COMPUTATIONAL DESIGN IN INDUSTRIAL DESIGN: AN INITIAL INVESTIGATION

APPENDICES

TUDelft Delft
University of
Technology

VAN**BERLO**
Part of **Accenture**

CONTENTS

A. INTERVIEWS VANBERLO

Main goals
> Gather information about the **VanBerlo Design Process**.
> Input on CD **opportunities**.
> **List of case studies** feedback.

Confidentiality.

Intro
> The main goal of this interview is to define the role of the design process as context for the project. You are the expert on this design process. I would like your help in identifying the key activities and deliverables in the DP. After showing you some case studies, I would like to identify some opportunities for CD to augment some of these activities.

Define each phase of the DP: goals, activities input and output.
- Can you walk me through typical project stages? What is the workflow?
  Focus on ideation and implementation
- How would you represent your process?
- What are the main activities?
- What are the success markers for these activities?
- Could you identify the main outputs of each phase of the DP?
- What is CD for you?
- What drives you to the decision on a specific design tool?
- How much divergence and convergence are part of your process?
  (Show Double Diamond)

Show case studies (from presentation)

CD questions
- Do you see opportunities for CD in your process?

- Where do you see this method/case study fit in the VB process?
- What functionalities would you like to see implemented into these tools?
- In your opinion, what are the limits of adopting this approach?

Show toolkit

List of case studies questions
- What would you change?
- What would be the first information you would like to encounter?
- How would you search for information in this toolkit?
- Would you prefer a focus on tools or case studies?

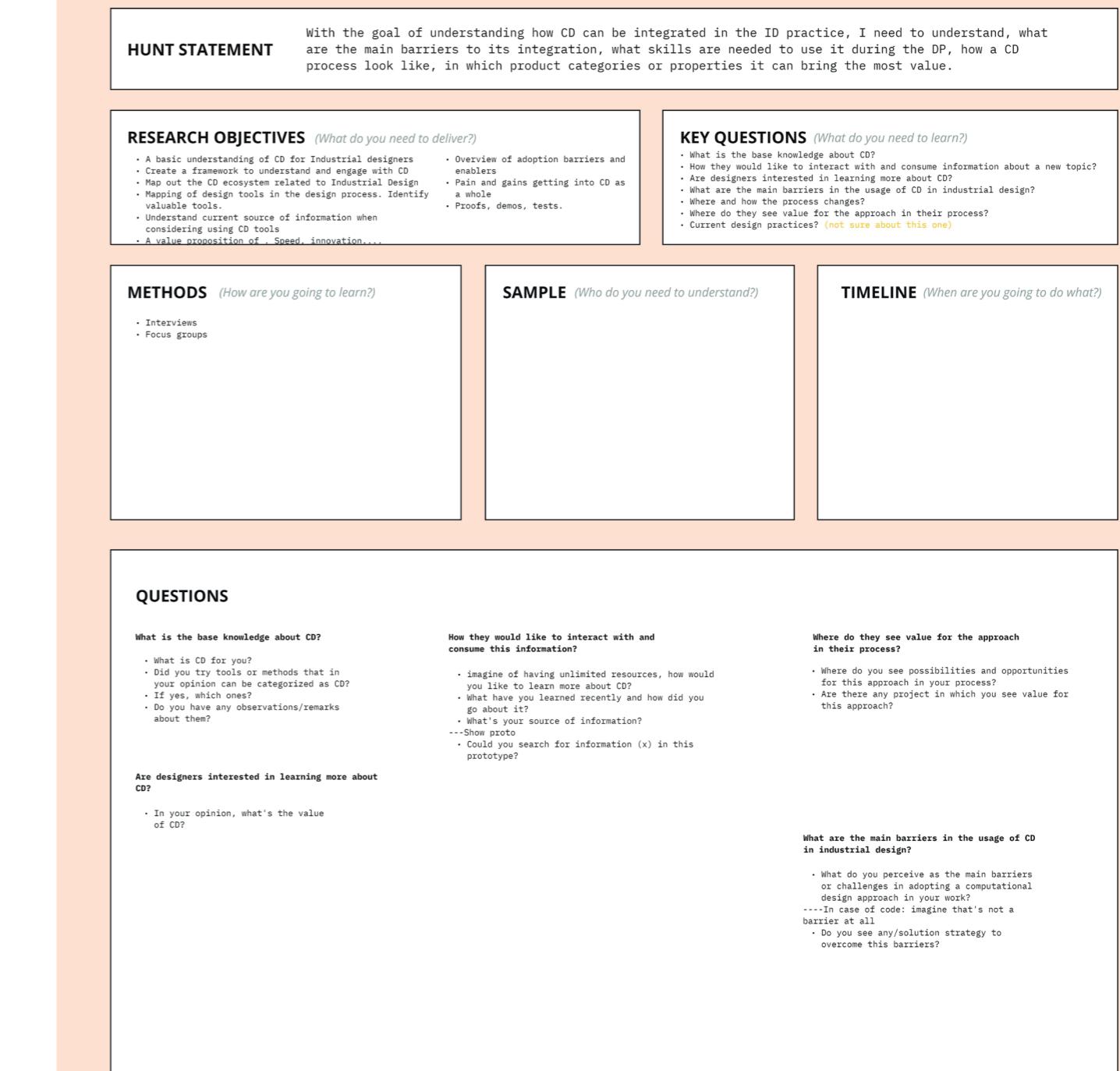# B. FOCUS GROUP VANBERLO

RESEARCH PLAN CANVAS

HUNT STATEMENT — With the goal of understanding how CD can be integrated in the ID practice, I need to understand, what are the main barriers to its integration, what skills are needed to use it during the DP, how a CD process look like, in which product categories or properties it can bring the most value.

RESEARCH OBJECTIVES *(What do you need to deliver?)*
- A basic understanding of CD for Industrial designers
- Create a framework to understand and engage with CD
- Map out the CD ecosystem related to Industrial Design
- Mapping of design tools in the design process. Identify valuable tools.
- Understand current source of information when considering using CD tools
- A value proposition of . Speed, innovation....
- Overview of adoption barriers and enablers
- Pain and gains getting into CD as a whole
- Proofs, demos, tests.

KEY QUESTIONS *(What do you need to learn?)*
- What is the base knowledge about CD?
- How they would like to interact with and consume information about a new topic?
- Are designers interested in learning more about CD?
- What are the main barriers in the usage of CD in industrial design?
- Where and how the process changes?
- Where do they see value for the approach in their process?
- Current design practices? *(not sure about this one)*

METHODS *(How are you going to learn?)*
- Interviews
- Focus groups

SAMPLE *(Who do you need to understand?)*

TIMELINE *(When are you going to do what?)*

QUESTIONS

What is the base knowledge about CD?
- What is CD for you?
- Did you try tools or methods that in your opinion can be categorized as CD?
- If yes, which ones?
- Do you have any observations/remarks about them?

Are designers interested in learning more about CD?
- In your opinion, what's the value of CD?

How they would like to interact with and consume this information?
- imagine of having unlimited resources, how would you like to learn more about CD?
- What have you learned recently and how did you go about it?
- What's your source of information?
---Show proto
- Could you search for information (x) in this prototype?

Where do they see value for the approach in their process?
- Where do you see possibilities and opportunities for this approach in your process?
- Are there any project in which you see value for this approach?

What are the main barriers in the usage of CD in industrial design?
- What do you perceive as the main barriers or challenges in adopting a computational design approach in your work?
----In case of code: imagine that's not a barrier at all
- Do you see any/solution strategy to overcome this barriers?

Figure 1-Research canvas from VanBerlo used to define questions for the focus group

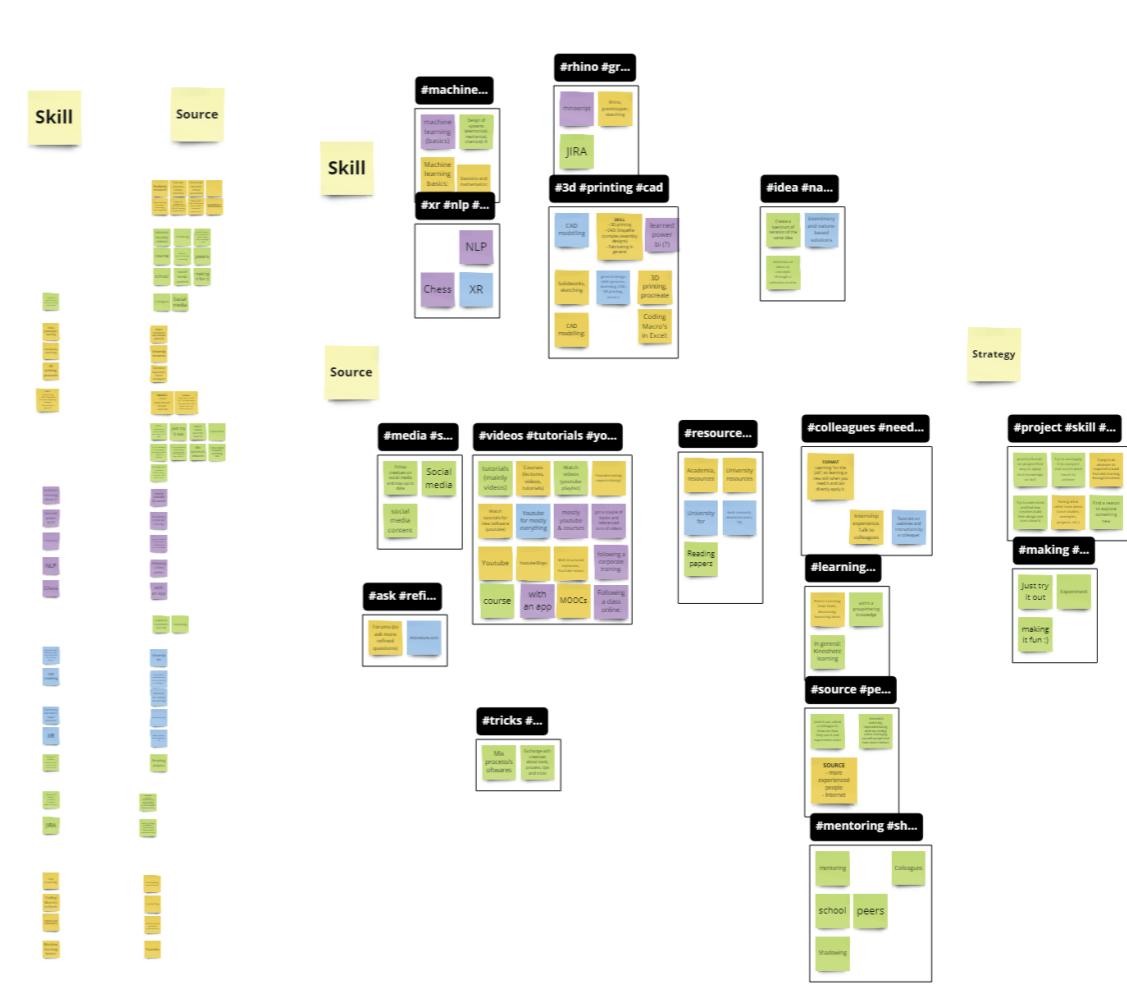Figure 2-The Miro board used for the focus group at VanBerlo

Figure 3-Clustering of the results:
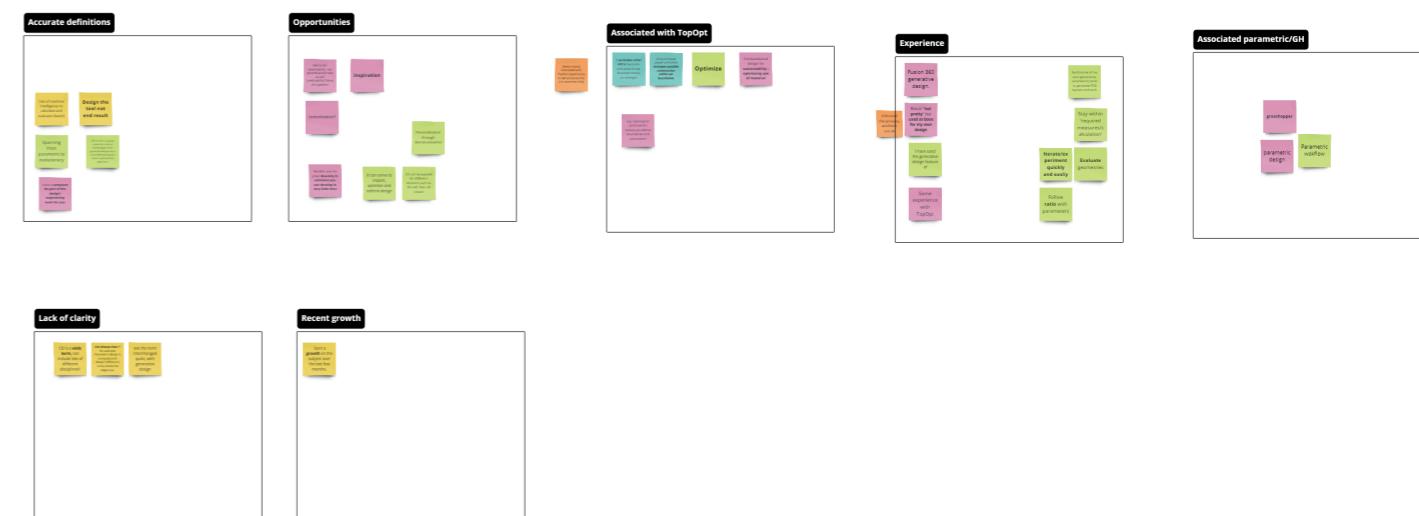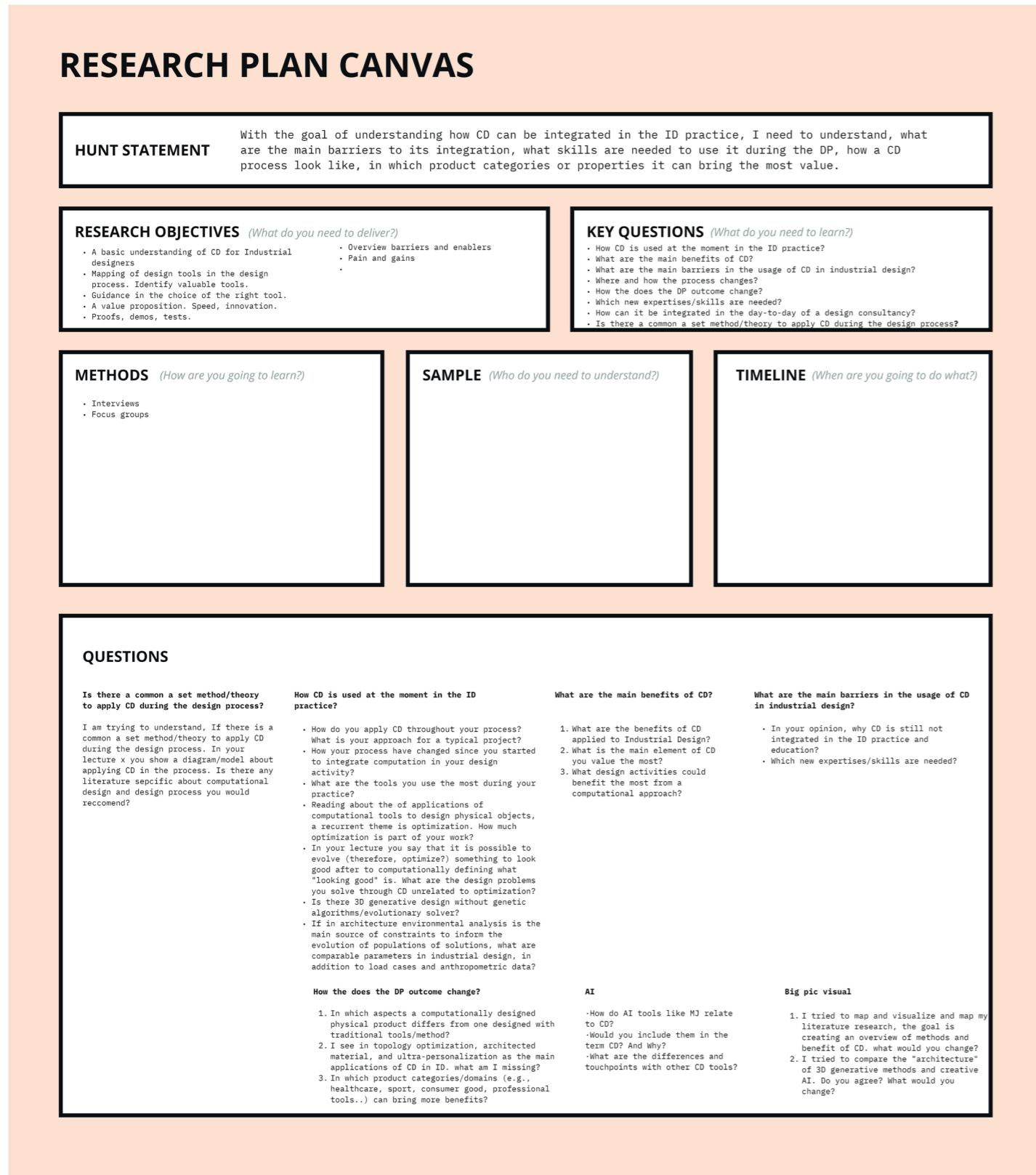skills, sources, keywords.

Figure 4-Clustering of the results:
definitions and previous experience
with CD.

C. COMPUTRATIONAL DESIGN EXPERTS INTERVIEWS

RESEARCH PLAN CANVAS

HUNT STATEMENT — With the goal of understanding how CD can be integrated in the ID practice, I need to understand, what are the main barriers to its integration, what skills are needed to use it during the DP, how a CD process look like, in which product categories or properties it can bring the most value.

RESEARCH OBJECTIVES *(What do you need to deliver?)*
- A basic understanding of CD for Industrial designers
- Mapping of design tools in the design process. Identify valuable tools.
- Guidance in the choice of the right tool.
- A value proposition. Speed, innovation.
- Proofs, demos, tests.
- Overview barriers and enablers
- Pain and gains

KEY QUESTIONS *(What do you need to learn?)*
- How CD is used at the moment in the ID practice?
- What are the main benefits of CD?
- What are the main barriers in the usage of CD in industrial design?
- Where and how the process changes?
- How does the DP outcome change?
- Which new expertises/skills are needed?
- How can it be integrated in the day-to-day of a design consultancy?
- Is there a common set method/theory to apply CD during the design process?

METHODS *(How are you going to learn?)*
- Interviews
- Focus groups

SAMPLE *(Who do you need to understand?)*

TIMELINE *(When are you going to do what?)*

QUESTIONS

Is there a common set method/theory to apply CD during the design process?

I am trying to understand, If there is a common a set method/theory to apply CD during the design process. In your lecture x you show a diagram/model about applying CD in the process. Is there any literature specific about computational design and design process you would reccomend?

How CD is used at the moment in the ID practice?
- How do you apply CD throughout your process? What is your approach for a typical project?
- How your process have changed since you started to integrate computation in your design activity?
- What are the tools you use the most during your practice?
- Reading about the of applications of computational tools to design physical objects, a recurrent theme is optimization. How much optimization is part of your work?
- In your lecture you say that it is possible to evolve (therefore, optimize?) something to look good after to computationally defining what "looking good" is. What are the design problems you solve through CD unrelated to optimization?
- Is there 3D generative design without genetic algorithms/evolutionary solver?
- If in architecture environmental analysis is the main source of constraints to inform the evolution of populations of solutions, what are comparable parameters in industrial design, in addition to load cases and anthropometric data?

What are the main benefits of CD?
1. What are the benefits of CD applied to Industrial Design?
2. What is the main element of CD you value the most?
3. What design activities could benefit the most from a computational approach?

What are the main barriers in the usage of CD in industrial design?
- In your opinion, why CD is still not integrated in the ID practice and education?
- Which new expertises/skills are needed?

How does the DP outcome change?
1. In which aspects a computationally designed physical product differs from one designed with traditional tools/method?
2. I see in topology optimization, architected material, and ultra-personalization as the main applications of CD in ID. what am I missing?
3. In which product categories/domains (e.g., healthcare, sport, consumer good, professional tools..) can bring more benefits?

AI
- How do AI tools like MJ relate to CD?
- Would you include them in the term CD? And Why?
- What are the differences and touchpoints with other CD tools?

Big pic visual
1. I tried to map and visualize and map my literature research, the goal is creating an overview of methods and benefit of CD. what would you change?
2. I tried to compare the "architecture" of 3D generative methods and creative AI. Do you agree? What would you change?

Figure 5-Research canvas from VanBerlo used to define questions for CD experts

Intro to the project

The project's main goal is to explore the potential of computational approaches in the industrial design practice and communicate it to the design community. This is the outline of my project's plan:

1. **Literature review:** understand CD's boundaries, evolution, terminology, theoretical foundations and methods.
2. **Interview with experts:** Understand how CD is already used in the field.
3. **Design process research:** interview and focus groups with design practitioners to identify entry points for CD in the traditional industrial design practice.
4. **Criteria definition:** Define the criteria to assess CD tools.
5. **Practical tools training:** Software training. Initial hypothesis on how the tools can materialize the approaches and methods identified in the initial phase. Small prototypes
6. **DP+CD: value and hypothesis definition:** Define the activities that can be substituted or augmented with CD tools
7. **Testing:** test the value of CD in the design activities previously defined.
8. **Toolkit creation**: Communicate the knowledge I gained during the process and create something to aid designers in using computational design in their daily practice.
9. **Use case sprint** Creation of a use case to test the toolkit and showcase the potential of a CD workflow.

These are the questions, I know there are many of them, they are in order of importance feel free to answer only the ones you retain crucial.

Theory

I am trying to understand If there is a common method/theory to apply CD during the design process. In the final video of your lecture "Parametric, Algorithmic, Generative Design Systems" you show a diagram/model about applying CD in the process.
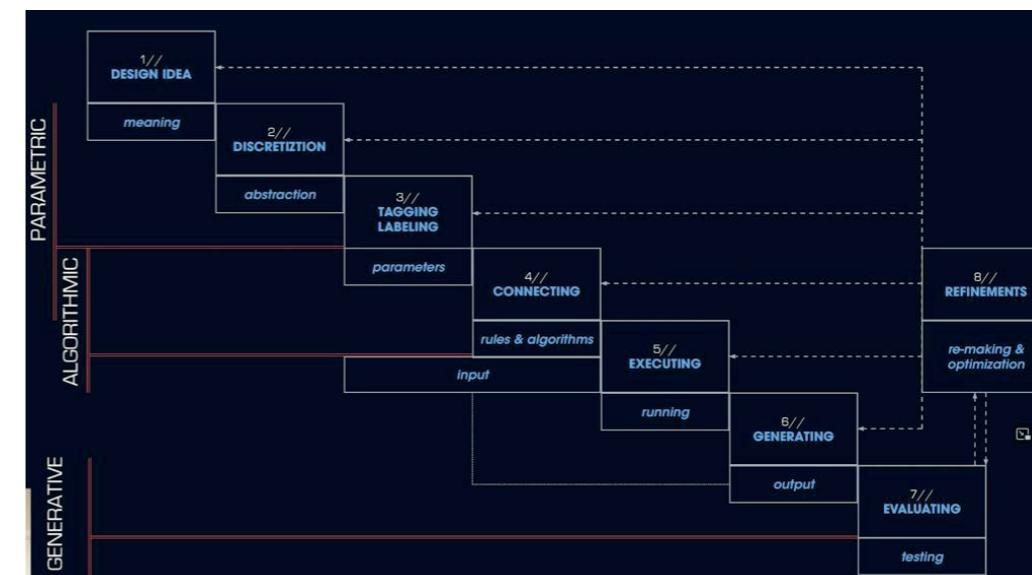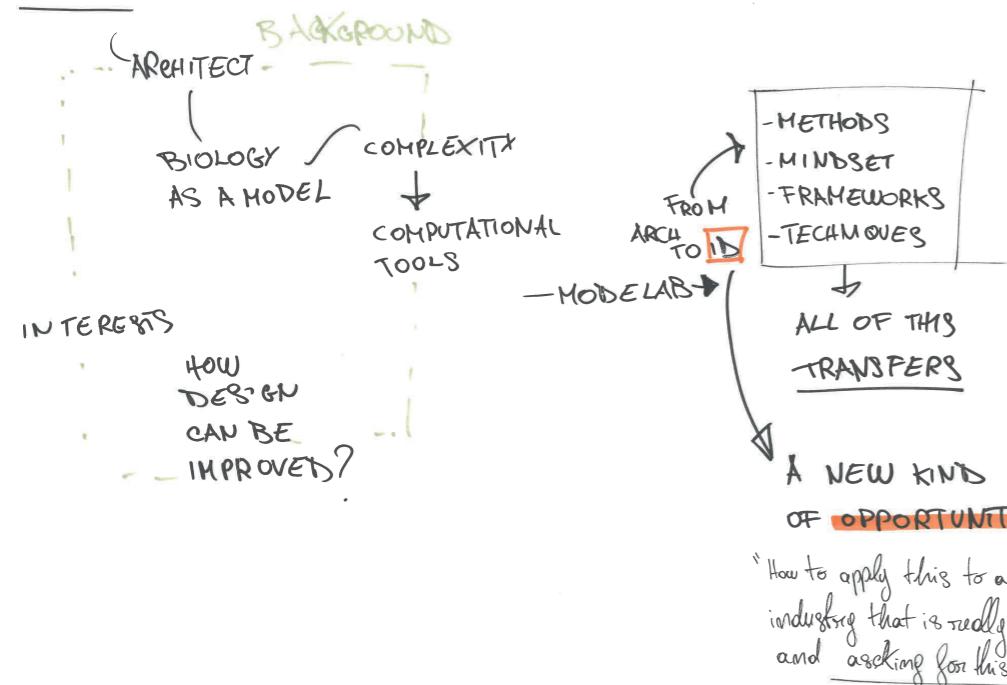
1. Could you elaborate a bit on how you created this diagram? (only for Onur)
2. Is there any specific literature you recommend about computational design and design processes?

Your process

3. How do you apply CD throughout your process? What is your approach for a typical project?
4. How has your process changed since you started to integrate computation in your design activity?
5. What are the tools you use the most during your practice?
6. Reading about the applications of computational tools to design physical objects, a recurrent theme is optimization. How much optimization is part of your work?
7. In your lecture, you say that it is possible to evolve (therefore, optimize?) something to look good after computationally defining what "looking good" is. What are the design problems you solve through CD unrelated to optimization?
8. Is there 3D generative design without genetic algorithms/evolutionary solvers?
9. If environmental analysis is the main source of constraints in architecture to inform the evolution of populations of solutions, what are comparable parameters in industrial design, in addition to load cases and anthropometric data?

Benefits

10. What are the main benefits of CD applied to Industrial Design?
11. What design activities could benefit the most from a computational approach?
12. From my understanding, the main value of most CD tools is divergence and creating many solutions to explore a wider solution space. Do you agree? Is this common in all the tools/approaches?
13. How do you see the evolution of CD and its tools in the industrial design profession in 5-10 years?

Barriers

14. In your opinion, why is CD still not integrated into industrial design practice and education?
15. Which new expertise/skills are needed?

Outputs

16. In which aspects does a computationally designed physical product differs from one designed with traditional tools/method?
17. In which product categories/domains (e.g., healthcare, sport, consumer good, professional tools..) can bring more benefits?
18. I see topology optimization, architected material, and ultra-personalization as the main applications of CD in industrial design. What am I missing?

Feedback

19. I tried to map and visualize my literature research, in this visual, the goal is to create an overview of the methods and benefits of CD. What would you change?

20. I tried to compare the "architecture" of 3D generative methods and creative AI. Do you agree? What would you change?
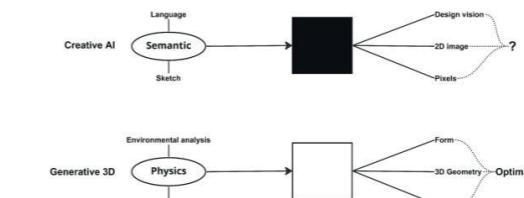
21. Do you have any suggestion/advice for this project?

AI and CD

22. ·How do AI tools like MidJourney relate to CD?
23. ·Would you include them in the term CD? And Why?
24. ·What are the differences and touchpoints with other CD tools?

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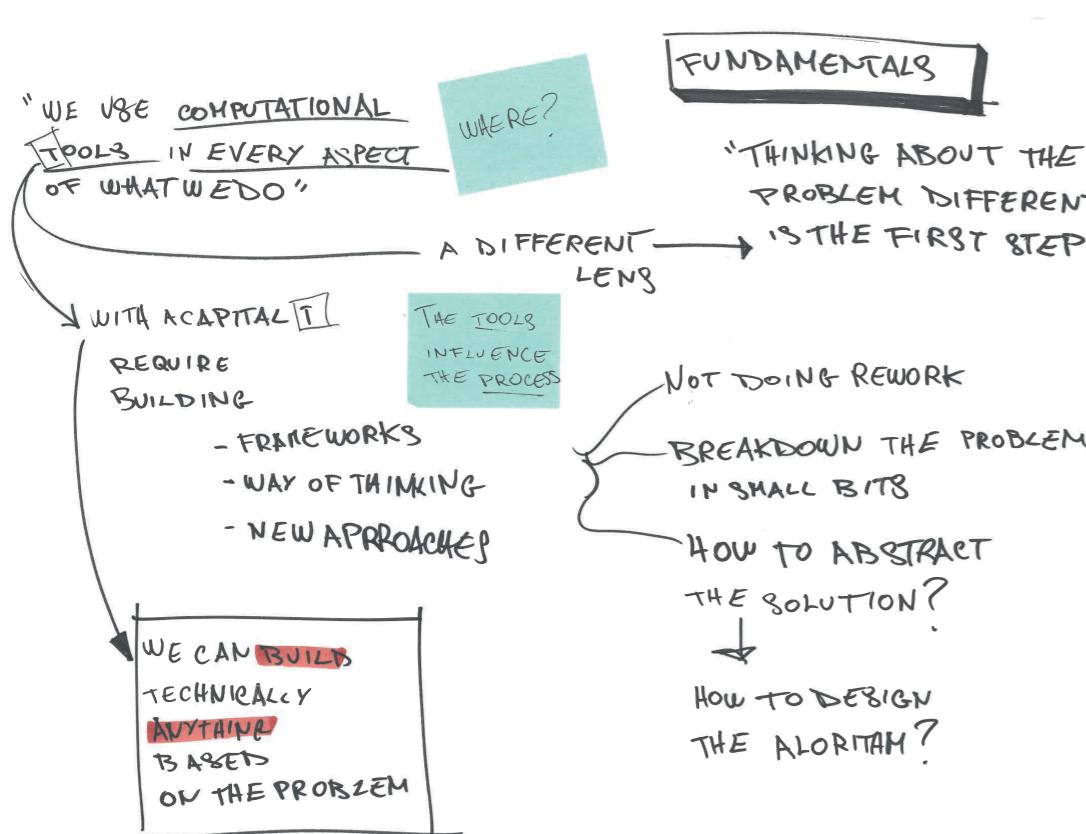Figure 6-Preliminary interview analysis (Multiple pages)

EVAN

BACKGROUND

ARCHITECT

BIOLOGY AS A MODEL → COMPLEXITY → COMPUTATIONAL TOOLS

FROM ARCH TO ID

—MODELAB

INTERESTS

HOW DESIGN CAN BE IMPROVED?

- METHODS
- MINDSET
- FRAMEWORKS
- TECHNIQUES

ALL OF THIS TRANSFERS

A NEW KIND OF OPPORTUNITY

"How to apply this to a new industry that is really ripe and asking for this?"

PROBLEM:

"WE NO LONGER HAVE TO SIMPLIFY A PROBLEM TO SOLVE IT"

→ BREAKING IT DOWN ≠ SIMPLIFY IT

"There is a limit to what an human can handle"

COMPUTATIONAL DESIGN PROVIDES THE ABILITY TO MAINTAIN COMPLEXITY

"WE USE COMPUTATIONAL TOOLS IN EVERY ASPECT OF WHAT WE DO"

WHERE?

WITH A CAPITAL T

REQUIRE BUILDING
- FRAMEWORKS
- WAY OF THINKING
- NEW APPROACHES

THE TOOLS INFLUENCE THE PROCESS

A DIFFERENT LENS

FUNDAMENTALS

"THINKING ABOUT THE PROBLEM DIFFERENT IS THE FIRST STEP"

NOT DOING REWORK

BREAKDOWN THE PROBLEM IN SMALL BITS

HOW TO ABSTRACT THE SOLUTION? ↓ HOW TO DESIGN THE ALGORITHM?

WE CAN BUILD TECHNICALLY ANYTHING BASED ON THE PROBLEM

"FOR SOME PROBLEMS EXPLORING THE 20% OF THE DESIGN SPACE MIGHT BE GOOD ENOUGH"

"BUT OFTEN EXPLORE THE ENTIRE DESIGN SPACE COMES FOR FREE AND CAN THROW A COUPLE OF WILDCARDS"

IS CD INTEGRATED IN THE ID PRACTICE?

PRESENT
"DEFINITELY THERE IS A BIG GAP IN THE INDUSTRY"

FUTURE: IT'S JUST A MATTER OF TIME.

SEE - HD ADIDAS NIKE

IT'S GOING TO CHANGE:
- THE INDUSTRY
- THE SKILLS NEEDED FROM NEW HIRES

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BENEFITS

- COLLABORATION

"WE ARE ABLE TO SEE A FULL DESIGN SPACE"

DISCOVERIES ABOUT THINGS YOU DIDN'T KNOW EXISTED → SEE THE UNIMAGINED

BUT ALSO IMAGINING SOMETHING AND DO IT WITH THE RIGHT AMOUNT OF COMPLEXITY

BENEFITS ON THE FUNCTIONAL SIDE

INTEGRATE DATA → IN EVERY STEP OF THE PROCESS

PERFORMANCE → BETTER FUNCTIONING PRODUCT

FOR A BRAND → DEVELOP UNIQUE AND INNOVATIVE PRODUCTS

PROCESS OVERVIEW

- SIMILAR FOR MOST OF THE PROJECTS

CREATIVE AI → QUICK RHINO MODEL → GH

PSEUDO CODE

- MOODBOARDS
- GET IDEAS FLOWING

- TO FAMILIARIZE

- ITERATE FASTER
- FAIL FAST
- PROTOTYPE
- REUSABLE WORKFLOWS

TOOLS

ADDITIVE → MESHES

"GH IS NOT GOING ANYWHERE" → FLEXIBLE → QUICK

- BLENDER   - HOUDIN   - GAMING → UNITY
                                  → UNREAL

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WHAT ARE THE
SKILLS NEEDED?

1 → CURIOSITY   ...TO SEE THE WORLD   .. INTEREST IN
                   IN A DIFFERENT   TECHNOLOGY
                   WAY   AGAIN WITH A
                                          CAPITAL T

2 ↝ CRITICAL   - QUESTION EVERYTHING
     THINKING

3 → SYSTEM   →   DESIGNING   VS   DESIGNING
     THINKING   THE ARTIFACT   THE SYSTEM
                                      THAT EXPLORES
                                      THE SOLUTION
                                      SPACE

4 ↝ BEING
     PROCESS
     ORIENTED

" I THINK THAT
TECHNICAL EXPERTISE
IS SECONDARY "   COMPUTATIONAL   DESIGN
                    →   DESIGNER   THROUGH
                        ≠   COMPUTATION
                        TECHNICIAN   ≠
                                               IMPLEMENT
                                               CODE

THERE   IF I CAN DESIGN
IS BEAUTY   AN ALGORITHM
IN IMPLEMENTATION   BECAUSE I UNDERSTAND
BUT .. -   HOW THE SYSTEM WORK

                     I DON'T NEED TO BE
                     ABLE TO IMPLEMENT IT

ALL DESIGN IS
COMPUTATIONAL   → A DESIGN PROCESS
DESIGN...   IS OFTEN AN ALGORITHM
IT'S A MATTER
OF MAKING IT   NOT ALWAYS CODIFIED
EXPLICIT

PERFORMANCE
ORIENTED
DESIGN   →   FUNCTIONAL

                AESTHETIC

          " LOOKS GOOD
            PERFORMS WELL "

OPTIMIZED   AS A   STARTING
PRODUCT   POINT   → EXPLORING THE
                                    DESIGN SPACE

                                    ENSURE
                                    PERFORMANCES

WHICH ASPECTS
OF A PRODUCT
ARE MOST SUITABLE
FOR CD?

PATTERNS/TEXTURE   AUTOMATION   CUSTOMIZATION

     ↓ FLEXIBLE   · MOLDED FIBER
     QUICK   GOGGLES
     FADING

SUSTAINABILITY   → CUSTOMIZATION → ONLY PRODUCTS → USED
                                   PEOPLE WANTS   LONGER
                                   ADDITIVE ↝
· D. FOR MANUFACTURING
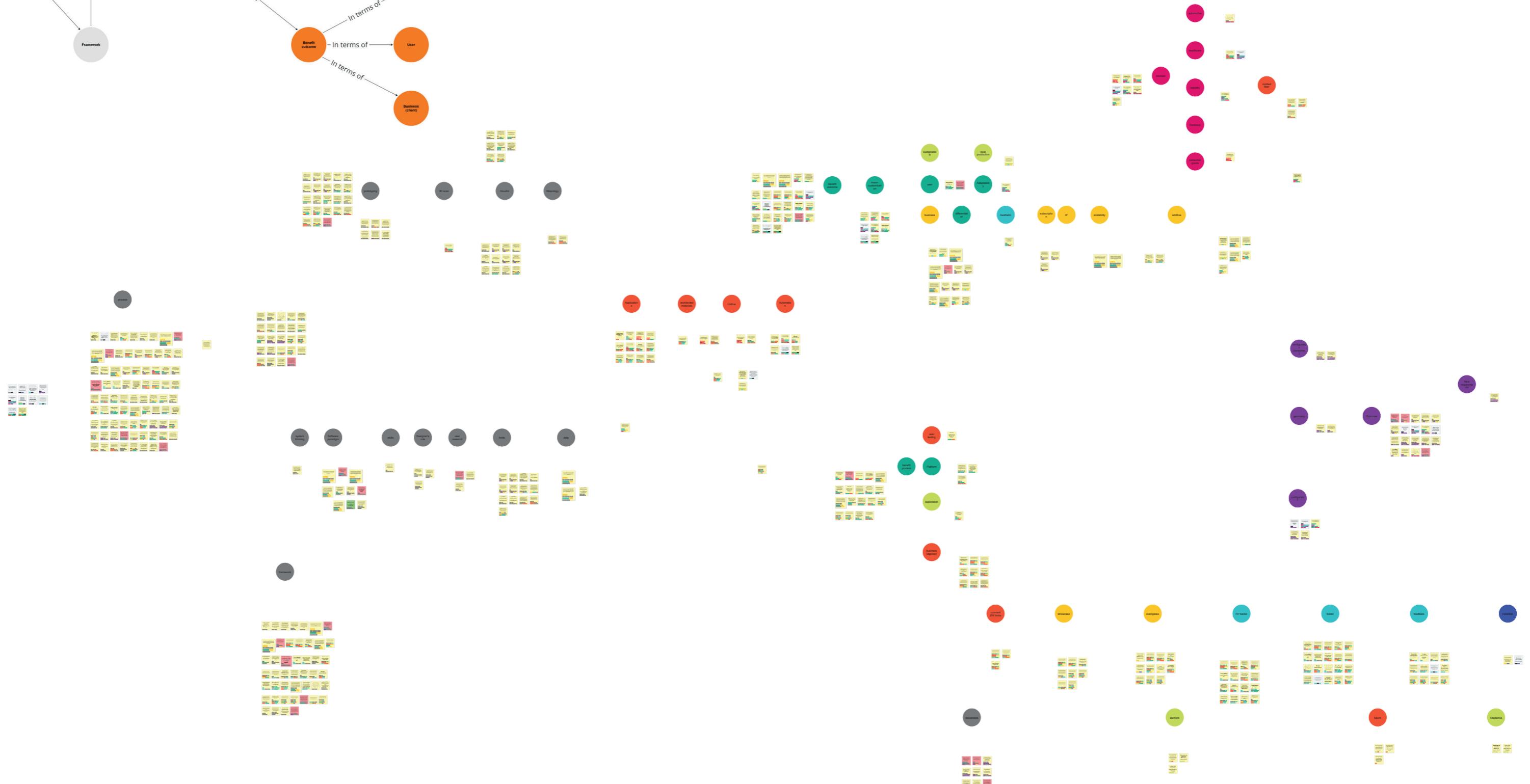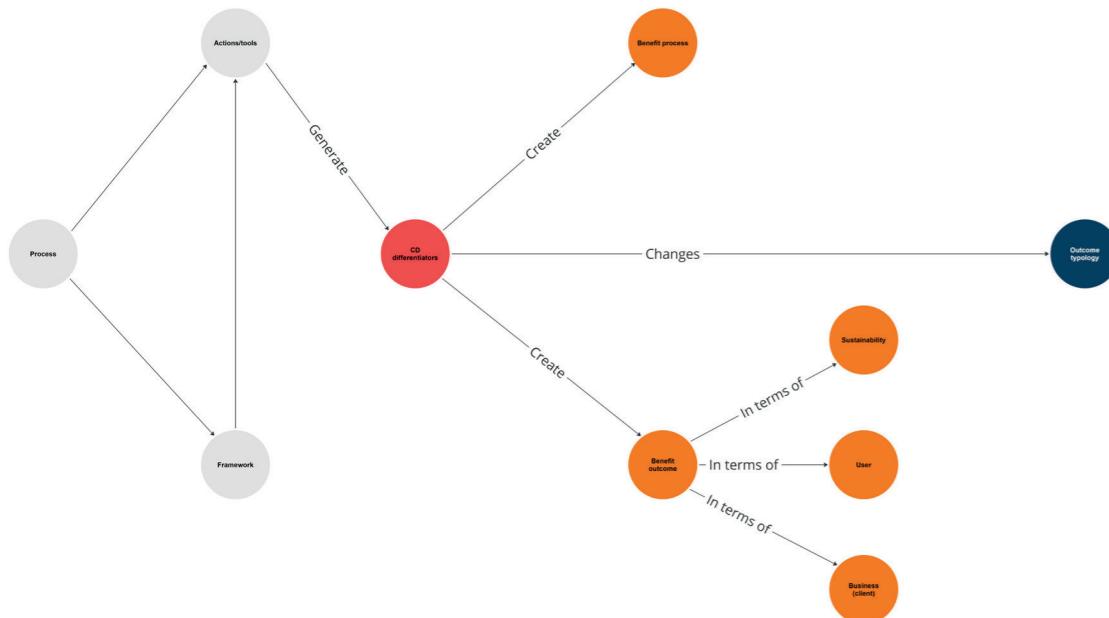
Figure 7-Clustering of the results: post it might be readable only on Adobe Acrobat.

D. OUTPUTS FROM RESEARCH ON ID PROFESSIONALS: PERSONA, USER JOURNEY, USE CASE NAVIGATION STRUCTURE, INFORMATION DESIGN USE CASES

Ana
Product designer

Actions, Motivations and Pains

What do I do?
- Strategize on my company's future
- Jump between meetings
- strategize on my own future
- Try to stay focused and get work done
- I try to stay up to date with the design world
- Try to find space in my schedule for creative work

Why do I do it?
- I want to get have a good impact through design
- I am passionate about my job
- One day I want to be tenured

What do I want?
- To create value by design
- Being up to date
- Have space to express my creativity
- Create positive impact through my work

What's stopping me?
- I don't know where to start
- I don't have enough time
- The learning curve seems to be quite steep
- It feels overwhelming sometimes

Values

What convinces me?
- Tangible results
- An holistic view
- Case studies

What or who informs me?
- Linkedin
- You tube
- Peers
- Design magazines

Context

Where am I?
- Working from home
- Working from the office
- Commuting

What's my day-to-day?
- Meetings
- emails
- Create content
- Having lunch with colleagues

Figure 8-Initial framing to define Persona after interviews and focus group

Name: Ava

Age: 32

Occupation: Product Designer at VanBerlo

Background: Ava is a product designer with years of **experience** in designing physical products. She has worked with various clients in the consumer goods industry and has won several design awards for her work. Ava is **passionate** about **sustainability** and believes that designers have a crucial role to play in creating products that have a **positive impact** on the environment and society. Ava is always **eager to learn** and stay up-to-date with the latest trends and advancements in the design world.

Goals: Ava is **interested** in exploring **new technologies** that can be incorporated into the design process to **create** sustainable products, **optimize** the process and **unveil** new design opportunities. She wants to learn about new tools and design strategies that can positevely change the impact of the products her agency designs and improve their quality. However, as a **busy professional**, Ava has **limited time** to invest in learning new topics.

Pain points: Ava is often **overwhelmed** by the amount of information available online and **struggles to find reliable sources of information**. She finds it challenging to keep up with the latest developments in design and new technologies due to her demanding job and other personal commitments. At the same time she feels that the **learning curve** of new tools could be too steep and the value not clear enough to justify the time investment. Ava also wants to ensure that any new tools or technologies she adopts align with her **values.**

Personality: Ava is a passionate individual who takes her work seriously. She is an open, curious and busy person. She is detail-oriented, meticulous in her work, and values collaboration and communication with her team and clients. Ava is committed to creating products that are sustainable and have a positive impact on society, while possibly having fun with her greatest passion: design.

Figure 9-Persona representing an hypothetical user for the digital guide on CD

USER ACTIVITIES
- Talk to colleagues, word of mouth
- Hear a about it during a presentation
- Evaluating the utility of the tool
- Check if something similar exist
- Evaluate first impression
- Check calendar to schedule an exploratory time
- Check sources
- Asks around
- Open the tool
- Search for information
- Explore the information
- Go to external source
- Apply it in projects
- Use for a new project
- Use to reinforce personal knowledge in computational design
- Share experience

USER GOALS
- None at this point
- Find a reliable source to learn more about CD
- Be inspired
- Find new approaches to solve design problems
- Plan
- Approach something new
- Optimize design activities
- Find something related to the problem they want to solve
- Find something related to their passions
- Find something related to the design phase they are in
- Find something related to a specific tool
- Learn something new
- Familiarize with the topic
- Have an immediate understanding of what I am looking at and contribute to my problem/project
- Effortless and predictable experience
- Understand how the information is structured
- Explore it **quickly**
- Easily understand where to find relevant info
- Understand how the information relates to similar topics
- Related topics
- How can I **apply** this information in my case?
- Have a clear and stimulant learning experience
- Trust the source
- Have asap ideas on how to apply it for her personal case
- Create a positive impact in the project, business planet for more people
- Optimize the process: Speed and quality
- Have fun while applying something new during work
- Quickly retrieve information relevant for the project
- Explain strategy to team mates
- Repeat same experience
- Experience improves because of the familiarity with the tool
- Share feelings achievements
- Give feedback
- Recommend the tool

PAINPOINTS
- None at this point
- Too many sources
- Sometimes this world does not seem approachable
- Sometimes seems far from design
- It evolves fast
- Where do I start?
- Will I find something useful?
- I don't understand what this word mean
- Cannot find the information I am looking for
- I don't understand what I am reading
- Not sure if this is useful
- Will I be able to apply/learn it?
- The source might be complex to understand
- The source might seem distant from the user
- The source might require time to be explored
- I cannot find again the information
- I am not able to transfer and apply the knowledge in my use case
- Will it work again?
- Can I apply the same method?
- Reminders based on order history
- Will it work also for people with different expertise/ goals/ interests?

TOUCHPOINTS
- Word of mouth
- Specific presentations
- Emails
- Word of mouth
- Specific presentations
- Emails
- Miro
- Home page
- Home page
- Spatial
- Search bar
- Semantic
- Pages
- Layout may change based on category the Tools library
- University websites
- MOOCs
- Experts (colleagues/external)
- Websites that collect and categorize tools
- Books
- Software websites
- Medium
- Other agencies websites
- "Actionable" pages: Tools and benefits
- Saved pages
- External sources
- Intro page
- Saved elements
- Reminders based on order history
- Word of mouth
- Social media
- Internal meetings/presentations

EXPERIENCE
- " It feels difficult to take the first step in a new tool, not very approachable"
- " I need to find a **reason to explore** something new"
- " What is the **goal** of the tool? What do I get from it?"
- Link between complex landscape, **a place where to start**
- "I would use it to be inspired and broaden my scope"
- Interested, curious
- Uncertain
- Excited
- Uncertain
- Requires effort, but exciting
- More effort
- Satisfied
- It was worth the effort/time investment
- "I have to share this"

RESPONSE

GOALS
- Increase awareness
- Deliver the right message: A tool to engage with the subject
- Increase interest
- Convince people to use the tool
- Trust in the tool
- Inform people about the breath and depth of CD
- Convince the user that using the tool worth the time investment
- Stimulate people to continue the navigation
- Reduce the time for getting to a certain solution
- ...while promoting the exploration of the topic
- Communicate the knowledge in the best way possible
- Useful
- Inspiring
- It must fit the user goal and previous knowledge
- Information must be easy to retrieve
- Information must be easy to show/share
- Increase people that use the tool for a second time
- Create a sense of achievement and growth
- demonstrate that can be useful in multiple
- Create a sense of belonging
- Turn users into advocates
- Spread the word :)
- Enable as much people as possible to have a positive impact through CD

KPI'S
- Number of people reached
- Number of people that start using the tool
- Number of people that take a second step after the home page
- Does the home page convey CD correctly without associations like craft?
- Did people find what they were looking for?
- Did they find information that they consider valuable for their process and business?
- Are they willing to explore the other sections of the tool(s)
- Are they ready to apply the knowledge in projects?
- Do they feel inspired?
- Are they interested in learning more?
- Computational approach (es) successfully applied in a project
- team mates are interested in the tool
- Number of people that use the tool for the second time
- Number of projects in which the toolkit has been used
- Would the user recommend the toolkit?

DESIGN ACTIVITIES
- Presentations
- Workshops
- Show how it can be useful through a use case
- clearly explain the advantages of using the tool
- Mention relatable case studies
- Give a visual snapshot of CD landscape
- The name and the visualization of the categories should convey the advantages of using it
- create a research by keywords options
- Concise and clear information
- Information hierarchy
- Order by difficulty level
- A system to pin relevant information
- Flash card/presentation function
- Tic page already explored
- Toolkit case studies demonstrate that can be useful in multiple contexts/projects
- Test
- Ask for feedback
- Iterate
- less explorative
- learning material
- Highlight on relevance for the user?
- Suggest pre requisites and learning path
- Relate to design as much as possible
- The possibility to create a "project" with all the relevant content for a given project, possibly ordered by design phase
- Keep it alive

Figure 10-Product journey for the digital guide on CD prototype

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Use case: **solving a design problem**
Scenario: **during a project**

User action	Open the tool, Reads introduction	Click solve mode, Scan the page for information related to the problem	Does not find relevant content / Finds relevant content	Clicks on the content Reads	Clicks on next steps	Reads content	**User action**	Uses the search bar	Clicks on next steps	Reads content
User goal	Solve a problem	Understand the page content	Evaluate options	Understand if it is relevant. Understand how to apply it	Understand if it is relevant. Understand how to apply it	Understand how to apply the tool, to realize the relative benefit in the project.	**User goal**	Think of relevant key words	Understand if it is relevant. Understand how to apply it	Understand how to apply the tool, to realize the relative benefit in the project.
Page	Home	Solve mode	Solve mode	Benefit, use case, design phase, product category.	CD solution	Tools, external sources	**Page**	Solve mode	CD solution	Tools, external sources
Information	Tool purpose	Related to the user goal: benefits, domains, design phase	Related to the user goal: benefits, domains, design phase	On CD related to the first contact point. With a focus on relevance and next steps	On CD related to the first contact point. With a focus on relevance and next steps	General information about the tool, level of difficulty, possibilities, general tutorials, tutorial applied to case studies.	**Information**	Related to the user goal: benefits, domains, design phase	On CD related to the first contact point. With a focus on relevance and next steps	General information about the tool, level of difficulty, possibilities, general tutorials, tutorial applied to case studies.
Interaction goal	Inform the user about the design's goal	help the user to find information related to the problem	help the user to find information related to the problem	Inform the user about the relevance of CD in the selected topic	Inform the user about the relevance of CD in the selected topic	Help the user to apply the tool in the project	**Interaction goal**	help the user to find information related to the problem	Inform the user about the relevance of CD in the selected topic	Help the user to apply the tool in the project
Interaction strategy		Present information that that can be related to the user project/problem	Present information that that can be related to the user project/problem	Present concise information	Present concise information	Practical tutorials applied to case studies	**Interaction strategy**	Tag solution and tools with information that that can be related to the user project/problem	Present concise information	Practical tutorials applied to case studies

Example

Context	General intent	Search		Learn		
		Problem	**Benefit (process)/goal**	**Differentiator(solution)**	**Tool (How)**	**Want to learn more/ make it part of your process?**
				Hyper production of images	Midjourney (E.g.)	
During a project Encountering a problem	Solve a problem	Stuck with ideation	Explore a wider solution space			Theory
				3D form finding	Grasshopper (E.g.)	

Figure 11-Sample of use case definitions: solve

What is CD

Explore — Network map — Theory
Tools
Solutions (list)
Change in product typology

CD for sustainability
CD for user experience
CD for client business

Product

Benefit (list) — Benefit page — Solution (differentiator) — Tool (specific)

Process

Home

Solve — Use case (list) — Category — Use case (page)

Design phases (list) — Design phase (specific)

CD solutions (list)

Plan

About
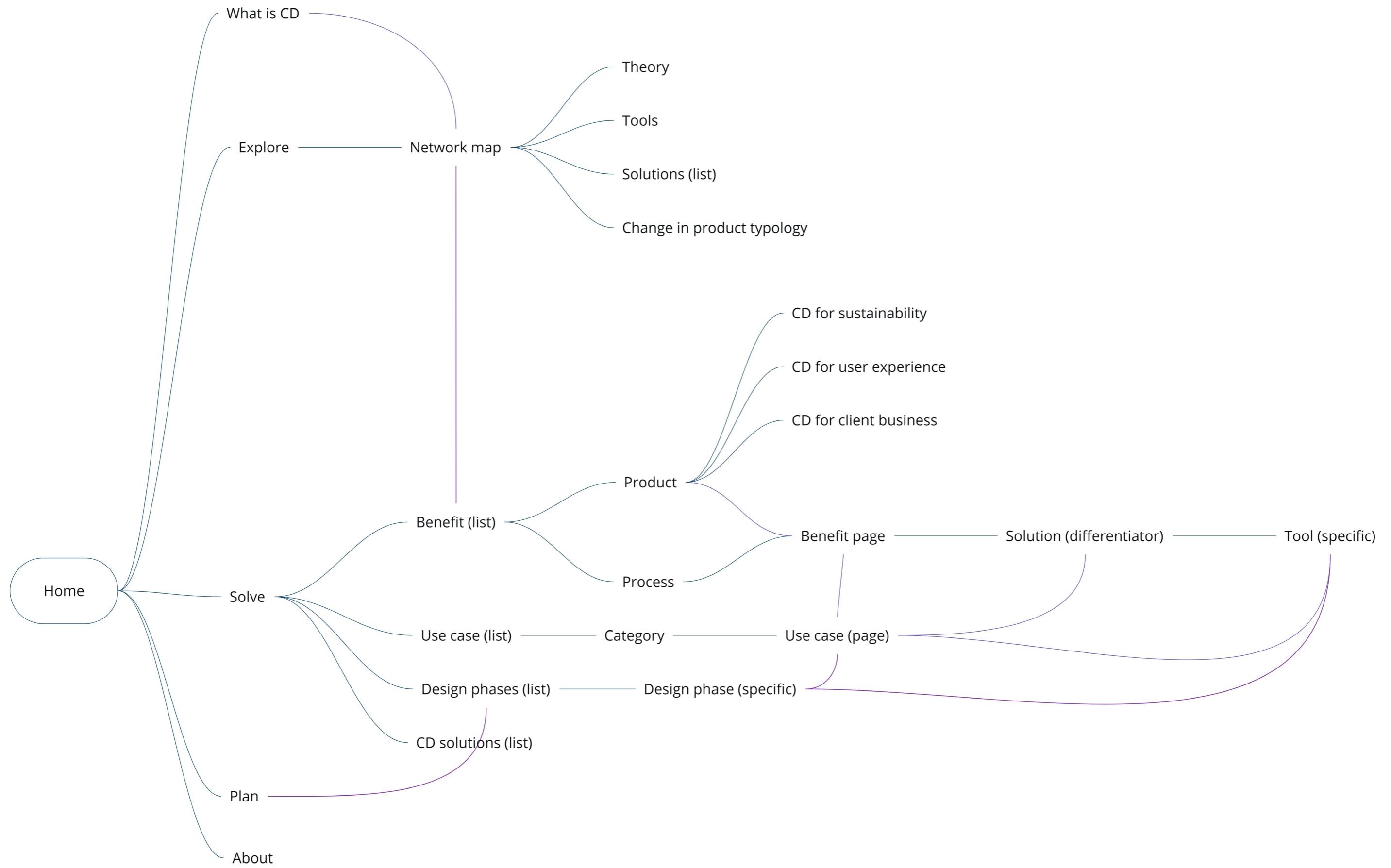
Figure 12-Digital guide navigation structure

2 9
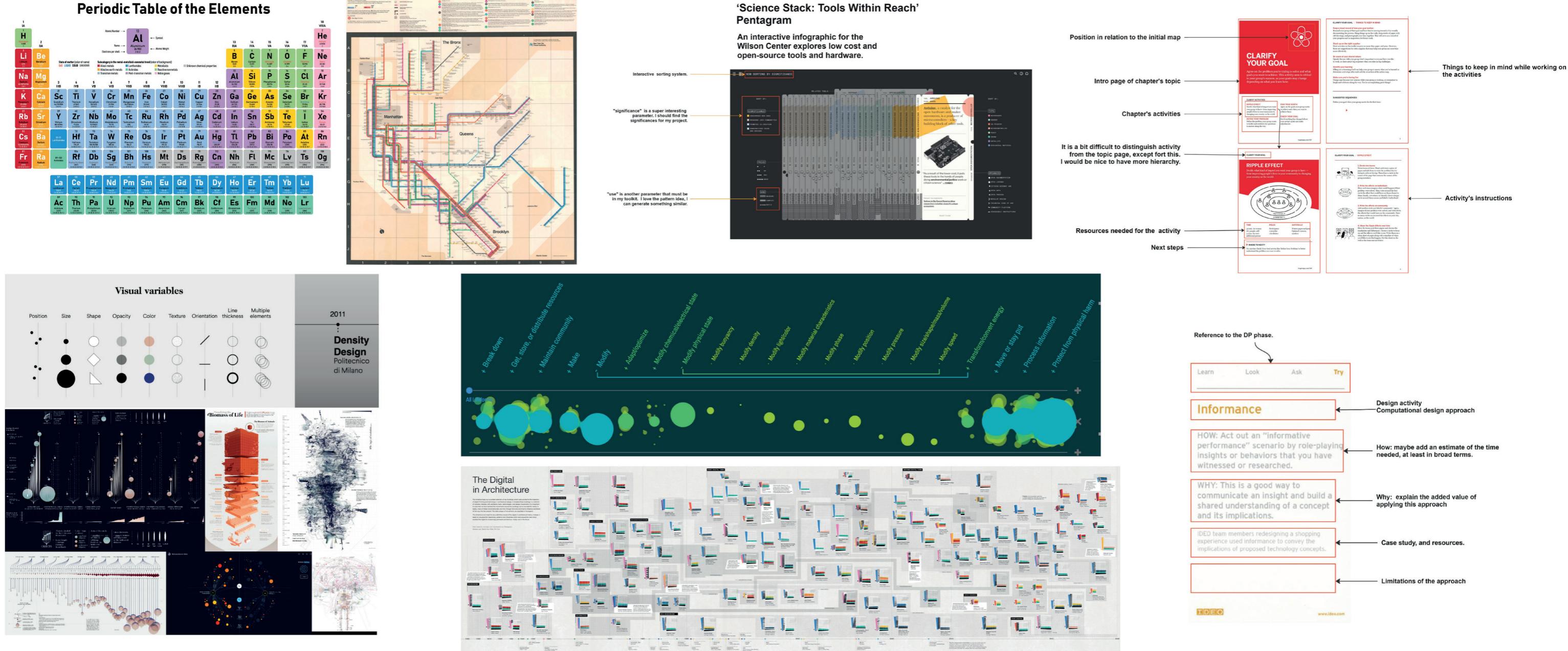
Figure 13-collection and analys of information designs

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E. GRASSHOPPER DEFINITIONS

PARAMETRIC MODEL+ CONFIGURATOR UI +BIOMORPHER
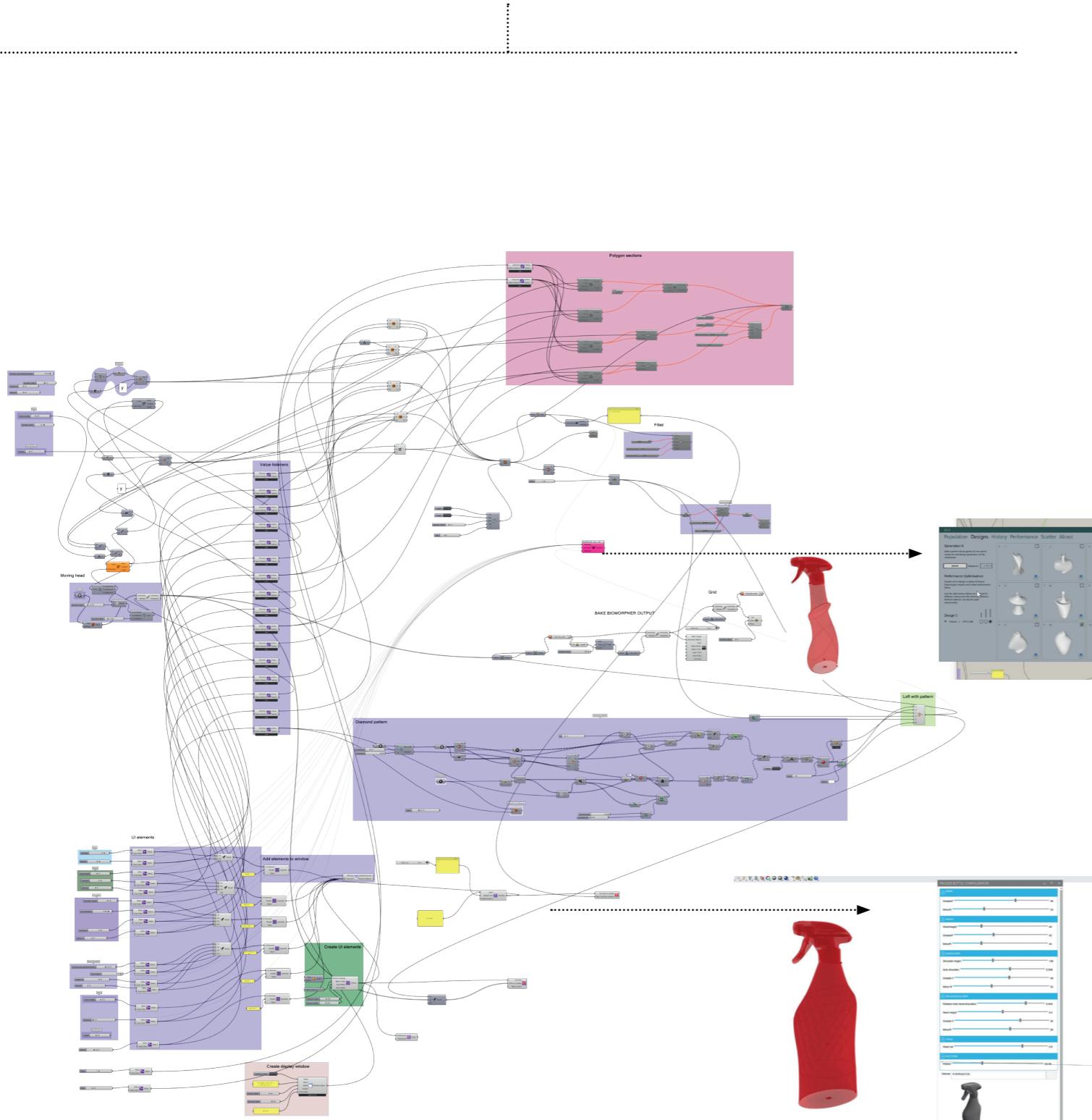
GALAPAGOS AND OCTOPUS EXPERIMENTS
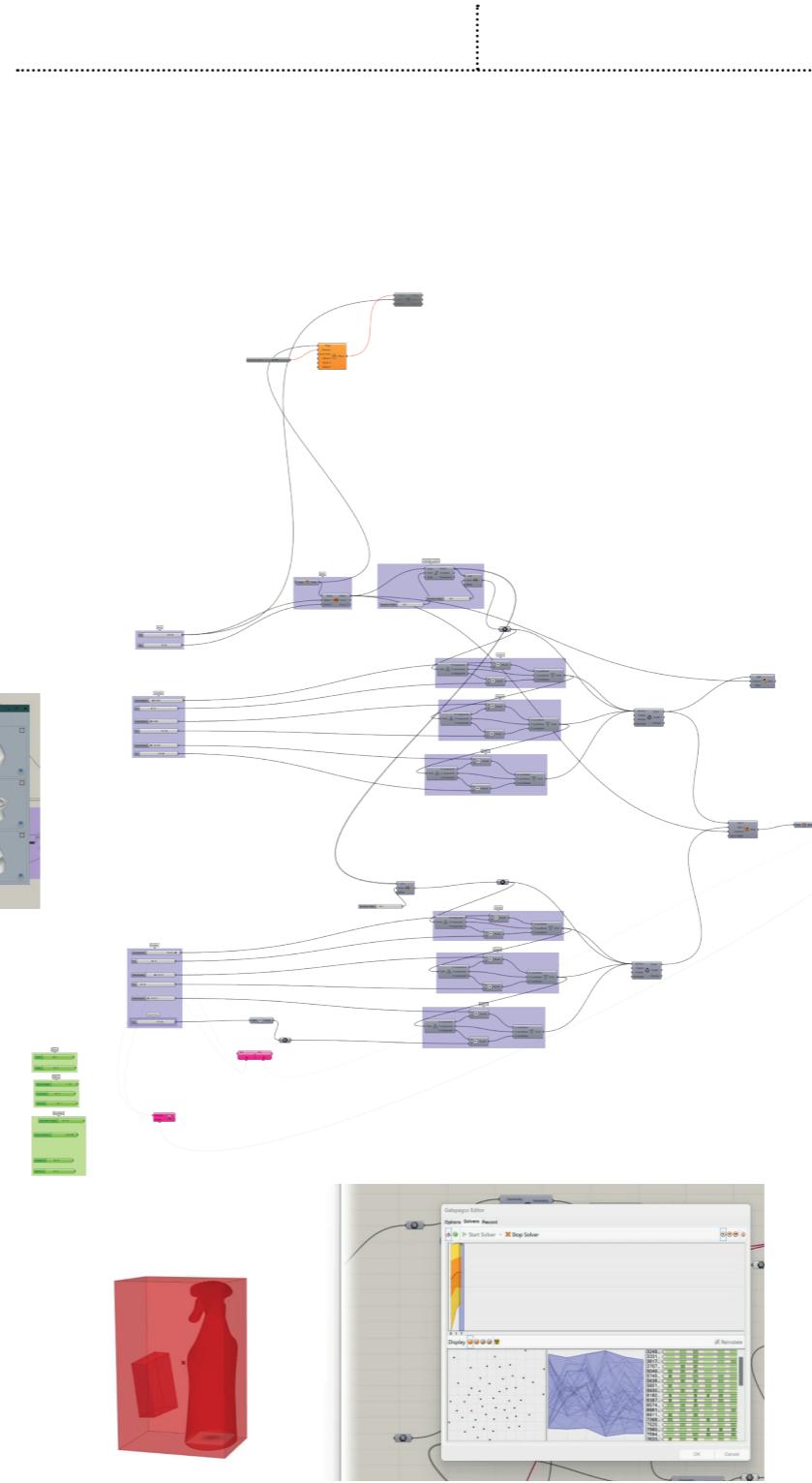
TEXT TO 3D EXPERIMENTS
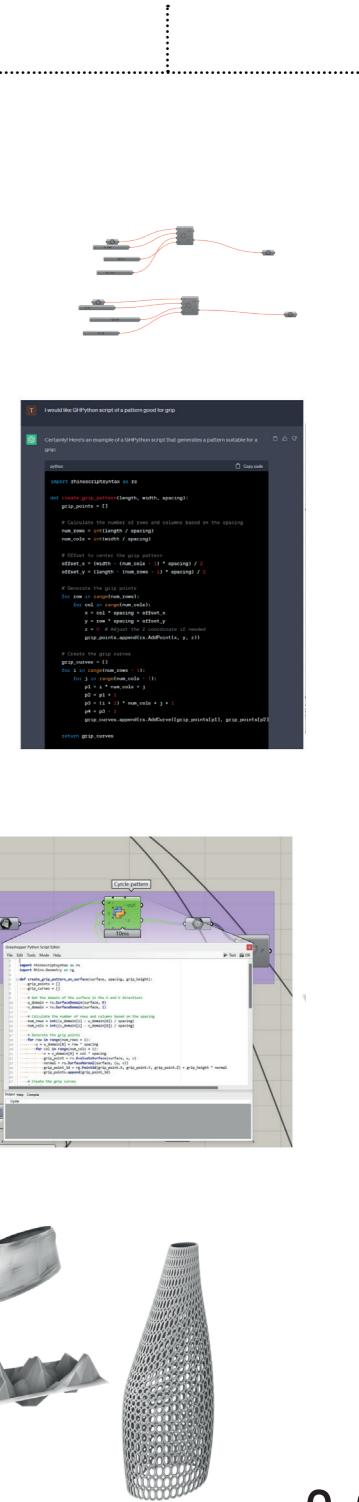
F. LEARNING RESOURCES ON COMPUTATIONAL DESIGN

BOOKS AND WEBSITES

MAEDA, J. (2019). HOW TO SPEAK MACHINE: COMPUTATIONAL THINKING FOR THE REST OF US. VAN HAREN PUBLISHING.

TEDESCHI, A. (2014). AAD ALGORITHMS-AIDED DESIGN: PARAMETRIC STRATEGIES USING GRASSHOPPER. LE PENSEUR.

MENGES, A., & AHLQUIST, S. (EDS.). (2011). COMPUTATIONAL DESIGN THINKING. WILEY.
WOODBURY, R. (2010B). ELEMENTS OF PARAMETRIC DESIGN. HTTP://CW.ROUTLEDGE.COM/TEXTBOOKS/9780415779876/

ANTONELLI, P., OXMAN, N., BURCKHARDT, A., & STEINER, H. A. (2020). NERI OXMAN: MATERIAL ECOLOGY. THE MUSEUM OF MODERN ART, NEW YORK.

ROBERT MCNEEL & ASSOCIATES. (N.D.). ESSENTIAL MATHEMATICS FOR COMPUTATIONAL DESIGN. WWW.RHINO3D.COM. HTTPS://DEVELOPER.RHINO3D.COM/GUIDES/GENERAL/ESSENTIAL-MATHEMATICS/
SCOTT,D. BITS TO ATOMS | DUANN SCOTT | SUBSTACK. BITS TO ATOMS. HTTPS://WWW.DESIGNFORAM.COM/

GENERATIVE DSIGN INTRODUCTION (DANIEL NAGY): HTTPS://MEDIUM.COM/GENERATIVE-DESIGN
DESIGN COMPUTATION HUMAN (ONUR YÜCE GÜN): HTTPS://WWW.YOUTUBE.COM/@COMPUTATIONALDESIGN

COURSES AND TALKS
MODELAB: HTTPS://WWW.YOUTUBE.COM/C/MODELABIS/FEATURED

REINHARD KOENIG (UNI WEIMAR): HTTPS://WWW.YOUTUBE.COM/@SUPERMACHINA/ABOUT

OTP | ONLINE TRAINING PLATFORM (UNI WEIMAR): HTTPS://OTP.UNI-WEIMAR.DE/

PARAMETRIC CAMP: HTTPS://WWW.YOUTUBE.COM/PARAMETRICCAMP

DIGITAL DESIGN UNIT - TU DARMSTADT: HTTPS://WWW.YOUTUBE.COM/@DIGITALDESIGNUNIT/FEATURED

GRASSHOPPER PRIMER (MODELAB): HTTP://GRASSHOPPERPRIMER.COM/EN/INDEX.HTML

DESIGNMORPHINE: HTTPS://DESIGNMORPHINE.COM/

DIGITAL FUTURES: HTTPS://DIGITALFUTURES.INTERNATIONAL/

G. GRADUATION BRIEF

DESIGN FOR our future

TUDelft

IDE Master Graduation
Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

❗ USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT
Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME
Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy".
Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 ! ❗

family name	Silluzio
initials	TS given name Tommaso
student number	5397421
street & no.	
zipcode & city	
country	
phone	
email	

Your master programme (only select the options that apply to you):

IDE master(s): (★) IPD   ( ) DfI   ( ) SPD

2nd non-IDE master: _____

individual programme: ___ - ___ (give date of approval)

honours programme: (Honours Programme Master)

specialisation / annotation: (Medisign)
(Tech. in Sustainable Design)
(Entrepeneurship)

SUPERVISORY TEAM **
Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair	Gerd Kortuem	dept. / section: SDE
** mentor	Vera van der Burg	dept. / section: DOS
2nd mentor	Roger Zambrano	
	organisation:	VanBerlo part of Accenture
	city: Eindhoven	country: The Netherlands

comments
(optional)

❗ Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..

❗ Second mentor only applies in case the assignment is hosted by an external organisation.

❗ Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.

TUDelft

APPROVAL PROJECT BRIEF
To be filled in by the chair of the supervisory team.

chair Gerd Kortuem   date 12 - 01 - 2023   signature _____

CHECK STUDY PROGRESS
To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: _____ EC

Of which, taking the conditional requirements into account, can be part of the exam programme _____ EC

(YES) all 1st year master courses passed

(NO) missing 1st year master courses are:

List of electives obtained before the third semester without approval of the BoE

name _____ date ___ - ___ - ___ signature _____

FORMAL APPROVAL GRADUATION PROJECT
To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **.
Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: (APPROVED) (NOT APPROVED)

Procedure: (APPROVED) (NOT APPROVED)

comments

name _____ date ___ - ___ - ___ signature _____

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Computational Design toolkit for Industrial Design.

project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date   10 - 01 - 2023   05 - 06 - 2023   end date

INTRODUCTION *
Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

The main research question that will steer my exploration during the graduation project is:
What is the potential of Computational Design applied to Industrial Design?
I will introduce in this section the term Computational Design (CD), and I will address in the "problem definition" section the meaning of the words potential an industrial design related to this project.
Computational Design is a broad term. I found various definitions that I would categorize into two groups. Some are more at an abstract level, and others are more practical.
Abstract level:
1: "The Design and Computation Group inquires into [...] the ways in which design meaning, intentions and knowledge are constructed through computational thinking, representation, sensing, and making. . We focus on the development of innovative computational tools, processes and theories, and the application of these in creative, socially meaningful responses to challenging design problems."[1]
2: "The approach for computational design focuses on the execution of variational methods for the purposeful intent of resolving complexities that exist in the interrelation and interdependencies of material structures and dynamic environments." [2]
 Practical level:
"…Design representation in its computational logic instead of its geometric aspects" [3]
An interpretation that I would personally give after the initial research is:
CD consists in the practice of going beyond the design of just the product, but in designing the system that generates not only the product, but the entire solution space from which the right outcome can be selected.
In the project's initial phase, I will continue the literature research to define a solid framework for the project and better scope the term CD.
I will conduct this project in collaboration with the design agency VanBerlo which will be one of my main stakeholders. Through this project, I want to investigate the relationship between computational design and design process. VanBerlo is one of the largest design agencies in the Netherlands and, in a certain sense, represents a continuously ongoing design process. Designing products and services is a daily activity at VanBerlo, and the agency has a thorough understanding of the design process. Furthermore, VanBerlo is an inspiring environment that can bring diverse expertise into the project, enriching its final quality and my learning experience. For this reasons, the agency represents the perfect ecosystem for me to develop my graduation project. I will have the possibility to have direct feedback from the industry and quickly test my hypothesis on design process and activities. The agency is investing in creating a computational design group and wants to put time and effort into better understanding this field. CD might have the ability to help navigate the design process and face client-related challenges in an alternative way, possibly improving the value proposition towards clients and optimizing parts of the process. VanBerlo is noticing these tools' impact on the design process and is convinced that their influence on it will increase in the future. On the one hand, there is an interest in discovering computational design's creative potential/value. On the other hand, there is a need for a prepared framework and a lens to analyze the tools that appear at a fast pace. The agency is interested in integrating and testing computational design tools/ approaches in its process and in developing a toolkit that can facilitate the choice of the right tool/approach for a determinate design problem/phase. Creating such a toolkit will be part of my graduation project. Furthermore, there is a need for a fresh and external perspective on the topic that I can bring together with a unified view, thanks to the depth that characterizes a graduation project.

IDE TU Delft - E&SA Department /// Graduation project brief & study overview /// 2018-01 v30   Page 3 of 7
Initials & Name   TS   Silluzio   Student number 5397421
Title of Project   Computational Design toolkit for Industrial Design.

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introduction (continued): space for images
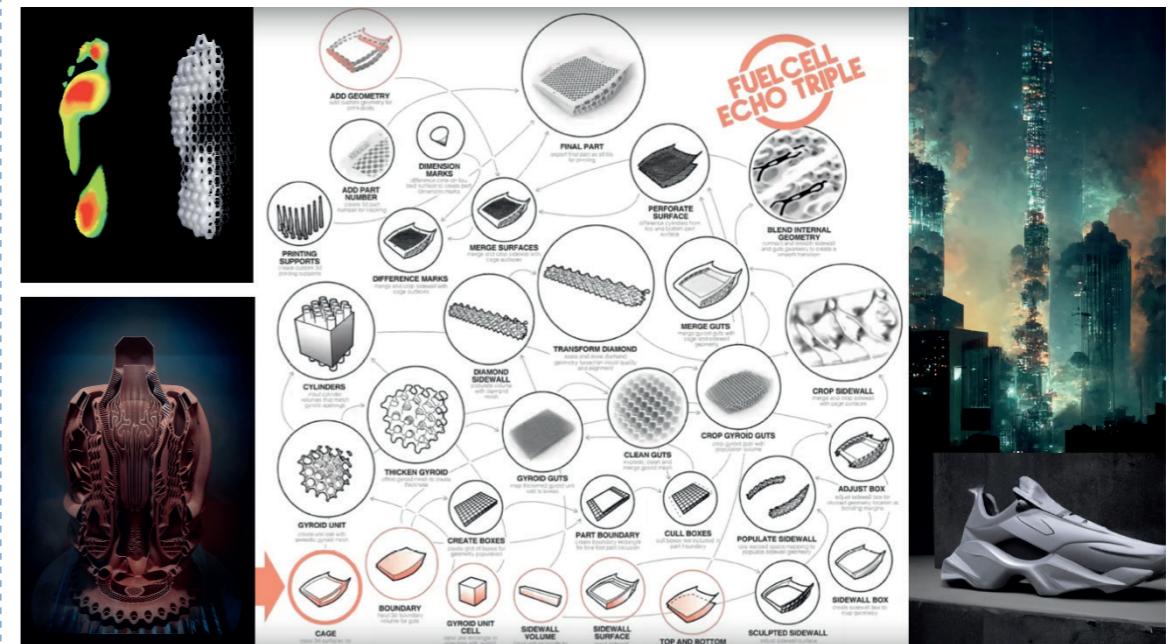
image / figure 1:   A representation of some of CD's possibilities

Sources:

1: The Design and Computation Group. (n.d.). MIT. https://architecture.mit.edu/computation

2: Menges, A., & Ahlquist, S. (2011). Computational Design Thinking: Computation Design Thinking. Wiley.

3: Caetano, I., & Leitão, A. (2019). Architecture meets computation: an overview of the evolution of computational design approaches in architecture. Architectural Science Review, 63(2), 165–174. https://doi.org/10.1080/00038628.2019.1680524

Images from left to right:

- Ultra personalization, KISKA
- Algorithmic engineering, Hyperganic
- A computational approach to a shoe's sole, Onur Yüce Gün Computational Design Manager at New Balance
- AI for storytelling and inspiration, Arturo Tedeschi

image / figure 2:   Sources

IDE TU Delft - E&SA Department /// Graduation project brief & study overview /// 2018-01 v30   Page 4 of 7
Initials & Name   TS   Silluzio   Student number 5397421
Title of Project   Computational Design toolkit for Industrial Design.

3 9

PROBLEM DEFINITION **
Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

Computational design is an approach, a set of tools, and a methodology whose potential seems to be only partially explored in Industrial design. The project's goal is an exploration of the potential of CD in industrial design analyzed through the lens of the design process. The project's focus will be measuring the potential and assessing the value that CD can bring to design activities. The project will cover a top-level exploration of the field, with a more in-depth exploration of selected tools or approaches based on the initial research results and the project schedule.
The main research questions related to the relationship between CD and design process are:
How can computational design contribute to each phase of the design process?
Which tool best suits each phase of the design process?
How to use a computational approach in the different phases of the design process?
The other keyword in the main research question mentioned in the introduction is "potential".
The definition of potential and value will be properly addressed during the project to define the guiding criteria of the analysis. However, an initial hypothesis in measuring the potential of CD in industrial design could be:
New applications and new ways of solving (design) problems. There are already exciting examples of computational approaches applied to industrial design: topology optimization, ultra personalization, architected materials, and AI for image production.
How can these applications be integrated into the day-to-day process of a design consultancy?
In addition to those mentioned above, I am sure there are plenty of fascinating possibilities enabled by CD.
What are these possibilities? How can they be categorized?
Time could be another valuable parameter for this analysis. I am convinced that leveraging computational power might make it possible to explore a much broader solution space in a minor amount of time.
How does a computational approach perform when confronted with a "traditional" one?
I will address these main research questions during my graduation project.

ASSIGNMENT **
State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

I will deliver: 1) A toolkit for choosing and utilizing the right computational tool/approach for the design activities/problems in which CD can bring more value. 2) A proof of concept that leverages and demonstrates the possibilities and qualities of CD applied to industrial design.

As CD capabilities still require further specification, which will be carried out during the project, the final outcome might be further defined after the research phase. That being said, I want to validate the hypothetical answers to the questions listed in the previous sections by testing them on specific design activities, related to the different phases of the design process. This will lead to creating a toolkit connected to design activities in which a computational approach can bring exact value. After the toolkit's test on design activities in a controlled environment, I would like to test the toolkit by creating a use case that can validate and express the approach's full potential. The product(s) shall demonstrate one or more advantages (compared to traditional processes) identified in the project's research phase. Computationally enabled form finding is a recurrent theme I encountered in my preliminary research. It has its theoretical roots in the work of Buckminster Fuller and Frei Otto. It is based on the principle of designing a process that gives life to the form instead of designing the form directly. Environmental analysis and the derived constraints are the boundary conditions in the system that generates the form. For the project's use case, I want to investigate what these parameters might be in the context of industrial design. Close-to-body applications might be interesting, considering that in the human body, multiple parameters can be used as input to generate the product, from body shape to temperature, to mention a few. Looking at some case studies, applying shape grammar or creative AI to an FCMG case like a bottle might be interesting. Some more options might be an office chair or a shoe in which I could map temperature and pressure to generate the parts in contact with the body and use topology optimization in the case of the chair's structure.

PLANNING AND APPROACH **
Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date   10 - 1 - 2023   5 - 6 - 2023   end date

The literature review will help me better understand CD's boundaries, evolution, terminology and theoretical foundations. Through this research, I want to identify CD's main benefits and methods in addition to the definition of a general framework. In this phase, I will also research design toolkits to create a collection of case studies that I will later use to design my own toolkit. I will then outline an initial value proposition of CD in industrial design and a toolkit draft. The next step will be getting in touch with the design community: within VanBerlo to research the design process on the field, and outside VanBerlo to talk with CD experts to have a first feedback on the toolkit and to understand how they integrate CD in their practice. I will define the criteria to assess the CD methods that will be included in the toolkit. In the meantime, I will gain practical knowledge of the software/methods able to materialise the most promising generative approaches. During this phase, I want to generate a series of small prototypes/proof of principles. I will then define which design activities can be augmented through CD and how. I will test each "augmented" design activity in a controlled environment with other designers and engineers at VanBerlo. I will then proceed with the creation of the toolkit based on the test evaluation. To close the project, I will test the whole toolkit with a design sprint of a use case that should showcase CD potential. Due to the non-linear nature of the design process, I will need to look at this planning with a flexible approach. Depending on the insights I gain during the process, I may jump between one phase and another. Furthermore, I plan to experiment early on during the project, and in some cases, I will need to learn the skills to do so. I will flank the research, with phases of practical training and creation, possibly on the same day. This will also help me to be more efficient during the day, considering that except for very practical tasks like 3D modelling, I find it challenging to focus on the same task for the whole day. In the image, in addition to the Gantt, there is a chart representing the sequence of goals and deliverables that will articulate the project (visible on Adobe Reader).

TUDelft

Personal Project Brief - IDE Master Graduation

Since my Bachelor's second year, mainly inspired by Neri Oxman's work, I have wanted to explore the world of computational tools applied to industrial design. I have chosen to follow a master's at the TUDelft because of its excellence and the open structure of the master's second year that allows for exploring personal interests. I believe that computational design might have the potential to revolutionize a bit the way we design products. Through this project, I want to create the knowledge foundations to understand this topic related to the field of industrial design, creating the basics that will allow me to thoughtfully bring this approach to my future practice.

During the elective semester, I followed the course Computational Design for Digital Fabrication, in which I learned the basics of Grasshopper, and I had a taste of Computational Design's potential. During the graduation project, I would like to put these skills into practice and extensively explore this topic.
From ACD and AED, I understood the importance of a thorough project plan and managing the complexity of discovering fields that were not part of my previous knowledge. I will use these skills to create a detailed plan that will be periodically updated throughout the project and to communicate continuously with the stakeholders involved.
Throughout the master's first year, interviews were a constant, from the most extensive projects to an IDE Academy workshop. I interiorized the importance of this research technique that put us in direct contact with stakeholders and users in the project. I plan to put this skill into practice multiple times during the project by interviewing experts and practitioners.
Thanks to the Bio-inspired design course from the 3mE faculty, I understood how to extract working principles from nature and be inspired by them to solve design problems. A Bio-inspired design approach can play a role in my graduation project. In addition to this, the skill of bringing concepts from other disciplines to the design domain will be fundamental during the project.
Throughout my studies, I was always passionate about prototyping and 3D printing. During my design engineer internship at VanBerlo, I had the chance to strengthen this skill further. I want to put this experience into the project's second part, trying to test and materialize my hypothesis as much as possible.

The Midterm Evaluation Form

>> Complete the form to prepare for the midterm evaluation, and send it to your supervisors, at least 3 days prior to your midterm evaluation session. <<

Name student	Tommaso Silluzio
Student number	5397421
Name chair	Gerd Kortuem
Name mentor	Vera van der Burg
Interim/In-between results	

Short description of realised interim results:
<to be filled in by the student>

- **Literature**
  - Clarity: terminology, theory (elements that helped to appropriately interact with experts and create the right set of questions targeted on what I could not find out through literature research).
  - List of tools and case studies.
  - Validate my research questions and the need for research on the topic: " Generative Product Design is a worthwhile topic of study." Mountstephens, J., & Teo, J. (2020).
  - Creation of an overview of CD in the design process + interactive collection of case studies (Used during interviews with users and experts).
- **VanBerlo design process research**
  - How creatives at VB approach projects: the plan is tailored to the client question, they use an internal method toolbox to compose a quote. Every project roughly follows the VB design process: Explore, Implement, Ideate, Create, Validate, Implement.
  - Feedback on CD overview and case studies: interesting, helpful, can help in fail fast, suggestions about possible filters.
- **Interview with experts**
  - Interest in my project: good for motivation 😊
  - Insights on their process from different perspectives: corporate, agency, 2 of them have experience in higher education (AA and MIT)
  - Insights on how the process expertise and outcome could change thanks to CD.
  - Insights on the future of this approach
  - Feedback on my work: CDoverview and collection of case studies (in one interviewee company, they are doing something very similar to showcase their offerings to clients and explain CD).
  - Analyzing the interviews and the effort of categorizing the insights led me to the creation of a conceptual framework (combination between my research questions and interviewees' input) about CD, That I would like to use as a skeleton for my guide/ toolkit.
- **Toolkit**
  - Representing my research: knowledge graph, network, ontology, a good way of structuring mixed data and highlighting relationships.
  - Small prototype to ask for feedback during the focus group with VB
- **Focus group, insights on:**
  - Base knowledge about CD.
  - Information consumption preferences.
  - Brainstorming on opportunities.
  - Brainstorming on barriers.
  - Feedback about the prototype.
  - Material to create user journeys.
- **Toolkit research**
  - Overview of possibilities on how the "front-end" part of the toolkit could look like
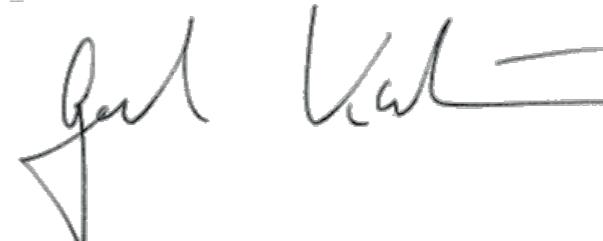
4 3

	o Collection of case studies.

Reaction on description interim results:
<to be filled in by supervisory team>

Reflection[1]		
<take the course's learning objectives as starting point when reflecting on the topics below [2]>		
Reflection on quality	*<to be filled in by the student>* I am satisfied with the quantity and quality of insights I collected from various sources. Both the collection and analysis of the insights forced me into a process of continuous sense-making to find meaningful relationships and causality within the fundamental concepts of my research. Regarding the "knowledge generation" part of the learning objectives, I am unsure if I am generating new knowledge. I am trying to offer an interpretation of existing knowledge to make it accessible and enable creatives to understand and use a different approach and set of tools during their process. I think that one of my main contributions is uncovering the process of professionals already using CD in industrial design to understand how this approach affects the current process, expertise and final outcome. This research helped to identify a set of benefits that CD could create to improve the current process and design outcome. I hope these benefits can stimulate creatives to invest time in learning more about CD. Part of my mission is to give them the framework and the tools to reduce the friction between the willingness to learn about CD and the actual learning. I think that on this side, my project is still lacking. I am close to a final categorization of the knowledge I collected, which is the backbone necessary to communicate it. However, I am still missing the communication part of the project: how creatives will interact with and consume this knowledge. I will focus my next steps on fulfilling this aspect of the project.	*<to be filled in by supervisory team>* Vera: The research work you do is very thorough and detailed. You have a curious mindset and are willing to take action to collect as much information on the topic as you can, in great fruitful collaboration with all the resources your client has to offer. While the research part shows a lot of potential, the design part could use a similar focus. Based on all the information you have collected now, it is important to make thought-through design decisions, and create a better understanding WHAT you are designing, for WHOM, and WHY. This translation from research to design is always challenging, so do not worry if you feel like you cannot cover all your research results in the final design. It is important, however, to create a clear understanding of the toolkit you are making; i.e. what this exactly entails, what form or shape (digital, physical) this will take and why,

and who will use it. Then, it is important to have a proof of concept: Does your design do what you say it does? You will have some weeks to focus on this, and I have the confidence you will be able to finish this in time.
Gerd: I completely agree. If you are designing toolkit (or whatever it might be), you need clarity on who it is for and what it should do. In other words, you need to go through a design process to identify and make appropriate design decisions. Ultimately, ideally, you will be able to defend reasons and argue your design decisions and make statements about the tools utility, efficacy, appropriateness, viability, ... (pick you own criteria)

Reflection on planning	*<to be filled in by the student>* I think my initial planning and the sequence of actions needed to arrive at certain results were pretty accurate. Regarding the timing, I hit the first stumbling rock during the interview analysis (a relatively new task for me). During that moment, I realized that analyzing interviews takes way more time than I expected or planned for, but at the same time, this process of analyzing brought me an incredible amount of insights. I had to learn a new process using new tools such as condense, and I realized that I had more material than I would have been able to analyze. For this reason, I had to prioritize some interviews above others. This affected my planning, and I had to remove the final use case sprint to be able to deliver the toolkit/guide. I also had to stop the -practical tools training- part (scripting in Grasshopper and an Hyperganic course) that was in my planning because I realized it was relatively out of scope for the toolkit creation, and the benefits were not	*<to be filled in by supervisory team>* Vera: Your planning up until now has received realistic adjustments; whereas your plans seemed quite ambitious at the start, you managed to adjust them to a feasible set of plans without losing depth in your project. I have good confidence that you can finish the project in time. Gerd: I agree. I would suggest to make a plan that starts from the end (graduation) and works back to identify

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[1] A short indication of your thoughts and considerations with regard to the graduation project up till now.
[2] Learning objectives are to be found in the Course Manual, and in the IDE Study guide.

	justifying the time investment. In general, I think that I could have done a better job in balancing the research/ collection of knowledge and content creation. I think that on some occasions, I got caught in the preparation-procrastination trap.	intermediate milestones between now and the end of the project.
Reflection on personal ambitions (if formulated in project brief)	*<to be filled in by the student>* The first personal ambition in the project brief was: " I want to create the knowledge foundations to understand this topic related to the field of industrial design, creating the basics that will allow me to thoughtfully bring this approach to my future practice." I think that I am getting closer to this goal, especially for the " thoughtfully" part 😊 . I am achieving a good understanding and overview of the relationship between computational design and industrial design. I am a bit concerned about not learning the "hard skills" of this approach, but I hope that I will have the possibility and the time to do so after my graduation. I have the arguments and the motivation to continue on this path. In the project brief, I wrote that I wanted to apply what I consider to be my core skills: 3D modelling and physical prototyping. I would have loved to do so, but at the same time, I am learning new skills, such as interview analysis, and discovering exciting fields that I didn't expect to encounter in the project, such as knowledge management.	*<to be filled in by supervisory team>* Vera: As mentioned before, your ambition as a designer is definitely recognized. However, it is important now to formulate a clear design brief for yourself that will guide you through the last couple of weeks and try to stick with it. This will create more focus in your project which now still seems broad. Gerd: a graduation project is relatively short. You need to align your ambition what is feasible and sensible.
Reflection on supervision and/or project context	*<to be filled in by the student>* I am happy with the supervision both from the university and the company side. I feel understood, despite my communication sometimes is not crystalline clear. A skill that I am trying to improve. I got many useful suggestions that helped me approach problems from a different angle and, in general, helped me exit a bit from the depth of problems I was stuck on. Doing the project at VanBerlo and working there every day is giving me the opportunity to be in continuous contact with my user group (and with fellow designers/strategists/engineers). This enabled me to have a continuous exchange with them and easily organize interviews and a focus group.	*<to be filled in by supervisory team>* Vera: I think you are very self-directive and autonomous and you take the supervision in your own hands, as in you ask for help when you need it. I think the collaboration with Van Berlo also offers a lot of tutoring opportunities for you which helps the project develop in the way you want it.

Decision supervisory team concerning progress graduation project at this moment		
X Continue	☐ **Adjust**	☐ **Discontinue**

Substantiate the decision:
There is clear progress, good intermediate results and a plan. Broadly, the project follows the original plan.

Adjustment of Project Brief: new arrangements

Proposal new arrangements based on this midterm evaluation:
<to be filled in by the student, based on the above reflection. If applicable: add appendices>
As I mentioned in the reflection on planning, I won't proceed with creating a specific product/ use case using computational design, but I will canalize my efforts on delivering the toolkit/guide.

Final arrangements
The indicated adjustment ("won't proceed with creating a specific product/ use case using computational design") is a sensible pragmatic decision that doesn't affect the overall project.

Main recommendation for the remainder of the project:
Focus on designing. Clarify what you aim to design, for whom (tool, toolkit,…). Clarify your design process. Clarify the success/evaluation criteria? Make and document design decisions.

Signatures (name, date and signature of student, chair and mentor)		
Name student: Tommaso Silluzio Date: 30 March 2023	**Name chair: Gerd Kortuem Date: 29 March 2023**	**Name mentor: Vera van der Brug Date:**

At the end of the Midterm Evaluation meeting: Please hand-in the filled-in form **on Brightspace,** upload to **'IDE Master Graduation Project'** organisation.

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I. POST-MIDTERM SCOPING: PRELIMINARY WHOM WHAT AND WHY

Whom:

My user group is designers working at VanBerlo, a creative agency based in the Netherlands.
VanBerlo has three capabilities strategy, design, and engineering. Since I focus on physical product design, the project focuses primarily on industrial designers and engineers. However, project managers and strategists could also benefit from my design.
There are two main profiles that I am targeting that can roughly be associated with the seniority level of VanBerlo employees.

Explorative, Junior, has more time to learn and will use the design to explore a new approach and apply computational design strategies to the project efficiently. Creates content.
Pragmatic, mid to senior, has less time to explore and could use the design to plan for a project or design activity and to answer broader design problems. They are less likely to produce content.

Of course, these are approximations and hypothetic profiles. Through the design, I want to foster exploration and cross-pollination. Therefore, I like the experience to be actionable but open to facilitating serendipity and happy accidents.

Through user research, I can conclude that my user is interested in exploring new technologies applied to design, like computational design, however, has limited time to do so.

What:

1. *A website mock-up or a series of web pages in the form of guidelines, storyboards, and wireframes to give initial directions on the interaction between the user and the knowledge I developed during the research. Based on the insights gained during interviews and a focus group with my user group.*
2. *An Obsidian vault containing the findings from my research with structure and links based on the (limited) understanding I gained during desk research and expert interviews. The goal is to create a starting point to build and feed the website mentioned above in the future.*

From the start of the project till now, I alternated using three names to refer to my project's final output: toolkit, guide and map.

The graph visualization will follow the logic of CD design concepts and their relationship, and this should be shown to the users to inform them about the knowledge domain.
The tagging system will address the discoverability. It will be strictly linked to the user's problem, interests, professional traits and all the elements that can make the computational design solutions discoverable without knowledge prerequisites about computational design.

It might be interesting to give the user the possibility to navigate the design based on their intent: explore, solve, plan.

Why:

As I stated at the beginning of the project and confirmed with my research (both literature and user), there is a need to:

1. *Create a top-level understanding of the implications of computational design in industrial design.*
2. *Communicate this understanding.*

The user group expressed multiple times (at the start of the project and during the user research) the desire to understand this topic better and the need for a framework and methodology to engage with it efficiently. As expressed by my coach at VanBerlo, and emerged during the user research, one of the main problems is designers trying to approach this topic and finding themselves lost in the sea of information. This often leads to them not being able to arrive at significant results in the time frame available in a project and sometimes being discouraged from trying again. Furthermore, as emerged from the focus group, computational design is often associated with specific software, a view that could limit the exploration of the possibilities of the approach itself.
Citing my coach at VanBerlo:
" Having a prepared framework could be way more efficient than just trying to digest this subject yourself every time you face it."

With the project, I would like to create a first step towards a guided approach to the subject. However, I am conscious of my limitations, from the limited time for the graduation project to the lack of prior knowledge in computer science.

I think that the three terms express the desire to address different sets of problems concerning the relationship between computational design and industrial design:

Map: to address the need for an overview of the topic, clarify the misconceptions and confusion about the term, and communicate its elements immediately. It could create an experience of exploration and visually represent the topic.
Requirements: Discoverability, engagement.

Guide: to address the need for guidance within this ecosystem and get an understanding of it without a significant time investment. An alternative to directly facing a sometimes overwhelming number of sources.
Requirements: Accuracy, and understandability.

Toolkit: to make the knowledge actionable in my users' daily practice: imagining and designing new products and solutions.
Requirements: actionability, understandability, discoverability.

I want my design to take the qualities of these three elements. The design will address the communication of the knowledge I collected during my research. I spent most of the time collecting and understanding information. Therefore, its structuring has priority. However, I also did some user research to understand how users want to interact with the CD world. For this reason, I would like to give input about what the interaction with this body of knowledge could look like.

This could take two forms: physical (hardcopy) or digital (website).

The digital option is chosen because of its ease of navigation, the possibility of applying filters for research and the potential to be updated and withstand the fast-changing world of CD.
So, I will design a website (wiki-like) that will exist as a standalone or in the VB website with the main aim of engaging creatives to CD, sparking interest and being an initial reference while applying this approach to their daily work.
This website will be a middle ground between a wiki and a [primer](#). The design goal is not to cover the entire topic spectrum but to create a starting point to engage with CD. It is intended to be a place where the users can go to evaluate if a tool or approach is relevant to their process or design problem.

The network structure will fulfil the "map" function, highlighting the big picture and the relationship between concepts.
Feedback from VanBerlo.:" There is a lot of value in being able to zoom in and then zoom out and learn from how things are linked more than just deep diving."
The 'guide function' will be fulfilled by the content of the single pages, accessible to digest and to the point.
The "toolkit function will be fulfilled by the filtering search and general UI.

List of requirements:

Accuracy
Does the design cover the most critical implication of CD in the industrial design practice?
Test: ask experts for feedback.

Reliability:
The information in the design should always cite sources or be verifiable. Where this is impossible, the lack of references should be made clear and explicit and explain the process behind eventual assumptions.

Discoverability:
Can information be accessed easily? Can the users find the solution to their problem with the minimum time investment?
The tagging system will be strictly linked to the user's problem, interests, professional traits and all the elements that can make the computational design solutions discoverable without knowledge prerequisites about computational design.
Test:
Ask the users to search for a solution for a design problem they could have.
Did they find the solution?
How long did it take?
Is a reasonable amount of time within a project? (Ask project managers)

Understandability:
Does the design help the users familiarize themselves with the topic?
No jargon, straight-to-the-point information, it should be accessible, and the users should not spend time searching words meaning outside the design.

Actionability:
Is the information applicable to a design project?
Test: ask seniors. Find similar case studies. Do they feel ready to apply CD strategies in their work?

Engagement:
Is the toolkit engaging? Does it spark interest in the topic?
Test: are users willing to invest time in exploring the design? Would users recommend the design to colleagues?

Does the design increase awareness about CD and its potential?
Test: ask users their opinion about how CD could influence their work.