

The implications of *Logical Argumentation* and *Experiment*

A reflection on research methods in the site analysis of the Plofbos in the 'Heritage and Architecture' studio.



I INTRODUCTION

Intro

This paper reflects on the methodology and two primary research methods that have been applied in my preliminary research of the Heritage and Architecture studio. By 'Methodology' is meant the rationale of the research approach. In other words, the lens through which the research occurs. In this paper, the research has been conducted from a typological perspective. The methods are merely *tools* that were exercised to achieve results.

The primary methods used are 'Logical Argumentation' and 'Experiment'. To show how I conducted research and why these two methods were used, I will use this studio research as a case to reflect upon my own methodology and subsequently criticize both the advantages and flaws of these methods. Therefore the main question of this paper is: What are the implications of Logical Argumentation and Experiment in the typological analysis and design research of the Heritage and Architecture studio? The answer to this question allows me to reflect on these methods in the greater discipline of architecture, to discuss their relevance and to formulate a position on these methods towards architectural research in general.

Relevance

When conducting preliminary research or design research as a designer, it is crucial to be aware of the types of research methods one uses as the method or type of research drastically determines the accuracy, objectivity and validity of the outcome. A research-methodological awareness is therefore crucial to develop, to which end this paper aims to contribute.

What interests me is the fact that both of the above mentioned methods of research simultaneously contrast as well as complement each other. As L. Groat & D. Wang question if design equals research (Chapter II), Logical Argumentation is a *research method* whereas Experiment could rather be regarded as a *design method*. This way, both methods are not entirely discussed separately in this paper. Therefore a paragraph is included to discover both the parallels as well as differences between the two.

Thesis theme and research question

The studio thesis revolves around the site 'Plofbos' which is part of the Hembrug Terrein in Zaandam. It is a former ammunition factory of the Royal Dutch Army that is now largely obsolete, awaiting transformation. On our first visit to the site, the first impression was reminiscent of that of a village. It was the small scale of things, the scenic diversity, the small workshops and the abundance of greenery that triggered these associations. This notion of a village in the Plofbos zone seemed to defy the military pragmatism of the Hembrug Terrein as a whole. This unexpected dichotomy sparked our curiosity in the area and led to the thesis question: How did practical military design unintentionally yield the qualities of a forest-village in Plofbos? ¹

Structure

This essay starts with discussing Logical Argumentation as the primary research method that was used in the studio analysis. The second paragraph discusses Experiment as the main design research method. This is done so by revealing relevant findings of the studio analysis, which are marked in the grey boxes throughout this paper*. As the former represents a more traditional and conventional research method, and the latter a design method, the third and final paragraph explores the key differences and similarities between research and design related to typology. Conclusively, the implications of Logical Argumentation and Experiment as representatives of research and design methods are discussed.

1. TU Delft Studio analysis by C. Toren, N. Schoonen & M. Luijmes, The Beauty of dealing with Explosives (2018), introduction.

* Note: The contents of the grey boxes are not calculated in the word count as they serve as reference of what was done in the studio analysis.

II RESEARCH-METHODOLOGICAL DISCUSSION

In the book *Architectural Research Methods* (2006), Linda Groat and David Wang describe seven methods for research. It includes Logical Argumentation and Experimental Research, both of which I chose for their effectiveness.² The former because of the fast result it produces. The latter because it always provides a result, no matter of what quality. I will elaborate both by explaining some key findings in the studio analysis.

Logical Argumentation

The sixth chapter, Logical Argumentation, concerns the theoretical part of my research and best describes the method of arriving at the main research question and hypothesis. Logical argumentation entails the framing of broad explanatory theories. When a broad explanatory theory is itself the targeted outcome of a research endeavor, most likely the strategy used to get there is Logical Argumentation.³ This is visible in the process of framing the theme and formulating a research question in the studio thesis. As described in the introduction, a frame and theme were already determined, using modes of thinking that fit with Logical Argumentation. Within the frame emerged the research question.



(Fig. 2.1) Research theme + question: Intended versus Unintended. Own diagram from studio thesis.

As the observations in the right balloon initially were not entirely self-evident, they needed some interpretation to determine the frame and theme. Although it was the beginning of a research, it is important to realize that setting the premises for that research is already a small independent research in itself. Logical Argumentation is accepted as a heuristic research method and lends itself well for this aim. It entails modes of reasoning: deductive, inductive and abductive. *Deductive* derives specific conclusions from a general rule, where as *inductive* establishes a general rule or conclusion from specific data. So both modes have one variable. Abductive is in between of the two. It combines two variables and looks for the most likely option. Deductive or inductive reasoning may have two or more variables, in which case they are syllogisms. A syllogism is constructed of a primary and secondary premise, which leads to a final conclusion.³

How Logical Reasoning is applied in establishing the main research question: the main research question as described in the introduction contains two components that are opposing each other, as illustrated in diagram 2.1. On the left the practical ‘military design’, which means the orderly, pragmatic and efficient layout as was historically intended and on the right the unintended scenic, seemingly disorganized and charming ‘village’ traits that were observed, and which we concluded to have emerged over the years. Both components concern typology, namely the ‘Military Facility’ and the ‘Village’. These opposing components were translated into sub research questions, which I will briefly elaborate on to show the modes of thinking that were applied. They are based on the *premise* that the function of Plofbos - which was testing explosives – valued safety above anything else. The hypothesis that this military design was about ‘*pragmatism, safety and efficiency*’ is therefore a product of Logical Reasoning.⁴

2. L. Groat & D. Wang, *Architectural Research Methods* (2002), 379-411.

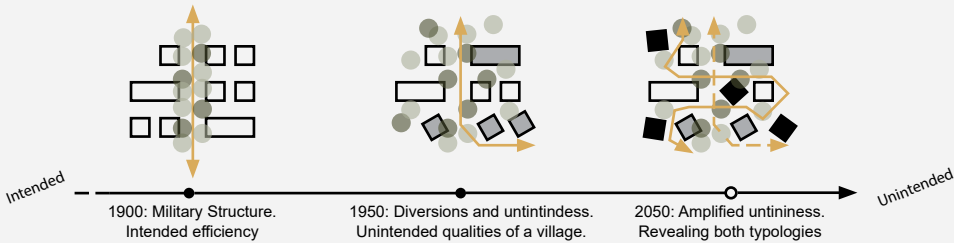
3. *Ibid*, 379.

4. *Ibid*, 383.

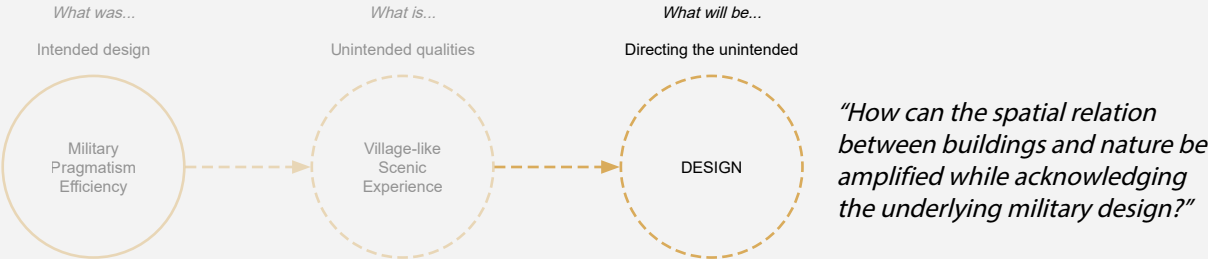
To better understand what was meant with *military design* in the case of Hembrug, it was necessary to first investigate Hembrug Terrein as a whole, which is done so with the first sub-research question: “What was the design approach behind the planning of Hembrug?”. An answer to this question can be formulated using logical reasoning, and by drawing on typological references. Other military facilities had been examined, such as the marine base in Den Helder.

Here, *Inductive* reasoning is used: it collected specific data and facts and uses them to support a general conclusion, which is in this case a historical overview of the Hembrug Terrein, which is shown in the appendix. In the act of inventoring, this overview aims to show relevant facts and leaves out irrelevant data. This is also called a ‘state of the art’ survey, which is one of the methods that Ray Lucas proposes for framing a research question.⁵

The second sub-research question zooms in on Plofbos itself and its buildings: What are the character traits of Plofbos and how did they come into existence? The aim here is to discover what elements stirred the associations of the ‘village’ typology, and how they relate to the history of the site. Here deductive reasoning is used. A general rule is the stereotype of a village; villages have small buildings with saddleroofs; there is lots of greenery and there are no large roads. Then there is the observation: “this area looks like a village”. The conclusion of this reasoning at the end of the chapter is therefore: because of the proportions, scale, greenery and roof type stirs the association of a village (see conclusion sheet in the appendix).



(Fig. 2.2) Narrative: The crumbling process. Own diagram from studio thesis.



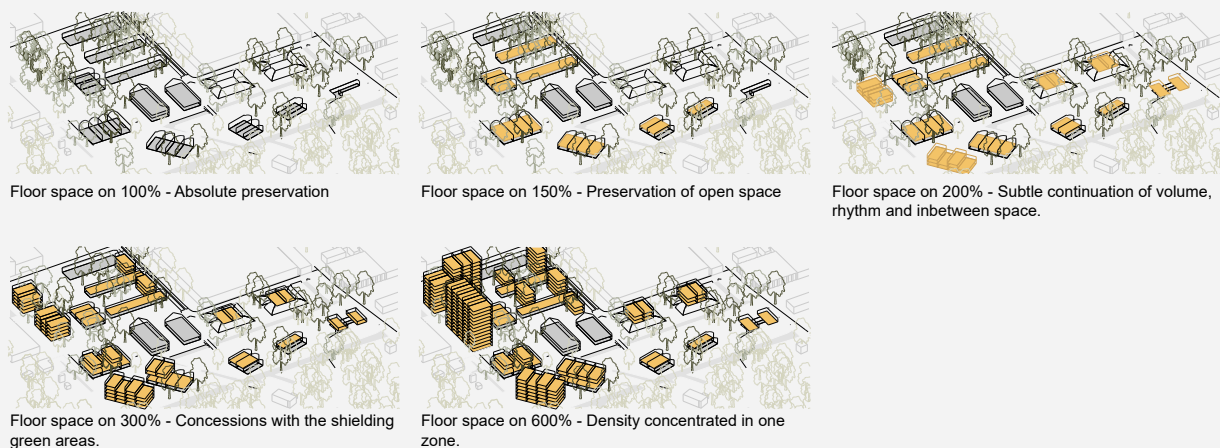
(Fig. 2.3) Design theme + question: directing the unintended. Own diagram from studio thesis.

So how does Logical Argumentation shape my project? Based on these findings a narrative has been developed, which is the *guiding theme* throughout the design stage (Fig. 2.2). The risk however is that, since Logical Argumentation is by no means a quantifiable method, the projected narrative gets entangled with seemingly scientific facts, resulting in vagueness and deteriorating credibility.

5. R. Lucas, *Research Methods in Architecture* (2016), 34.

Experiment

Referring back to the conclusion table in the appendix, the analysis concluded that the *village-like qualities* that we were looking to expose consisted of spatial properties: openness, rhythm, consistent scale, inbetween-space etc. This outcome of the studio analysis formed the foundation for the design question which guided the design research. How can the spatial relation between nature and building be amplified whilst acknowledging the underlying military design? A part of this following design research was a mass study that tested through *experiment* how the environment, form and space, would respond to certain configurations and densities.



The study partially rested on intuition. Interesting to see is the prioritizing of spaces that resulted from it. 100% in which no floors are added in case of absolute preservation; 150% which only uses interior volume and preserves in between space; 200% which adds small volumes in the in between spaces that follow the original scale and thus form a continuity; 300% where concessions have to be made and volumes are placed within the 'shielding green zones' which are so important for the transitioning; and finally the 600% where vital concessions have to be made and a part of the Plofbos loses its sense of scale and character. This study however does not yet question if original buildings can be (partially) demolished in order to focus on the relation between density and amplifying existing qualities.

(Fig. 2.4) Diagram and text. Density study from the studio analysis, investigating density configurations within the 'village-typology'.

Five scenario's and densities of adding floorspace are explored, ranging from 100% to 600%. The study subtly attempts to establish a continuation on the original qualities that balance between the 'military organization' and the untidy village'. Thus volumes and floors are placed carefully by testing the rhythm, composition and scale of the original plan. The role of experiment here is evident. By methodically testing different volumetric configurations, the variables of mass, density, rhythm and open space are tested.

Relevance and challenges of Logical Argumentation and Experiment within studio research

The state of the art survey was the first step in the analysis of the Plofbos, in which the current situation of Plofbos was explored. Here, conclusions were drawn regarding the associated 'village typology'. However, although the 'military facility' had been investigated through references, a typological research to the 'village' had not been conducted. Logical Argumentation allowed to shortcut to conclusions by drawing on general stereotyping. Therefore Logical Argumentation is a heuristic method that generates immediate results, but may lack accuracy and thoroughness. Effective, but crude. Therefore a novel challenge within the studio research may be the consolidation of these findings with typological research.

A comparable challenge exists with experimenting. The method relies on certain elements that provide grip on the process. Elise van Dooren provides insight on these elements in her paper *Making Explicit in Design Education: Generic Elements in the Design process (2013)*. Although experiment is mentioned as one of these elements, it is important to understand the other elements as well in order to assess the implications of experiment as a research/design method.

III RESEARCH-METHODOLOGICAL REFLECTION

Historical-theoretical context

As stated in the introduction, Logical Argumentation is a research method. Experiment rather a design method. Although they may appear separate methods, there are overlapping characteristics, which can be identified when zooming out and opposing them. Design versus research. This is done best by discussing some key developments that occurred in the last half of the century.

Groat & Wang claim that Logical Reasoning comes closest to Philosophical inquiry. "Of all the disciplines, it is noteworthy that works of philosophy themselves often do not state a "research method." Why? Because the task of philosophy is to identify fundamental principles that frame a domain; in one sense philosophical inquiry encompasses any method to get to these principles."⁶

Coinciding with their point of view, Ray Lucas defines research as "the process by which you understand the world in a verifiable and consistent manner." His view concurs the modes of reasoning that were discussed in the previous paragraph. Lucas describes that typically, research concerns the application of an existing model to a new set of circumstances, or a new framework may be developed from empirical facts.⁷ These two angles represent deductive and inductive thinking. From these two points of view it might be debated if Logical Reasoning by itself is a research method. Although Lucas presents his book as architectural research theory, it is more general research theory than specific for architects. He seems to forget that architects and designers have their own method of research: design. As design relates to experiment, it is necessary to explore design as a research tool.

In the book 'Designerly Ways of Knowing', Nigel Cross recognizes that there are things to know, ways of knowing them, and ways of finding out about them. During history, designers and theoreticians have often been seduced to the 'scientific and scholarly ways of inquiry' instead of developing the culture of 'designerly inquiry'.⁸ Cross advocates for a designer method of research and uses Lawson's (1979) studies of design behavior to demonstrate two types of focus that separate the ways of knowing of scientists and that of designers. As a result of this study, Lawson concludes that scientists are problem-focused. They systematically approach the problem, analyze it, until a solution presents itself. The scientific method is a pattern of problem-solving behaviour employed in finding out what exists. The designers on the other hand, the designers generate solutions, and optimize these solutions in a generative way. "The design method is a pattern of behaviour employed in inventing things of value which not yet exist. Science is analytic. Design is constructive." Lawson (1979) quoted by N. Cross (2006).

Where Cross differentiates design as a research method within its own right, he was preceded by Linda Groat and David Wang who point out some key differences as well, but then demonstrate the many parallels between the two. In their book, the second chapter deals with the question "Does design equal research?" and research is disentangled from design as two distinct kinds of activity. Quoting Herbert Simon they define research as "courses of action to change existing situations into preferred ones".⁹ Groat and Wang stress however, that design activity is complementary to research for which it is necessary to be reciprocal by nature: "research can inform design in many ways and at many times in design in the design process and the design process and the eventual designed artifact can yield an abundance of questions that lend themselves to many forms of inquiry."¹⁰ In other words, there is an interplay between research and design where research informs design in an analytical way, to which design responds in a generative way, generating possible solutions and which in their turn provide new substance to analyze.

Although there are indeed many similarities as defined by Groat & Wang (Fig. 3.1 + 3.2 on the following page), the most prominent difference between research and design lies particularly in their contribution. The design will always lead to a product, whereas research leads to applicable knowledge. In design the dominant activity is generative, whereas research is conducted analytical and systematically. Design focuses on the future, whereas research focuses on past and present. And finally design is initiated by a problem, and research is initiated by a question.

6. N. Cross, *Designerly ways of knowing*, (2006), 410.

7. R. Lucas, R. Lucas, *Research Methods in Architecture* (2016), 8.

8. N. Cross, *Designerly ways of knowing*, (2006), 23.

9. L. Groat & D. Wang, *Architectural Research Methods* (2002), 24.

10. *Ibid.*, 27

Facets of difference	Design	Research
<i>Contribution</i>	Proposal for artifact (from small-scale to large-scale interventions)	Knowledge and/or Application that is Generalizable (in diverse epistemological terms)
<i>Dominant Processes</i>	Generative	Analytical & Systematic
<i>Temporal Focus</i>	Future	Past and/or Present
<i>Impetus</i>	Problem	Question

(Fig. 3.1) Facets of Difference: Design versus Research (Ill. Groat & Wang, 2002, p.26)

Facets of similarity	Design	Research
<i>Models of Reconstructed Logic</i>	Systematic Design Process	"Scientific" method
<i>Multiple Logics</i>	Abductive Inductive Deductive	Abductive (Research Design/Hypothesis Formation) Inductive Deductive
<i>Logics in Use</i>	Generator/Conjecture Model Problem/Solution	Multiple Sequences of Logics, Dependent on Research Questions and Purposes
<i>Scope</i>	Macro/Micro and Mid-level in applied/clinical setting	Big/Medium/Small
<i>Social Context</i>	Situated Practice	Situated Research

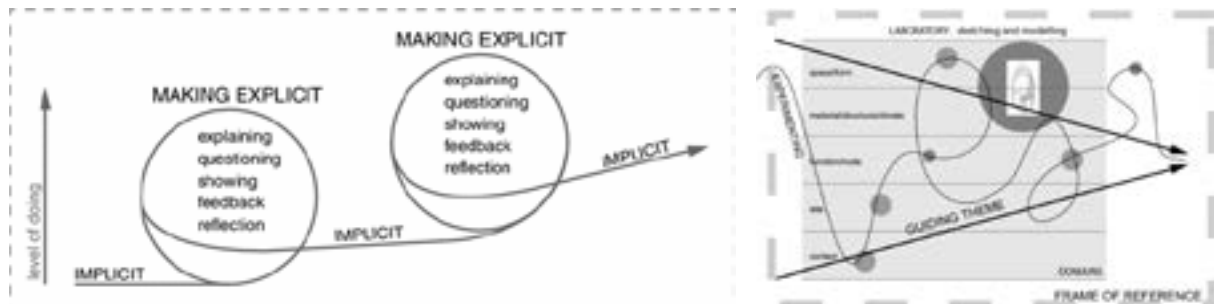
(Fig. 3.2) Facets of Similarity: Design versus Research (Ill. Groat & Wang, 2002, p.27)

Experiment and intuition

More about the interplay between the analytical and generative is found in the paper Making Explicit in design education: generic elements in the design process by Elise van Dooren (2013). She claims that in each creative process, five generic elements exist, that I will briefly touch upon. They are an abstracted system of the complex design process that provides support and helps understanding this process.¹¹ To support Cross' Designerly ways of knowing it is important to explore the main method behind design: experiment, with its driving force being intuition. Cross emphasizes that all the relevant information cannot be established and predicted in design activity. Design is therefore opportunistic, as its direction is influenced by what is learned along the way, whereas with research and hypotheses the direction is predicted and established in advance. "Given the apparently ad hoc and surprise-full nature of creative design activity, it is not unusual for designers, when talking about design thinking, to refer to the role of 'intuition' in their reasoning processes."¹²

The five generic elements of Van Dooren are: Experimenting, guiding theme, working across domains, frame of reference and visual language. Coinciding with Groat & Wang's notion that research informs design to which design responds in a generative way, Van Dooren shows that this is a method of making explicit, after which the designer makes implicit. Similar to diverging ideas, and then converging them in an iterative process which takes the designer further with each cycle. In this model, experimenting assumes the role of the driving force. As Schön (1985) describes: "Designing is conducting experiments and learning about the implications of these experiments".¹³ It is important see these five elements as a complete iterative process. It is a symbiotic whole of which in practice no single element is ever fully absent in a design process.

What this shows is that although 'Experiment' is a design research method, it can't be seen apart from the process of designing in which other elements co-exist. When in the process of designing, experimenting is unavoidable, and the designer should be aware and in control of the other elements such as guiding theme.



(Fig. 3.3) Left: Iterative process. Right: Experimenting and generic elements (E. van Dooren, Making Explicit In Design Education, 2013, p.3-5)

11. E. van Dooren, Making Explicit In Design Education (2013), 3-9

12. Quote by N. Cross, Designerly ways of knowing, (2006), 52-53.

13. Quote by E. van Dooren, Making Explicit In Design Education (2013), 7.

IV POSITIONING

In this essay I discussed Logical Argumentation as a *research method* and Experiment as a *design research method*, both with their advantages and flaws. Secondly, the differences and similarities between design and research in general are shown. My question “what are the implications of these two methods?” can now be answered. The answer to this question provides additional methodological understanding that this paper sought. Addressing these implications is a position in itself.

One of the issues raised during the talks on heuristics was that of *confirmation bias*. Heuristic methods such as Logical Reasoning can be effective because they generate quick results. These methods shortcut to conclusions by using stereotyping, categorizing or using associations or analogies. Groat & Wang, who claim that Logical Reasoning leans towards philosophical inquiry, fail to recognize the danger that when a researcher defines a hypotheses, he or she unconsciously becomes more reciprocal to evidence to support their theory. Additionally, as heuristic methods depend much on personal frame of reference, the results may become very subjective. Due to the Research Methods course I became aware of the fact that simply supporting personal interpretations and assumptions with ‘facts’ may lead to an inaccurate reconstruction of facts, consequently resulting in a blurred or bended version of the truth. The ‘facts’ then only serve as corroborations and may become interpretations in themselves, serving one subjective point of view.

So without a logically argued hypothesis, a more thorough, objective reconstruction of the same facts may have been produced - however, at the cost of more time and energy. Therefore, when applying heuristic methods, it is important to question the degree of subjectivity of the research which should be included in the research so the audience may do a validity check, and to be aware of where a hypothesis comes from. It is not wrong to make certain assumptions to establish a premises as a foundation of research, which may be proven right or false during the process.

As Nigel Cross shows, experiment is rather a *design* research tool. Agreeing with his point of view, I empirically found that since design is a form of research that does necessarily have a hypothesis, it is harder to estimate the needed time or determine the requirements of the end-result. Although it is possible to formulate an end-goal, or features of the final design, it is likely that discoveries amend this formulation which can cause the designer to get lost in the design process or spend excessive time and energy on little result. The role of experiment, but also guiding theme and frame of reference as proposed by van Dooren, are therefore crucial elements to actively keep in mind so one can maintain control over the process. However, as design continuously generates new solutions, more energy generally equals a better fitting solution. The advantage of design here is that there will always be a solution, even when only designing for a relatively short amount of time. With research however, if the research is not finished, it is unlikely that there is a satisfying answer to its question.

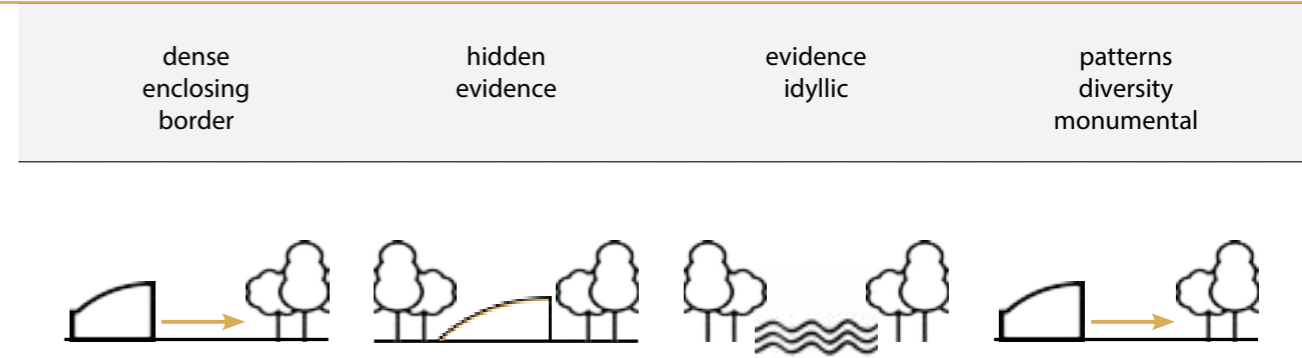
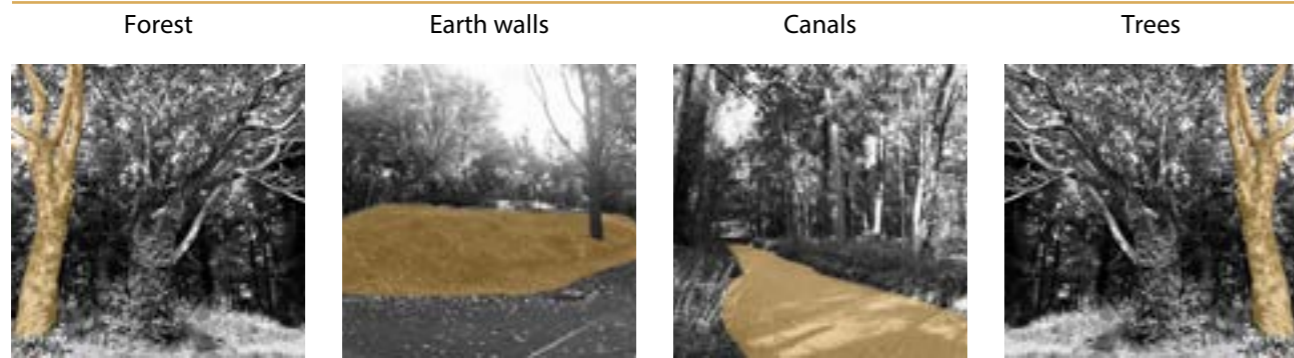
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2. L. Groat & D. Wang, *Architectural Research Methods* (New Jersey, Wiley & Sons, 2002), 379-411.
3. *Ibid.*, 396 - 397
4. *Ibid.*, 383.
5. R. Lucas, *Research Methods in Architecture* (London, Laurence King, 2016), 34.
6. N. Cross, *Designerly ways of knowing*, (2006), 410.
7. R. Lucas, *Research Methods in Architecture* (London, Laurence King, 2016), 8.
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9. L. Groat & D. Wang, *Architectural Research Methods* (New Jersey, Wiley & Sons, 2002), 24.
10. *Ibid.*, 27.
11. Van Dooren, *Making Explicit In Design Education* (Delft, Springer, 2013), 3-9
12. Quote from N. Cross, *Designerly ways of knowing*, (London, Springer, 2006), 52-53.
13. Quote by E. van Dooren, *Making Explicit In Design Education* (Delft, Springer, 2013), 7.

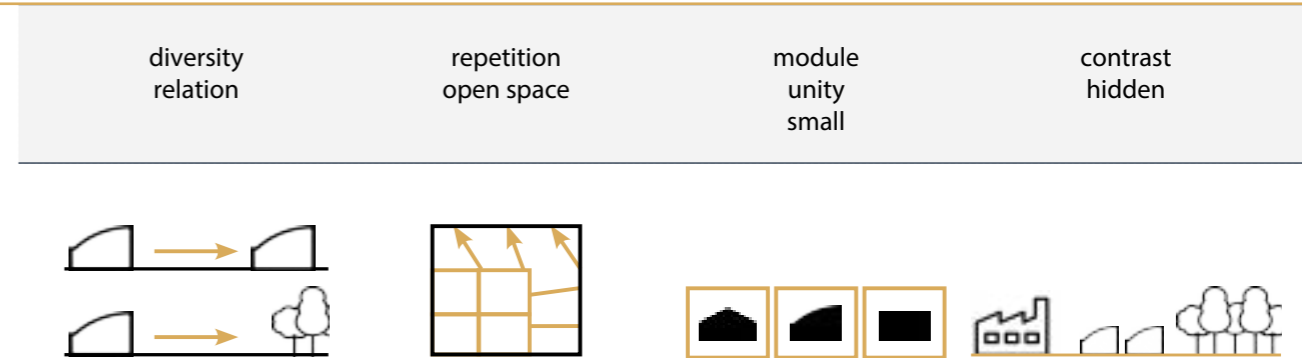
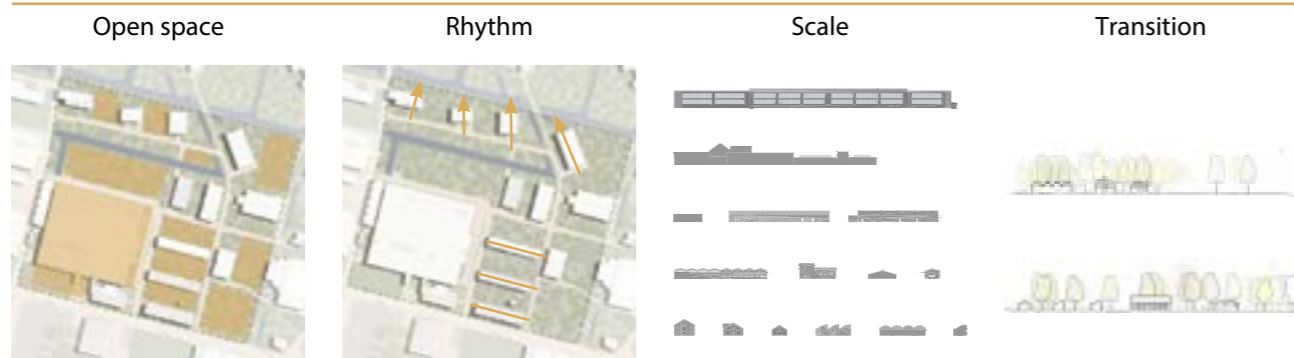
APPENDIX

Conclusion sheet

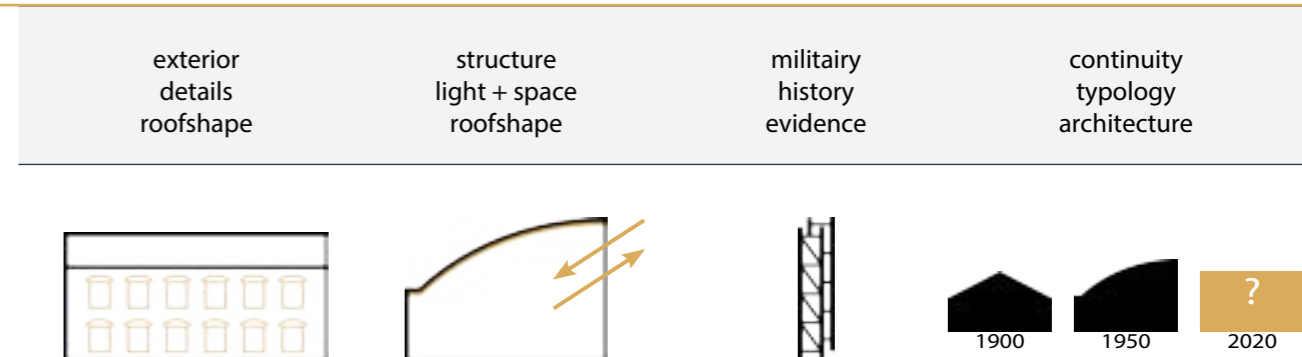
Nature



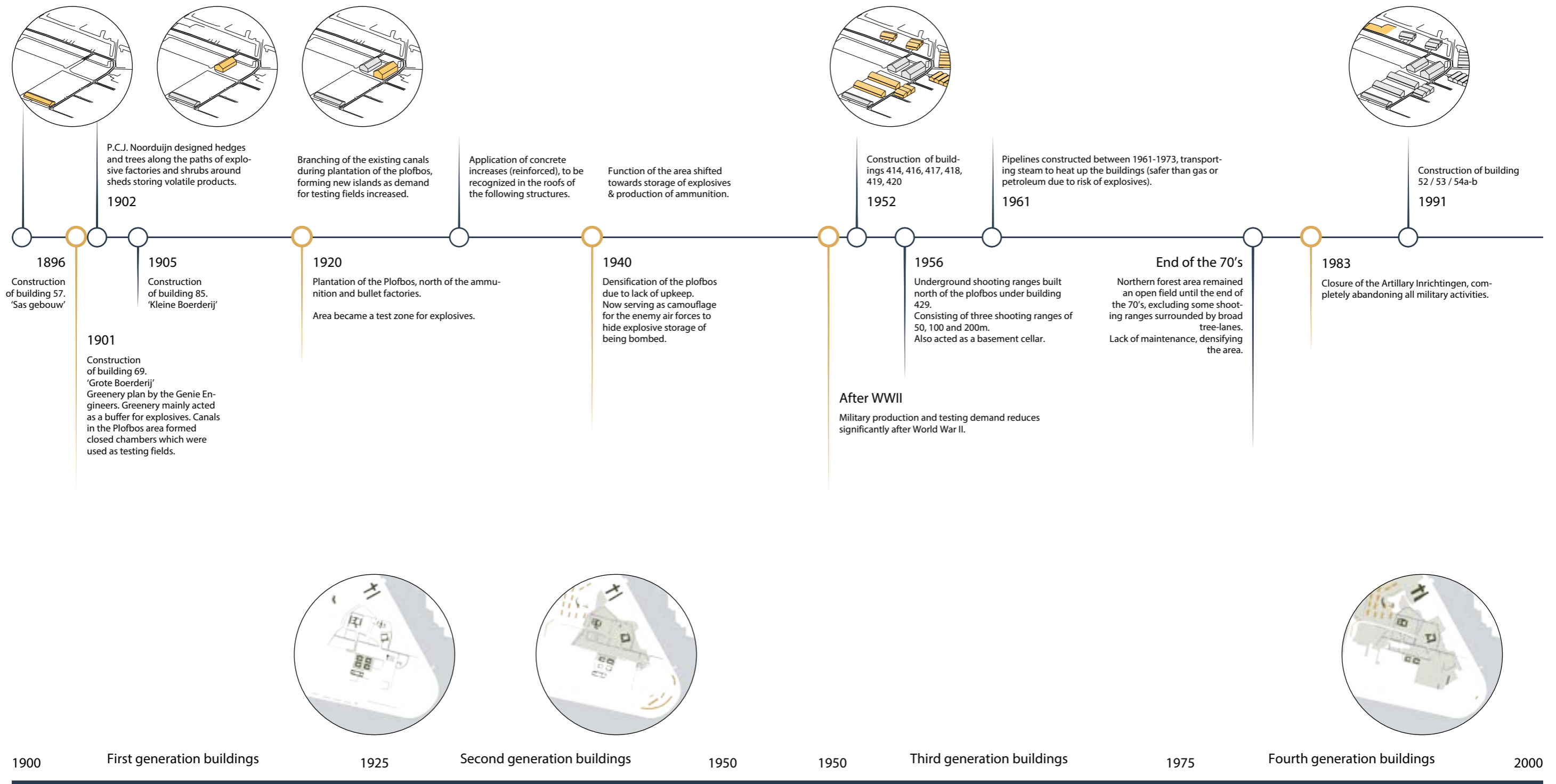
Spatial plan



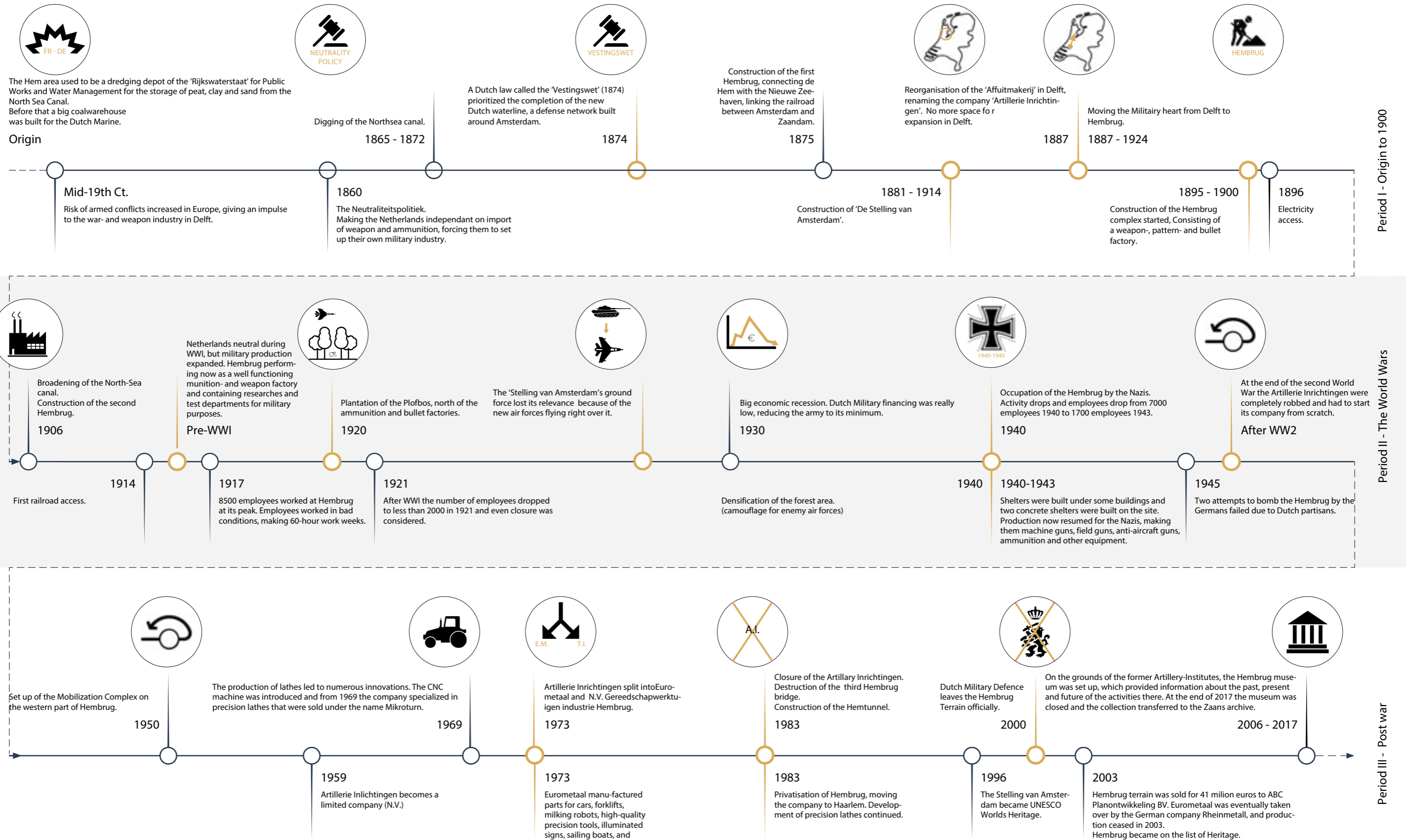
Buildings



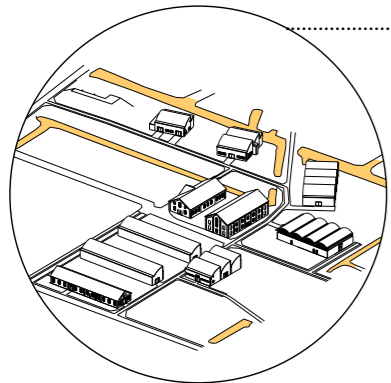
Timeline Plofbos



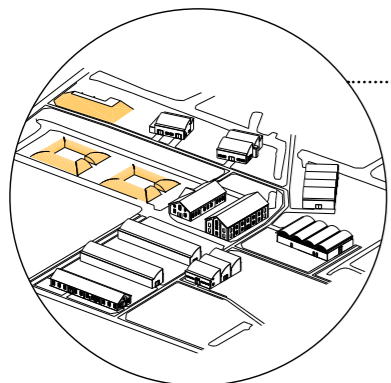
Timeline Hembrug



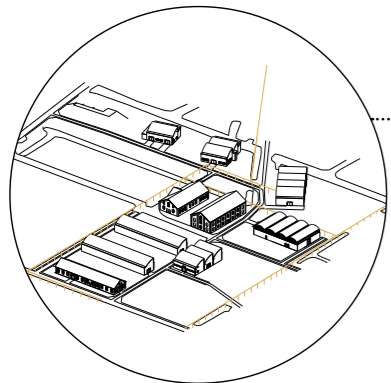
Building overview



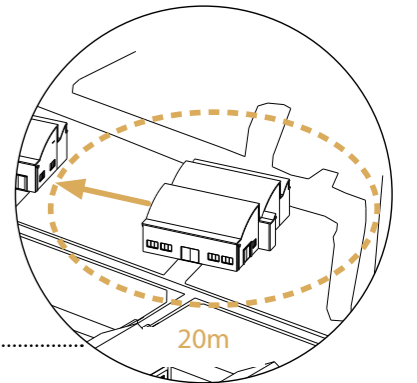
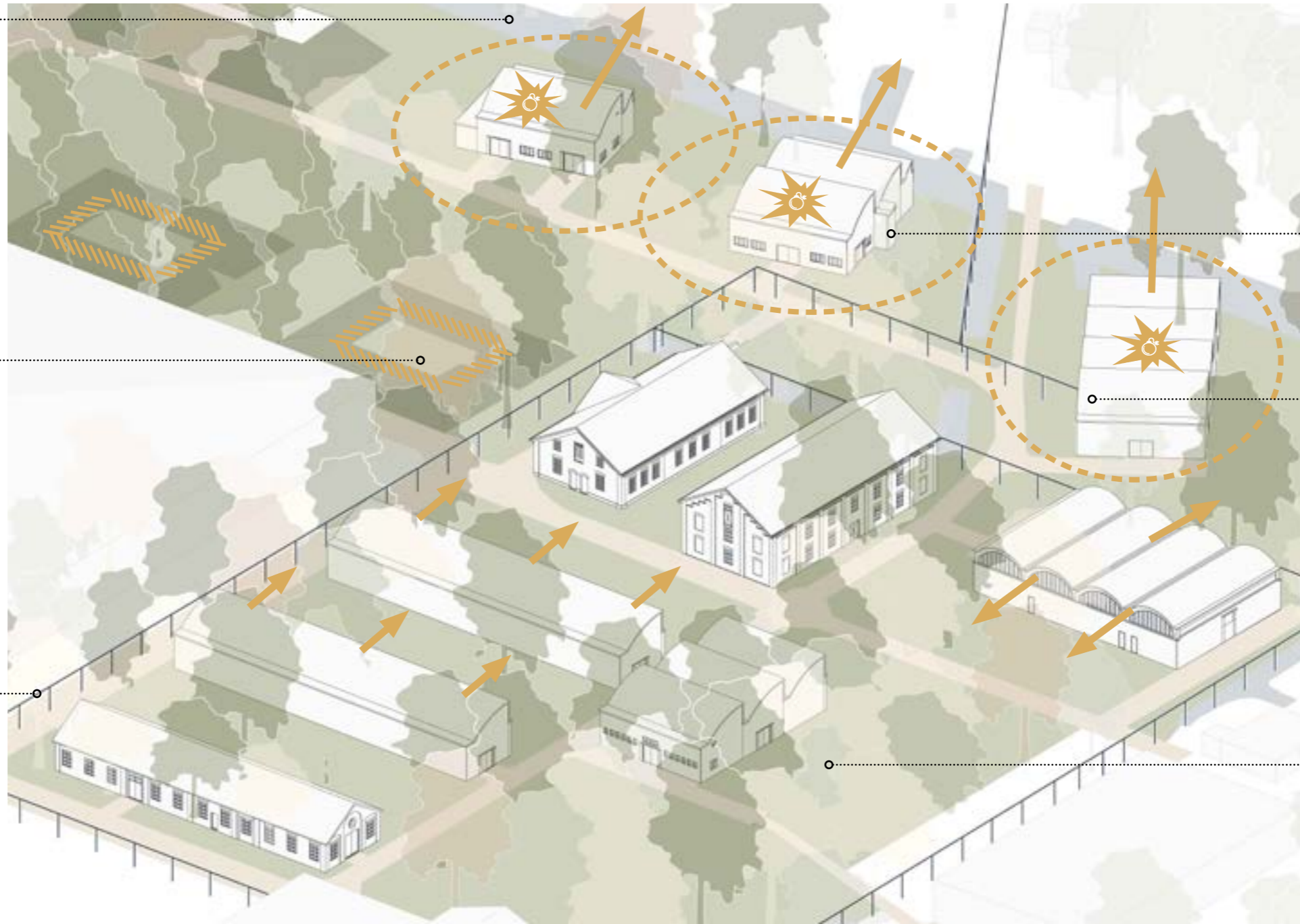
Canal system as fire compartments



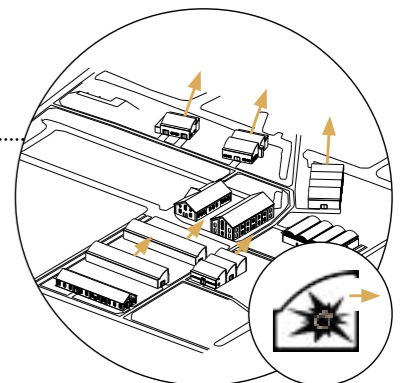
Earth walls to sustain blast impact



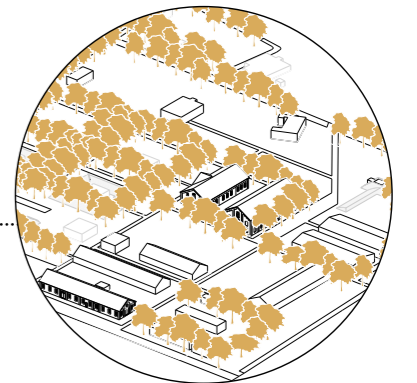
Pipelines providing steam to heat the buildings, instead of flammable gas



Blast radius
20m



Directing potential explosions



Treelanes for camouflage

Typological inventory of buildings

