on Friday (MyCourses student folder)**

**Use Zotero – A free reference manager**

# Project Schedule

**Period III** User-centred design concept creation

**Period IV** Prototyping rounds 1 & 2

**Period V** Prototyping round 3, Final Presentations



# Lectures/Workshops – Wed 09-12

- 09-10 Lecture
- 10-12 Workshop

**Do not miss more than 2 sessions! Unless you want to receive additional reading & writing assignments.**

# Lectures/Workshops – Period III

- w03 Users and technology**
- w04 Interpreting and ideating**
- w05 Reflective prototyping**
- w06 Idea framing & screening**
- w07 Concept presentations**
- w08 No teaching – exam week**

# Lectures/Workshops – Period IV

**w09 Technical arguments**

**w10 Financial arguments**

**w11 UX and Visual Design**

**w12 UX and Interaction Design**

**w13 UX and Physical Design**

**w14 Effective Concept Presenting (+final session reqs)**

w15 Easter – no teaching

w16 No teaching – exam week



# Lectures/Workshops – Period V

**w17 Custom topic by students (Teams 1 2 3)**

**w18 Custom topic by students (Teams 3 4 5)**

**w19 Custom topic by students (Teams 6 7)**

**w20 Custom topic by students (Teams 8 9)**

**w21 Custom topic by students (Teams 10 11)**

**w22 Final Presentations (31.5.)**

# Exercises

## Period III

Circuit schema design (EDA)

PCB layout design

PCB carving

PCB etching

PCB soldering

PCB testing

## Period IV

Weekly specialized tracks



# Teamwork and specializations

# Teamwork and specializations

- This is a project course
- Project is done in teams of 4 persons
- Each person will have a specialization (on period IV)

# Specializations

**Embedded Design**

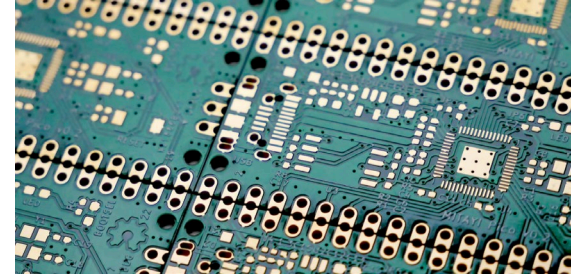
**Physical Design**

**Web App Design**

**Cloud Service Design**

# Embedded Design

- **Advanced PCB circuit design**
- **Battery management design**
- **USB-C powered charging of Lion batteries**
- **IoT Network connectivity with Matter standard (aka connected home over IP)**
- **Advanced use of the new Circuit Shop**



<https://unsplash.com/photos/vE6WEdZA6Vg>

# Physical Design

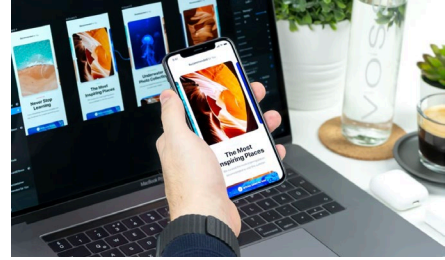


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- Deeper understanding of physical product architecture
- Modelling more sophisticated 3D models in Fusion360
- Learning to consider manufacturing techniques, especially injection moulding, when modelling the form
- More knowledge about how PCBs and physical shapes interact
- More experience in managing 3D printing process



# Web App Design



<https://unsplash.com/photos/mxPiMiz7KCo>

- **Learning about the building blocks of Web Apps**
- **Learning about Interaction Design for User Experience with technical point of view**
- **Learning to use Figma and ProtoPie to create illustrative visual and interactive prototypes of web-based design concepts**



# Cloud Service Design

- Learning the basics of Linux server
- Creating a web service on Linux
- Learning to create Application Programming Interfaces (REST APIs) for the web
- Using Linux server to connect devices and services



<https://unsplash.com/photos/Q1p7bh3SHj8>

# V5 or V8?

# Teaming Up

# Interest

**Embedded Electronics Design (green)**

**Physical Product Design (yellow)**

**Web App Design (red)**

**Cloud Service Design (blue)**

# Expectations – Ambition level

**V5 – Medium – High – Great – Insane**

# Team Agreement

**Each Team needs to negotiate and sign a Team Agreement  
Submit it by Friday night by email (one / team)**

# Design Thinking – Recap

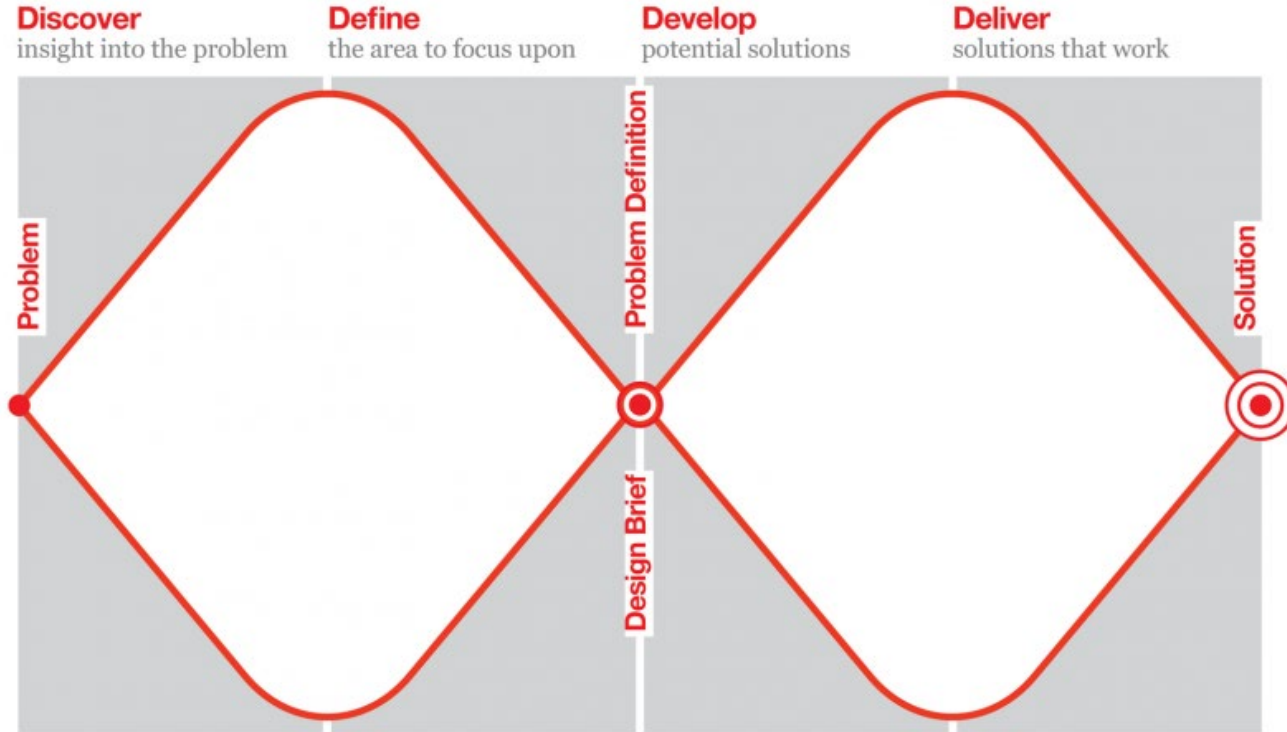
# Design Thinking is NOT product design

- Do not confuse Design Thinking (DT) project with Product Design (PD) project
- DT project results in a design concept
- PD project results in a product specification





# The Double Diamond



Council, D. (2007). *Eleven lessons: Managing design in eleven global companies. A study of the design process.*

# Do not confuse 'solution' with 'product'

Design Thinking (DT) process results in a concept, not a product that can be put into market.

Product Design (PD) process leads into product. This is not a product design course.

Design Thinking does not result in product, NOT even into minimal viable product (MVP).

- However, the boundary between DT and PD is blurry

-- Presence Check --

# What is a concept?

**Käsite = General notion (e.g., bacteria, neuron)**

**Konsepti = Purposeful Construct (e.g., design concept)**

# What do general concepts do?

- Enables us to talk about, to share 'it' – to reflect
- Enables us to do something about 'it' – to plan
- Enables us to dream about 'it', to experience – to relate



# What do design concepts do?

They enable you to

1. Be sure that your product has great potential
2. Attract funding/support for the real project
3. Prepare you for possible partnerships / sourcing
4. Look fresh, cool, and innovative
5. Learn a lot

# Design concept

Design concept is a management tool!

# Innovation project planning



# Project planning in innovation context

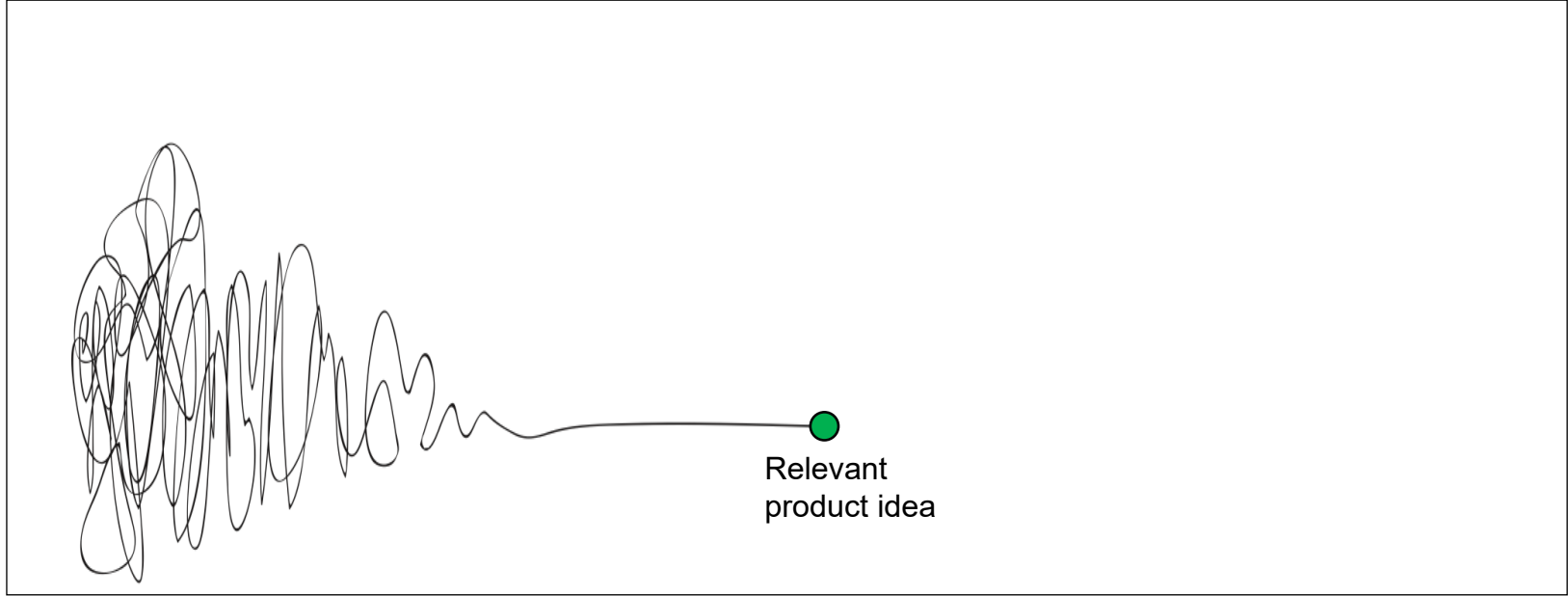
- **Dilemma:**
  - You do not know all the stuff yet
  - You need to accommodate learning into the planning
  - The learning may result in such discoveries that you need to re-plan your project

# Innovation vs. Engineering project planning

# Projects are different

Uncertain

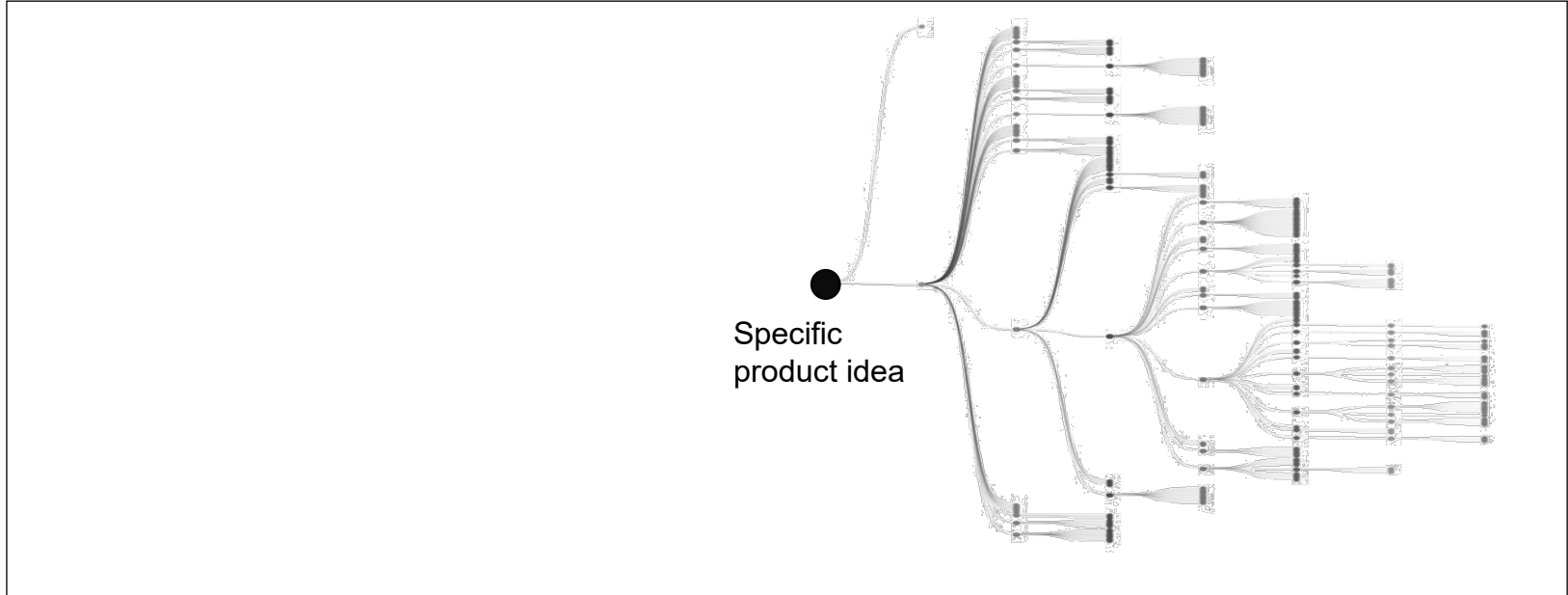
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# Projects are different

Uncertain

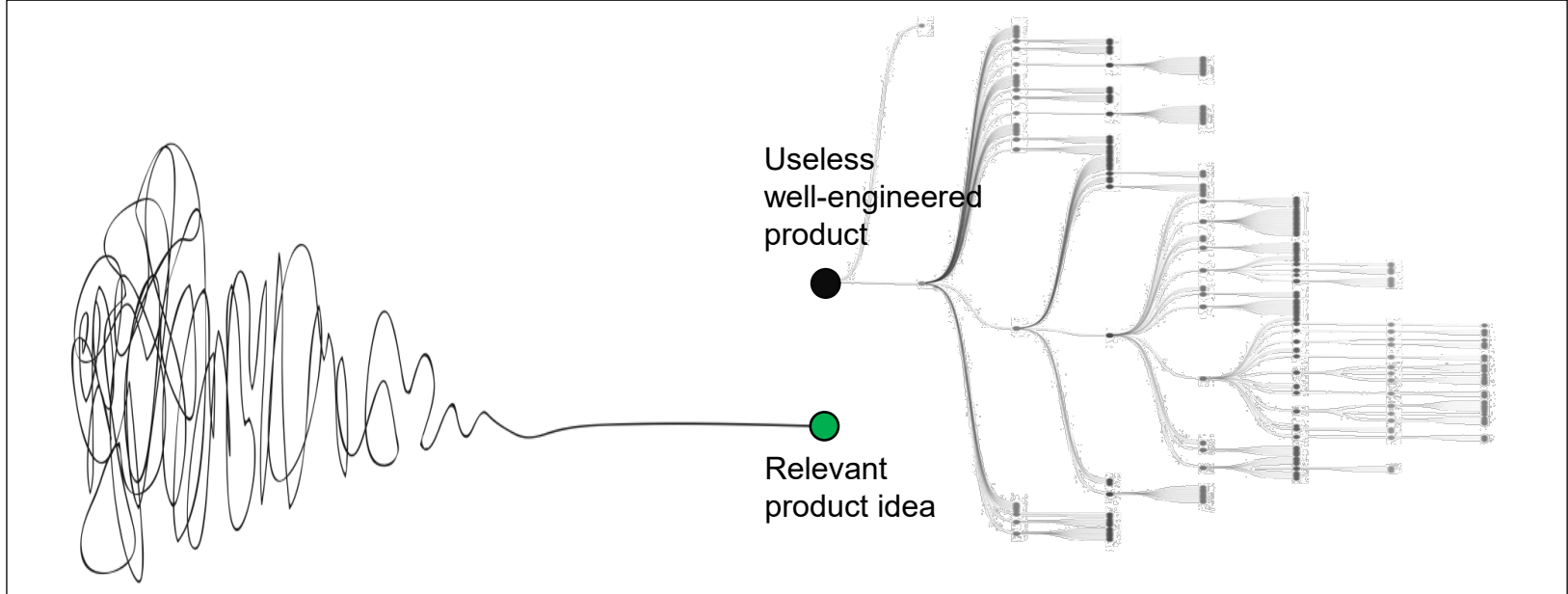
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# Projects are different

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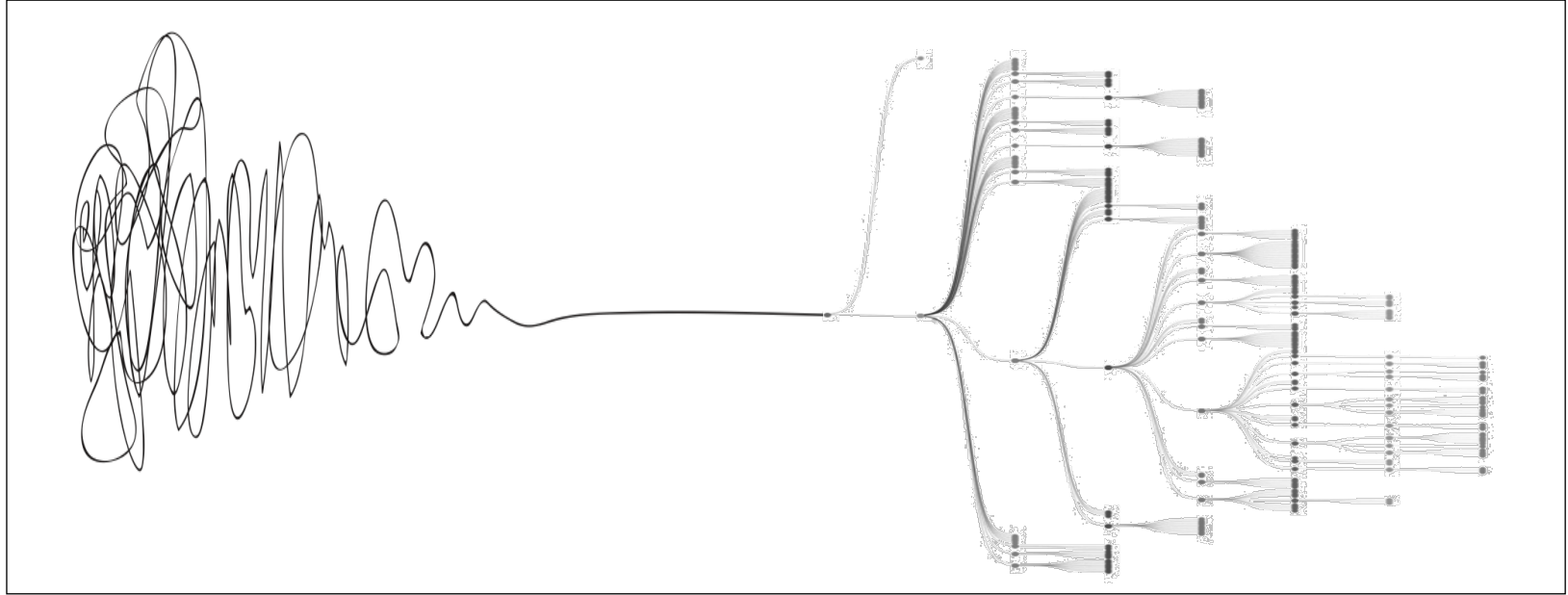
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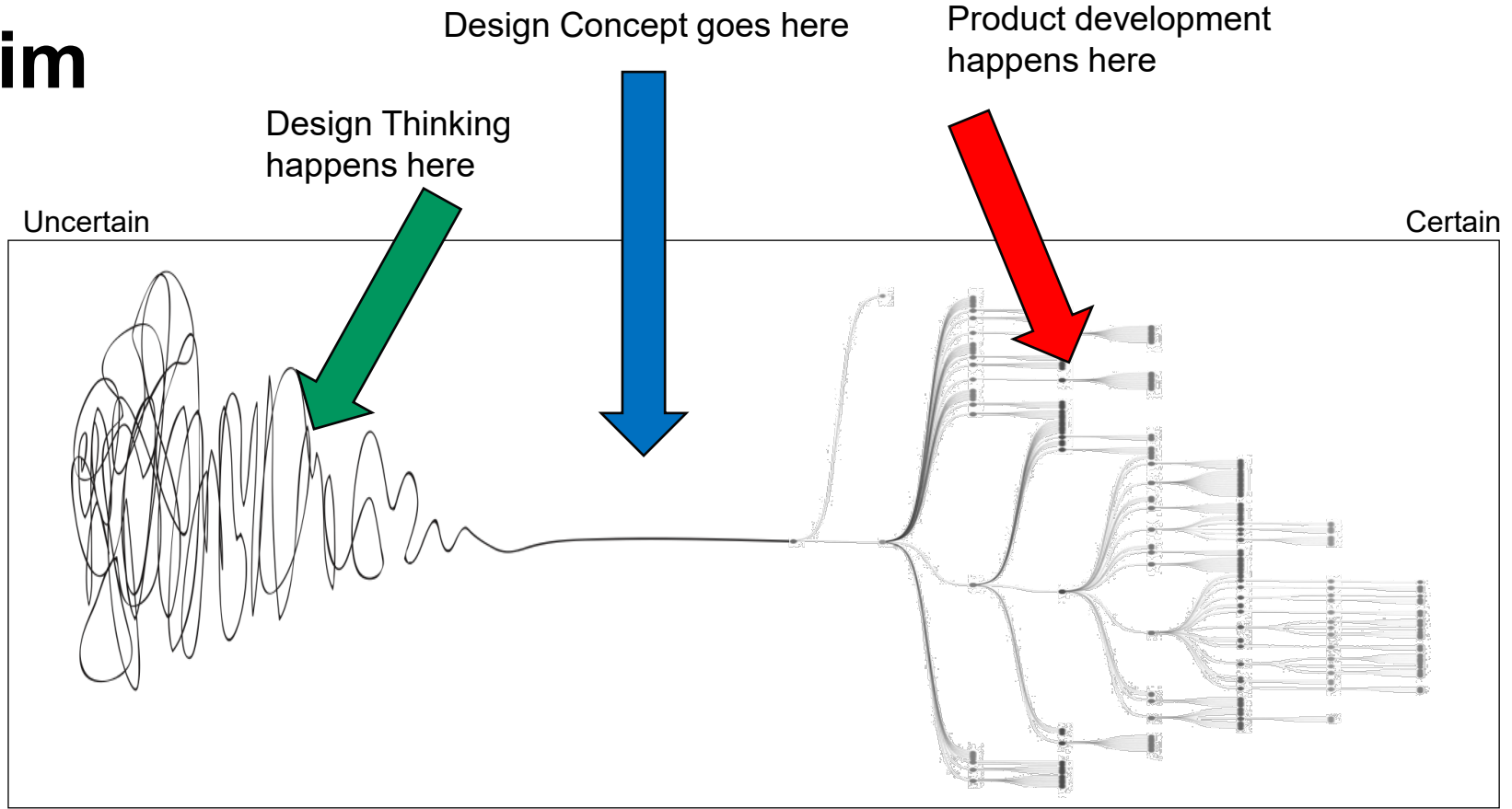
# Aim

Uncertain

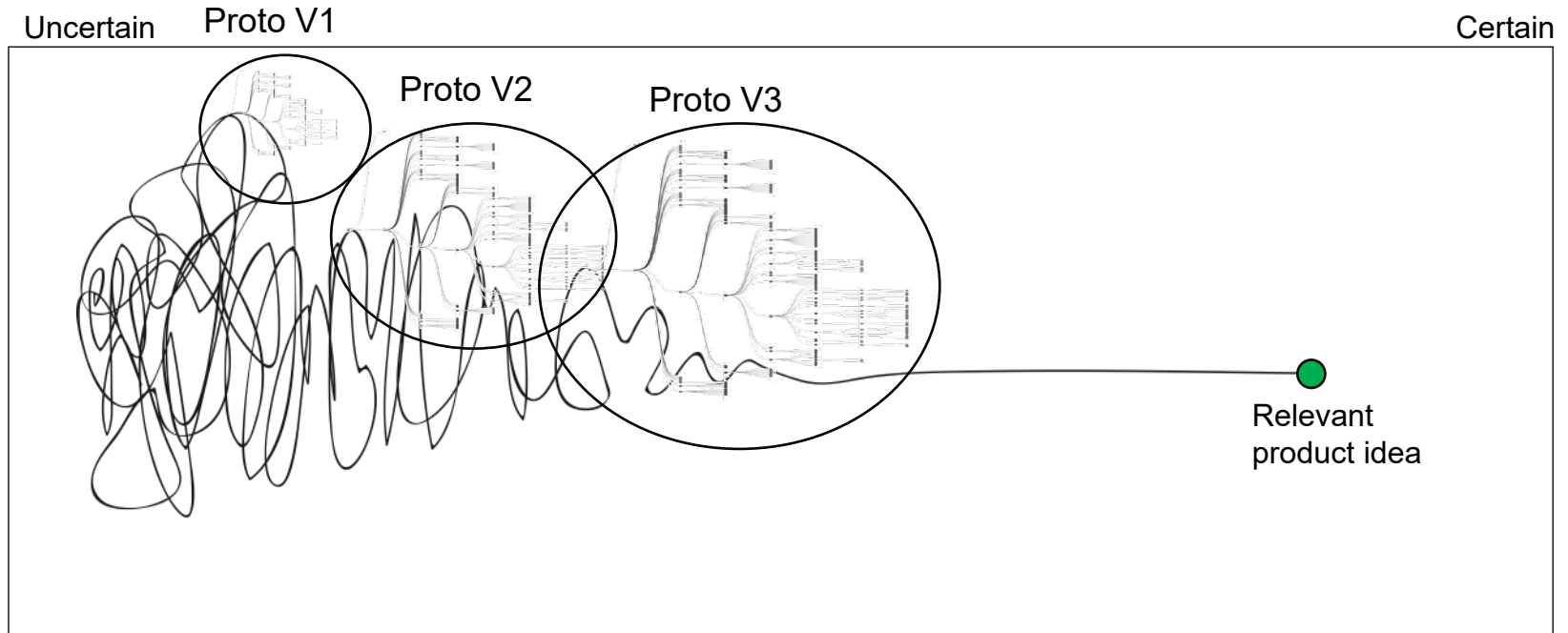
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# Aim

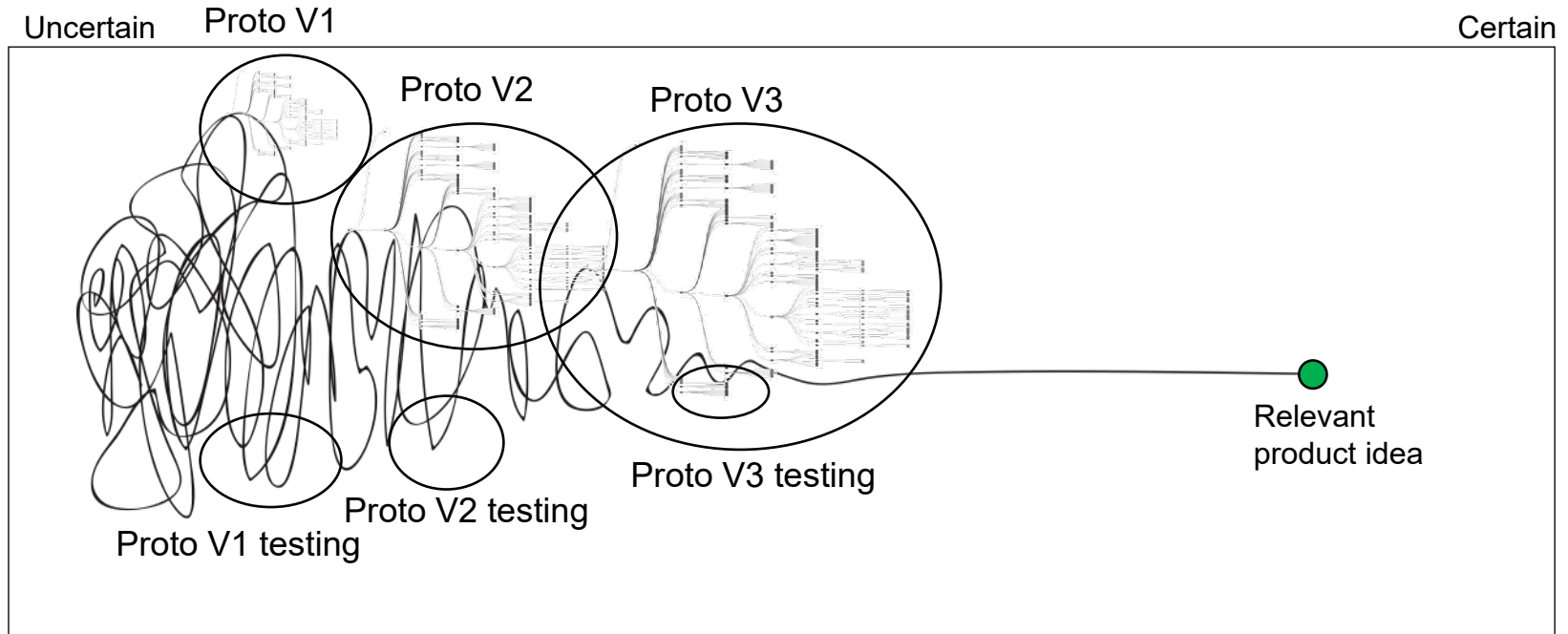


# The DTAP23 case





# The DTAP23 case



# The project

# Resource Tracking

- The aim of the project in DTAP23 is to create an IoT product that is related to ‘resource tracking’.
- **Workshop:**
  - Create a mind map -> What is a ‘trackable resource’?

# This week

- **Write your diary and submit it**
- **Submit your Team Agreement**
- **Submit your Team's mindmap**
- **Start the exercises (Fri 14-16, Mon 14-16, Tue 10-12)**
  - in Vilhon Paja Lab (former Sähköpaja)