Project Design

Protopaja – ELEC-D0301

Aalto University
School of Electrical
Engineering

Salu Ylirisku

4.6.2019

Are teams clear?

1. JoyHaptics Sending Touch Over Distance
2. Aboense Real-Time Data-Analyzing for Sports
3. Helvar 1 Energy Harvesting Bluetooth Low Energy Beacon
4. Helvar 2 Sensor Testing Rig
5. Savox ThrowCam
6. Riot Innovations Etäohjattava virranohjausmoduuli
7. Futurice 1 At Night in the Library
8. Futurice 2 Speed Demon
9. SICK Aikakauslehtien lajittelu konenäöllä

Course background

- **This part was lectured originally by Dr. Timo Oksanen**
  - We will utilise the project plan and report templates created by him
  - Timo’s approach comes from rigorous engineering

- **My background is in concept design**
  - Projects there are open and exploratory, with a plan-as-you-go type of approach
  - Project plans give broad outlines for discovery

Next steps in the project

- **Contacting the companies**
  - Calling or e-mailing (contact info in the contract)
- **Making the project plan**
  - Deadline 19.6.
  - You need to use the template

What is in Timo’s template?

What does it say you need to do?

Exercise 30 min. - Enactment:

Contacting the Company Now

Exercise

Roles:

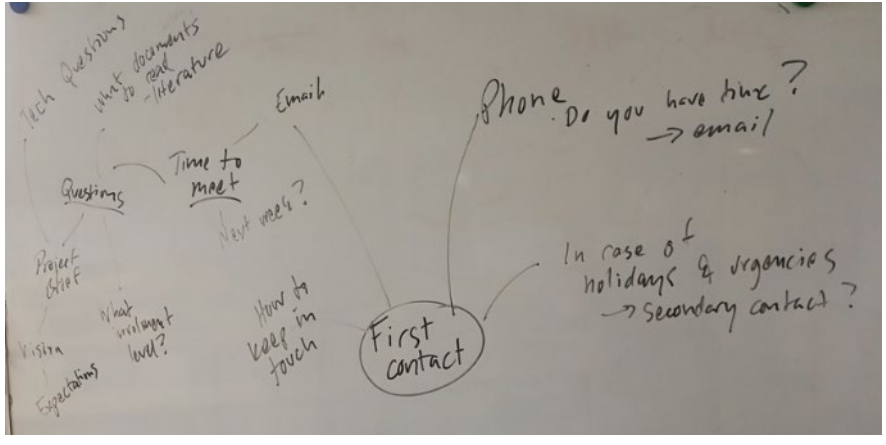
- **Project manager**
- **Customer**
- **Observer(s)**

What to do (2 rounds):

- **5 mins Plan how you start, your first message**
- **5 mins Run the communication**
- **5 mins Reflect**

Two different situations for the customer:

- **Too engaged with your topic**
- **Too busy**



The Dilemma between Planning and Learning

- **Projects are different in regard to how much learning they involve**
- **How can you know how much time something takes, if you do not yet know**
  - what that something is,
  - what skills it requires to be implemented, or
  - what skills that you have in your team?

Different kinds of projects

- **Product search projects, “Conceptual Design Projects”**
  - Result is not known at the start
  - Dynamic roles, high reflection, high ambiguity
  - A lot of research into the context, technology and business opportunities
  - Persuasive documentation, overall requirements, roadmaps
- **Product design projects, “Production Projects”**
  - Result known, technology known, business known
  - Clear professional roles, high specialisation, high certainty
  - Planning is done by breaking the work down into task structurally and functionally
  - Definite documentation, detailed specification

Planning-Driven Projects

- **Planning-Driven Projects are such where the Problem, Solution, and Resources are essentially known**
  - The project can be planned in terms of clear chunks (Tasks), which are based on detailed Work Breakdown Structure (WBS) implied by the parts or functions of the solution
  - Tasks can be estimated very precisely, in reality down to 15 min. accuracy with known resources
  - Tasks are hierarchically bound to specific Work Packages, Outcomes, and Milestones
  - Once Tasks are outlined, they can be assigned to workers, executed with specific resources, monitored, and controlled

Learning-Driven Projects

- **Learning-Driven projects are such where the Problem, Solution and Resources are essentially not known**
  - The project cannot be readily planned in terms of clear chunks (Tasks) but needs to be governed by broader Goals, Deliverables, and Deadlines
  - The process is highly exploratory, iterative, reflective, constructive, and dialogical

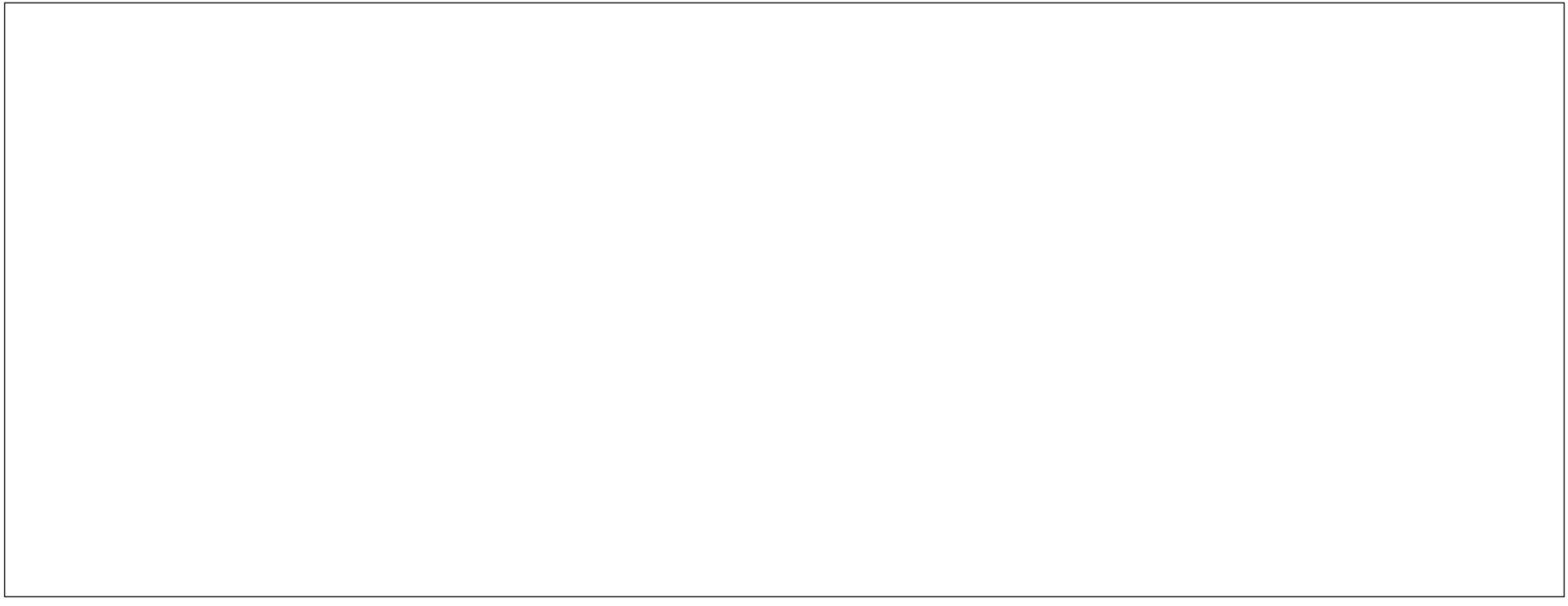
Note: Educational Projects

- All projects in university are Educational Projects
- Regardless of the kind of project you are in, it will always be an intensive learning project here at university
- Your learning is documented in project documents (plan and report) – hopefully also into your personal learning diary

Different overall values of projects

(functioning product vs. good idea)

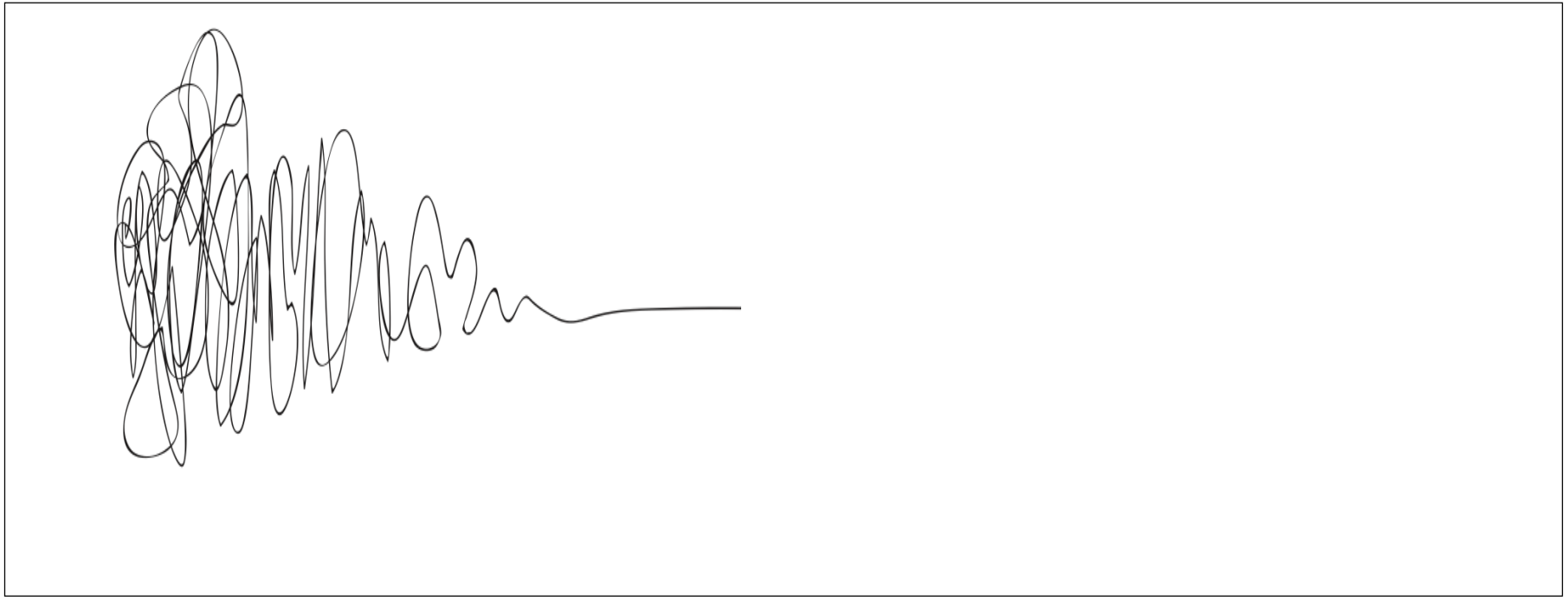
Uncertain Certain



Different overall values of projects

(functioning product vs. good idea)

Uncertain Certain

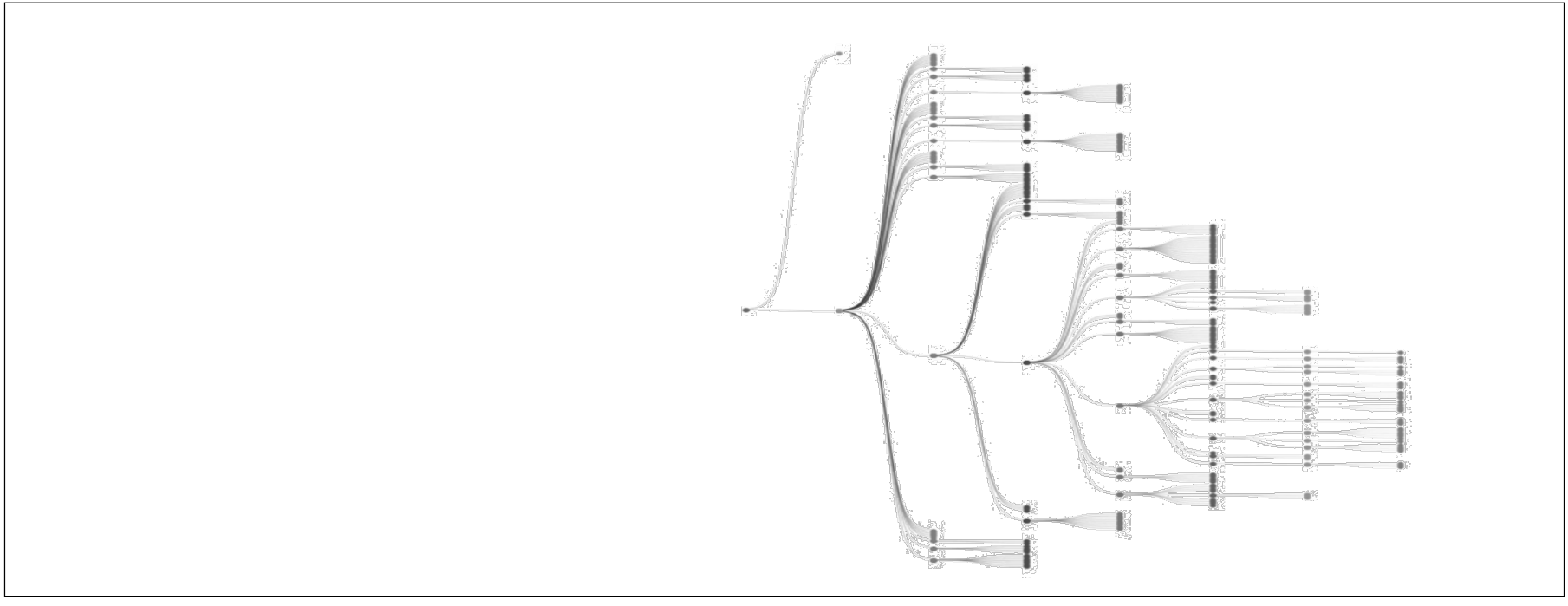


Different overall values of projects

(functioning product vs. good idea)

Uncertain

Certain

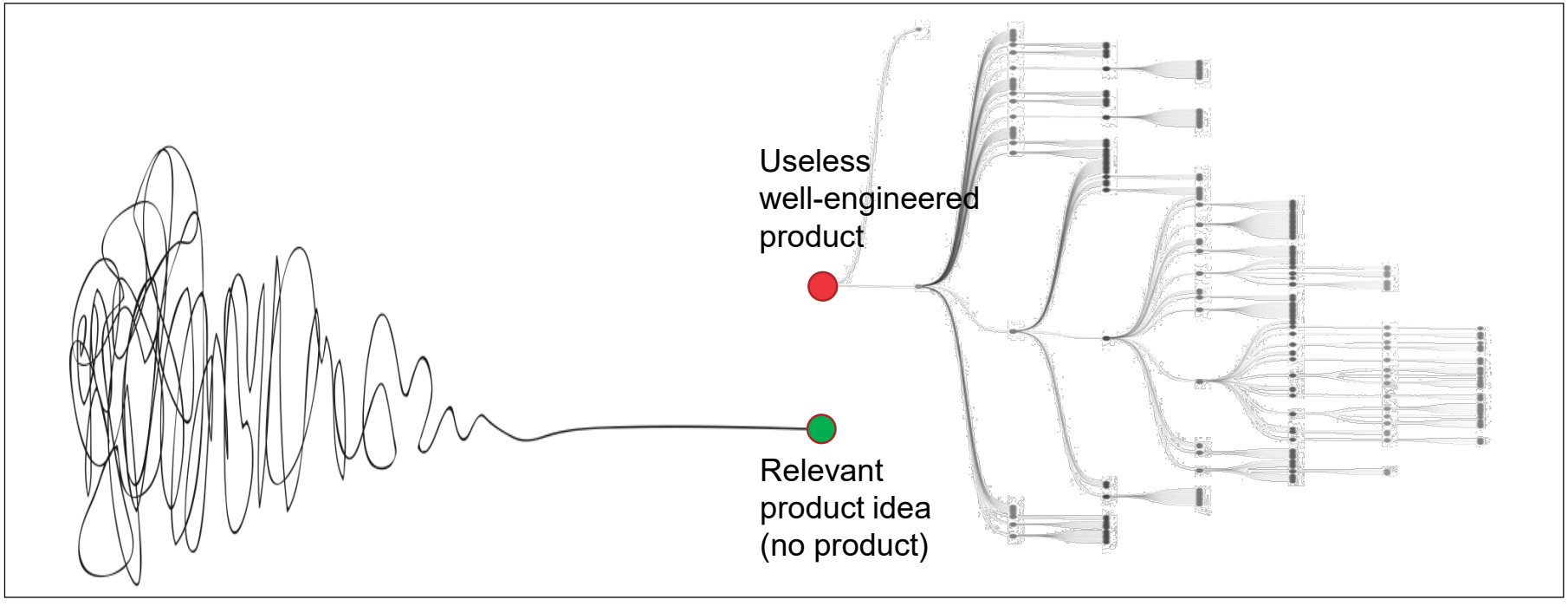


Different overall values of projects

(functioning product vs. good idea)

Uncertain

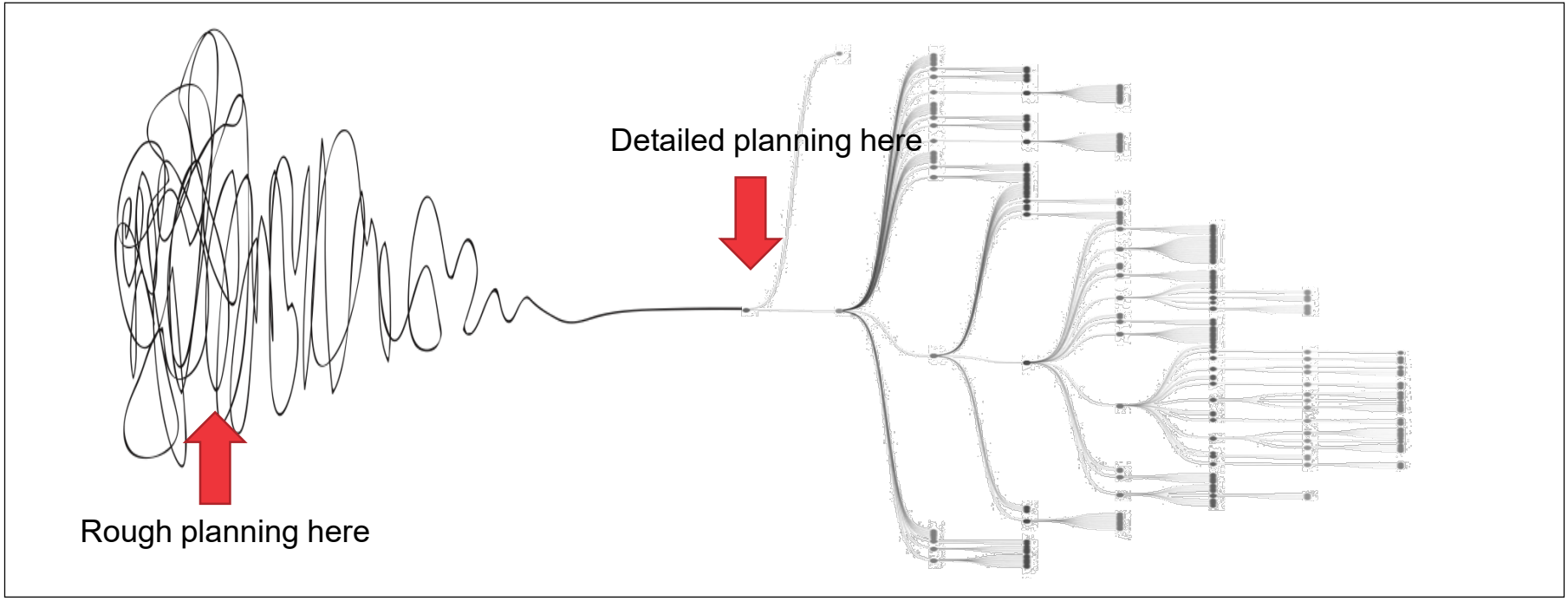
Certain



Process for creating a good product

Uncertain

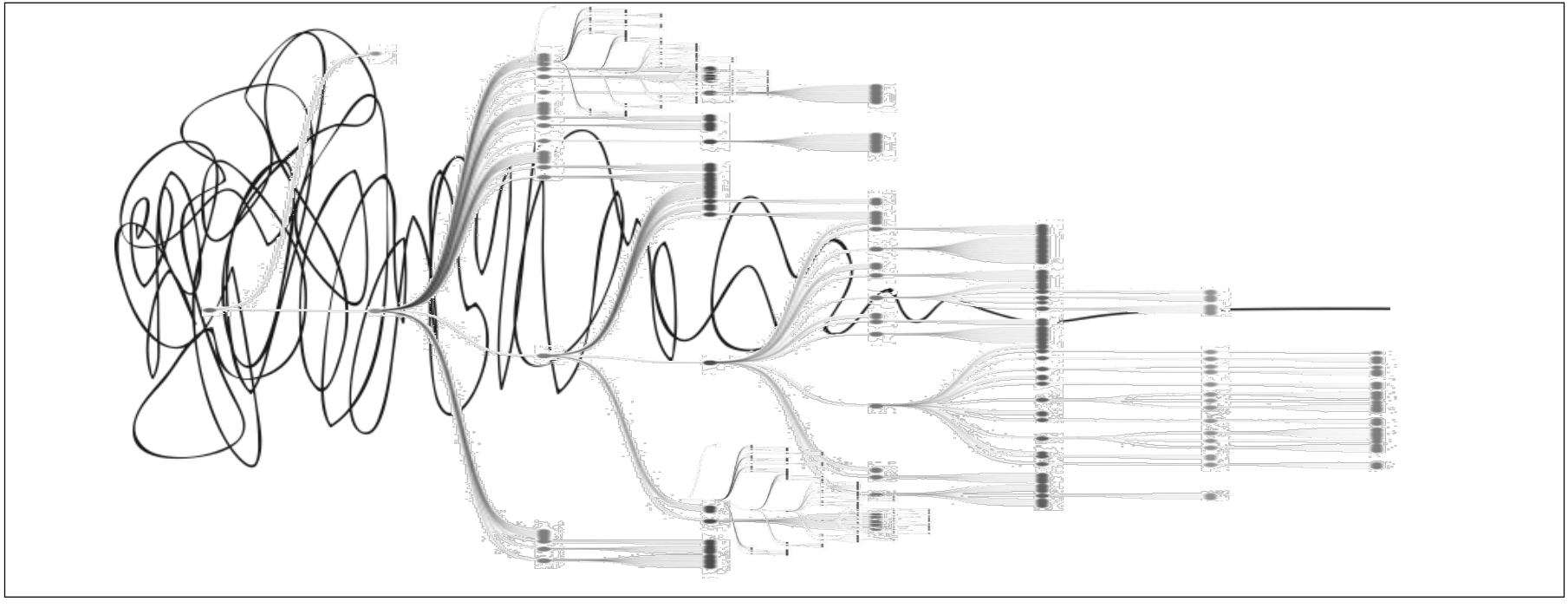
Certain



Prototyping as a planning strategy

Uncertain

Certain



Father of Management Theory

Max Weber (1864–1920)

- **Clearly defined job roles**
- **Meticulous record-keeping**
- **Hiring based solely on specific qualifications**
- **Work-appropriate relationships only**

Father of Scientific Management

Frederick Winslow Taylor (1856–1915)

- **“Work should be done as efficiently as possible”**
- **Standardize work into tasks**
- **Assign tasks to specialists**

Father of Modern Quality Control

W. Edwards Deming (1900-1993)

- **“Continual improvement can help increase quality while decreasing costs”**
- **Developer of the Plan-Do-Study-Act (PDSA) cycle**

Project is an ‘institution’

- **When working on a project, you are not just creating a product, or result**
  - You also form an organisation, typically a new one, for a new purpose
  - You need to familiarise with your team

Common ingredients to Planning- and Learning-Driven projects

- **Partners** – Who are you collaborating with
- **Goals** – What you think you want to achieve
- **Deliverables** – What you expect as the results
- **Deadlines** – When you agree to be done
- **Phases** – What you plan to do before the deadline
- **Budget** – How much can you spend

Why to make a project plan?

1. Getting funding & resources
2. Clarifying the goal
3. Agreeing on the process
4. Making sure that it is possible to do
5. Enabling tracking progress and responding to changes

The difficulty of estimation

1. **New requirements can emerge even in rigorously specified projects**
    1. Customer changes their mind
    2. Environment changes
    3. The spec was only such rigorous..
2. **When building and trying things, you may find novel ways how things work (technically / experientially)**

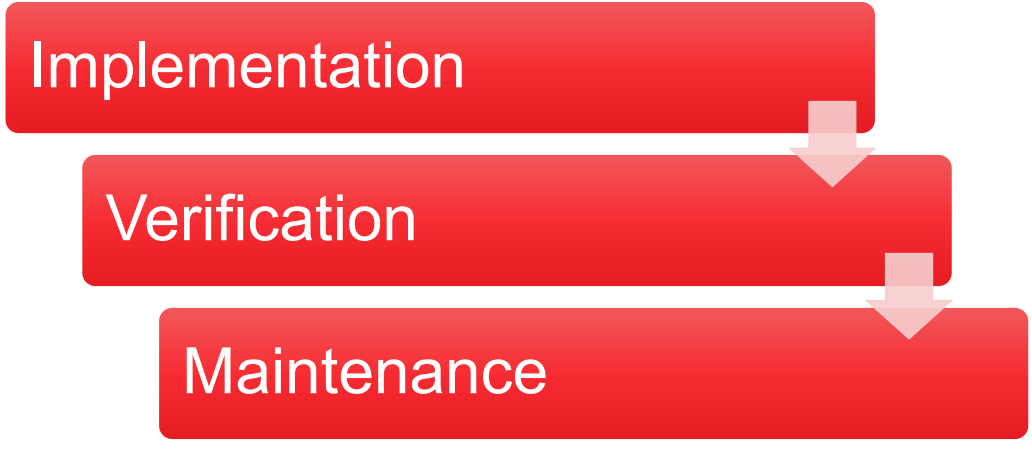
Frameworks to think about project

1. Waterfall
2. Diamond Process
3. Lean Startup
4. EAT
5. SCRUM
6. Stage-gate process
7. PERT

Waterfall

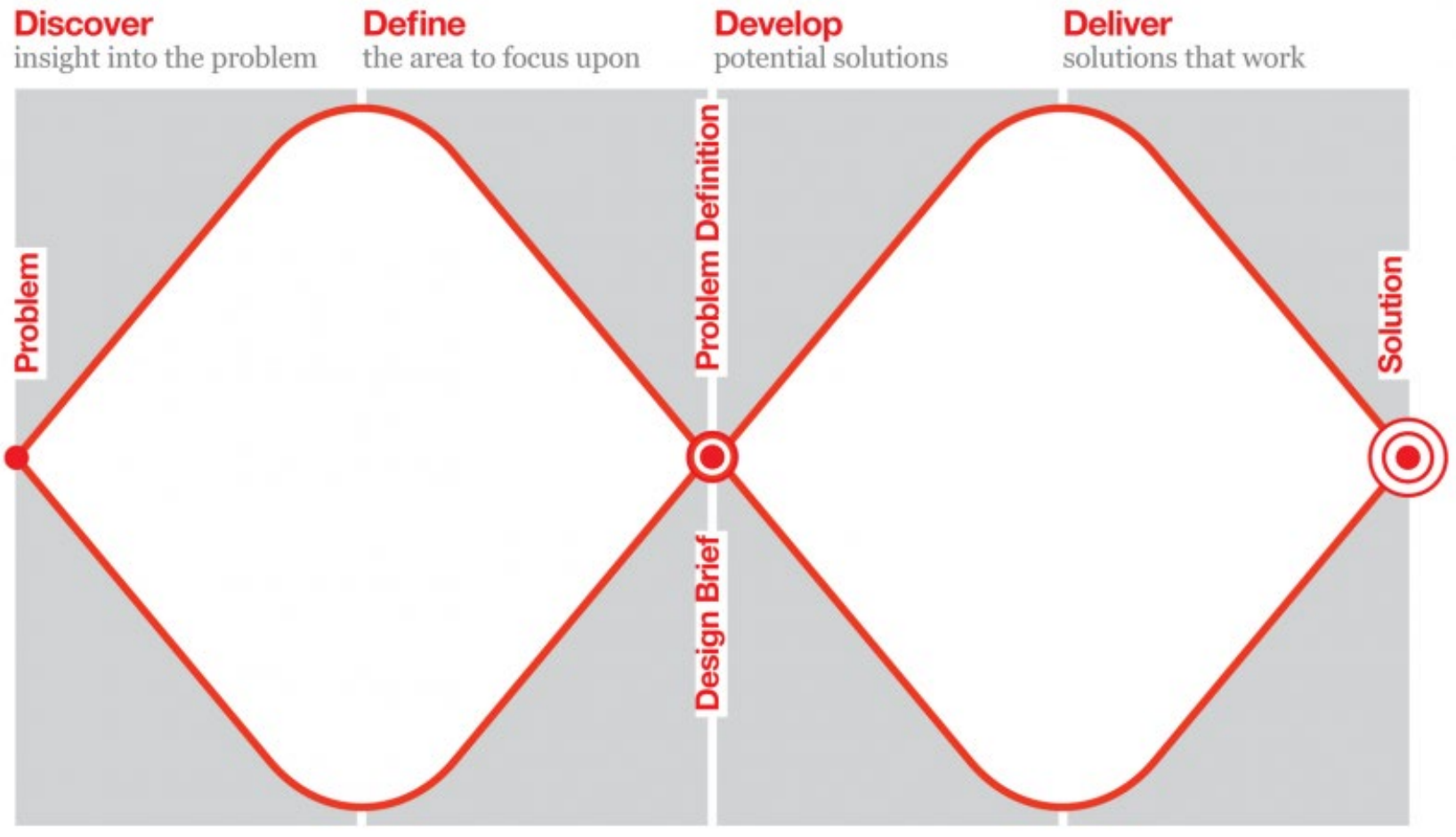
Problem: Known

Solution: Known



Double Diamond

Council, D. (2007). *Eleven lessons: Managing design in eleven global companies. A study of the design process*. British Design Council. Retrieved from www.designcouncil.org.uk



Lean Startup

Eric Ries has written about this, you can also find videos online

This approach is based on some key principles – search and you will find those online

Key aspects:

Minimal Viable Product (MVP)

Rapid Experimentation

EAT – Explore, Adjust, Task

You can find more about this online, check Hiten Shah's works

Basically this approach emphasises the first two activities to get the task estimates right – Hiten has been able to make project plans with 15 min. accuracy

- Note: Achieving such accuracy requires lots of attempts

SCRUM

This is from software development realm.

You will find the “manifesto” online

Principles

Sprints

This approach is the cousin of so-called Extreme Programming XP

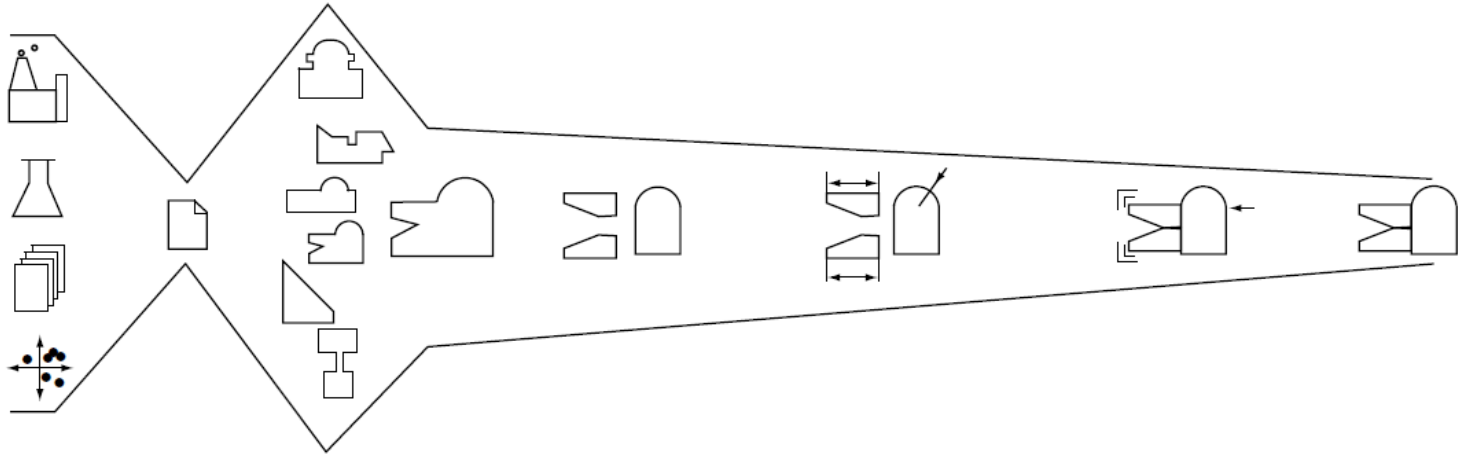
Stage-Gate Process

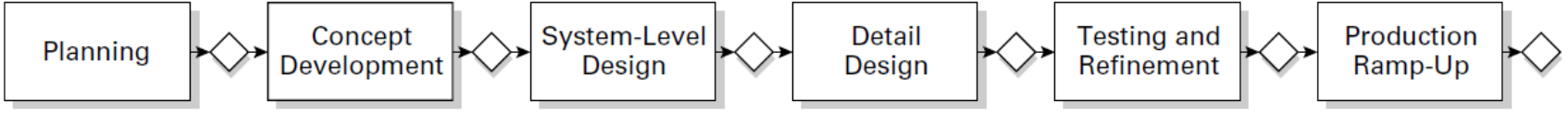
This approach is Robert Cooper's thing

Key issue is the 'gate' – a key decision-making point

Cooper has written books about this, and you will find some of this online

Generic Product Development Process





Ulrich, K. T., & Eppinger, S. D. (2012). Product design and development (5th ed). New York: McGraw-Hill/Irwin.

PERT

Timo used to talk about PERT. This stems from US army, from the 1960s. Very effective when you have big projects with special stuff and high stakes for getting things delivered in time.

Constraints

Constraints are necessary and helpful!

1. **Time**
2. **Budget**
3. **Quality (standards)**
4. **Ethics & laws**
5. **Technology (to be used, and to enable)**
6. **Materials (Bill of Materials, BOM)**
7. **Target price (Price of Goods Sold, PoGS)**

Begin with the project brief

- **The project brief is a suggestion**
  - You can question / suggest / negotiate it

Ask your client

- **Make NOTES!!**
- **Ask what the client expects**
  - Ask for recommendations (tools, parts, materials, etc.)
  - Ask for training/collaborative sessions
- **Write down every requirement / constraint / proposal / idea**
  - This is important, because clients tell more than they give you in writing
- **Verify you interpretation**
  - Tell your client how you are planning to proceed, get feedback

Plan key activities

- Phases
- Milestones
- Work packages
- Tasks

Work Breakdown Structure (WBS)

- **Hierarchical structure for the project to organise work**
- **Helps to coordinate work and schedule tasks**
- **The smallest units should be defined on the basis of what is 'manageable'**
  - i.e. you know what there must to be done and what it will take
  - You may need to do quite a bit of work before being able to do a proper WBS

How to create a WBS?

- **With physical products start with the structure of the thing and consider its parts**
  - Examples?

How to create a WBS?

- **With functional products start with what the thing should do and consider what systems/services is needed for that**
  - Examples?

How to create a WBS?

- **Consider ready-made components that you can use**
  - Examples?

How to create a WBS?

- **Consider the scheduling order when things depend on each other**
  - Identify critical paths
  - Examples?

How to create WBS?

- **Consider the <u>required deliverables</u>**
  - What must be done in order to meet the deadline?

How to create WBS?

- **Consider the <u>resources</u>**
  - People and their availability (man-hours)
  - Tools
  - Money

Scheduling: Activities take time…

- Setting up the development context, installing things
- Learning the tools, software, etc.
- Negotiations / meetings
- Modelling, building, coding, soldering, testing, debugging
- Reading data sheets, purchasing, waiting for stuff to arrive
- Travelling, Writing
- People have different skills, and may be available at different times
- ASK – Don’t assume!

What is in a schedule?

- **Phases, milestones, work packages and tasks**

- **Try to sketch one now!**
  1. Think what needs to be done
  2. Think how these are related
  3. Consider time and resources
  4. Sketch out a presentation (phases, milestones, WPs, tasks)

What is a Phase?

A product development project may have phases, such as

1. Planning
2. Concept development
3. System-level design
4. Detail design
5. Testing and refinement
6. Production ramp-up

Phases always end with a milestone

What is a Milestone?

Milestones are moments of presenting results/handing out deliverables and making decisions

- In conceptual work milestones do not move
- In construction work milestones may have to move
- Examples?

What is a Work Package?

- **Work package represent one of the key activities in a project**
  - They may overlap different phases, such as ‘project management’ and ‘awareness raising’
- **Tasks within a work package share the overall goal as well as the resources**

What is a Task?

- **A task is the lowest level unit in the plan**
- **It is a single manageable thing to be done**
  - Clear start and end condition
  - Clear resources
  - Clear expectations on results

Multitasking?

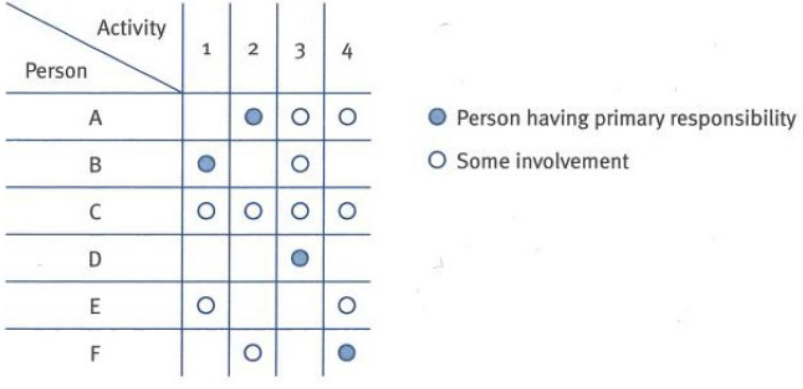
When and how to work in parallel?

Durations

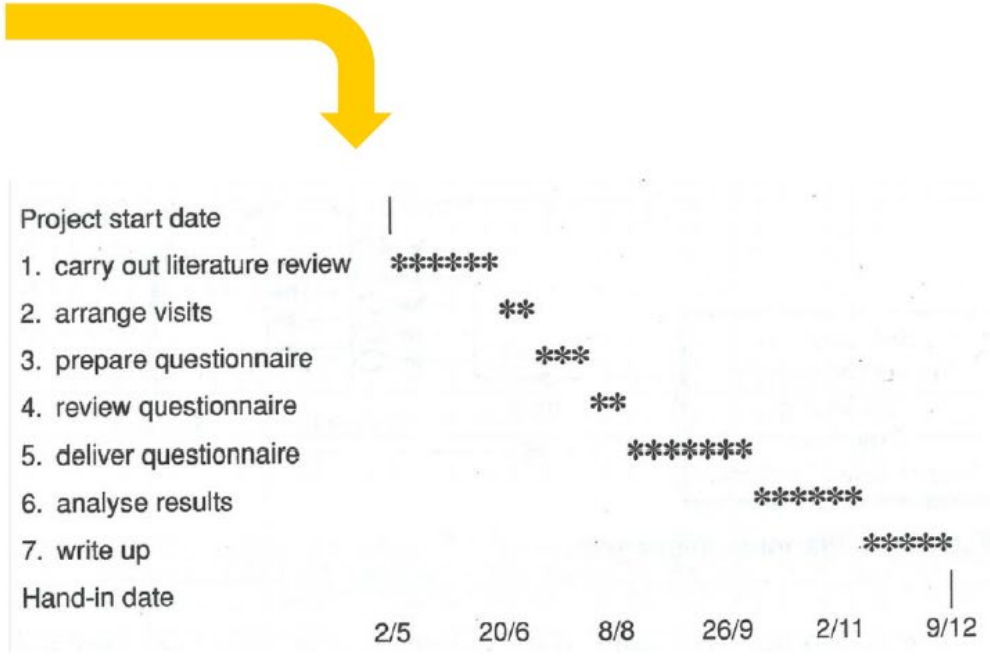
Interfaces

Responsibilities

- 1 responsible / task
- Max 3 persons on a task



Project start date	2/5
1 carry out literature review	2/5–20/6
2 arrange visits	20/6–4/7
3 prepare questionnaire	4/7–25/7
4 review questionnaire	25/7–8/8
5 deliver questionnaire	8/8–26/9
6 analyse results	26/9–2/11
7 write up	2/11–9/12
Hand-in date	9/12



Risk management

What are risks?

- **Expected undesirable events that make it more difficult for you to reach the desired goal**
- **Sources**
  - Internal: tech, people, process
  - External: supply, environment
- **Avoiding risks**
  - Expert judgment, informing, planning, negotiating, agreeing
- **Responding to risks**
  - Changing scope, budget, or schedule

Project management

You need to select a project manager

- Communicates with course staff
- Responsible for submitting documents
- Invites meetings and assigns responsible for making memos on decisions
- Tracks project progression
- Other responsibilities agreed in each team

Discuss and agree on the roles in your team:

- Write these down into your project plan

Effective meetings

Always have clear goals for each meeting

- **Is it a meeting for decision-making or information gathering?**
  - What do you need to decide in the meeting?
  - What do you want to learn about in the meeting?
- **Information gathering meetings can be about**
  - Substance for the project, i.e. discussing with client
  - Coordinating the project, i.e. checking the situation (task updates, risks)

Each meeting results in a document (or other artefacts)!

Updating the plan

- **When you need to update your project plan, make a new version with a version date**
- **Get agreement for the updated version**
  - With minor changes internal approval is enough, for major changes you need to agree with your client
- **A complete version needs to be handed to the staff through MyCourses on the 19th of June by midnight**

Workload

10 ECTS => 10 * 27h = 270h

Project Plans - Due 19.6.

- **Use the given template**