Research Plan | Architectural Engineering Studio

Personal Information

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Studio

Name of the studio: Architectural Engineering
Design tutor: Mo Smit
Research tutor: Nico Tillie

Argumentations of choice of the studio:
In my view, the integration of architecture and technology is the future for the architect. Also, I like the studio's freedom. Within this studio, I can research my main interest in architecture, and at the same time, I can reach very interesting people in this subject.

Title

The Biophilic Stress-Relieving In Between Space by Direct Nature

Graduation Project

Keywords
Stress-Relief, In-Between Space, Biophilic Design, Direct Nature, Stress Recovery Theory, Mental Health

Definition Key Terms

Biophilia
''The innate, genetically determined affiliation of human beings to nature and other living organisms'' (International Living Future Institute, 2018).

Biophilic Design
''A nature-based design that impacts our satisfaction with the built environment. Biophilic design can reduce stress, enhance creativity and clarity of thought, improve our well-being, and expedite healing; as the world population continues to urbanize, the qualities are ever more important'' (*14 Patterns of Biophilic Design*, 2014).

Direct Nature
''The direct experience of nature refers to actual contact with environmental features in the built environment including natural light, animals, water, landscapes, and others'' (*Biophilic Design Toolkit*, z.d.).

In-Between Space
The space that makes the connection between nature from the context and the main functions of the building, from the user's experience.

Mental Health
''Mental health is a state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community. It is an integral component of health and well-being that underpins our individual and collective abilities to make decisions, build relationships and shape our world. Mental health is a basic human right. And it is crucial to personal, community and socio-economic development'' – (World Health Organization: WHO, 2022).

Stress
''A process of responding to events, environmental features, or challenging situations, that exceed coping resources or threaten wellbeing''(Kellert et al., 2009).

Stress Recovery Theory (SRT)
The Stress Recovery Theory by Ulrich links stress recovery to design criteria, based on natural elements. ''Stress recovery, according to Ulrich, involves the recovery or restoration from excessively arousing states, both psychologically and physiologically''(Kellert et al., 2009).

1. Problem Statement

''We humans are programmed as we experienced the world years ago in nature, but over the years, we lost our balance. We moved from being a part of nature to being apart from nature'' (Attenborough & Hughes, 2020, p. 125). This has many adverse effects on our mental health, for example, the level of stress in the modern world (Kellert et al., 2009).

1.1. Stress as a common problem for young adults

When looking at mental well-being in the modern world and different age groups, it appears that young adults in particular suffer from mental problems. The study ''Health Monitor Young Adults 2022'' by GGD & RIVM (2022), which focuses on ages 16-25, indicates that 53.5% of young adults experience mental complaints. It also shows that stress is the biggest cause of getting mental problems (GGD & RIVM, 2022). The same study concludes that 82.3% of the age group 16-25 are sometimes or often stressed and 48.3% are (very) often stressed. It further shows that study/school is the biggest cause with a percentage of 62.1 percent. This is a very high figure, especially when compared with adults who experience the most stress at work, with a rate of around 12% (*Mentale gezondheid volwassenen*, z.d.).

Mental health	
Satisfied with oneself	81.5%
Psychological complaints	53.3%
Stress	
Stress study/school	62.1%
Stress at work/secondary job	42.2%
Stress health	22,8%
Stress family/friends/relationships	36,4%
Stress opinions of others	29,0%
Stress expectations of others	33,1%
Stress self-demand	44,5%
Stress social media	11,1%
Stress combi. of everything that has to be done	45,7%
Stress living situation	15,6%
Stress money matters/debts	25,9%
Stress identity/sexuality/gender	7,4%
(Very) often stressed	48,3%
Sometimes to very often stressed	82,3%

Figure 1: Health Monitor Young Adults (GGD & RIVM, 2022)

1.2. Stress levels students TU Delft

Among students studying at the Delft University of Technology, the average stress level appears to be even higher. A national study by RIVM, GGD GHOR, and the Trimbos Institute concluded that 97% of students at TU Delft experience stress. Furthermore, 70% experience (too much) performance pressure, and 51% experience psychological complaints such as anxiety and gloom (Rooijakkers, 2021).

1.3. Biophilic Design

As previously concluded, our brains are more programmed to live in and with nature, as people lived years ago, than the modern life of today. Within the role of the architect, biophilic design is a trend. Biophilic design is a nature-based design that affects our satisfaction with the built environment. Biophilic design can reduce stress, promote creativity and clear thinking, improve our well-being, and accelerates healing. With biophilic design theory, architects can have a major impact on people's mental well-being and stress levels. Biophilic design can therefore be seen as a solution for the architect when the architect wants to design a stress-reducing environment, but the problem is that too little is known about concrete tools for architects within this topic.

2. Objective

The main aim of this graduation project is to discover how an architect can design a building that increases stress relief through biophilic in-between spaces. Here, the direct nature will provide an experience consisting of a gradual transition between the experience of nature from the context and the main functions of the building. The design realized in the second half of the graduation project will serve as a prototype. The main goal, which will lead to the overall design question, has four goals. From these four goals, the sub-design questions will be formulated, including the thematic research question.

2.1. The prototype

The design will serve as a prototype. The context and program of this prototype will be as follows:

Program

The program will consist of a mixed-use concept with student living, study places, and stress relieving functions. The entire building will focus on students and stress relief. This connection stems from the problem statement. Both additional housing and study places are important for the growing TU Delft and for the mental well-being of students. Applying mixed-use will ensure that this building and the campus show activity throughout the whole day, which is part of the TU Delft campus vision 2040. Furthermore, the chosen functions of living and studying are general functions woven into students' everyday lives. Within the prototype, this was chosen because a change in commonly used functions can make a very big impact.

Context

The TNW building on the TU Delft campus was chosen as the context. A renovation project was chosen as a prototype because due to sustainability requirements and changing demand for functions, many buildings in the Netherlands will have to be renovated in the coming years. This building is centrally located on campus, as shown in figure 2, and is looking for a new function.

Furthermore, this building has the potential for integrating biophilic stress-relieving in-between spaces, as shown in figure 3. Within this research, the definition of the in-between space will be as follow: The space that makes the connection between nature from the context and the main functions of the building, from the user's experience.

Figure 2: TNW building in the context (*Science Park Fund stimulates innovation on TU Delft Campus*, z.d.)

Figure 3: Opportunities for integrating biophilic stress-relieving in-between spaces (by author)

2.2. Design goals

To achieve the desired design, the following goals are important:

Direct nature

Biophilic design can be divided into three types, namely: direct nature, natural patterns, and place & culture (*Biophilic Design Toolkit*, z.d.). Direct nature provides the most stress relief (Kellert et al., 2009). ''The direct experience of nature refers to actual contact with environmental features in the built environment including natural light, air, plants, animals, water, landscapes, and others'' (*Biophilic Design Toolkit*, z.d.). Furthermore, direct nature also creates opportunities, in terms of other goals within a project. For example, when in addition to stress relief, it is designed with climate adaptation, biodiversity, or energy efficiency in mind

Rethinking of activities

The associated activities of living and studying will be rethought, by focusing on the modern world lifestyle of students and stress relief. This is partly done by incorporating stress relieving as a function in the mixed-use concept, as mentioned in the program.

Flexible approach

Designed from an open design vision, the in-between spaces will have a construction with a flexible approach. This ensures that the in-between spaces can be adapted as stress relieving needs change. For example, the quality of the existing in-between spaces can be examined every 10 years. Also, the flexible approach ensures that the design of the TNW building serves as a prototype and that those integrated in-between spaces can also be applied to other locations.

Integration in Prototype

The research has a general approach, meaning that the results found can be integrated into many different projects. The prototype serves as an example here. Part of the research per design goals is to investigate the integration into the prototype when results are found. This research per design goal focused on the TNW building, will come together in the final design question.

2.3. **Design questions**

The main goal of this graduation project will be formulated towards the following overall design question: How to design a building that increases stress relief through biophilic in-between spaces? The overall design question will be answered through the sub-design questions below, which have emerged from the design goals. The implementation per sub-design question is listed in the Research structure, which can be found in Appendix 1.

1. How can biophilic in-between spaces increase stress relief through direct nature? (Thematic Research)
2. How to rethink activities in a mixed-use building to increase stress relief in students' modern lifestyles?
3. How to design the new in-between spaces according to a flexible construction that can be adapted every ten years?
4. How can biophilic in-between stress-relieved spaces be integrated into the renovation design of the TNW building on the TU Delft campus?

3. Frame of Reference

Below, the main sources of existing research will be briefly discussed. Then the research gap will be discussed. This will lead to the thematic research question.

3.1. Existing research

In recent years, interest in the relationship between the built environment and stress levels has increased. There is a lot of literature on environmental psychology showing that the design of the environment has a major impact on mental health and stress levels. It is also known that stress levels are an important factor in viewing mental health. In the world of architects and designers, biophilic design is a trend. This trend is being led by the International Living Future Organisation, among others. This organization runs the Living Building Challenge, the world's most rigorous green building standard. They also have a platform dedicated to biophilic design and present the Stephen R. Kellert Biophilic Design Award every year. Stephen Kellert was the Tweedy Ordway Professor Emeritus of Social Ecology and Senior Research Scholar at the Yale University School of Forestry and Environmental Studies. He is considered the foremost researcher of biophilic design. He published the following book in 2009: Biophilic Design - The Theory, Science, and Practice of Bringing Buildings to Life. This book considered ''the pioneering guide to the emerging practice of biophilic design'' compiles twenty-three essays by world-renowned scientists, designers, and practitioners. These include Roger Ulrich, the world's most cited and influential evidence-based healthcare design researcher, who laid the foundation for what is now called biophilic design with his study View Through a Window May Influence Recovery from Surgery (1984). His studies led to the Stress Recovery Theory, which includes design criteria for the recovery or restoration of excessively excitatory states, both psychological and physiological (Kellert et al., 2009).

Through Ulrich's design criteria, the graduation research will translate existing theories into technologies. Technical knowledge about direct nature in architecture is very old and is still being expanded. Especially in recent years, due to the importance of sustainability, there has been a lot of research on this knowledge again.

Finally, technologies will be integrated into the in-between space. Within psychology and architecture, there is a focus on the meaning and experience of a given space. In recent years, there has also been researching into in-between space. For instance, the book Ecopsychology, Phenomenology, and the Environment - The Experience of Nature (Vakoch & Castrillón, 2014) talks about self-perception and awareness of transition when moving to another space.

3.2. Research Gap

The research gap here is a toolbox for architects that provides tools to achieve stress relief through biophilic direct nature. The application of this can have a big impact in the in-between space. The result of the thematic research will be a toolbox in the form of diagrams consisting of the following ingredients:

- Design criteria, based on the Stress Recovery Theory
- Explanation of stress relief experience of each design criteria
- Case studies per experience
- Technique per case study
- Rules, based on interviews with professionals

This research gap leads to the following <u>thematic research question:</u>

How can biophilic in-between spaces increase stress relief through direct nature?

<u>Sub-thematic research questions</u>:

1. How can Stress Recovery Theory be related to biophilic in-between spaces which increase stress relief through direct nature?
2. What techniques can be linked to the various design criteria of Stress Recovery Theory?
3. How can these techniques together provide biophilic in-between spaces which increase stress relief through direct nature?

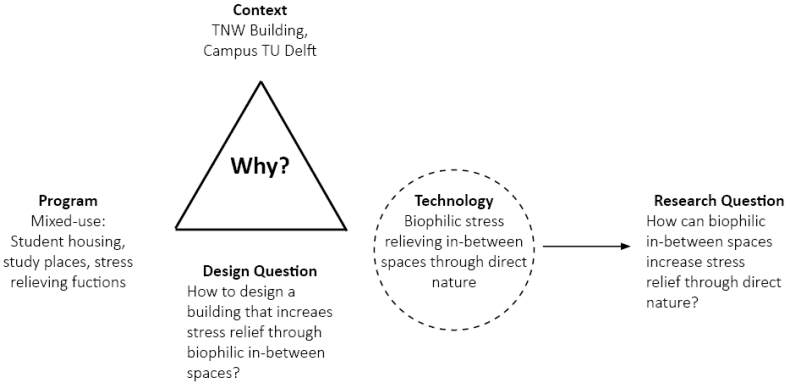


Figure 4: Architectural Engineering Triangle (by author)

4. **Hypothesis**

Stress relief can be increased through direct nature by applying the design criteria of Ulrich's Stress Recovery Theory. A system of tools consisting of a diagram of the design criteria, techniques, case studies, and experience together form a toolbox for architects to design biophilic in-between spaces that increase stress relief.

5. **Positioning & Methodologies**

The research method will consist of literature research, case studies, and in-depth interviews. The entire research is divided into three parts below. Each part is related to a sub-research question. This connection can also be seen in the Research Structure, which can be found in Appendix 1. The literature examined for each part is shown in the bibliography.

1. Literature research will be conducted on Stress Recovery Theory and the relationship between the Stress Recovery Theory and biophilic in-between spaces which increase stress relief through direct nature.
2. Examples of biophilic direct nature will be examined as case studies. Each case study will present an experience as an example of a design criterion. In addition, the technique that was needed to reach the experience will also be examined. Together, this will result in a diagram presenting the toolbox. The case studies and technologies will be shown in sketches. An outline of this diagram can be found in Appendix 2.
3. In-depth interviews will be conducted with professionals. This part will first look for rules to apply to the toolbox. Second, it will explore how the toolbox and associated rules can serve for the TNW building on the TU Delft campus, which serves as a prototype.

Professionals:

- Jolanda Maas
  Associate Professor, Faculty of Behavioural and Movement Sciences, Clinical Psychology, Associate Professor, APH - Mental Health

- Cecil Konijnendijk
  One of the world's leading urban forestry experts, director of Nature Based Solutions Institute, Global Urban Forester

- Marc Mieras
  Science journalist and physicist specialising in brain development

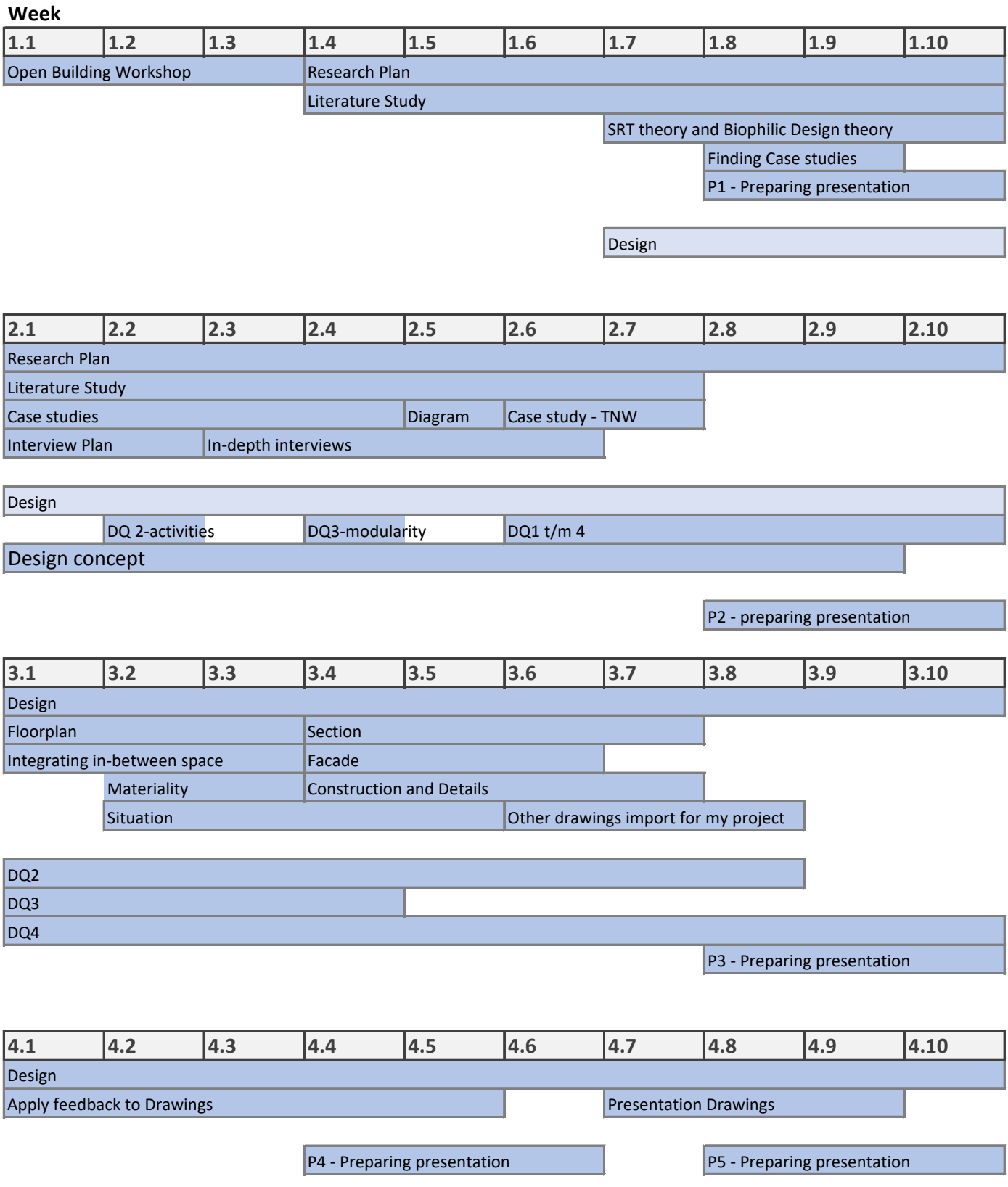
- Joren van Dijk
  Environmental psychology consultant and owner of
  De Omgevingspsycholoog

6. **Relevance**

The relevance of this study arises from its connection with the problem statement. This connection is shown in the P1 Collage, which can be found in Appendix 3. The problem statement establishes the link between stress level, direct nature, and biophilic design. In this study, biophilic design examines the design theories that influence stress levels. In the objective, the prototype is introduced. This prototype targets the target group identified in the problem statement, namely students at TU Delft. Linking the Stress Recovery Theory to the prototype creates a toolbox that can be widely used by architects. Furthermore, several techniques are used, namely literature research, case studies, and, interviews. This increases the relevant knowledge found.

7. **Graduation Planning**

The planning is linked to the three parts of thematic research, as described under positioning & methodologies. For design question 3, which is about a flexible approach, preliminary research will be done until week 2.9. , so that interesting conversations can be held with the Building Technology teacher after the P2 presentation.



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Thematic Research (Design question 1)
How can biophilic in-between spaces increase stress relief through direct nature?

1. **Sub-research question 1**
   How can Stress Recovery Theory be related to biophilic in-between spaces which increase stress relief through direct nature?

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1. **Sub-design question 2:**

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Figures

Figure 1: Health Monitor Young Adults (GGD & RIVM, 2022)

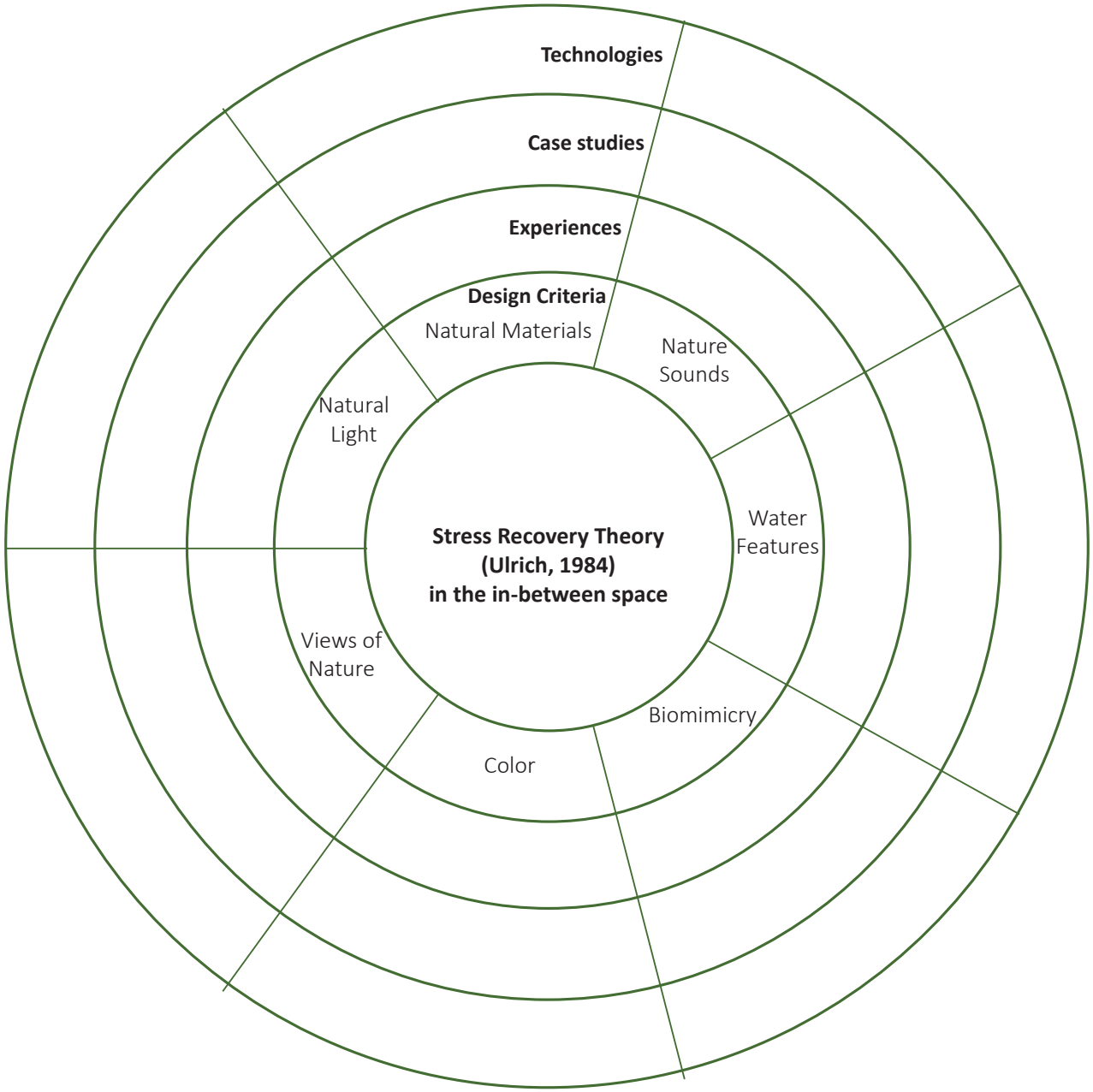
Figure 2*: Science Park Fund stimulates innovation on TU Delft Campus*. (z.d.). TU Delft. https://www.tudelft.nl/en/2019/technology-transfer/science-park-fund-stimulates-innovation-on-tu-delft-campus/

Appendix 1: Research Structure

			What data do you need?	How can this data be collected?	How will this data be analysed	What will be the expected results?
Design Question: How to design a building that increaes stress relief through biophilic in-between spaces?	Prototype: TNW building, TU Delft Campus, Renovation project Mixed use: student houses, study space, stress relief activities		Results of all the sub-design questions	See sub-design question 4	Diagram + sketches	The renovation design for the TNW building
	Thematic Research Question (sub-design Q1): How can biophilic in-between spaces increase stress relief through direct nature?		Results of all the sub-research questions	1.Diagrams (sub-research Q2) 2.Rules (sub-research Q3) 3.Integration in the TNW building	Diagrams with different relations	1.Thesis 2.Integration in the renovation design of the TNW building
		Sub-research Q1: How can stress recovery theory be related to biophilic in between spaces which increase stress relief through direct nature?	1.Explanation of SRT 2.Relation SRT and biophilic interstices that increase stress relief through direct nature. 3.Explanation of how each design criteria provides stress relief.	Literature study See bibliography Research Plan for specific sources	1.Summarizing the stress recovery theory 2.Analyzing the connection between the SRT theory and biophilic in between spaces which increase stress relief through direct nature. 3.Summarizing the experience of each design criteria	1 and 2. Written conclusions of the relation between the SRT and biophilic in between spaces which increase stress relief through direct nature. 3.Written conclusion about the experience of each design criteria. 1 t/m 3. Diagram with relations within sub-research Q1 + SRT diagram met design criteria's
		Sub-research Q2: What techniques can be linked to the various design criteria of the SRT?	1.Biophilic direct nature examples of design criteria's in the in between space of buildings. 2.The architectural engineering part per technique to achieve this technique.	Literature study and case studies See bibliography research plan for specific sources	Case study 2.sketches (1 small sketch per technique)	Diagrams showing techniques by design criteria. Each technique includes a small sketch.
		Sub-research Q3: How can these techniques together provide biophilic in-between spaces which increase stress relief through direct nature?	1.Rules that ensure the desired result.	Literature study In-depth interviews: Jolanda Maas Cecil Konijnendijk Marc Mieras Joren van Dijk	Literature study + In-depth interviews	Rules to use the toolbox as an architect

			What data do you need?	How can this data be collected?	How will this data be analysed	What will be the expected results?
	Sub-design Q2: How to rethink activities in a mixed use building to increase stress relief in students' modern lifestyle?		1.Connection between different activities and stress-relief 2. Students' needs in terms of stress relief and activities 3. Integration in TNW building	1 + 2. Literature research 1 + 2. Case study of buildings focussed on stress-relief (and students) 3.Drawings of the TNW building	1 + 2. Literature study + sketches 3. Sketches	1 + 2. Written conclusion 3. Sketches related to the TNW building
	Sub-design Q3: How to design the new in-between spaces according to a flexible construction which can be adapted every ten years?		1. Examples of flexible constructions 2. Technical knowledge of flexible constructions 3. Technical knowledge of the TNW building	1. Case studies 2. Design research + BT teacher 3. Drawings of the TNW building	1 t/m 3. Drawings Sketches of details + overall sketches (in relation of the TNW building)	1 t/m 3. Sketches of details + overall sketches focussed on the TNW building
	Sub-design Q4: How can biophilic in-between stress relieved spaces be integrated in the renovation design of the TNW building on campus?		1. TNW Context information 2. Results of sub-design question 1, 2 and 3 and integration in the TNW building	1. Visit, Drawing research, literature research 2. A diagram with the relations of the different outcomes + design research	1 + 2. Diagram + Sketches	The renovation design for the TNW building

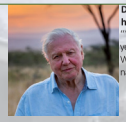
Appendix 2: Toolbox diagram as a result of the Thematic Research Question



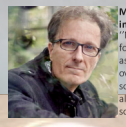
The Design Criteria circle and Experiences circle will consist of written information. The Case studies circle and the Technologies circle will consist of sketches. Each Design Criteria is connected to several case studies. Each case study is linked to one technology.

Appendix 3: P1 Collage

PROBLEM STATEMENT



David Attenborough - broadcaster, biologist, natural historian and author
"We humans are programmed as we experienced the world years ago in nature, but over the years, we lost our balance. We moved from being a part of nature to being apart from nature" (Attenborough & Hughes, 2020, p. 125).



Mark Mieras - Science journalist & physicist specialising in brain development
"Natural areas, parks, trees and gardens provide a refuge for the mind. There is robust scientific support for this assumption. Even small bits of nature contribute to overstimulating our attention system and help cope with social stress. A short walk or a view of a green canopy already helps restore cognitive functions and function socially.

However, urban people's relationship with nature is complex. People who grow up in an urbanised environment are the most sensitive to environmental stimuli and stress, thus have the greatest need for nature and yet are actually less inclined to seek it out. Under the influence of all stimuli, their brains develop a stimulus-seeking strategy at the expense of active control over attention and self-control. Because of this diminished self-control, urban dwellers easily get carried away in a life pattern full of busyness and stress" (Beetje natuur, grote invloed- Mark Mieras, z.d.).

Source: (Beetje natuur, grote invloed- Mark Mieras, z.d.)

RIVM: National Institute of Public Health and the Environment
"Young adults who experience more stress due to work, their home situation, their own problems or other issues are most likely to have mental complaints.
In addition, we see a link between mental complaints and typical stress-related physical complaints such as irritability, sleep problems, fatigue and memory and concentration problems" (GGD & RIVM, 2022).

Mental health	
Satisfied with oneself	81.5%
Psychological complaints	53.3%
Stress	
Stress study/school	62.1%
Stress at work/secondary job	42.2%
Stress health	22,8%
Stress family/friends/relationships	36,4%
Stress opinions of others	29,0%
Stress expectations of others	33,1%
Stress self-demand	44,5%
Stress social media	11,1%
Stress combi. of everything that has to be done	45,7%
Stress living situation	15,6%
Stress money matters/debts	25,9%
Stress identity/sexuality/gender	7,4%
(Very) often stressed	48,3%
Sometimes to very often stressed	82,3%

Source: Health Monitor Young Adults (GGD & RIVM, 2022)

Stress levels students TU Delft

Stress (general)	97%
Stress (too) much pressure to perform	70%
Psychological complaints	51%

Source: (Rooijakkers, 2021)

TU Delft: "We strive for a natural, biodiverse campus where people and nature co-exist 💙"
Source: tudelft instagram (2023)

THEORY

Roger Ulrich - The most cited and influential evidence-based healthcare design researcher in the world. Professor, Department of Architecture and Centre for Healthcare Architecture, Chalmers University of Technology

"The growing literature indicates that evidence-based biophilic design can have a positive impact by reducing stress and improving emotional wellbeing.

Stress-reducing effects of looking at nature are manifested as a constellation of beneficial changes that include reduced levels of negatively toned emotions (fear, anger), elevated positive emotions (pleasantness), and changes in physiological systems. Studies in both laboratories and real environments have consistently found that viewing nature produces significant physiological restoration within three to five minutes at most, as evidenced, for example, blood pressure, heart activity, and muscle tension.

Stephen Kellert - Tweedy Ordway Professor Emeritus of Social Ecology and Senior Research Scholar at the Yale University School of Forestry and Environmental Studies

The intuitive belief that contact with nature promotes psychological well-being and physical health dates back at least two thousand years and has appeared widely in Western and Asian cultures. Evidence from a large scientific literature showing that diverse cultures and socioeconomic groups show high similarity in responding positively to nature views. The evolutionary framework holds that modern humans, as a genetic remnant of evolution, have a capacity for stress-reducing responses to certain nature scenes and content (vegetation, water), but have no such disposition for most built or artifact-dominated environments and materials. In addition, daylight and sun exposure also were critical for the well-being, health, and survival of early humans. As a legacy of this importance, modern humans are psychologically and biologically attuned to sunlight and changing cycles of light and darkness. Properties of nature settings that should be effective in producing restoration include security linked to spatial openness that fosters visual surveillance; sunshine or good light in contrast to poor, light or threatening weather; and qualities linked with high habitability and food availability, including calm or slowly moving water, verdant vegetation, flowers, savanna-like or parklike properties (scattered trees, grassy understory), and unthreatening wildlife such as birds" (Kellert et al., 2009).

Stress Recovery Theory (SRT)
"Stress recovery, according to Ulrich, involves the recovery or restoration from excessively arousing states, both psychologically and physiologically. This theory is linked to the following design criteria: Natural light, natural materials, nature sounds, water features, biomimicry, color and views of nature (Ulrich et al., 1984).

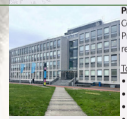
Masja Rietveld - Architecture Graduation Student (Architectural Engineering studio), TU Delft
My childhood in the countryside combined with my student days in Delft made me experience the contrast between the feeling of nature and city. As a future architect, I think it would be great to understand how design can influence how people feel. When I ask myself how to create positive feelings as an architect, for me the answer is integration of nature. Nowadays, there is a lot of literature on biophilia that confirms this.

As a student in this modern world, I see a lot of stress around me. This is especially true with TU Delft students.

When focusing on experience and architecture, I think the most impact can be made in the in between space of general everyday buildings. Here, I define the in between space as the space that makes the connection between nature from the environment and the living spaces of a building, from the user's perception.

In conclusion, the biophilic in between space can be a great opportunity for the architect when the goal is a stress-relief environment, but the problem is that too little is known about concrete tools for architects within this topic.

OBJECTIVE



Prototype
Context: TNW Building, TU Delft Campus
Program: Mixed-use, namely student housing, study spaces and stress relief activities

Toolbox ingredients:
- Design criteria, based on the Stress Recovery Theory
- Experience of stress relief experience of each design criterium
- Case studies per experience
- Technique per case sudy
- Rules, based on interviews with professionals, to use the toolbox as an architect

			What data do you need?	How can this data be collected?	How will this data be analysed	What will be the expected results?
Design Question: How to design a building that increaes stress relief through biophilic in-between spaces?	Prototype: TNW building, TU Delft Campus, Renovation project Mixed use : student houses, study space, stress relief activities		Results of all the sub-design questions	See sub-design question 4	Diagram + sketches	The renovation design for the TNW building
	Thematic Research Question (sub-design Q1): How can biophilic in-between spaces increase stress relief through direct nature?		Results of all the sub-research questions	1.Diagrams (sub-research Q2) 2.Rules (sub-research Q3) 3.Integration in the TNW building	Diagrams with different relations	1.Thesis 2.Integration in the renovation design of the TNW building
		Sub-research Q1: How can stress recovery theory be related to biophilic in between spaces which increase stress relief through direct nature?	1.Explanation of SRT 2.Relation SRT and biophilic interstices that increase stress relief through direct nature 3.Explanation of how each design criteria provides stress relief.	Literature study See bibliography Research Plan for specific sources	1.Summarizing the stress recovery theory 2.Analyzing the connection between the SRT theory and biophilic in between spaces which increase stress relief through direct nature 3.Summarizing the experience of each design criteria	1 and 2. Written conclusions of the relation between the SRT and biophilic in between spaces which increase stress relief through direct nature. 3.Written conclusion about the experience of each design criteria. 1 t/m 3. Diagram with relations within sub-research Q1 + SRT diagram met design criteria's
		Sub-research Q2: What techniques can be linked to the various design criteria of the SRT?	1.Biophilic direct nature examples of design criteria's in the in between space of buildings. 2.The architectural engineering part per technique to achieve this technique.	Literature study and case studies See bibliography research plan for specific sources	Case study 2 sketches (1 small sketch per technique)	Diagrams showing techniques by design criteria. Each technique includes a small sketch.
		Sub-research Q3: How can these techniques together provide biophilic in-between spaces which increase stress relief through direct nature?	1.Rules that ensure the desired result.	Literature study In-depth interviews: Jolanda Maas Cecil Konijnendijk Marc Mieras Joren van Dijk	Literature study + in-depth interviews	Rules to use the toolbox as an architect
	Sub-design Q2: How to rethink activities in a mixed use building to increase stress relief in students' modern lifestyle?		1.Connection between different activities and stress-relief 2. Students' needs in terms of stress relief and activities 3. Integration in TNW building	1 + 2. Literature research 1 + 2. Case study of buildings focussed on stress-relief (and students) 3.Drawings of the TNW building	1 + 2. Literature study + sketches 3.Sketches	1 + 2. Written conclusion 3. Sketches related to the TNW building
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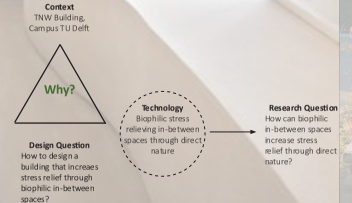
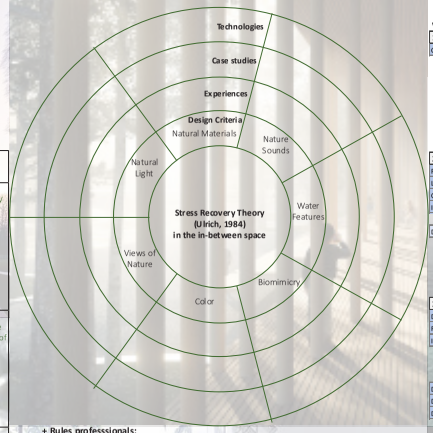


Architectural Engineering Triangle (by author)

RESEARCH METHODS



+ Rules professsionals:
- Jolanda Maas
  Associate Professor, Faculty of Behavioural and Movement Sciences, Clinical Psychology, Associate Professor, APH - Mental Health
- Cecil Konijnendijk
  One of the world's leading urban forestry experts, director of Nature Based Solutions Institute, Global Urban Forester
- Marc Mieras
  Science journalist and physicist specialising in brain development
- Joren van Dijk
  Environmental psychology consultant and owner of De Omgevingspsycholoog

SWOT Context & Program
Direct connections in the in-between space

Central location on campus, connection to:
- Mekelpark
- Library
- Auditorium

Campus = open area
Separated from location
No character
Long boring corridors

Strengths | Weaknesses

Opportunities
Making connections
- Mekelpark
- Library
- Auditorium

Repetition
Footbridges
Paths Mekelpark

Threats
Parking places
Traffic routes (car, bicycle, pedestrian)

SWOT Context & Program
Indirect connections in the in-between space

Many large windows
Central location on campus

Separated from location
No character
Long boring corridors
Monotonous
Unaware of where you are in the building

Strengths | Weaknesses

Opportunities
Making connected views:
- Mekelpark
- EWI
- 3ME
- Civil engineering
- Auditorium
- Library

(becoming aware of location)

Threats
Parking places

DESIGN

Week

1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10
Open Building Workshop			Research Plan						
			Literature Study						
						ART and SRT theories		Interview Plan	
								Finding Case studies	
								P1 - Preparing presentation	
						Design			

2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	2.10
Research Plan									
Literature Study									
Case studies				Diagram		Case study - TNW			
Interview									
Design									
	DQ2- activities		DQ3- modularity		DQ1- t/m 4				
					Design concept				
							P2 - preparing presentation		

3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.10
Design									
Floorplan			Section						
Integrating in-between space			Facade						
	Materiality		Construction and Details						
	Situation				Other drawings import for my project				
DQ2									
DQ3									
DQ4									
							P3 - Preparing presentation		

4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10
Design									
Apply feedback to Drawings						Presentation Drawings			
			P4 - Preparing presentation				P5 - Preparing presentation		

Building as a park, Campus as a landscape