The Paradox of Architecture Education at Science Institutions

Why technical universities may not be equipping designing engineers with the right methods to address the big problem of our time

Abstract

**** addition for TU Delft repository ****
This research deals with some big questions architecture students might have during their education: How are good (design) decisions made? What makes a good architect? Why is a design process so uncomfortable? It's an exploration of design process and ethics, set in the context of the ever-changing world that worries us deeply.

Being an Architecture student at a Technical University over the period of 2017-2025 caused the author of this paper to experience intrinsic discomforts. An accidental wicked problem approach to demystify this experience led to the insight that the knowledge gap was nonexistent in literature. However, the uncovered knowledge led the author to identify a relation between the intrinsic discomforts and lack of clarity about wicked problems and their implications at the faculty. This leads to a new hypothesis: there may be a predisposition for technical universities to favor science based approaches over more volatile iterative design practices. To approach this *wicked* problem, more explicit inclusion of wicked problem methodology in design education and more general focus on critical thinking are proposed.

Science paradigm – wicked problems – design thinking – academic methods – design education – science thinking

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Preface

This is the story of my graduation year presented in a format that kind of looks like a scientific research report. It's a bit unusual, but it helped me understand the world much better than I ever thought possible.

I don't know if this approach is scientific or academic research, and – to be frank - nor do I really care anymore. It's imperfect and unfinished, just one endpoint of a learning experience of a designer that is not yet fully equipped to do everything right.

No-one will likely ever use or read my research report as it is not peer-reviewed and it is merely a graduation product. It will end up in the repository of TU Delft, where maybe, very maybe, another student will find it, I hope it helps them too. Thus I argue that improving my personal contribution to the world is the most that can be achieved with this research, the most impact that can be achieved.

Because: I feel that my contribution to the world will matter, whether I know what I'm doing or not. Just living on this planet as an inhabitant of the Netherlands, having traveled the world with my family in my teenage years and as a part of a social group that tends to use up quite a lot of resources, just my presence here is a burden to the planet. Yet with the things I will do in my life I may be able to turn this around, even if just a little bit.

In summary, it is the struggle of a young person who wants to do something for a better future, and tries to figure out how: A personal crisis with unexpected conclusions.

Some spoilers:

To be a good architect in 2025 is just as much (or maybe even more) about being a good person than being a good engineer.

To be a good architect is to stop staring at your screen and start doing anything else your intuition tells you: go outside, talk to strangers, ask all the questions you have on your mind. TU Delft is just one place where you can learn about the world.

Science institutions try to give correct answers, not necessarily useful ones. The scientific method is pretty useless in impactful design, as design deals with 'wicked' problems that are approached with iterative processes.

And a consideration:

the things I learned this year led me to finally understand the practice of design. An iterative process, something that I never understood before. Every time I was confused, I found yet another piece of the puzzle: some essential, well known work that had been around for over decades.

This left me deeply disappointed in the education I'd worked so hard for. I'd been doing it all wrong. All this time. The wisdoms presented in this research are not new, but they were new to me. This is why the tone may be a bit frustrated at times.

Each time I felt that I missed a theory or piece of knowledge, then I came up with it myself, only to find a well-known theory/book that was decades old or to hear from my roommate in Strategic Product Design (a TU Delft Industrial Design Master), that this was indeed an important thing they had had a course about.

I felt like I did not only have to reinvent the wheel, but the entire wagon and the horse too. Only to find out that all of this already existed, right around the corner.

This made me completely disconnect from this education. If it's not to design, then what are we learning here? I had to learn these things myself, and I almost missed it. I don't think my

education was useless, and I still value everything I've learned here, but I needed to be a little bit angry to move on.

It helped me a lot to start taking care of myself, to start trusting the process, to understand the values and shortcomings of design education at a science institution, to start understanding what things I should (and should not) care about and to start loving my practice again.

Introduction: the uncomfortable position of architecture students

I started this year with a lot of underlying ambitions. Like many other students at this faculty, I regarded my graduation as an opportunity to show what I'm worth, a proof of mastery over my discipline, a final change to pursue my personal passions rather than listening to bosses, commissioners and regulatory limitations and really maybe a last chance to gather up the remaining tools I need to become the able and talented architect that would make the dreaming 10-year old me proud.

This led me to carefully consider my ability to complete a design process: I realized that I did not in any way experience it like a natural flow, more like a very uncomfortable struggle. Why is that? Why are design processes so uncomfortable?

Over this year I repeatedly sat down to try and formulate to myself why this is, coming up with varying answers. These are some of the essential ones:

Discomfort 1: The existential tragedy of being a designer

In our day-to day work we draw inspiration from examples, intuition and anecdotal information. We make choices based on knowledge, experience, conversation, concession and - more than we'd like to admit - just on a passing craze. We are submerged in examples of cool projects we see. We try to keep our head up between commissioner, municipality, contractor and other actors. At the same time we navigate the inspiring but equally competitive field of our own kind. Our choices are well motivated, oh yes! But are they traceable? Not a chance. We are the shameless black-box AI models of society.

One if the issues that arises in my decision making mind - that I am able to grasp - is the input. I have to base my decisions of off incomplete information: aspects of architectural plans range from large scale to small scale, completely measurable (like typical construction calculations) to completely immeasurable (like behavioral stimulants). They include considerations about environment, inhabitant, stakeholder, costs and an infinite list of other factors. How can I ever know for sure which decision is best?

Yet in my future career I will have real influence on changes made to the world: a serious responsibility. I will do this by proposing designs which are a product of my decision-making. My decisions should therefore represent what I – as a trusted expert – believe to be right, to the best of my knowledge. Yet this scares me as the process of decision making feels completely random or very precarious at best. I can't clarify what happens in my mind to myself. So how can I ever take substantiated decisions? I don't think of my mind as an accountable decision-making tool, this makes it very uncomfortable to feel responsible for the solutions I propose. I want to use my abilities to contribute to a better future but I don't know where to start.

During my entire design career I felt uncomfortable to:

- compare seemingly incomparable options
- undergo untraceable decisions-making processes
- choose directions and decide a career path

Which for me often led to a state of endless research and very little action, decision, progress: a state apparently referred to as 'executive dysfunction'[1] or 'analysis paralysis' in more popular framing. After being with myself for my entire education, I can testify that I have spent years and years of cumulative hours in

this state. This is not a very practical behavior as it takes a lot of time and energy, limiting my ability to be impactful significantly.

Discomfort 2: being a design student surrounded by technology

I was raised in a world of engineers: like many of my generation I learned to pick beta over alpha and gamma, ratio over emotion. When, after the first three years of high school, it was time to elect the subjects I wanted to take for the other three years, I was heavily doubting. To choose between Arts and Mathematics D – a complementary course to expand the already extensive Mathematics B -, my parents (see image 1) advised me to ask both teachers how their subjects would benefit my development. The Arts teacher told me that her course would help me train the right side of my brain – which is related to creativity, intuition, imagination, spatial awareness, visual processing, and emotional expression. The Mathematics teacher told me I would learn to work with probability theory and statistics. From then on I restricted my arts to a hobby. I tell this story regularly my engineer friends at TU Delft to explain to them that - even though I study at the faculty of architecture, that fuzzy place for arts and crafts - I really am a smart girl.

I learned that with critical thinking, optimism and confidence humans can solve just about anything. So, like all other problems, I learned to approach design problems in a rational way: define the problem, analyze it to my best ability, then base decisions of off that objective knowledge. Say critical, avoid fuzziness. May the biggest computer model win.

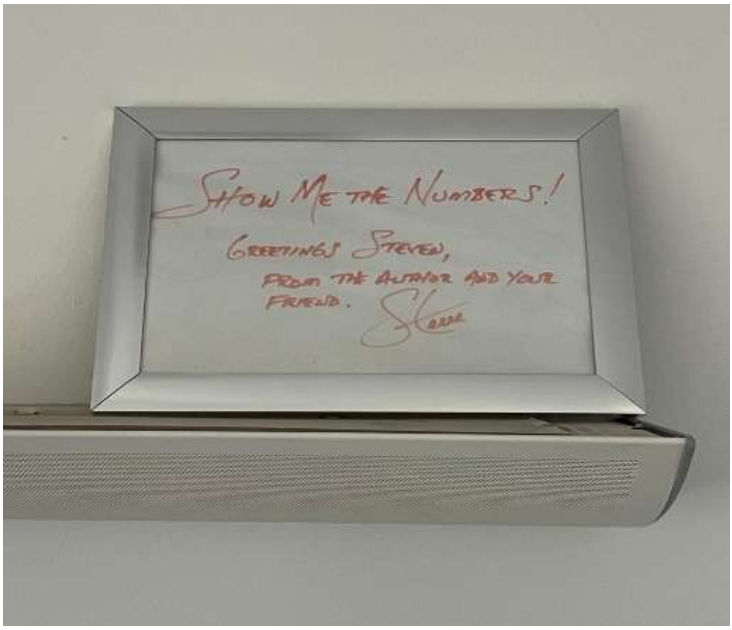

Image 1: Message of Stephen Few, the author of 'Show me the Numbers' (2012), to my father Steven Lugard, mechanical engineer by education and healthcare data consultant by profession.

Yet during my design at the faculty of architecture I was introduced to a different kind of solutions. Plans presented as this faculty are dotted with community spaces, vegetable gardens and shared facilities. They are solutions that are less measurable, effects are less predictable, they don't work in every context. They are solutions that aim to offset some desirable behavioral changes, designs that aim to create some awareness, designs that enable something, foster something: the 'fuzzy' kind. When learning more and more about these approaches, I slowly started accept that they are important, even though they're not fully predictable and thus not fully measurable.

But still, when you present me with a fuzzy solution, I will always be extra critical: why will it work? Why will people do this? Why is this solution the *best* one? Is it really better than a measurable one? Can we make it measurable?

Well we can try, but we will never be sure until we implement. Yet after 8 years between these walls, in a vague but profound way I know we need them. But to my non architecture peers they remain fuzzy and thus inferior. This makes me uncomfortable for sure.

Discomfort 3: the 'Inconvenient Truth' of our generation

Our generation enjoyed what is arguably the best place in time and space that has ever existed. We were raised in freedom and safety, pampered with care, love, education, and all sorts abundance. It's a gift no one of us could ever truly understand the value of, but we know it's worth protecting. At the same time we hear - again and again - that our generation will be the last to grow up in more prosperity than our parents. Our garden of Eden, that generations before us assumed could only get better, cannot grow infinitely into the future. We are the first generation to grow up in awareness of this daunting threat. We are the first that will live through these consequences, the first whose wellbeing is at stake. And we're told that we're the last that can change this fate. As Al Gore so strikingly framed it when I was still in primary school, we are for sure facing 'An Inconvenient Truth'.

For this reason I find it hard to believe that we lack motivation to save what is left: There is plenty incentive to save our world, right?

Combining this with my belief in human abilities to solve so many problems, I find it hard to believe we would lack intelligence and critical thinking.

Yet taken from a personal perspective, I may be missing some confidence and optimism: It just deeply frustrates me, and I assume many others of my generation, that we don't know what to do anymore. Assuming my belief that we have guns aplenty, we just don't know where to point.

We have been trying for so long to come up with truly effective solutions, yet the problem only seems to be getting worse. The world around us and the illness below the surface seem so incredibly complex that we just don't know what action to choose. We are daunted by a lack of direction: analysis paralysis. And - as paralyzes, discouraged soldiers, fighting a battle that seems unwinnable - we are starting to jump the ship.

In order to fight, we need motivation. To stay motivated, we need to know that our fight is worth fighting. To know the fight is still worth fighting, we need a new strategy: we see that the current ones don't really work. Because why would we sacrifice ourselves to save a sinking ship?

It's a matter close to my heart, not because I'm that noble, but because my future is at stake too. I (hopefully) will be around for at least half a decade. I have to decide whether I want to raise children here. What will the world look like in 25, 50, 75 or 100 years? What will be left of our garden of Eden? Will there be disasters, wars, famines and diaspora? What will be left when the dust settles? I cannot close my eyes for those prospects.

I'm no idealist, but if there's any chance that I can make a difference, I'm willing to work for it. But to stay motivated, I need to know that there is something we can do. That there was

something wrong with our previous attempts. That it's not yet time to be dancing on the flames.

Grounds for fascination and exploration (and implosion)

The combination of these discomforts led me to a specific fascination. This fascination sparked when I was introduced to the work of Donna Haraway by my teacher Alejandro Campos Uribe. In her book 'Staying with the Trouble, making Kin in the Chthulucene,' she sets out on an explorative narrative to look for creative solutions for our 'Inconvenient Truth': solutions of the *fuzzy* kind. Her exploration tries to explain how humans ended up in a system that is so harmful for the planet. Then, by telling the stories of communities that practice entirely different ways of life, she uncovers characteristics of societies that might be better suited to address the 'Inconvenient Truth'.

This inspired me to go looking around myself: I noticed that, contrary to my state of 'analysis paralysis', some people in our society, that don't know exactly what to do, just start somewhere. I wanted to know what they thought. I wanted to know what they do.

So I went to meet these people, to do what they do, to talk to them, to learn what they know. My exploration brought me to sustainable living communities (or ecovillages), community farming initiatives (Community Supported Agriculture, CSA) and other people (volunteers, meddlers, scientist, farmers, writers) that do what they can to contribute in ways they think is right. Ways that I would call the fuzzy kind.

Yet their simple approach stuck with me: they take their abilities as a starting point to apply tactics to contribute to the solution of a problem they all frame differently. And with visible impact!

This lead deepened my fascination even more: I want to find tactics to effectively use my abilities for the good of the planet too!

My weapon of choice appears to be architecture. This year I spent trying to learn and use it better.

It turns out I had to unlearn everything I thought I knew to get there, an intense experience of self-implosion that completely dragged me away from the original goal: research for the purpose of a graduation design project.

So I'm sorry that I went a bit off script with this graduation project. I needed to answer these questions to know that it's still worth swimming upstream. In the end I finally figured out why that is. If I understand it well, there really might be something profoundly wrong with the way I experienced my education. There might be a way to address it, and along the way I learned a lot about design. Just in no way I expected.

1 Problem framing: there must be something missing

In my future career I will be working on structures that shape the built environment. With how much has been said[2] about the influence of the built environment on people's lives, how they behave and think, I might assume that my decisions will have a influences like this as well.

Then again, I have a sensation my education and other, more general nurture have granted me with a lot of potential to make impactful things. At the same time, I find myself in a place in time and space of a lot of uncertainty: Humanity and all life on earth are facing a big crisis if we don't respond soon.

Assuming that the TU Delft Faculty of Architecture uses all relevant existing knowledge to educate its students to engage in designing questions for the future, there must be a knowledge gap.

1.1 Relevance

The relevance of this research is based on a set of uncomfortable but, by traditional academics perceivable knowledges:

1. **There is no certainty top-down institutions can fix this**

There is no certainty at all that large scale 'top-down' institutions can be trusted with the responsibility to avert an ecological crisis that will cause a lot of harm to humans and all other life on planet earth within the foreseeable future. With all the pretty graphs we can make, all the projections that can be drawn up, no-one can predict the future. We can make assumptions, extrapolate data, study trends, but we simply cannot predict the future with certainty.

Looking at recent developments on the geopolitical scale, sustainable interventions are proving to be too slow to provide us with sufficient action[3]. Recently, many are worried by the recent trend of far-right parties winning elections that generally tend to de-prioritize environmental concerns[4]. A striking example of this is the withdrawal of the USA from the 2016 Paris Climate Agreement by Donald J. Trump, who has repeatedly called climate change a 'hoax' or 'scam'[5]. Many other countries are not even close to meeting their goals aimed to limit global warming to 1,5 °C[6].

The latest development in this being the fact that experts, among which these institutions themselves are calling out urgently to the local level to take action. (IPCC, Vasbinder, Bernie Sanders, Al Gore). After the 6th report weighing 29 kg's in print, the IPCC realizes that their extensive academic approach limits their public impact[7]. For the 7th report they realize that top-down action often runs into local resistance, and devise locally driven strategies[8]. This includes the involvement of local communities and local knowledge for decision-making.

2. The chance that the implications of human activities will lead to the collapse of life as we know it is not negligible

It needs to be consider is that it's very tempting to assume that humans are able to solve this issue, that we are able to our way out of global heating and pollution with sustainable technologies. When we look at a few acknowledged projections, we see that this is really not that certain.

In 1972, the world was made aware of the possible consequences of human practices on a large scale for the first time. Donella H. Meadows, Dennis L. Meadows, Jørgen Randers, and William W.

Behrens III presented a set of projections, aimed to showcase what would happen if human activity kept growing like is was doing at that time. This report was commissioned by the Club of Rome, a nonprofit organization with 'a global and a long-term perspective, and the concept of "problematique", a cluster of intertwined global problems, be they economic, environmental, political or social.'[9]

There were 13 projections in total, studying a range of development courses for humanity and their effect on the world unit the year 2100. The book and the studies were revised and re-published twice, once in 1992, once in 2004[10].

Recently, in 2020, a study was conducted by Gaya Herrington, in this study she compared recent measurements to the Limits to Growth projections[11]. The results gained much attention worldwide.

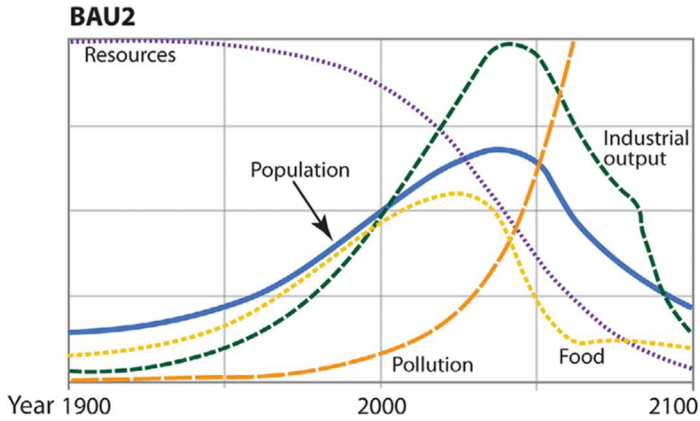

Image 2: Business As Usual 2 secenario (BAU2) of the second Limits to Growth-publication Beyond the Limits (1992), an updated projection of the original 1972 BAU scenario, as the input for the variable 'resources' was originally too low. Taken from Update to limits to growth (Herrington).

One projection indicated that if humans would not change anything about their behavior, there would be total collapse of our system setting in about 10-15 years from today (2025). This would first lead to a rapid decline of available food due to a lack of resources and uncontrollable pollution. Eventually, this would lead to a rapid drop of industrial output and population. Eventually this would in a population and food availability similar to around 1900, on a heavily polluted and resource-depleted planet.

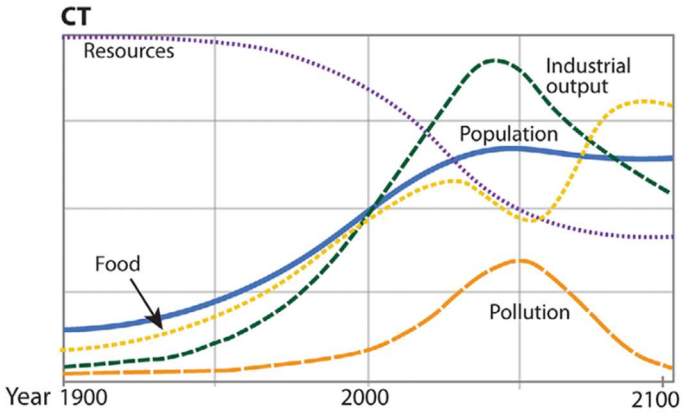

Image 3: Comprehensive Technologies (CT) scenario of The Limits to Growth (1972), showing projections in case of exceptionally high technological development and adaptation to planetary boundaries. Taken from Update to limits to growth (Herrington).

Another projection showed the same parameters if humanity would be able to provide unprecedented technological solutions to decouple the growth of the economy from burdening the planet. This projection still led to an eventual collapse of industrial output, but the crisis because of a lack of food will be less severe. This would result in a stabilized population and an

eventual decline of pollution.

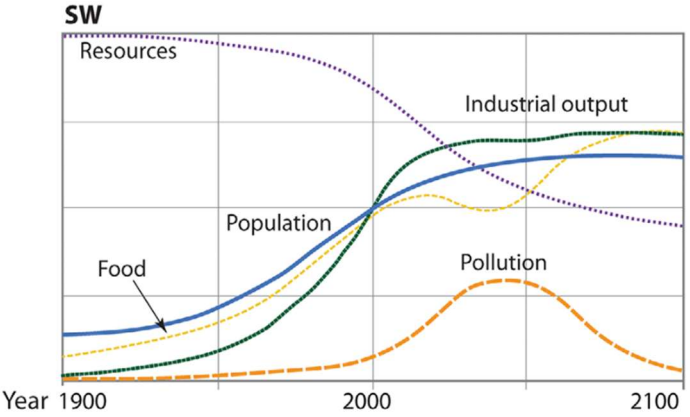

Image 4: the Stabilized World (SW) scenario projects trends in case of the CT-scenario combined with a system change that would enable humans to gradually stabilize the growth of their industrial output, meaning to stop economic growth. After a peak in pollution and a dip in food availability, this would result in a situation of sufficient food and industrial output to sustain a relatively large population comfortably. Taken from Update to limits to growth (Herrington).

The third projection showed a scenario in which humans are able to both decouple emission and pollution from economic growth, and are able to reign in economic growth by achieving changes in societal values and priorities. This would be a result of a profound change in our system, and would eventually lead to a stable world that provided enough food and other resources four all humans alive.

This study is very old, and back when it was published, it was considered doom-thinking by a lot of people. Yet as it is very old, we can now review the predictions. In 2020, Dutch econometrician and sustainability researcher Gaya Herrington concluded that, with all the efforts we made up until today, we are still largely on track of the first scenario: business as usual, as if we had done nothing at all.[12]

Of course this is just one study. Yet there are plenty of studies out there that suggest similar outcomings. The risks of collapse of our system are very real and need to be taken seriously. This is scary indeed, this is why it's not surprising that we don't like hearing this.[13]

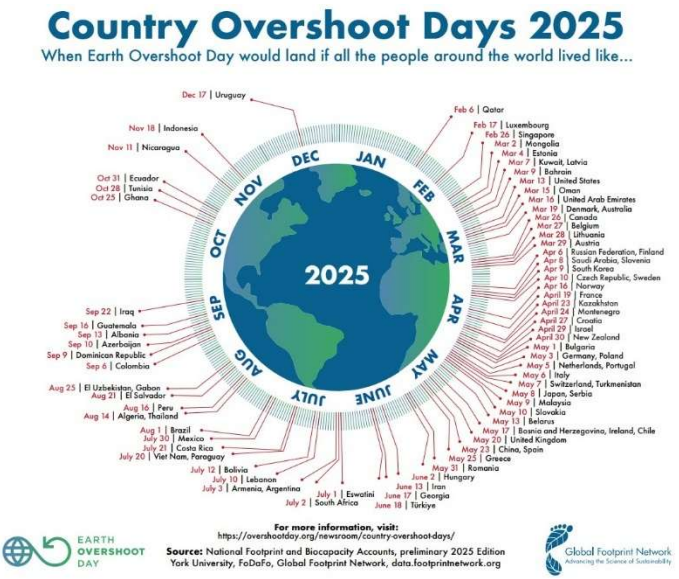

Image 5: The day the resources available for that year would be used up if everyone on earth would live like the inhabitants of different countries around the world. In the Netherlands, this day highlighted on the news every year. This year it was om May 5th. Retrieved from: Global Footprint Network 2025, www.overshootday.org and www.footprintnetwork.org.

More recently, there have been studies concerning *overshoot*: the increasing depletion of planetary resources to meet human economic and consumption growth demands. To make this effect more tangible to the general public, concepts like ecological footprint and Earth Overshoot Day have been

introduced. Currently, humanity would need about 1,7 times the resources that planet earth can provide in one year to maintain its current practice over a long period of time. Yet, our economy and resource use is still increasing each year.[14]

The IPCC too reports worrying projections if the current trends don't change drastically.[15]

At this point, renewable energy technologies are gaining ground rapidly, but it's time to take a broader perspective. Is seems that pollution of our soils, waters and bodies and broken ecosystems caused by human land use may pose risks equally as worrying as climate change[16]. Renewable energy technologies contribute to those issues on a significant scale. Yet, existing systemic approaches for these issues are far from promising[17]. If we would like to keep using our planet, significant adaptations have to be made in those fields too.[18]

This is why, apparently for over 50 years, experts worldwide have been implying that a change of our entire (growth-based) system will give us much better chances of winding off this Problem than technological fixes.

For each new technology, new risks arise: while we are getting pretty good at lowering our carbon emissions, we have very little control over other types of pollutions. Especially pollutions of soils and waters are hard to reverse, while they directly affect our health and the resilience of our ecosystems.[19] Moreover, in a world that is growth and success oriented, there is an incentive to hide harmful practices (see appendix A).

Pursuing this system change is challenging, yet we believe that there are strategies that seem to be effective. Hence, a solution of this nature cannot be taken for being impossible to achieve. Even if this solution is improbable, the stakes (life in wellbeing

on earth for all human generations to come) are so incredibly high that any measure can be deemed reasonable.

In his book What We Owe the Future, William MacAskill argues for Longtermism:

> The idea that positively influencing the long term future is a key moral priority of our time.[20]

We know that humans are on all levels influenced by their physical environments.

> If you can ensure that people in the future adopt a particular goal, then you can trust them to pursue whatever strategies make the most sense, in whatever environment they are in and with whatever additional information they have. You can therefore be fairly confident that you have made the achievement of that goal more likely, even if you have no idea at all what the world will be like when those future people act.[21]

Architects hold a pivotal position in shaping the physical environments in a way that could change our system as:

a. Architects (and all other professionals that are educated at this faculty) are among the individuals that most directly influence these environments in which people shape their view of the world
b. their knowledge is interdisciplinary
c. they are trained designers
d. their personal benefit within the current system (which incentivizes them to amplify the current system) gained from project is relatively limited.

Thus, the chance of an architect contributing significantly to the solution of the Problem on a systemic level is too substantial to be wasted, a notion that is only amplified with the recent call for local solutions.

Yet, knowledge on systemic change is limited and the solutions proposed are often not taken seriously: they are not measurable.

2 The method that was intended: speculative reading and writing and ethnographic research

taken from my research plan, this is the initial method I proposed:

written on 8 November 2024

Main question:

What is the role of housing in the development of local communities that care for ecosystems?

Like ecosystems, the relations explored in this research are of complex nature. An open-ended investigation will set out to answer the following subquestions:

1. **What can be learned from important theoretical works on the nature of human-ecosystem care relations?**

   What is the role of current mainstream housing practice in the lack of human-ecosystem care? What should theoretically be done to fuel these care practices? What are possible design implications? What should be looked for in fieldwork? What questions could be asked?

2. **Why and how do humans care for their local ecosystems in practice?**

   What inspires individuals to care for their local ecosystems? Ideals? Compassion? Climate change? Their surroundings? What drives individuals to take action? Intrinsic motivation? Friends and

neighbors? Recreation? Meaning-making? What curbs humans in their potential of caring? Agency? Time? Money? Knowledge? Conflict? Priorities? How do community dynamics influence this process? What are possible design implications?

3. **What can be learned from important theoretical works on cooperative housing?**

   What aspects can be distinguished that differs cooperative housing from current practice? What possibilities does that give for ecosystem care and protection? What pitfalls should be considered? What does this imply for process and design?

4. **What possibilities for enhancing human ecosystem-care can the housing cooperative offer in practice?**

   What comes of taking action and pursuing ideals in housing co-ops? What are advantages and limitations? How do community dynamics differ in housing co-ops? How do these communities relate to the "outside world"? What design implications can be derived from this?

Question 1 and 3 will be answered through literature studies and will provide a framework for the fieldwork intended to answer question 2 and 4. The theory will help me know where to look, acting as the basis for a set of questions I would like to answer in ethnographic research.

For question 2, a careful approach is paramount. To find qualitative information on motivations of humans to participate in ecosystem care, I feel that more than an interview is needed. By asking individuals to spend a day

with them in their caring activities, I hope to get insight in what sparks their connection to nature.

For question 4, a location visit is also preferable. I would like to be able to meet 1 or more individual at each site visit to get an idea of community dynamics. Although the project does not necessarily need to be nature oriented, a requirement is that the inhabitants engage in some kind of externally oriented action. Seeing the way in which housing cooperatives are used can be especially useful in uncovering design implications.

Documentation will be done by analyzing literature through speculative writing. For the ethnographic research, drawings will be made to collect spatial data. A framework needs to be developed to organize more value-based data.

3 Speculative literature experiences

3.1 The problem with defining the problem

One of the first thing one stumbles upon when looking for effective solutions to *climate change*, is that many experts seem to agree that climate change is not the problem we should be solving.

Climate change is an understandable, measurable and tangible phenomenon that in varying levels produces consequences and risks all around the world. Although this makes it tempting to assume that this is the problem we need to solve, experts on the matter agree that climate change is merely a persistent symptom of a problem that causes many more interrelated symptoms. One might think of pollution, resource depletion, biodiversity and ecosystem loss, over-consumption and many more. Yet contrary to climate change and other symptoms, this underlying problem is hard to grasp.

I spent about half of my graduation year trying to grasp that Problem. For now I will give it a capital P, to indicate its position as the Problem that overarches all other problems, symptoms and systems that have anything to do with humans causing harm to the planet they inhabit. Looking for the Problem I visited the intellectual legacy of many thinkers from a broad set of disciplines. Each time I felt enlightened by the authors deep and insightful understanding of the world. Yet they all refer to other thinkers, that inspired them in advance. They define the Problem in a way that is interrelated, but not exactly the same.

This led me to an exploration of interrelated yet essentially different p/Problem definitions that was equally inspiring and confusing. In the following paragraph I will try to illustrate this

exploration, so you too might be able to understand that it's an endless rabbit hole. Looking back, I now realize there *is* no clear structure to it: each time I was fully invested in an author's work, I believed that I had found the Problem, only to realize later that this too was a symptom, or (lower case p-) problem. so the most sensible way to present it might simply be in the chronological order of my exploration.

Overshoot and the human on a powder keg – William E. Rees

The first author I explored was introduced to me during the studio's introductory seminars: William E. Rees is a prominent ecological economist and one of the scientist that introduced the concept of the ecological footprint concept. He is celebrated for his logical and critical reasoning.

Rees defines the Problem as '(ecological) overshoot': human society in a state of 'overshoot' is consuming resources faster than Earth's ecosystems can regenerate. He suggests a multifaceted Problem with deep roots in the human system. Humans cannot solve overshoot as a result of evolutionary traits that influence our responses to this type of threat(ref rees what's blocking sustainability). The human brain — evolved for survival in small-scale, short-term environments — is not suited to comprehend the complex, long-term, global problems we now face. This predisposition, which Rees refers to as 'cognitive obsolescence' leads to underestimating, ignoring or denying environmental threats that don't present immediate consequences (ref cognitive obsolescence paper). Even though we may feel a certain urgence and take minor actions, we will never truly prioritize a looming and vague issue like overshoot or climate change over our daily sores.

Following CNN's November 5, 2024, U.S. election coverage, Rees' interpretation of the problem was once again amplified.

Polls and interviews throughout the evening revealed that the average U.S. voter prioritizes "the economy" over other issues, linking it closely to individuals' daily stability and prosperity. Notably, support for Donald J. Trump even increased among African Americans, Latinos (including Puerto Ricans), and women, despite him publicly discriminating these groups in the past. For policy-makers and climate action-takers this was an eye-opener. Most individuals have other priorities: caring for their families, earning money and paying off debts, finding appropriate housing.

Yet looking at the people around me, I know that human nature cannot be limited to the careless consumer sitting on a powder keg Rees sees. When he quotes Heidegger: "Man today is in flight from thinking" ["The Memorial Address"] The human he sees is hard to align with the climate activists, vegans and vegetarians, green voters and motivated volunteers and all the hopeful humans I met during the fieldwork for this research.

This can also be seen in the public opinion on climate matters in the Netherlands. A nationwide study by the Dutch Central Statistical Office (CBS) in 2020 showed that at that time 94% of Dutch civilians were aware of the fact the global climate is changing. 76% thought that climate change will be a serious problem in the future and was worried about the effects of climate change. This indicated that we are indeed broadly aware of the urgency of climate change. The same study shows that we also believe that we can solve this serious problem: 74% of the respondents to this study believed that humans could bring climate chance to a halt.

Although he is skeptical, Rees does acknowledge that humans are generally well-intentioned, and he does not completely deny our ability to solve the Problem. He just identifies it extremely

unlikely that we will. He acknowledges that with a profound change of our entire system we could indeed

Haraway – Storytelling to change paradigms

The second author was also introduced during the studio seminars. Donna Haraway - a posthumanist[22], feminist and speculative thinker - suggests many more situated ways to look at the Problem

One of her main problem definitions is our deep belief in human capacities, which she addresses through criticizing the term 'Anthropocene' as a name for the current geological epoch. Human individuals are given the idea of being able to think, make choices and act fully autonomously. We believe that we are not influenced by others. In this interpretation influence is a one-way street: we direct all other species and matter on planet earth to shape the world we envision. The more powerfully one can do this, the more successful the individual. Haraway calls this view 'autopoietic'.

She vividly illustrates that it is impossible not to be influenced by others. We need each other and other species to survive, and as our perception of the world depends on them, they shape us too. We are in fact 'sympoietic' - interdependent like all other earthly creatures. Life is a complex network that cannot be untangled, interdependent in a way that one entity cannot be separated from the whole. Yet in humans great mission to make the world as we envision it, humans seem to have forgotten. This is why she criticizes traditional science and language that reinforces this paradigm. (ref)

Haraway explores solutions by playing with possible futures through extensive speculative writing combined with ethnographic research. She practices and promotes storytelling to

exemplify how human communities today live in balance with their natural companions and environments to explore how those who don't might find new ways to do so.

If we don't align our idea of success with something that benefits both humanity and the planetary ecosystem, we will continue to see every effort to save our planet as a restriction on our freedom.

In order to achieve this we need to 'stay with the trouble': devote ourselves fully to the case, taking up care response-ability, spend time and effort in interaction with our ecosystems to gradually gain understanding. She introduces the concept of 'kinship': a family-like commitment of mutual responsibility and meaningful connection. The entanglement of humans and non-human species in kinship would be the solid base for instinctive care and protection.

She ends with a speculated story of a future ecovillage network where people can distance themselves from the current harmful system in order to focus on the gradual development of a sustainable way of life for humankind.

One critique I have is that the examples she gives are, maybe intentionally, but nonetheless, not very relatable to anyone living that is part of the hegemonic system.

The communities she covers are almost exclusively of people that are bound to nature out of necessity. They are often marginalized groups like ethnic minorities and indigenous peoples. This means we get a clear idea of what a life in balance with nature could look like, but intentionally transitioning to a lifestyle like this still seems hard to imagine, or at least unattractive to people practicing comfortable yet harmful lifestyles.

Reading Haraway's work is an intense experience in itself. Although I understand that personal experiences and interpretations are frowned upon in traditional scientific approaches, I feel it's essential to address this 'non-objective' aspect of her work. However objectively we position ourselves, in design, the designing individual always plays a part (ref how designers think), so might admitting my first-hand interpretation be substantiable here?

Haraway's speculative writing challenges the reader to think deeply about their separateness from other species that inhabit this planet. Whereas Rees keeps his writing realist, clear, and traceable (ref. I am a realist), Haraway's stories are bizarre, freakish, and fantastical. No single page of her work will make any sense to anyone. Reading just chapter 2 for the mandatory seminar readings, I got so confused at each sentence that I decided to just start from the beginning. Yet when one stays with the trouble of this entire reading experience, one might eventually understand the Problem without defining it. One might understand that most humans may understand that the Problem is complex, but not in what way.

Subtextually, she shows the reader the deeply intertwined and chaotic nature of the problem, rather than explicitly trying to describe it. Her book worked as a tool for me to transcend my own paradigm (ref Meadows), causing me to literally feel distanced from things in my day-to-day life for a couple of weeks, like I had learned something enlightening that I couldn't possibly explain to others—just like my summary of the book above does not do justice to the way she enables people to experience. For this reason, Haraway, her post-humanist peers, and the real, action-taking people I met in this time were the ones that stayed with me, not Rees. I thus have to sincerely accredit her for that.

A new goal for humans on earth – Bruno Latour

Bruno Latour was a French philosopher, anthropologist, and sociologist best known for his work in science and technology studies, where he challenged traditional distinctions between nature and society, fact and fiction. Haraway frequently refers to his work. He believes that an essential part of the problem lies in the fact that humans have no clear view of what a sustainable future looks like.

The main work I used to understand his interpretation was:

Down to Earth: Politics in the New Climatic Regime. (2018)

Other sources include:

Facing Gaia: Eight Lectures on the New Climatic Regime. (2017)

Reassembling the Social: An Introduction to Actor-Network-Theory. (2007)

Critical Zones: The Science and Politics of Landing on Earth (2020)[23]

For as long as all living humans can remember, we have acted in the belief that we are the gods of our planet: our collective mission is to shape the world to fit our desires to provide abundance to all. After centuries the conclusion can be made that this exact system is bound to lead to self-destruction. We know that. Yet as an individual, it may seem there's nothing you can do about it. Latour says: no wonder we are scared and no wonder we deny the problem. As we lack a new goal that most humans believe will save humanity, the situation does seem hopeless. The current geopolitical trends can in fact be interpreted as a symptom of our poignant awareness.

Latour developed a theory on this discrepancy: He states that humanity is in a state of shock. For centuries we have believed that the globalized system, when fully optimized would provide

plenty for us all. This appears to be untrue, the project of modernization turns out to be utopian. This leaves us to respond in panic: denial and discouragement, hence the current geopolitical trends, hence the inability to unite, hence the inadequate response of (inter)national policy makers.

Because of this state of distress, he proposes that humanity is in need of a new direction. Humans are in need of a new goal to pursue, that – just like globalization did for centuries – gives humans a general paradigm to make decisions in. This goal needs to be somewhat convincing of leading to a prosperous future while also providing some flexibility.

According to him, the future should be oriented locally, to the earth rather than the Globe. He calls it Terra: different to local primitive lifestyles we now see as archaic, but contrasting to global nonetheless.

He proposes that there is a need to envision this new goal in an attractive way to make it tangible and understandable to humans today. Although he excuses himself for his inability to provide a more clear instruction, he does point out examples of returning to the soil, community approaches.

What I appreciate about Latour, is that he thinks about solutions that could be embraced by humanity in a way. He is very self-critical. In his earlier works, he proposes the introduction of a new religion: he conceives a new god, named Gaia, to represent the Earth as an entity for humans to devote themselves to. Of course, a religion has historically proven to be able to quickly spread a new paradigm across human society, and change human behavior completely. Yet he also acknowledges the unlikeliness of this idea being put to large-scale practice: 'it'd be way too much reading for most people' (p. 40).

He's also dissatisfied about the fact that he is unable to present a more detailed description of the future we need to aim at (p. 90). Yet I appreciate him for it: a solution to an undefinable problem like this has to be open-ended (ref wicked problems). The broadness of the goal also allows for local appropriation and adaptation over time. Just like capitalism, this gives it the challenge for humans to get creative, passionate and driven, allowing them to embrace and adopt the goal along the way.

Then again he recognizes that his idea of Terra 'doesn't look very attractive' (p. 91). Although he may be right that it's hard to compete directly with the Global idea of human prosperity and superiority, I think that it's not impossible. The examples I came across this year are attractive to a lot of humans. There are extensive networks, waiting and interest lists of people for interested in living in specific ecovillages across the Netherlands and the globe. From all across the world sustainable living initiatives gain widespread enthusiasm[24]: an amazing opportunity for architects to think about better ways to show the potential for sustainable living through housing. Architects can play an essential role in making this even more attractive and coming up with upscaling proposals.

'look around, rather than ahead' – Anna Tsing

Another posthumanist friend of Haraway's is Anna Tsing. In The Mushroom at the End of the World, on the possibilities of life in post capitalist ruins, she explores communities that find surprising ways to use the ecosystems damaged by humans. She intends to bring to attention that new ways of life can emerge in these places, and much value can be found in that for both people and ecosystems.

As a main example she takes the reader on an exploration of the practices of matsutake mushroom picking: an encounter between the matsutake mushroom that grows in damaged-and-then-deserted pine forests and marginalized people that find freedom through the income from these mushrooms. This creates a fascinating network of interactions between humans and seemingly useless forests: humans need to gain deep understanding of species and local context to find these rare mushrooms. To learn this skill, one must pay careful attention to an ecosystem, its behavior and its changes.

Along the way, Tsing introduces many more examples: places where people and ecosystems need each other to find balance and thrive. She concludes that to find futures in our damaged world, these types of connections are paramount. She intends to 'show us to look around, rather than ahead' (p. 22)

Like Haraway, Tsing uses stories and speculation as a vehicle to bring across a message on a more emotional (or paradigm) level. While Haraway explores existing structures of human-ecosystem intertwining that still persist under pressure of the 'Anthropocene', Tsing explores new ones that emerge as feral effect of it.

Inventing a new color – Roanne van Voorst

Like this, my exploration brought me to the ethnographic work of future thinker Roanne van Voorst.

Roanne van Voorst is a Dutch future anthropologist. She studies how people change their mind about something. For her book Once Upon a Time We Ate Animals (2022), she researches how people and society can change their opinion and behavior. She argues that in our time these changes can happen quickly: in the matter of a few years, being vegan has evolved from a niche idealist behavior that has a very negative image, to a popular diet

that is both sustainable and healthy. She visits farmers who changed their entire lives after coming to the profound emotional realization that killing the animals they care about is morally unjustifiable. After experiencing a change in paradigm, they quit their activities as bio-industry farmers. She explores how marketing techniques intended to offset the rise of dairy consumption in the Netherlands in the second half of the 20th century, before that our diets contained far less animal products. She also explores the emergence of veganism on social media and concludes that it's very much imaginable for humankind to become completely vegan in the future.[25] She explains how society is able to change drastically, but right now it is hard to imagine. She calls thinking ahead like this almost as hard as inventing a new color. Over this year I too changed my diet from eating meat multiple times a week to a maximum of once a week. I also decreased my dairy consumption by about 80%.

Care as a bonding practice – Maria Puig de la Bellacasa

The last book I read was Matters of Care by Maria Puig de la Bellacasa. She explored the relationship between humans and nature in a care perspective. She shows how practices like permaculture can offset more natural care relationships between humans and nature. Building on Joan Tronto's definition, care includes "everything that we do to maintain, continue and repair 'our world' so that we can live in it as well as possible. That world includes our bodies, our selves, and our environment, all of which we seek to interweave in a complex, life-sustaining web". Puig de la Bellacasa challenges conventional notions that care is something only humans do, and argues for extending to non-humans the consideration of agencies and communities that make the living web of care. The book offers a framework for thinking about how to live ethically in a world where humans, technology, and nature are inseparably entangled, emphasizing care as both practical work and political commitment.[26]

preliminary thoughts

The speculative works I read inspired me: they made me get more comfortable with the idea that the world can actually be a great place, even if the exact details were very different. Maybe we can really be happy and live in wellbeing without a travelling the world on a yearly basis, without all those new clothes. Maybe we really can enjoy living closer to nature

This leads to the next challenge: how do we change the way we think and behave? That's a difficult question. It led me to explore the fields of systems thinking and future anthropology. From both, I've learned valuable lessons about which strategies are most effective in shifting the way people think—and, in turn, the way they act.

4 fieldwork experiences

As mentioned in the introduction, I held a fascination for people that are taking action for nature, especially those who are doing something that (to me) seems unexpected. In ethnographic fieldwork among people who take action in caring for their natural environment (in the Midden-Delfland region and other places in the Netherlands), I learned a lot of valuable lessons.

The people I spoke to are spending time, effort and money to do something 'fuzzy': they are using their personal capacities not to implement technological solutions, but to give some resistance to the Looking back, I realize why this is, but that will be enlightened further on in this research.

My ethnographic research on people that take action to care for nature brought me on interesting paths. As no one specific experience taught me what I needed to learn, but rather the cumulative experience, I will just shortly illustrate the activities and some highlights.

Sustainable housing initiatives, ecovillages

In the three sustainable housing initiatives I visited, I learned about the promising ways in which people in ecovillage-settings incrementally make their lives more sustainable.

I learned that the people that live in these settings take on a very pragmatic approach: they understand that they are sometimes seen as hippies, outliers, so they actively connect with the neighborhoods that they live in. They actively try not to be too odd.

I learned how people living in these places incrementally make their lives more sustainable: over time they change their diets, they switch to car-sharing, they share things, they share spaces, they transition to more sustainable energy resources, they build

water filters, they grow their own foods, they iteratively make their surrounding ecosystems more healthy.

These changes happen on a voluntary, no pressure basis, anyone is free to do it their own way, at their own pace. You don't have to be a vegetarian, you don't have to live your life car-free, you can buy new clothes, you can go on vacation. One inhabitant at The Aardehuizen in Olst told me how he had once commented on the flying behavior of another inhabitants' son. The son, who had at the time just graduated high school, had taken a trip around the world. The man told me how he really regretted his comment, and how he had apologized soon after.

At the Aardehuizen – 24 dwellings - , the inhabitant that manages the food forest told me that there were not always enough hands available within the community. This led them to broadening their volunteer network outside the project boundaries and into the village of Olst. A good thing, I would like to argue, as it's a reason to connect to others in the region to find extra help. A great breeding ground for connection.

Especially when living in a larger community, it is preferable to create clusters withing the overall group. When spending a day with Peter, an inhabitant of Boschgaard who has lived in different communities for over 40 years, he advocated strongly for this. It helps with forming closer bonds among members, therefore it gives people a point of reference within the community. It also makes the decision-making process more viable. Most intentional communities practice a form of inclusive decision-making that transcends plain democracy. To make sure that the minority is heard too, it's important to hear everyone's opinion and attempt to come to solutions that work for all members of the group.

One thing that stood out to me was that the people living in these places came to live here for a variety of reasons, ranging from looking for a place with a big green space for their children to grow up in a lot of sustainable ambition to an appreciation of the collective/community aspects.

other people that care for nature

Like this, I met many other people that care for nature around 40 in total, a complete list can be found in appendix E. What struck me is that they were using their personal skills to do something to make changes in the network: change people's minds, create places for new ecosystems, stop unsustainable developments. They were creative ways of which they explained the impacts to me, and it felt so much more useful that putting solar panels on your roof.

preliminary thoughts

These people kept fascinating me deeply, yet I could not really give one final answer why.

at some point I distilled this list of things that happen in ecovillages that make them valuable:

- learning by doing
- pragmatism and optimism
- intentional communities as enablers for change
- re-used and bio-based
- weaving with locals for impact
- being seen and being heard to inspire others
- giving agency to lower authorities

Yet the points on this list overlap: weaving with locals and being seen and being heard are both about making waves, creating impact beyond the project. Agency and intentional communities

overlap too: they are both ways to give people room to make more sustainable choices and induct a feeling of responsibility on people. I could also not claim that this list is complete. It's not scientific. It does not belong at a Master of Science.

I thought long and deep to create a list of things that they were doing differently, to distill one essential answer that would comply with my obligations as a scientist: provide traceable, objective and precise, something measurable or empirically sound. Yet I did not have a list of questions I'd asked people, I did not solve a formula. I could not identify one precise thing that made these approaches a better investment than a solar panel in a way that scientifically supportable from my results.

Therefore I was not finished, I needed more information.

5 The method that really happened: A messy super-diverging iterative study of my own designing mind

I collected a lot of data to answer the initial research question, yet I kept being unable to answer it in a scientific way. This frustrated me a lot throughout the year. There had to be one final answer, on that was scientifically substantiable.

I don't know exactly when this method was first introduced to me, somewhere early on in high school, but I know it goes something like this[27]:

A. **Observation** - Noticing phenomena or patterns in the world
B. **Question formation** - Asking specific, testable questions about what you observed
C. **Hypothesis development** - Creating educated guesses or predictions that can be tested
D. **Experimentation** - Designing and conducting controlled tests to gather data
E. **Analysis** - Examining the results and drawing conclusions
F. **Peer review and replication** - Sharing findings with others who can verify and reproduce the work

It's very clear, clean, traceable. Two things are paramount: no emotion, and no interference with the subject of research. It's been imprinted in my mind for the better part of my life.

Looking back, I now know that these methods are not scientific to begin with. They require the researcher to interfere in the subject they are researching. They require the researcher to be

human, to talk, to feel, to communicate. No other researcher could replicate this research, as they are different from me, and the specific moments I experienced will never occur again. I change my subject through being part of their lives for a day.

Yet, how can a research output from an MSc, Masters of *Science*, student possibly in non-scientific? I didn't know this beforehand. I was never made explicitly clear that the methods I was using were non-scientific.

This led me to my first crisis: as you, Brook, know I spent months and months trying to structure my research. I wanted to showcase that system-oriented approaches like ecovillages were *objectively* better than technological solutions.

It's impossible to answer complex questions like this in a scientific way. I ended up running around in circles and diverging endlessly until panic (read deadline) struck: something needed to be presented! This is a process that reminded me of another thing I'm supposed to learn at this faculty: design

To illustrate this, I've come to the following line of though:

Let's first think of a science problem. In exact sciences like physics, mathematics, chemistry and all other disciplines that use calculations, it's the case that the problem can always be solved if only one variable is missing. If you're missing two variables, the problem might still be solvable, but with a detour. The more variables that are missing, the more detours. But solvable problems are a clearly defined area in the world of problems. There are also problems where too many variables are missing: then you have to search for extra variables before you can solve the problem. As long as there are too few variables to solve the problem, your problem is 'wicked' for science (more on that later). You can keep searching until you've found enough

variables. This distinction is clear: solvable problems and unsolvable problems.

This is exactly the same for design assignments in my science-mind: If you want to go from a wicked problem to a solvable problem, you go, just like all other scientists, to gather information. That is 'the scientific method'. But in an assignment with endless context, like in the complete, real world, with real people, there can naturally be infinitely much to analyze, infinite factors, infinite interrelations. You start with a few pieces of information, and then you keep collecting more information whenever you know you still can't solve the problem: a very 'scientific' way of thinking. But the level of detail and complexity of the entire world as context, and then the uncertainties of the future also taken into account, you naturally never get out of that. The smartest fastest computer can't do it either, pieces of missing information remain: the problem is not complete. So it's very logical to get confused as an upright scientist: you keep collecting data, so you run over your schedule. But well, in the scientific world you have to present a traceable plan: conclude whether the problem is unsolvable or not. So you continue analyzing until panic arises: the deadline approaches and you still haven't found all the information. Help!

But in architecture school, you're naturally expected to *make designs*. So reluctantly you begin your design process with incomplete information. You want to be a truthful scientist but you also have to pass your studies. So, with a contradictory feeling, you start your design process anyway. Only then do you end up, much too late, in your iterative process. A non-scientific method, because you also can't really objectively trace what happens in your head and what comes from that onto paper. Then comes the final presentation: You have to present a complete picture, you have to convince people of your design.

But you still can't trace it yourself, you actually know for sure that this is not the best solution anyway. It's merely one possible solution. Because you got stuck in endless analysis, you actually know for sure that your process was also very imperfect. If you're a scientist, your solution should be singular and the best. Yet your process was a total mess and the answer is just one possible answer, If you are a scientist this is very unethical, you're just lying when you're trying to convince people of your idea. This is how you have to suppress your own sense of integrity in order to function in your studies.

I tried to maintain my integrity, really. From January on I hardly took a break, I did not earn it as I did not solve the problem yet. I know I did not produce much, I got distracted all the time. But It's because I did not have enough results, input, variables, information, to answer my question in a scientifically satisfying way: yes or no, a number, a law, a list of elements that are mutually exclusive, collectively exhaustive.

Because I never knew that in order to designer or a researcher in wicked problems, I cannot be a scientist. That was never explicitly made clear to me: to complete a Master of Science, I cannot think merely like a scientist. I never learned that there are ways to solve problems that are also integer, that are not scientific[28].

Now back to research: To answer my question, I naturally started doing what a scientist would do: I started gathering more information about the world. I got 'distracted', I made my question bigger: *'How can architecture save the world?'*

Because, if you're a scientist and you want an answer to the question: '*What is the role of housing in the development of local communities that care for ecosystems?'* , you need to know everything about housing, everything about local communities, everything

about caring for ecosystems. And for that, you need to know everything about architecture and the world.

This sounds extreme, but it illustrates the determination that takes hold of you when you want to give a perfect answer. You naturally broaden your scope instead of narrowing it. There is no use in focusing on one factor.

Sadly, I did not have the tools to document this at hand, there are some out there, but they require rigorous upkeep throughout the process. I did not do this because these methods were unknown to me. Documenting this now would be wrong, as the research changed me as a person, I'm now an unreliable source to back-document my own process. Furthermore, the research I really went through this year can impossibly be described in a scientific paper because it contains emotion throughout. The researcher researches a subject she can't possibly maintain objective distance from. This might all be acceptable if the research would take place in a clinical setting, a laboratory where input and output is controlled. Yet as my life goes on, experiences influence me all the time, pivoting my mind, my decision making, all the time.

So I researched myself: how can I become a good architect?

For that I answered the – not mutually exclusive, not collectively exhaustive – set of sub-questions:

How can I make reliable decisions as an architect?

How do I make the engineers that surround me in my personal and professional life understand that designing is more than arts and crafts?

Why are (approaches like) ecovillages better than (solutions like) solar panels?

Is it still worth fighting for a sustainable future of humankind?

I felt that these answers were missing from me as a designing entity, they limited my ability to promote and take responsibility for my designs.

During my graduation year I tried to find answers to the big questions you encounter as a designer in the context of our society: how do you position your non-quantifiable ideas in a world where science expresses itself in measurability and stoic logic? How do you justify your own design choices when you experience your own choice process as a kind of black-box generative AI?

These questions cannot really be posed to the current scientific system, because they assume a non-objective researcher. How can you be the subject of your own research? My teachers therefore told me that it was indeed better to ask limited, scoped questions, and I understand that protective intention.

Only my questions were too urgent, I couldn't really manage to suppress them. Because so much is going wrong in the world: the climate crisis and all related problems were my main concerns, yet they interrelate with inequality, pollution, the welfare of farm animals. These issues are, as far as I can say, pretty tangible, pretty real.

Last summer, for the first time, I saw the immense severity of this problem with my own eyes. I took a hike on a path that I had hiked so many times as a kid. It's near the Turtmann Glacier in Switzerland. Yet when we got there, it looked so different. In 12 years the glacier halved. In less than half of my lifetime, the ecosystems of my youth are disappearing. I cannot approach global heating without emotion. I don't think anyone can. But does that mean we thus cannot do something?

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Image 6: How I remembered the Turtmann Glacier when from I hiked there as a kid. A photo from 2012, retrieved from: https://www.swissnature.org

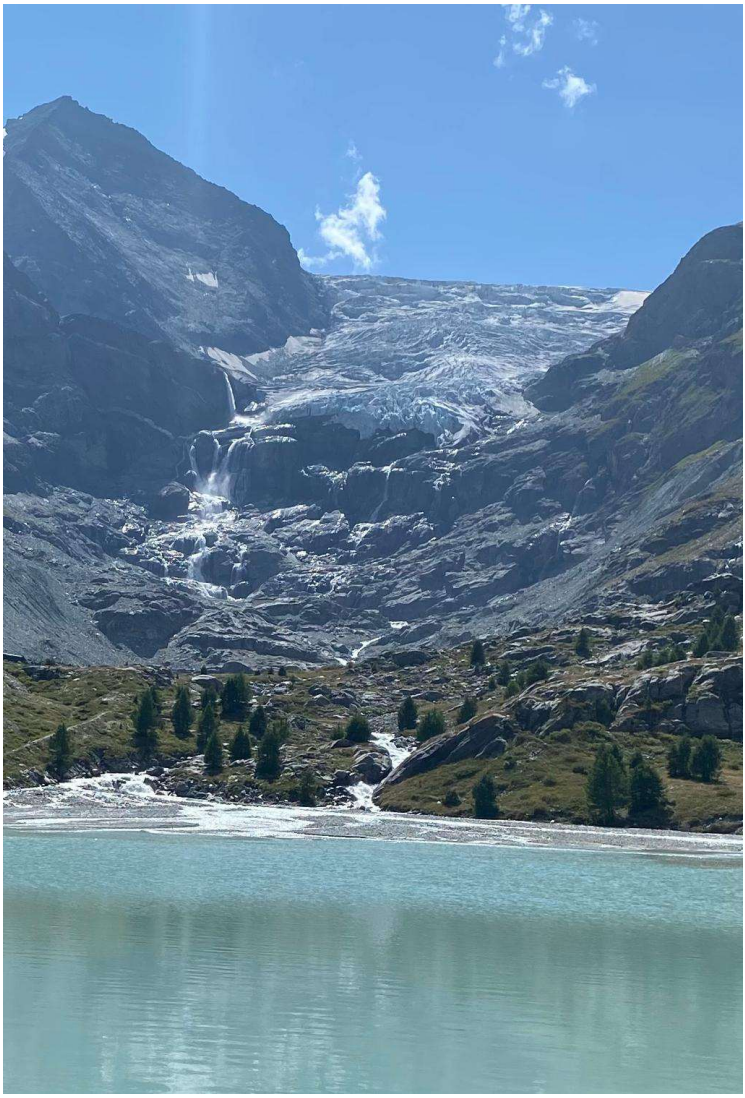


Image 7: Turtmann Glacier now, photo taken on 26 August 2024 by my friend Katie.

With the position that architects have an essential influence on the built environment, and the built environment on the experiential world of humans a huge responsibility will be on my shoulders. The Problem of our time is about as real as it gets, and so is my position to be able to do something. So I found a kind of unstoppable stubbornness to keep investigating my questions: If there is so much at stake as the future of all life on earth, is it then not justified to ask questions that call the norms of science into question?

The climate Problem is something that very many people experience as a substantial threat (I know that climate change is merely a symptom, but for the sake of naming it). Is the climate Problem then impossible for me to approach with objectivity? Shouldn't we try it at least once, non-objective science? Because no-one can be objective about this? If we do it with rigorous critical thinking, excessively correct formulations?

So, against the many advice from my teachers to 'kill my darlings' and choose a focus, I still couldn't let it go. I kept asking more and more questions, instead of getting smaller the questions kept getting bigger.

Methods used: getting lost beyond imagination

Being frustrated, reading, getting lost, being determined, being devoted, bothering your friends with your ideas, emailing people that may have answers, designing, going on ethnographic fieldtrips, reading about sustainable initiatives, trying to write, chatting with ChatGPT and Claude.ai, wasting an afternoon on Pinterest, listening to a podcast, watching a YouTube video, reading more, feeling, thinking you understand, trying to come up with a concise definition, realizing you can't, making a lot of schemes on post its, then throwing it all away, feeling down, feeling enlightened, thinking you're almost there, realizing you're not, doing it again.

6 Accidental fieldwork

Next to the planned fieldwork, I also learned a lot from my friends, family and the world around me this year. I wish I'd had system/structure/method to document this, because I've learned so much from this and I never might have learned what I did otherwise. It's about communication, feeling, emotion, conversation. These are means of testing your hypothesis, your ideas, your concepts. apparently these is a name for this too. Expert Validation. Or just: asking for help from someone who you think might be able to help you.

one part I've written is about a care experience:

7 Care as a learning experience

Over the course of this year, I learned a lot about care in my personal life. The loss of both of my biological grandmas made me think more about the little efforts of which life on earth is composed. The first grandma to pass away lost her partner half a year before her own death. Because she was suffering from terminal cancer, we, as her close family of 3 children and 5 grandchildren, started staying with her during the night and a few hours every day. Gradually, this became more and more and for the last months we never left her alone for longer than one hour. I never cared for someone in this way before, and it made me realize firsthand what kinship entails. As my grandma was very clear of mind right until the last day, caring for her was a warm and interactive practice. I was her hands and feet, but other than that were equals. My goal was to make her final months as comfortable as possible, but she – still being my grandma – was mostly concerned with my wellbeing. While the thermostat was keeping out the winter frost with a comfortable 25 ^{o}C room temperature, she kept asking me if I didn't want to borrow a sweater. While she worried that I would dislike helping her get

dressed or use the bathroom, I felt honored to be able to help her.

Caring for someone you care about is a deeply emotional experience. The most important part of the care for could only be given by people that knew her well. In this realm, there is no clear division between care tasks and social interactions. While giving her medication and monitoring pain might be clear care tasks, and her wanting to give me one of her favorite scarves is clearly a social interaction, most tasks float somewhere in the middle. Drinking a cup of tea by the side of her bed and laughing together to distract each other from fear of the near future are activities that intertwine caring for and caring about. These types of activities maximized her quality of life near the end, and can only exist in kin relationships.

The story of my other grandma is a less endearing one. Suffering from Parkinsons disease, she spent the last 3 years of her life in nursing homes. As the disease comes with dementia and the drugs to fight the physical symptoms cause hallucinations, she often complained that the people that cared for her did not pay attention to her. This makes sense: although her caretakers had the best intentions and did the very best they could to communicate with her, they did not understand her. The only people that understood her were the people that knew her very well, for a very long time. With three mumbled, incohesive words, my mother could derive that she wat talking about one of her close friends or a certain place in the house they lived in for 50 years. These were the only moments my grandma still experienced a bit of what she really needed to feel like life was still valuable: kinship.

8 Understanding system dynamics

My roommate, Bloem Brouwers, studies Strategic Product Design. She introduced me to the work of Donella Meadows, one of the academics who worked on The Limits to Growth Books.

She uncovers a way of thinking that could help us optimize the impact of our actions without needing to quantify them: thinking in systems.

> A system is a set of things – people, cells, molecules or whatever – interconnected in such a way that they produce their own pattern of behavior over time.[29]

Almost everything we encounter on a daily basis is a system: other humans, the supermarket, your car, the shower, the solar system, a computer, the internet, an ecosystem, animals and people are systems too. Some we are very knowledgeable about, some we hardy understand. She adds:

> the system may be buffeted, constricted, triggered or driven by outside forces. but the systems response to these forces is characteristic of itself, and that response is seldom simple in the real world.

8.1 phenomenon-systems, familiar systems and mechanism-systems

Although Meadows does not explicitly split them up like this, she does talk a lot about understanding systems and their characteristic/dynamics, understanding what input results in what output, understanding how to change it. I've come to divide systems up into three groups.

phenomena-systems

These are systems we don't really understand. We may be able to interfere, yet we don't know exactly what will happen, how it will respond. You may be able to predict a general effect, but you might not know how much effect there will be, and whether there will be side effects.

The term phenomenon in systems thinking is much used by Herbert A. Simon in The Sciences of the Artificial. He uses it to refer to large systems that humans experience as black-box.

The only thing you can do is to interpret the phenomenon-systems' behavior, make a hypothesis (I think if I do this, something preferable will happen) and give it a try. Give an input, and then carefully study the reaction. Throw a ball at a surface and see how it bounces back.

familiar systems

When you keep giving inputs and studying the reaction, over time you will get acquainted wit the system, literally, like getting to know a person: you don't know exactly how they work, but you know what they like, you can predict more or less how they will respond to a situation.

This may happen to the ecosystem in your backyard, after you've taken care of it for some time.

It will become less phenomenal, and more understandable. It will become a familiar system: you don't fully understand it, but you can work with it. But it takes practice: doing, seeing, learning, trying something else.

mechanism-systems

mechanism-systems are systems we fully understand. We know how they work, the same input delivers the same output every time. They hold no secrets for us. Examples are: an engine to a

mechanic, a structure and foundation system to an architect: they know exactly how weight is distributed. An insulation system with exact R-values, construction joints, water proofing etcetera.

from phenomenon to mechanism

The same systems can be experienced differently by different people (or animals). For example: some, especially elderly people experience modern technology like iPhones like phenomena: they don't know how to control them. For you and me, they are likely predictable: familiar systems: you understand them well enough to work with them, you can control the situation enough to work together, but you can't recreate them, surprises might always occur. Only for some people these systems are mechanisms: A handful of technicians working at Apple know all the parts.

A door may be a familiar system to most people, close to a mechanism to architects, we know quite a lot about the frame, hinges and materials. I don't understand the exact mechanism of the door handle, and to design with them I don't need to. Nor do most people. To a mechanical engineer, it's really a mechanism. To most dogs a door is a phenomenon, and if the family dog gets too familiar with this system, it can be very unpractical.

8.2 open systems and closed systems

open systems

Donella Meadows emphasizes that most real-world systems are open systems - they exist in constant exchange with their environment. The system may be buffeted, constricted, triggered or driven by outside forces, but the system's response to these forces is characteristic of itself. Your backyard ecosystem exemplifies this: it receives inputs of sunlight, rain, nutrients, and

wildlife and seeds from beyond its boundaries, while outputting oxygen, hosting insects and birds, and influencing the broader neighborhood ecology. The ecosystem's identity emerges from how it processes these flows, not from isolation.

closed systems

Closed systems, by contrast, operate independently of external inputs and outputs. While useful for scientific analysis – like studying the behavior of chemical substances in a lab-setting - truly closed systems are rare in the real world. This is why it is so hard to study the influence of one action, policy implementation or intervention. Even your iPhone, though it might seem self-contained, is actually an open system: it receives signals, updates, user inputs, and power from its environment, while outputting data, heat, and electromagnetic signals.

open, closed and in between

Yet a lot of systems are relatively closed, and this once again differs per entity that relates to it: to me as an individual, the global climate feels like a pretty closed system, I cannot influence it significantly with my individual actions. The government feels like a closed system: I cannot change it directly when I don't like it, and my vote is a really minor contribution. A car is a closed system to me as I don't understand how I could change it.

Understanding whether you're dealing with an open or closed system changes how you approach it - open systems require you to consider their broader context and relationships, while closed systems can be analyzed more mechanistically.

Donna Haraways's story is a systems story in this sense. She states that we, anthropocentric humans, are thinking of ourselves as closed systems: absolute entities that are not influenced by the outside world. When she argues for sympoiesis, she basically argues that humans should accept that they are not closed

systems. They accept that, as living and thinking creatures, we are constantly being shaped by our experience and interaction with our environments.

When I design this is exactly what worries me. I'm expected to be an absolute, reliable decision-making machine. Yet I know for a fact that I cannot separate myself as a person, an open system, and myself as a designer, which should be a closed system to be reliable. Experiences in my daily life, whenever they occur, influence the way I think, the opinions I have, the knowledge I work with and thus the decisions I make. It's unavoidable.

8.3 Natural systems and artificial systems

the last distinction that is interesting to consider is the distinction between natural systems and artificial systems, this has been written a lot about by Herbert A. Simon.[30]

natural systems

Natural science concerns itself with how things are, whereas the sciences of the artificial are concerned with how things ought to be - ought to be, that is, in order to attain goals and to function. Natural systems like your backyard ecosystem or the solar system operate according to physical laws without intentional design - they simply *are*. Their behavior emerges from natural processes: plants grow toward light, predator-prey relationships create population cycles, weather patterns develop from atmospheric physics.[31]

artificial systems

however, are designed and created with purpose and goals in mind. Your iPhone is artificial - every component was intentionally created to enable communication, computing, and connection. But Simon's insight goes deeper: Artificial systems

are aimed at changing existing situations into preferred ones. This means human organizations, economic systems, and even agricultural landscapes are artificial systems - they've been shaped by human intention and design, even when we don't fully understand how they work.

Importantly, the same physical entity can be viewed through both lenses. A bird can be studied as a natural system (how its metabolism, flight mechanics, and instincts operate according to biological laws) or as an artificial system (how evolution has "designed" it to solve problems of survival, reproduction, and environmental adaptation). Yet even an iPhone can be seen as a set of natural happenings combined together. This dual perspective helps explain why living systems often feel both mechanical and mysterious - they operate as natural phenomena while also appearing remarkably well-designed for their purposes.[32]

9 utilitarianism as a global goal

Because it remained so difficult to define my problem: not climate change, but something growth related, underlying, I decided that It might be better to think of a goal. An approach that would guide my decision-making.

In summary, it is a way to assess your decisions:

As we like assessing so much, we must first try and create a new way to compare things. I propose a utilitarian approach. This is a theory that states that the most ethical thing to do is always the thing that creates the most wellbeing. It's useful because of three reasons:

1) When I would have a chance to put all the people I learned from this year in a big room together, and ask them to come up with a reason to do whatever they do they can all support, the aim for the most cumulative wellbeing would be the least contestable goal. We can still debate on whoever is included: people now, people that may live in the future, animals, plants, but it's a good starting point.
2) It allows us to compare all of our actions in one single 'currency' that makes it impossible to validate our answer to a convenient problem definition: if you execute it well you must include all considerations, of all your impact, all around the world. To paint a complete picture, to be aware of what you do. It tells you to weigh the wellbeing of the people in the Netherlands that enjoy free energy from solar panels for 25 years to the waste left after this time. We have to account for people that work in the mine in Mexico to dig up the raw materials for them and the materials used to make them.

3) This leads us to the conclusion that easier solutions are found closer to home: in this assessment, re-used materials are essentially free, biobased materials score good as well. Things we don't know the origin of, we should research a lot, and things can't trace should be estimated as high risks. This will lead to more conscious decisions.

I was very enthusiastic about finding utilitarian ethics: a way of thinking that focuses on maximizing overall wellbeing. Yet when I told my boyfriend about this amazing find, he was not impressed. Of course he learned about this in his studies: Engineering and Policy Analysis, a Master at the faculty of Management, Society & Technology at TU Delft.

But this is what I learned about it:

9.1 Utilitarianism: the greatest good for the greatest number

Reading MacAskills work, It becomes clear he interprets doing the most good as 'producing the greatest good for the greatest number (of people)', an approach that is reflected in utilitarian philosophy. A well-known contemporary utilitarian, Peter Singer, has been very influential in the field of doing good too: He is the author of books like 'The Most Good You Can Do: How Effective Altruism Is Changing Ideas About Living Ethically' (2016) and The Life You Can Save: Acting Now to End World Poverty (2009). In his work he applies classical utilitarianism to modern moral challenges to show how to do good. Although MacAskill is not an outspoken utilitarian himself, he does agree with its general line of thought and has co-written a book about it.[33]

Peter Singer and Katarzyna De Lazari-Radek's contribution to the Oxford 'A Very Short Introduction'-series: 'Utilitarianism, A

Very Short Introduction' teaches me what I need to know about this theory. [34]

Utilitarianism is an ethical theory that evaluates actions based on their consequences, aiming to maximize overall happiness or well-being. The core principle in this theory is that 'we should make the world the best place we can' (chapter 1)., who argued that in any scenario the morally right action is the one that produces the greatest good for the greatest number. Rather than focusing on intentions or strict moral rules, utilitarianism asks: What will lead to the best outcome for everyone affected?

A utilitarian approach seems highly useful in design decision making practices that do good for the world. Yet while the principle of utilitarianism at first glance seems obvious and sensible, it has been criticized by many. Thus before adapting it blindly, let's take a look at some possible critiques.

Imagine a scenario where a doctor has five patients in need of organ transplants, and one healthy person walks into the hospital for a check-up. Under strict utilitarian logic, the doctor should kill that one healthy person to harvest their organs and save the five others—maximizing utility. But this is clearly intuitively wrong, as it involves the killing of an innocent individual.[35]

Many critics take on thought experiments like this. These types of examples apply to a strict utilitarian approach and consider the fact that the theory might in practice lead to immoral acts. The ideology responds to this with an adaptation: rule utilitarianism. In contrast to strict utilitarianism or act utilitarianism, proposes to build a set of rules that – in general – would lead to as much good as possible, to as many as possible. The ideology then proposes to keep re-assessing these rules over time and adapt them when imperfections arise. A well known example to describe this difference is: in act utilitarianism

stealing can be moral if it leads to more good for more people: stealing a loaf of bread from someone that could live without it to feed someone that is dying would be the utilitarian thing to do. But in that case, where do we draw the line? A rule utilitarianism approach considers this broader interests: a society in which the reasons for stealing could always be augmented would lead to undesirable situations in the long term, thus stealing should not be allowed. Yet if new grounded reasons to question the rule would arise, reconsideration is possible(ref).

Rule utilitarianism leads to complex dilemmas when applied strictly. Sometimes utilitarian rules lead to conflicts. For example: lying is generally not right, but what if in a specific case it can protect wellbeing of people significantly? Dilemmas arise too when decisions must be made between new optional rules. Philosophers like Brad Hooker[36] and R. M. Hare[37] argue for flexible or two-level utilitarianism, where rules are deeply important but not blindly followed. The core idea is that rules help guide behavior, but can and should be reconsidered when the consequences are clearly worse than making an exception.

The climate crisis is a long term problem. If we manage to find a way to solve it, the timeframe of this process will likely exceed the specific rules we live by today. Arguably, all exceptions should be considered

Yet this research does not intend to use utilitarianism to make decisions in the present, but to use it to craft a vision of a long-term desirable outcome.

As I considered earlier, practicing architecture demands me to make decisions that influence people's lives. Whether architects do this unknowingly, consciously or actively, each decision will in some way influence others. Yet no rules exist about this influence. Effectively, it's up to my preferred ethics, any other

liking or un-knowingness to influence the planet in whatever way I can achieve. If I want to design a building merely to make it look good on my website, I'd be free to do so as long as I can get the commissioner to pay for it and the municipality to allow it. For this I am constrained by a set of rules that (exceptions could be thought of here) I cannot contest. I don't work with ethically conflicting rule dilemmas. Except for some integrity outlines by the BNA (the Dutch Architect Trade Association) I operate with no rules for design ethics at all. Yet my influence on the world could be of great proportion. I could thus do well with a workable ethics framework to assess my design choices.

So let's assess whether the simple and noble idea of 'doing as much good as possible, for as many as possible', is applicable to serve that goal: A final common critique, that ís relevant in decision-making ethics, states that a utilitarian approach would only be beneficial to people that are part of the dominant majority. Utilitarian theory tells us to aim to do the most good for as many as possible: this means that a decisions could be considered right even if it overlooks the interests of minority groups. This is especially worrying when themes become subjective or culturally biased, leading to rules that benefit some but harm others. (ref)

Yet in their interpretations of the theory, both act and rule utilitarians across time actively expand the moral circle to include more marginalized or voiceless groups. This can be illustrated by the works of some leading utilitarians that apply the theory to practice. The philosophy was introduced by thinkers Jeremy Bentham and John Stuart Mill, whom are widely recognized as theory's founding fathers. Ahead of their time, both Bentham and Mill strongly opposed slavery, arguing it caused suffering to many and benefitted few. They also both made strong arguments for universal democracy and suggested how it should be

implemented to benefit the most people, with special attention to minorities[38]. As early as 1789, Jeremy Bentham argues for the rights of animals in 'An Introduction to the Principles of Morals and Legislation'. The quote from this book: "The question is not, Can they reason? nor, Can they talk? but, Can they suffer?"[39] is still used widely by animal welfare advocates today. In Panopticon (1791) he advocates for humane treatment and reformation of the prison system[40]. In a posthumously published essay Offences Against One's Self (written c. 1785, published 1978) he defends consensual same-sex relationships and calls for the decriminalization of homosexuality as it does not 'threaten population or marriage' [41]. Doing so, he made the first known written argument for homosexual law reform in England. The Subjection of Women (1869), written by John Stuart Mill argued that excluding women from full participation in society not only caused suffering but also wasted a great amount of human potential, which was morally indefensible from a utilitarian standpoint[42]. In The Life You Can Save, previously mentioned Peter Singer promotes global altruism, urging people in wealthy countries to help the global poor[43]. In Animal liberation (1975), he too reasons that the suffering of non-humans can suffer too and deserve equal consideration[44]. MacAskill, in his most recent book 'What We Owe the Future', departs from a view that in our assessment of ideas, we should start including the wellbeing of beings whom have not yet been born.[45]

Utilitarian philosophers that apply the theory keep arriving at conclusions that include the interests of more beings than are represented in current practice, precisely because their interests also matter in the utilitarian calculus. If each suffering individual is counted as equal, it's in practice hard to arrive at thoroughly considered conclusions in which a less inclusive world provides more happiness, good, welfare pleasure to more people.

So if we take a utilitarian approach to assess utilitarianism itself, we must assess its results rather than its intentions. For the purpose of this research, a utilitarian approach would be applied to think about possible solutions to the global climate crisis: a global issue that threatens the wellbeing of large groups of people and other living creatures. To explore this we can look at large-scale revolutions of inclusivity like the abolition of slavery, the emancipation of women and the decriminalization of homosexuality. These developments to decrease suffering were deemed necessary by utilitarians and have taken place in reality, so we can assess their success. Although many of these revolutions caused times of friction in society, they enabled great increases in the well-being of many. As dust settled, these new ways of thinking were gradually adopted by the general public. Over time these newly acquired ways of treating others turned into highly valued, cornerstone morals of our societies.

While the theory may not always be applicable: strange moral dilemmas arise when short-term, out of context situations are tested. But in long-term practice, utilitarian thinkers arrive at conclusions that address structural faults in our system and are able to overlook the short-sighted interests of the few that benefit in the present. The conclusions they drew through implementing their theory have in practice led to essential revolutions in inclusivity that are supported by majorities in societies today (ref). Might this be enough reason to say we can safely apply utilitarian thinking to our current global threat?

9.2 A utilitarian approach to climate change

Utilitarianism aims to maximize overall well-being, and work in a result oriented way. It thus challenges us to look for the most effective solution possible. To do so meaningfully, we must

understand the true scope and structure of the problem we're addressing. That naturally pushes us to look deeper than symptoms, and ask: what system causes the suffering or inefficiency we're trying to fix?

This aligns with how Dennis Meadows, William Rees, and Bruno Latour frame the climate crisis—not as an isolated environmental issue, but as the result of a broader socio-economic paradigm (e.g. infinite growth, disconnection from planetary limits, and human exceptionalism).

10 changing systems

Most of us encounter systems that aren't working well. The instinct is often to push harder, add more resources, or blame the people involved. But dysfunctional systems are different from other obstacles we encounter and knowledge about their behavior can help us significantly conceiving more effective interventions.

Meadows explains how systems, however big or small, depend on a number of factors to keep them in balance. From her experience at MIT, she explains that it's important to consider how different types of interventions influence systems on the long term. Some interventions only cause temporary variations in output: here one might think of subsidies for more sustainable land management. Some interventions cause lasting change: here one might think of the women's rights movements in the 20th century.

To be able to categorize different types of interventions, she places them into a hierarchy: The Leverage Point Theory[46]. The beautiful thing about leverage points is that they're accessible to everyone. You don't need to be in charge of a system to influence it. Instead of fighting against the system, you're working with its own dynamics – finding the places where it's ready to reshape itself around new patterns.

10.1 Leverage Points and Fieldwork

In ethnographic fieldwork I encountered myriad of these examples. To illustrate this, I will I introduce the fieldwork, indicating in which leverage points of systems the subjects of my fieldwork apply changes. In her book, Meadows visits the leverage points in an order of 12 (low impact) to 1 (highest impact). Let's keep the same order.

12. Numbers – Constants and parameters such as subsidies, taxes, standards

Although changing through artificially incentivizing behavior is not a way to change the system as a whole – the system will change right back if you remove your intervention – it is a quick and easy way to evoke action. Yet a clear downside is that you have to keep adding to it in order to keep up the change.

In the Midden-Delfland region, a lot of farmers get subsidies to wait spreading manure over their land unit after meadow bird breeding season. This allows them to stay competitive in the rigid dairy market, while contributing to biodiversity at the same time. This is a good short-term strategy: it's even attractive to farmers that don't have a personal fondness for meadow birds.

John Kleijweg explained to me how caring for these birds without needing to make a personal sacrifice does in fact have a long-term side effect: As these farmers see the wildlife activity unravel on their lands, they over time start to appreciate these animals and 'adopt' them as their brood. Freely incentivizing farmers to take responsibility in providing a habitat for endangered species, eventually leads them to adopt this care relationship as part of their identity.

11. Buffers – The sizes of stabilizing stocks relative to their flows

Buffers adjust the capacity of systems to absorb shocks (like reservoirs or inventories), helping them stay balanced longer under pressure. Yet as they in most systems take a lot of means to alter, it's usually a big investment to make a change in this way.

A clear physical example of a buffer is the enormous mass of the rammed earth walls in the Earthships (aardehuizen) we visited in

Olst. The mass of these walls stores a lot of heat. This helps keeping the temperature of the houses relatively constant over time, even as outside influences vary greatly.

A buffer example can also be found in regenerative farming. Because soil organisms thrive, soil health increases. This allows it to store more water: even after multiple weeks without water the soil is still moist enough for crops to sprout. This means less artificial watering and drainage is needed: an increased balance to withstand weather fluctuations.

10: Stock-and-flow structures – Physical systems and their nodes of intersection

Change the physical infrastructure (roads, pipelines, buildings) can significantly affect how a system behave. These alterations are often slow and costly, yet in the field of architecture we have extraordinary influence over these structures. They are thus at the core of our strategies and need to be considered thoroughly.

It's generally difficult to alter a building significantly after it's built: renovating with significant alterations in the 'system' is a costly practice. Yet because of the large influence on the daily behavior of a house, it happens a lot. Recently, 2 patio doors and 2 other window frames on the before single glazed back façade of the house I live in were replaced. This cost my landlord € 25.000,- , an investment that will take years to compensate in gas saving. Although resource-intensive, insulating walls and replacing window frames, underfloor heating and heat pumps are very impactful in changing the physical system of our house.

Although not a stock and flow system in a physical sense, eliminating intermediary parties in farming can be seen as a similar intervention. This is the primary concept of CSA (Community Supported Agriculture farms. By selling to the

consumer directly, these farms eliminate the distributer and the Albert Heijn and avoid them deciding and taking up a share of the price. This allows them to get a higher revenue on their produce, which can be used to farm more sustainably without significant increases in costs.

The CSA-approach creates a framework that enables changes much higher up in the system.

- Consumers learn where their food comes from, how it's produced, and how seasonality, soil health, and climate affect it. This contributes to leverage Point #6 – The structure of information flows

- Through collective ownership, CSA farms enable consumers to become participants and influence their food resource directly. This falls into leverage Point #4 – The power to add, change, evolve system structure (self-organization)

9. Delays – The lengths of time relative to the rates of system change

Delays in feedback loops are critical: if the influence of behavior takes a long time to become clear, it is very hard to respond adequately. This puts the system at risk of losing its balance. Once again this is a leverage point that is low in the ranking because it usually takes high investment to be implemented, yet it can have big effect.

This is a commonly addressed issue with climate change. Many experts argue that its effects unravel at a pace that is difficult for humans to comprehend. At the time we widespread awareness of its effects is established, the balance of the planetary ecosystem is already disturbed severely. This makes that much bigger interventions will be needed to restore it. (ref)

The principles of permaculture provide an ingenious example of systemic change by reducing delays. This land management approach was developed by Bill Mollison and David Holmgren as a more 'natural' approach to agriculture. The method was coined after studying indigenous practices and combining the knowledge of many early and mid 20th century explorations of no-dig and permanent farming. The basis of the practice it to eliminate as much artificial interference as possible. This can be achieved by thorough extensive system observation and learning-by-doing by the gardeners. This is possible because fertilizers and pesticides are eliminated to uncover ecological feedback loops. This allows farmers to quickly notice changes in their garden. Typical responses include the planting of companion species that - in symbiosis with the desired crop – manage pests. Over time, gardeners get to know these complex systems well and provide deeply tailored care. This results in highly diverse productive ecosystems that are resilient to varying external influences. This approach proves to work very well: after some years of balancing out, the need of interference (and thus the workload for gardeners) decreases significantly.

8. Balancing Feedback Loops – The strength of the feedback relative to the impacts they are trying to correct

The strength of feedback loops must match the forces they're trying to control. If impacts get stronger (like fishing technology), the controls must strengthen too (like fishing regulations). When feedback systems get overwhelmed or corrupted, the whole system breaks down.

Essentially, it's about keeping the correction mechanisms strong enough to handle whatever challenges the system faces.

At the Aardehuizen in Olst we learned more about these practices from Fransjan de Waard. As inhabitant and food forest expert[47], he manages the application of permaculture principles to develop a food forest in a nearby pear orchard. Years ago, the inhabitants reached out to the owner of the land. He recently passed away and his daughter, who would like to see a more sustainable future for the land agreed to let the inhabitants experiment on this plot. As the pear trees had been treated with a lot of fertilizers and pesticides before, they had performed very well. Yet after treatment stopped, their productivity collapsed and most of them died. This is typical in industrial farming. Because feedback loops provide inconsistencies in productivity, farmers try to eliminate their influences: they weaken the feedback loops. Yet this makes systems weak too: the trees had lost all their resilience as they became dependent on pesticides and fertilizers.

Fransjan thus decided to cut most of the trees down and start planting a resilient system: varied fruit tree species and many other productive plants and trees. Now, feedback loops still generate a lot of work. This meant that on a cold December day, we assisted him and some other inhabitants to remove unwanted species like young oak trees from the system. Active monitoring to identify 'feedback' allows Fransjan and the other inhabitants to tailor responses. By responding in a way that does not disturb these feedback loops, he is able to nurture a system that naturally balances itself out more and more. Eventually, the aim is to arrive at a point where interference is minimally needed: beneficial to both humans and ecosystem.

Image 8: regenerating healthy ecosystems with Zedi and Joaquim at the Aardehuizen, when you do it together it's fun even in the December rain! Own photo taken on 14-12-2024.

7. Reinforcing Feedback Loops – the strength of the gain of driving feedback loops

Reinforcing feedback loops are feedback loops that produce more of the same behavior with its behavior. For example: the more people catch the flu, the more they infect others, and so on. The more money people have, the easier it becomes to make even more through investments etc. Because these impacts can severely derail a systems balance, it's important to keep a close view on them.

A problem like this occurs in the Dutch housing market: there are more people looking for housing than there are houses available. This means the housing prices increase. The quickly rising prices attract investors with intentions to buy-to-let or speculate. This leads to further increase in housing prices, making the housing market even more attractive to investors. Combined with low interests that make it easy for people to get high mortgages and strict building codes that make it expensive to build new housing, this cycle creates an exponential self-reinforcing feedback loop that is difficult to combat.

Collective housing projects like Boschgaard have found a way to break this cycle. An inhabitant that strongly values fair economics – he recommend me to read all books by Thomas Piquett - told me about a strategy he helped develop in the Netherlands.

Inspired by the German Mietshäuser Syndikat, VrijCoop is a cooperative network for projects that aim to remove their housing from the private market. They provide a construction that organizes ownership through collective ownership rather than individuals. Each resident has equal voting power, regardless of financial contribution. Rent is paid separately from capital investments, and new members are not required to invest when joining. Residents manage the properties themselves—

handling rent, maintenance, and long-term planning. But as a partial owner, VrijCoop must agree on major decisions, such as buying or selling property. As rising housing values might make selling the property very attractive in the future, VrijCoop can protect the ideals against market incentives on the long term. A solidarity fund supports new and existing projects through financial and knowledge-sharing support.

6. Information Flows - The structure of who does and does not have access to information

Almost all sustainable communities I researched and visited understand the importance of sharing their knowledge to offset change.

Donna Haraway recognizes this too: she stresses the importance of storytelling: she advocates for showing the hopeful stories of communities that thrive in close relation with nature, instead of doomsday predictions that make us believe there is nothing we can do as individuals. Roanne van Voorst addresses how social media and celebrities have turned vegan diets from a movement of unpopular weirdos to an attractive and conscious way of cooking, gaining millions of views on Instagram.

For a few years now, I have been watching the YouTube videos op Project Kamp, an off-grid settlement in rural Portugal - this community introduced me to the idea of ecological living. Starting off with a few people, they brought some overgrown land and started living and farming there. Each year they invite people from all over the world to come and spend a season there. Together they undertake many sustainable projects like renovating the stone house ruins, fireproofing the forests and repairing the water management structure at the site. They help out the – mostly elderly – farmers in the area in exchange for

local vegetables and build tiny houses of reused materials. While doing so, they thoroughly document all their projects in attractive videos that show the fun of collective sustainable living. By inviting people to join them and by sharing their activities with over 700.000 followers, they spread information and enthusiasm around the world.

This happens at the Aardehuizen too. They know that they can be a great example, so they actively look to spread their knowledge. Students, policy makers and others who are in any way interested in the project are always welcomed. Yearly, a public festival is organized.

Image 9&10: Sustainable building knowledge sharing at the Aardehuizen, building with straw and recycled glass. Own photos taken on 14-12-2024.

Image 11: Sustainable examples at the Aardehuizen, zip-locks hanging out to dry. Own photo taken on 14-12-2024.

5. Rules – incentives, punishments, constraints

Alter laws, incentives, punishments, or norms that govern system behavior. New rules can shift how all the parts interact.

CSA farm Herenboeren Vlinderstrik is an excellent example of changing the rules of a system. Their model is to own a farm collectively among a group of 200 families or +- 500 mouths. To run the farm, a farmer is hired. Most farms in the Netherlands are owned by the farmer him- or herself. This means that farmers are dependent on selling the produce of their farm for their income. As farmers cannot influence the price at which they sell their produce, the goal of the farmers thus is to produce consistently at low costs to maintain a reliable income. The people I spoke to at Herenboeren Vlinderstrik, just north of Rotterdam explained to me that this is an important reason for farmers to fall into unsustainable practices: they use fertilizers and pesticides as an 'insurance' for a reliable income. At Herenboeren the farmers receive an income that is unrelated to the quantities they produce. They are paid by the families that own the farm to produce sustainably. Together they make decisions about the farming process, quality over quantity. When a poor harvest occurs, or it takes a few years to balance the systems at the farm, they thus don't have to worry about their income. This gives farmers time to listen to the ecosystems in which they operate, and search for a balance rather than enforce a reliable harvest.

4. Self-Organization – The power to add, change or evolve system structure

This is pretty self-explanatory: when the parts of a system have direct influence in its structure, they can shape it to fit their needs. This happens a lot in ecovillages: they often start out with a structure suited for the development process, and when they move in there are extensive sociocracic decision-making structures. Yet after a few years, these structures are often revised to be less labour-intensive, but inclusive nonetheless. Formats like this work well in smaller domestic community structures where it's possible for every voice to be heard.

Especially when living in a larger community, it is preferable to create clusters withing the overall group. When spending a day with Peter, an inhabitant of Boschgaard who has lived in different communities for over 40 years, he advocated strongly for this. It helps with forming closer bonds among members, therefore it gives people a point of reference within the community. It also makes the decision-making process more viable. Most intentional communities practice a form of inclusive decision-making that transcends plain democracy. To make sure that the minority is heard too, it's important to hear everyone's opinion and attempt to come to solutions that work for all members of the group.

3. Goals – the purpose or function of the system

Shift what the system is fundamentally trying to achieve. Changing the goal from, say, profit to sustainability can redirect the whole system.

At Lenteland they set a very clear goal to oppose the goal of traditional farming. They intend to build a farm system that can still be used in 200 years. This means careful soil management, but also the construction of a resilient organization and community to support the farm.

At Boschgaard's VrijCoop and Mietshäuser Syndikat, the goal is also clear: to create a system of affordable housing that can withstand market incentives.

2. Paradigms – the mind-set out of which the system – its goals, structure, rules, delays, parameters – arises

Transform the underlying beliefs and assumptions that shape the system. This alters every part of how the system functions.

These strategies I encountered everywhere. Letting people with different paradigms live together: some are really idealist (think extinction rebellion activists), some more pragmatist (think

incrementally adopting some sustainable practices) while others may have never thought about things in a certain way (think people that just like the green environment or the community qualities). Yet the way they worked together seemed really natural, everyone has a right to privacy and their own lifestyle, no-one is judged. By doing things together they gradually inspire each other, in an environment where it's possible to adapt to more sustainable practices. Their lifestyles inspire people around them: their families, friends and neighborhoods.

The lush open gardens, the playing kids, the welcoming people, the care for each other, the fun activities, the sharing of items, the cost efficiency, these values are universal in society, even without considering sustainability. They show that sustainable living in communities is fun and attractive. Together, they broadcast a new paradigm: it's possible to pursue happiness without economic growth and consumption. People can find wellbeing without welfare an without harming the planet.

Image 12: Introduction meeting at the collective gardening day at Geworteld Wonen/Warmoestuin in Rijswijk. Own photo taken on 23-03-2024.

Image 13: Collective sustainable decision-making at Boschgaard, organic potatoes from a local farmer in the shared food storage. Own photo taken on 15-12-2024.

1. Transcending paradigms

When a person transcends their paradigms, they start to understand what has been shaping their world view. They realize at a gut level what paradigms are, and understand that the reality of the world and universe are far beyond human comprehension. Through this research and my experiences this year, I started to

understand and transcend my own paradigm. But first, we have t go on with the exploration.

10.2Cobb Hill: the ecovillage founded by Donella Meadows

A few years before Meadows unexpectedly passed away, she started the development of her own ecovillage: Cobb Hill. Although she never lived there, the village was built and to this day, the inhabitants continue to implement her systems thinking in a search for sustainable lifestyles. Doing so, they share a lot of their knowledge, especially on organization and sustainable farming.[48]

"One thing I'm desperate to get funded (in case any of you have any ideas) is a super metering system for Cobb Hill. I want the Institute to be able to monitor all the flows through the community — electricity, water, heat — to see how these "green" homes actually perform, relative to each other, through the seasons, over the years."… "It will be invaluable data. I'm shocked at how few actual performance numbers there are for green constructions." [49]

On the blog of the Donella Meadows Foundation, Elisabeth Sawin, an inhabitant, notes that the upsides of ecovillage life significantly outweigh the downsides and that she is driven to:

"participate in more sustainability experiments than I could in ten lifetimes of solitary living" [50]

preliminary thoughts

This already makes it much more clear to me that the approaches in ecovillages are valuable. They intend to change the system,

they intend to inspire people and create precedents for new ways of living that are inherently more sustainable. They create grounds where people can change their paradigms and goals: high leverage points that can create lasting change.

Yet it's still difficult to value from a scientific perspective: how do you test this in a scientifically supportable way? It'd have to be measured.

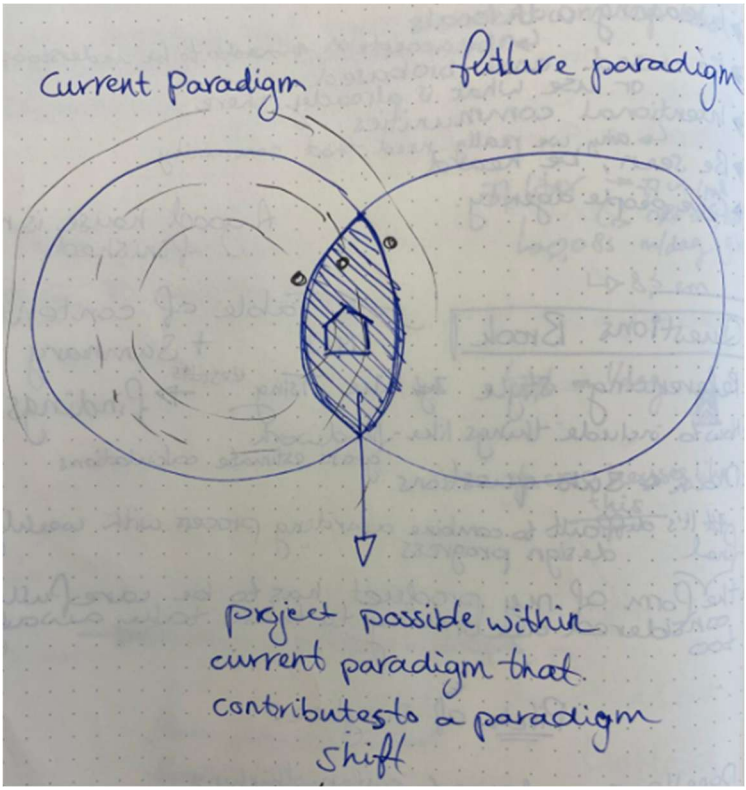


Image 14: Preliminary conclusion about a paradigm shift in my notebook

11 The adjacent possible: an iterative process of change

"What is actual now,
enables what is next possible"

- Stuart Kauffman[51]

When I showed my drawing of the paradigm change to Olv Kleijn, my architecture tutor, he said: you mean *the adjacent possible*. I had never heard about that, but it's exactly what I meant, and more.

11.1 life as an iterative process

A theory that originated in evolutionary biology shows that immense goals can be pursued at a small scale, and what strategy is needed to do so. This way of thinking, commonly referred to as the theory of the adjacent possible, essentially describes life on earth as a creative practice in itself. While the biology behind it already existed, the adjacent possible was first named by biologist Kauffman in the 90's. Steven Johnson later applied it to design practice.

With the theory of the adjacent possible, Stuart Kauffman compares biological evolution to human-made things. In influential book: The Origins of Order[52], he explains how everything new that comes into existence, comes forth out of things that already existed. Multicellular organisms could have never come into existence if unicellular organisms hadn't been there first. Yet because unicellular organisms were around multicellular organisms became possible. In a world where unicellular organisms are possible, under the right conditions multicellular organisms are thus part of the adjacent possible.

Through an extensive chain of evolutions, eventually the first humans started walking the earth. Yet at the time the first uni- and multicellular organisms were around, nothing could have ever predicted the existence of complex species like mammals. Referring to this chain of development, the adjacent possible captures all 'first-order combinations' that could follow out of everything that exists at a certain point in time and space. The course of history consists of a long sequence of possibles, each with its own adjacent possible.

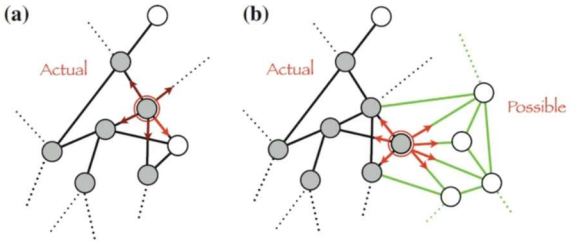


Illustration of the "adjacent possible" in a graph that conditionally expands from situation (**a**) to situation (**b**) when the white node in (**a**) is visited for the first time. Retrieved from Dynamics on expanding spaces: Modeling the emergence of novelties, 2016[53]

This can all be explained by Darwin's the origin of species[54], yet Kauffman adds another layer. He states that we must also consider the fact that the environment created by the elements in the actual, create a probability of survival for adjacent possible. He supports this theory by showing that multicellularity arose 6 times in a relatively short period of time 1,5 billion years ago. This means that the conditions for this development did not just make it possible, the conditions also made the development very likely. The evolution of scales into feathers also happened multiple times, just like the evolution of species that could fly and species that have eyes.

In evolutionary biology, this was further explored by Sewall Wright. He identified that the development of a certain species was, in a certain environment, much more likely to move in one direction, rather than another. Individuals of a population with certain variations or traits, that made them more successful at survival at the moment in space and time they lived, were much more likely to reproduce. This means certain adjacent possible traits were more probable than others. [55]

In biology this is also a limitation: species will evolve to adapt to the environments they inhabit, and lose traits that make them more resilient to more varied conditions. Evolution is short sighted: Adaptations that would greatly benefit a species, but would for some generations in between cause a decrease in reproduction chances, are less likely to occur. The path of evolution is not goal-directed but exploratory.

Yet with the limitation of not being able to predict the future, this makes evolution arguably the most creative solution of all. As life on earth evolves, it tests new prototypes and eliminates less successful ones: evolution in itself a design exploration.

When this idea is interpreted the other way around it can be made applicable in creative thinking. Steven Johnson explains this well in 'Where Good Ideas Come From' (2010)[56]. He states that the adjacent possible 'captures both the limits and the creative potential of change and innovation' (p.31).

11.2 The Adjacent Possible in the artificial

Let's explore these ideas through a local example. In the 16th century, people in (what is now) the Netherlands and Belgium started using horse-drawn barges (trekschuiten). One could argue they were a likely development at the time. Horses were commonly used as means of transport, the Netherlands had a rich network of waterways and a thriving shipbuilding industry. Horses were a much more reliable source of energy than wind for sailing on canals. So as demand for systematic transportation networks grew, the amount of people looking for solutions grew too. At varying points in history, the horse-drawn barge was 'invented' and used on multiple locations around the world. The first one in lowland western Europe was established on the Willebroek-Brussel canal in 1561, and was thus arguably part of a very likely adjacent possible. [57]

Image 15: drawing by Paulus Consantijn la Fargue, tow canal between Delft and Leiden (seen in background), second half if the 18th century. Retrieved from Atlas der Trekvaarten in Zuid-Holland

The horse-drawn barge proved very effective: it spread quickly throughout the lowland western Europe. Yet many existing routes were impassible with horse-drawn barge. Even if natural waterways were suitable for barges, adaptations were needed to navigate them efficiently. These necessary appropriations were for example implemented on the Vlaardingervaart in 1654. The canal, that was previously dug for water management, was

Image 16: how the network of tow-canals has shaped network of the Midden-Delfland region. In dark red, the existing developed areas around 1800 are shown. Retrieved from Atlas der Trekvaarten in Zuid-Holland.

provided with a towpaths and horse-drawn barge-specified jetties and bollards. All new things that came into existence as a result of these developments.

The horse-drawn barge offset more new development: the digging of new canals that were specifically for this use: the tow canal (*trekvaarten*). The tow canal and the horse-drawn barge thrived in symbiosis: around 1630 an extensive public transportation network was implemented in Holland: for the first time in history it was possible to precisely plan a journey. This was a revolution for the soggy-soiled region that was otherwise difficult to go around. Around 1700, 415 km of tow canal was completed. For over 2 centuries, the horse-drawn barge remained a primary means of transport for goods and people: according to estimations, in the second half of the 18th century it accounted for 68% of the transportation market share. One can imagine too that many other developments will have been offset by this sudden explosion of widely available and relatively affordable an reliable way to move around.

Yet the rise of the tow-canal and the emerging transportation market (quite literally) paved the way for other developments. The by then mostly paved tow-paths on the strong embarkments of the canals allowed for much more efficient movement by horse and wagon. One must know that before that time, there were hardly any paved routes. Going around by horse and wagon was very slow and uncomfortable. The paved road network led to the development of transport by horse and carriage to deliver mail and people much quicker than the tow barge. I imagine this on its turn contributed to the coming-to-extensive presence of paved routes, which kept developing incrementally. This might have eventually created the right conditions for the bicycle, that originated in France, to become so successful in the Netherlands.

With the invention of the steam engine another potential application arose for all of those rigid, easily maneuverable waterways. The invention of the steamboat was this so probable/incontingent that it was already though of before serviceable steam engines (1764) saw the light of day. The steamboat, also being much faster than the tow barge, quickly outcompeted the horses on the water in the late 18th century. By the mid of the 19th century, traveling by horse-drawn barge was considered somewhat archaic, and the numbers quickly decreased.

Today, when planning a trip from Rotterdam to Delft, I would never consider looking up the schedule of the horse-drawn barges. Nor would anyone with an entrepreneurial spirit consider setting up a service for that. Except for the canals and the roads beside them, all of the infrastructure has long disappeared. If it had never been invented in the past, it would be very unlikely in the present. Because of the existence of much faster transport by motorized vehicles over paved roads, there is no use for such a thing. Something that was a very probable and successful development in the past, would not make much sense in the present, it is no longer part of the adjacent possible. Yet its traces, among which 415 km of canal, are very unlikely to disappear any time soon. Moreover, its existence has paved the way for many things that eventually led to the things we use today, and thus continues to contribute to what is now the possible, and adjacent possible. Our history shapes our future.

11.3The adjacent possible in planning

In a system as complex as the world we live in today, one can imagine that the probability of one of the many things that exists in the present evolves into something new is very likely. Yet

another condition arises: the new thing must also be able to thrive in the world in which it comes into existence. If a new thing is not successful at thriving in the world it emerges in, it will disappear or go extinct very quickly. This happens all the time, not only with new things, but with things that have been very successful for a very long time. All creatures that were around in the early days of life on earth went extinct long ago as the environment changed because of all the new things, and was no longer suitable for the old things. The new environment also did not provide a the conditions for them to develop again.

An idea should be feasible in the now in order to exist. Whenever we cannot design something that directly leads to our imagined outcome, we should thus design something that will make our desired outcome more probable.

The adjacent possible idea serves as a base to implement existing design strategies better. It helps me to set a goal and explore how to achieve it without getting lost. Options of all kinds can be tested to the same theory and thus be assessed better. This will lead to a more effective design to finally reach the defined goal.

This is strange, we can apparently work on the problem without having actually defined it.

11.4 iterative problem-solving

Yet adjacent possible thinking has a more profound consequence to problem solving: it means that problems that can't be completely solved now, can be solved later if the right actions are taken in the present. Even if those actions are not specifically directed at achieving a certain goal.

This means that there is something like a problem that can't be defined, and can't be solved perfectly, or completely. Yet, we can still work on these problems.

In traditional modern science, this is wicked!

A thing I never realized was that behaving like a scientist inherently made you a bad designer.

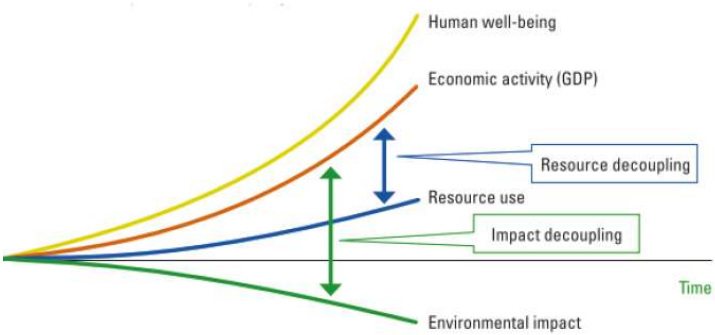
then I figured out that I was not the first to realize that science thinking can completely cloud the mind of a designer.

design is iterative, just like life.

12 systems-change arguments for engineers

Gaya Herrinton, of the Update to Limits to Growth, speaks about decoupling as a term for sustainable solutions that uncouple economic growth from harming the world. Renewable energy is a way of doing so. It is certainly effective, but Herrington notes that at this moment we are by far not doing enough[58]. Even if we reach a point where we are doing enough to not use any more resources, we still have to decrease our impact to withing the range of 1 planet instead of 1,7. Then, for every year we keep growing our economy, we have to keep decoupling.

Herrington, among many others, thus speaks about a second kind of decoupling: decoupling growth form wellbeing. If we change our system gradually, like the technological adaptations, our wellbeing might still grow while we stop increasing our accumulative consumption.



Conceptual approach to resource decoupling and impact decoupling Source: UNEP (2011).

I liked this ‘measurable’ approch because it helped me explain the idea of system-change approaches more tangible, less fuzzy and less threstening to my engineer-friends and family. Give it a percentage, and we can talk about it. And just a little bit of system change is not so scary. Incremental change is imaginable for most people, while a change of the system is very hard to imagine and leads to resistance or misunderstanding.

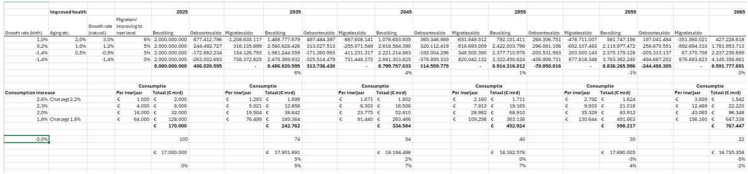
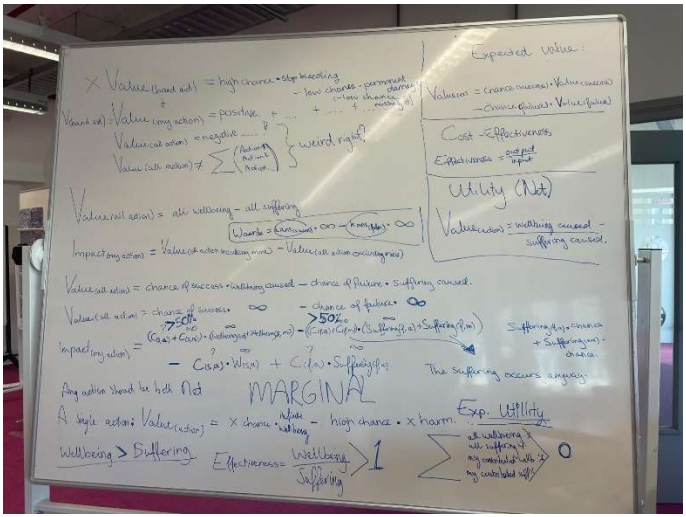
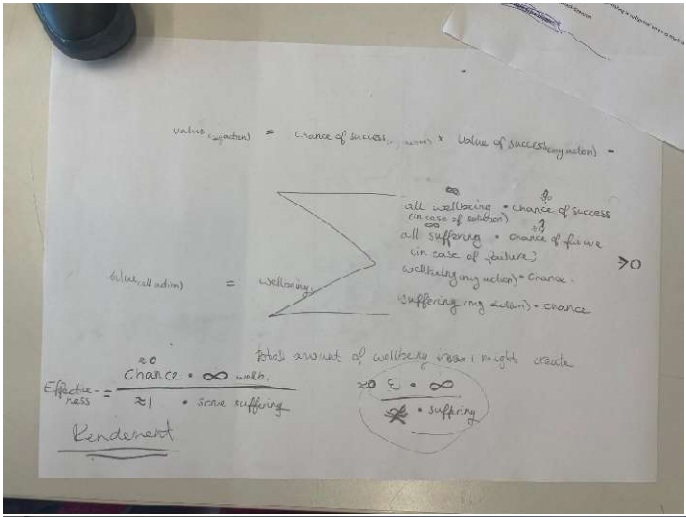
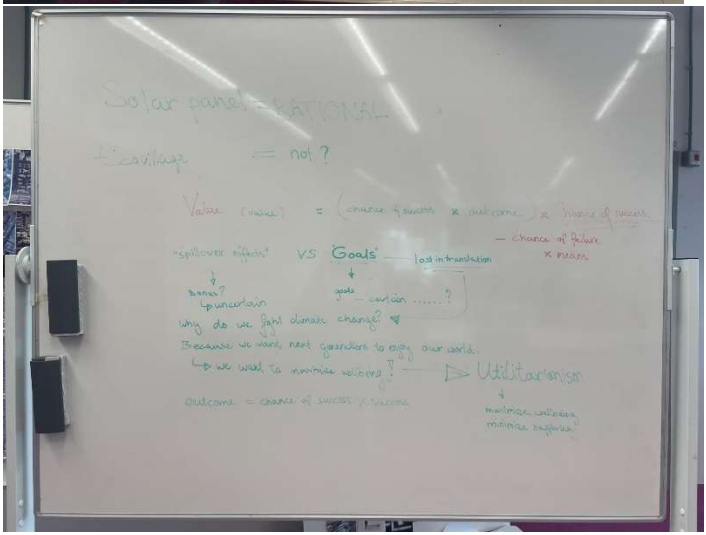


Image 17: When I explained the idea of decoupling growth from wellbeing and resource depletion from growth to my father, he immediately built me an excel model. Good news! if we decouple growth and rescources by 1,8% and decouple wellbeing and growth by 1%, we will survive according to this sheet. Model by: Steven Lugard.




Value (action) = Chance of success (action) * Value of success (action) -
all wellbeing • chance of success
(in case of solution)
all suffering • chance of failure
(in case of failure)
Value (all action) = Wellbeing
Wellbeing (my action) = Chance
Suffering (my action) = Chance
Total amount of wellbeing - weight create
Effective-ness = Chance • ∞ wellb. / ≈1 • some suffering
≈0 ∞ • ∞ / ∞ • suffering
Rendement


Solar panel = RATIONAL
Disadvantage = not ?
Value (action) = (chance of success x outcome) - (chance of failure x outcome)
"spillover effects" VS Goals — lost in translation
Why do we fight climate change?
Because we want next generations to enjoy our world.
↳ we want to maximize wellbeing? ▷ Utilitarianism
outcome = chance of success x success

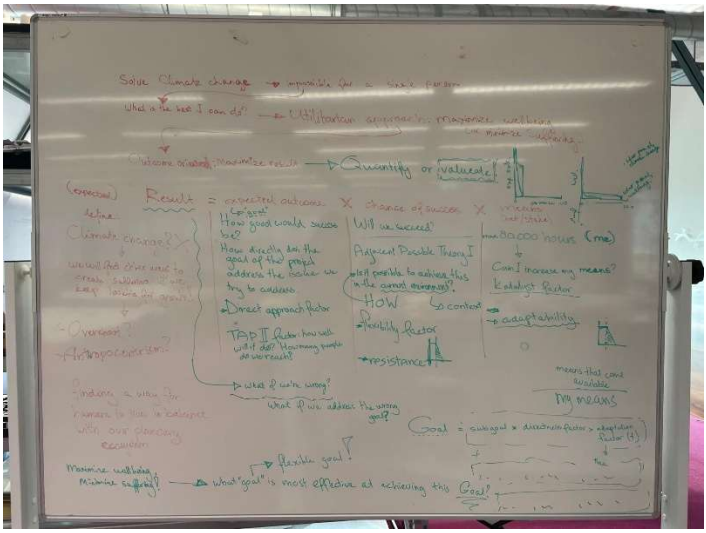


image 18-21: attempts at a mathematical proof for decoupling.

Here I tried to make a mathematical proof for systems-change as more effective solution than technological solutions. My math is a bit rusty and I did not use it in the end. Yet I think it's possible, but for now it does not make it more explainable. Doing math about the future is a bit speculative anyway. So I ended up abandoning the idea.

13 Wicked problems

And then I learned about wicked problems. They are problems that are in every way different from the problems we encounter in traditional science.

All along I was searching for one single truth, but that was precisely what was impossible. We're dealing with wicked problems here, of course: undefinable problems where the approach is completely, absolutely different from classical science. My studies just never made that clear to me.

wicked problems differ from normal science problems in every way.

1. The problem is not understood until after the formulation of a solution.
2. Wicked problems have no stopping rule.
3. Solutions to wicked problems are not right or wrong.
4. Every wicked problem is essentially novel and unique.
5. Every solution to a wicked problem is a "one shot operation".
6. Wicked problems have no given alternative solutions.

Yet to us architects, they are normal problems. All design problems are wicked. So we don't consider them wicked?

So then I got a bit frustrated. Why was this never made explicitly clear to me? The implications are huge! Why did I spend half of my year defining the problem?

With the most basic knowledge of wicked problems, it's very simple to reason that solutions like ecovillages and community

supported agriculture are better suited to tackle wicked problems: they are iterative in nature and don't define a specific problem.

13.1wicked problems in science

Wicked problems are "wicked" to science because they violate almost every assumption that traditional scientific methods depend on:

Well-defined problems vs. messy reality Science works best with clearly bounded, well-defined problems. Wicked problems like climate change or poverty are fuzzy - there's no agreement on exactly what the problem *is*, let alone how to solve it.

Objective analysis vs. value-laden questions Science aims for objectivity, but wicked problems are inherently political and value-laden. "How should we address homelessness?" can't be answered without making moral and political judgments about what society should prioritize.

Replicable experiments vs. unique contexts Scientific method relies on controlled experiments you can repeat. But each wicked problem is unique - urban planning solutions that work in Copenhagen might fail in Lagos. You can't run controlled experiments on entire societies.

Right/wrong answers vs. better/worse solutions Science seeks true/false answers. Wicked problems don't have "solutions" that can be proven correct - only interventions that are better or worse for different stakeholders. There's no stopping rule that says "problem solved."

Linear causation vs. complex systems Traditional science looks for clear cause-and-effect relationships. Wicked problems emerge from complex systems where everything influences

everything else, making it impossible to isolate variables or predict outcomes reliably.

Disciplinary expertise vs. transdisciplinary challenges
Science is organized into specialized disciplines, but wicked problems don't respect academic boundaries. Climate change involves physics, chemistry, biology, economics, psychology, politics, and more - no single scientific approach can grasp the whole.

This is why tackling wicked problems often requires approaches like systems thinking, participatory research, and adaptive management rather than traditional scientific methods alone.

These are approaches that are interdisciplinary. These are approaches that work in an iterative way: that sounds a lot like design!

This year was the first year I actually did some things that are part of an integrated design process.

13.2 A definition of the Problem

Because a wicked problem is so hard to talk about, especially in education seems important to provide clarity, I would like to propose a name for the wicked problem that causes climate change (and pollution and resource depletion etc.). Consider it a working title, a sticker on a clear window so that birds that don't understand windows conceptually, can adapt their behavior, and not fly into it.

It's merely there to address it, but let's try and make it useful too:

For the time being I propose:

Our Wicked Growth Problem

Our – refers to the fact that this problem is indeed caused by humans, yet it does not so much matter who caused it. It's a problem we, as inhabitants of planet Earth, are all faced with, and only through collaboration might we be able to take the right action. I'll leave open whether we include non-human species in this 'our', but at least we indicate that no autonomous individual can solve it. An essential part is that the term is ambiguous: something that's ours can, on one hand, be interpreted as our possession—how humans might view the Earth in the present. Yet it enables a paradigm change within the same definition: ours could also be interpreted in the posthumanist, kin-sense. Over time one could see in it the need for community action, intertwining, and familial care relations that might eventually transcend species. This refers to some posthumanist, emotional, intertwined aspects of the Problem: We need to 'stay with the trouble' to solve it.

Wicked – Wicked, of course, indicates the wicked nature of the problem: its resistance to being described and understood, its multifaceted consequences, its self-reinforcing characteristics, the fact that solutions are never right or wrong, only better or worse, etc. I think it's essential to have the word wicked explicitly in there, because we urgently have to avoid the diversion of focusing on a definable sub-problem. We need to keep the wicked Problem in sight, and this appears to be very difficult, so at least for the time being, a reminder every time we address the Problem might be in place. Yet it's really only wicked to scientists. To designers it's just a problem, which they approach with our designerly ways of knowing. But as long as that practice is seen as fuzzy, we may need this word for clarity.

Growth – Even though wicked problems cannot be defined, I think we must at least point at the problem in question in some

way. Just like the problem definition climate change stuck, a bit of tangibility makes anything easier to talk about and work with. It could be overshoot, like Rees defined, yet it's not a term that is widely known. Climate, pollution, resource, and any word that starts with eco- or bio- might be too similar to our current flawed problem definitions. Sustainability is a valid contender, yet the word has been so widely used that it has lost all of its meaning in contemporary discourse. It's used carelessly for solutions that have no long-term vision and nonchalantly for harmful greenwashing practices. Just system is too broad—there are too many systems. For now, I landed on growth, a reference to Limits to Growth and a direct invitation to reconsider our current system. Growth challenges us to look at what we have now: do we really need more? It also stresses that the Problem will keep growing, that any outcome is likely to be exponential and thus dangerous. To balance out the fuzziness of our, growth keeps it more rational, mathematical, and engineer-approvable. Lastly, in a wicked problem approach, there is hardly ever an instant, full solution. This means that solutions or approaches have to grow gradually too.

Problem – as introduced earlier, with a capital P, inviting anyone who strategizes by identifying a sub-problem to keep distinguishing between their definition and the overarching, underlying mess.

'Our' and 'growth' can, if it were up to me, be replaced by any other words to update the term if any other. More accurate specifications of the Problem arise or there is a societal need to point at it differently to approach it.

'wicked' and 'Problem' can only be removed from the definition if we manage to identify the complete nature of the problem. And, if Rittel and Webber are right, this will occur only after a solution is reached.

14 what is architecture at a technological university?

I had to understand what architecture is really about. For that I had to go back to the dictionary. I took out a pile of definitions that seem relevant.

These definitions are translated from the Dutch dictionary De Grote Van Dale. This is the dictionary used in Dutch education, so I felt these definitions are more suitable to speak about Dutch education then taken from an English Dictionary. Moreover, thinking in my own language helps me maintain critical clarity of mind when thinking and communicating about complex problems.

They were taken from a 1992 edition, more than 30 years ago. This makes the definitions possibly dated. Yet as the other books I learned so much from also all stem from before 2000, and I feel that the modern time may have clouded these knowledges, maybe in this case older is better. Furthermore, this is the dictionary that is available at this faculty, meaning that this specific information is available to this specific institution.

English Translation	**Dutch Term**
MSc – Master of Science	*MSc – Master of Science*
VWO – Preparatory Scientific Education	*VWO – Voorbereidend Wetenschappelijk Onderwijs*
WO – Scientific Education; university-level scientific and theoretical education.	*WO – Wetenschappelijk Onderwijs*
Academy	*Academie*

English Translation	**Dutch Term**
1 – a society for the practice and promotion of science 2 – college or university 3 – institution of higher education for training in a specific profession.	*1 – genootschap ter beoefening en bevordering van de wetenschap* *2 – hogeschool, universiteit* *3 – instelling van hoger onderwijs ter opleiding voor een bepaald beroep*
Academic – pertaining to or associated with an academy or university.	*Academisch – behorend of betrekking hebbend op een academie of universiteit*
Architect – a structural or architectural engineer; someone who designs building plans and supervises their execution.	*Architect – bouwkundig ingenieur, iem. die de plannen voor gebouwen ontwerpt en op de uitvoering daarvan toezicht houdt*
Architecture 1 – the art and discipline of designing and executing buildings. 4 – building; construction.	*Architectuur* *1 – kunst en leer van het ontwerpen en uitvoeren van bouwwerken* *4 – bouw, constructie*
Architectural Engineering – the science that studies the requirements for composing structures.	*Bouwkunde – wetenschap die de vereisten leert kennen om bouwwerken samen te stellen*
the art of building 1 – a major branch of the arts, focused on designing and erecting buildings. 2 – practical ability to erect buildings.	*Bouwkunst 1 – hoofdtak der kunst, tot voorwerp hebbend het ontwerpen en optrekken van bouwwerken* *2 – praktische bekwaamheid tot het optrekken van bouwwerken*

English Translation	Dutch Term
Education – instruction; the systematic and principle-based transfer of basic and advanced knowledge and skills by appointed, qualified teachers to individual or assembled (young) learners.	*Onderwijs – onderricht, het systematisch, volgens aangenomen beginselen, georganiseerd overbrengen van elementaire en uitgebreide kennis en kunde door daartoe aangestelde, bevoegde leerkrachten, aan afzonderlijke of daarvoor bijeengebrachte (jonge) personen*
University – institution for higher scientific education.	*Universiteit – instelling voor het hoger wetenschappelijk onderwijs*
Technology (technique) (2025) 1 – the operations or the entirety of the operations or actions required to bring something into being in a specific branch of art, craft, industry, science, etc. 2 – the totality of operations and actions that belong to industry and the applied exact sciences	*Techniek (2025)* *1 - de bewerkingen of het geheel van de bewerkingen of verrichtingen, nodig om in een bepaalde tak van kunst, handwerk, industrie, wetenschap enz. iets tot stand te brengen* *2 - geheel van de bewerkingen en verrichtingen die behoren tot de nijverheid en de toegepaste exacte wetenschap*
Technology (2025) 1 – the study of the processes that natural products must undergo to be made functional for industrial use; the study of operations and mechanical aids, and the methods associated with manufacturing 2 – systematic application of a science within the field of engineering or technical practice	*Technologie (2025)* *1 - leer van de bewerkingen die natuurproducten moeten ondergaan om ze ten dienste van de industrie te laten functioneren; leer van de bewerkingen en mechanische hulpmiddelen, van de methoden die met de fabricage samenhangen* *2 - systematische toepassing van een wetenschap in de techniek*

English Translation	Dutch Term
Science (1300) – knowledge, cognition, awareness, shared knowing, permission, communication, notification, judicial declaration.	*Wetenschap (1300) – wetenschap, weten, denkvermogen, bewustzijn, medeweten, toestemming, mededeling, kennisgeving, rechterlijk aanzegging*
Science (1992) 1 – the knowing of, the knowledge of, familiarity with something 2 – what one ought to know about something 3 – the knowledge of rules, laws, theories, hypotheses, and systems through which further knowledge is acquired 4 – knowledge in a specific domain; the humanities or the natural sciences, indicating branches of a specific field of knowledge 5 – the practitioners of science	*Wetenschap (1992)* *1 – het weten omtrent, de kennis, de bekendheid met iets* *2 – wat men omtrent iets weten moet* *3 – het weten van de regels, wetmatigheden, theorieën, hypotheses en systemen waarmee verder kennis wordt verkregen* *4 – het weten op een speciaal gebied, de geesteswetenschappen resp. de exacte wetenschappen; ter aanduiding van takken van een bep. gebied van weten* *5 – de beoefenaars der wetenschappen*
Engineer (until 2002) 2 – Holder of the highest academic degree from a technical university or an agricultural university 3 – Graduate of a higher technical school, textile school, agricultural academy, or the polytechnic division of a university of applied sciences	*Ingenieur (until 2002)*[59] ***2** - bezitter van de hoogste academische graad van een technische universiteit of landbouwuniversiteit* *3 - afgestudeerde van een hogere technische school, textielschool, agrarische academie of polytechnische afdeling van een hbo-instelling*

Today, central words at our university have completely changed meaning.

Since 2002, a more central system for European education was coined, making the title ‘ingenieur’ go extinct.

The Wikipedia definition is more current:

Engineer (Wikipedia, june 2025)
A "ingenieur" is a highly educated technician who uses, develops, and applies scientific knowledge in the design of products and services that solve technical, scientific, technological, and organizational problems.

Ingenieur (Wikipedia, june 2025)
Een ingenieur is een hooggeschoolde technicus die wetenschappelijke kennis gebruikt en ontwikkelt en toepast in product- en dienstontwerpen die technische, natuurwetenschappelijke, technologische en organisatorische problemen oplossen

yet the original etymology of "ingenieur" comes from Latin *ingenium* - meaning "invention, artifice, natural capacity, talent" - which sounds much more like what Cross and Lawson describe as "designerly ways of knowing" or “design thinking” than pure scientific method.

Just like Technische Universiteit was translated into a University of Technology. We now interpret it like this: *institution for scientific education* of *a systematic application of a science within the field of engineering or technical practice.*

rather then an education of technique*: the systematic and principle-based transfer of basic and advanced knowledge and skills by appointed, qualified teachers to individual or assembled (young) learners* about *the operations or the entirety of the operations or actions required to bring something into being in a specific branch of art, craft, industry, science, etc.*

I have the feeling that I may have been a cause of the lack of depth in science.

14.1education with a mission

However, due to my chaotic education at TU Delft, it took me a whole year of intensive self-study to realize this. But not everyone is as crazy as I am. Most people simply conduct a brief investigation and don't ask these questions. Imagine if many more future designers miss this insight — wouldn't that be terribly unfortunate?

But, assuming for a moment that the TU Delft Architecture program (ranked #3 in the world) values its leading position in the scientific world stage as much as I do, there might be an opportunity to say something about this: it's a chance for TU Delft to demonstrate its critical stance.

With TU Delft's mission: "Impact for a better society," and its strategy: "As TU Delft, we want to contribute to solving societal challenges through high-quality education, research, and innovation activities."[60] (see:), there might be reason to make this claim.

If the education at this faculty of Architecture were to truly pursue *'impact for a sustainable society'*, it should pay close attention to ensure no student could go through the education without having to transcend this paradigm.

TU delft takes on a responsibility to pursue impact for a sustainable society

This makes me wonder why, having gone through the entire curriculum of the Architecture bachelors and masters track at TU Delft, the notion of wicked problems has never been brought to my attention, and only in my graduation year I have stumbled upon it by coincidence?

And rather, why does one of the most notable Architecture faculties worldwide still incentivize their students to present plain

problem-solution loops, rather then educating them to …… wait. Doesn't our faculty already teach this?

We do learn to identify a problem each time. A problem definition to move around the fact that we cannot define the underlying Problem.

We do indeed have to go through an iterative design process. One that I have resisted all my education. I keep believing that, in my superiority as an objective thinker, I can come up with something perfect in the last minute.

It's a societal challenge that has been around as long as human history. Persistent enough to have already been relevant to Socrates in his time, the 5th century BC:

> "Socrates distinguished himself from the sophists on an important point. He did not consider himself a sophist, that is, not a learned or wise person... No, Socrates called himself a 'philo-sopher', in the true sense of the word. A 'philo-sopher' actually means 'someone who strives for understanding'... So a philosopher is someone who realizes that he does not understand many things." (Gaarder, 1995, pp. 79–80, author's translation from Dutch edition)

We learn to 'think critically', but we learn to do so in the straitjacket of *science* thinking, not *design* thinking (or a more integrally defined e*ngineering* thinking). This means if we manage to practice design thinking, which includes ill-defined problems, iterative processes, intuition, interaction with research subject instead of distance

This raises questions about whether a technical university can be critical enough to reveal non-technical solutions if those solutions are in fact better.

I think one possibly impactful way to improve our approach to the big problems of our time could lie in addressing architects' lack of knowledge about wicked problems.

This is my interpretation. In summary, I would almost say it makes sense to spark a kind of small scientific revolution, or an education revolution. It seems that this could seriously have an impact on achieving the necessary change in our system and giving humanity a better chance at sustainable well-being in the future.

14.2 my paradigm implosion

I also understand why I didn't really get it before. The current system makes it almost impossible to look for it: if you believe you're right and science keeps confirming that, there's no real reason to keep questioning. If you think you have mastered the best method—the one that generates optimal answers—it's no longer obvious to be self-critical. This system sustains itself: science is becoming less and less self-critical. But if you try to find a radically thorough answer to a wicked problem while sticking to today's scientific norms, you have to make your question bigger and broader. Then you start to physically experience that resistance.

In addition, the entire Dutch education system has a hierarchy: the higher level, the most prestige, is science, exact science. The better you are at filling into that paradigm, the more it rewards you: high grades, programs for excellence, great job opportunities. Recently, a book about this issue hit the shelves: The Bermuda Triangle for Talent. It explores how students that excel tend to end up at big consultancy firms, that make their money with very little integrity. Yet they continue that exact system of education: a place where you can measure your excellence against others. A rat race.

Isn't it the same in science? Somewhere down the line, embedded in the principles of science methods, didn't we start valuing prestige over quality? Absolution over relativity? High Tech over Low Tech?

I was part of that rat race: I wanted that 9. Over the last months I visited the student counsellor a couple times (he granted me consent to write about this). He asked me bluntly: why do you want a 9? Well, because I work hard and I'm smart, I told him. He told me that he had struggled with that too. He was an excellent student, and after graduation, he had struggled with that a lot. Then he told me that I should not forget that the Technical University of Delft is a research institution, a scientific research institution.[61]

In my experience, which just dawned on me at the beginning of June, weeks before my P5, science today suffers from a kind of dominance of overconfidence, which, in my experience—and I sense also at TU Delft and in the scientific community—leads to feelings of superiority and arrogance.

When my peer-students present ethnographic research findings, I did really find them bad students: they are either unethical (they present anecdotal data for science facts) or they don't understand how to 'science' correctly. I now understand how arrogant that was.

This science-paradigm led me to completely misunderstand what I had to do at this university. I kept proving myself to my teachers, instead of listening to them or learning from them. I did my projects with a lot of analysis, very little design, a lot of nice image making and very little reflection. And each time I was rewarded for doing so. So each time my planning got worse. I did not sleep, I did not take breaks.

The methods I learn in my studies are, in my experience, totally inadequate for training students trapped in that science paradigm to become skilled designers capable of solving the big problems of our time. We learn nothing about these topics: undefinable wicked problems, iterative processes of trial and error. We are just thrown into the pool and expected to figure it out as we go. Or that's how I experienced it at least.

Every time I opened a book like Kuhn, Rittel & Webber, Herbert A. Simon, Lawson, or Kauffman, I was completely confused. These books have been sitting on my university's shelves for decades. So why do we do so little with them? But I can also imagine that they're only moderately understood by pretty much everyone at the faculty who just wants to do their job, complete their studies. You really have to throw yourself into the deep end to make sense of them. After that, you probably can't just explain it to others who haven't been in the deep end.

These books, and some papers that are in the same wicked problems and design versus science methods, are among the most cited works ever written[62]:

"Dilemmas in a General Theory of Planning", Horst Rittel & Melvin Webber (1973), 28 000 citations
Introduced "wicked problems" - complex, ill-defined problems that can't be solved through traditional scientific methods. They showed that social/design problems resist the linear problem-solving approach that science demands, requiring instead iterative, participatory processes that embrace uncertainty.

The Sciences of the Artificial, Herbert A. Simon (1969), 38 000 citations
Distinguished between natural sciences (studying what is) and design sciences (creating what ought to be). He argued that design thinking involves "satisficing" (finding good enough solutions) rather than optimizing, directly challenging science's pursuit of perfect, objective answers.

The Structure of Scientific Revolutions, Thomas S. Kuhn (1962), 162 000 citations

Revealed that science itself operates through paradigm shifts, not steady accumulation of truth. He showed that scientific "progress" is actually discontinuous and that dominant paradigms can become barriers to seeing new solutions - exactly what I experienced with "science-paradigms"

"Designerly Ways of Knowing", Nigel Cross (1982), 7200 citations

Established design as a legitimate third way of knowing (alongside scientific and humanities approaches). He argued that designers naturally think through synthesis and abduction rather than analysis and deduction, validating your intuitive problem-solving methods.

How Designers Think, Bryan Lawson (1980), 7600 citations

Demonstrated empirically that designers and scientists approach problems fundamentally differently - designers work through solution-focused, iterative processes while scientists work through problem-focused, analytical ones.

Now that I realize this, I feel like I could suddenly handle many things I found very difficult much better. I see symptoms of this pattern everywhere I go and stand. One moment I feel like someone who can see through *The Truman Show*; the next moment, I felt like a crazy conspiracy theorist. That's how deeply I experience the realization that—even with an infinite amount of time—I really can't find a perfect solution for everything, like suddenly realizing after 27 years of going to church that God doesn't exist.

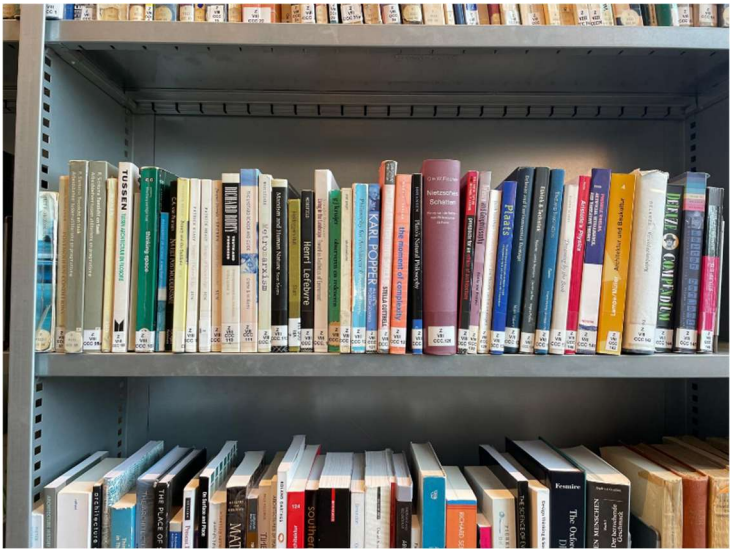


Image 17: That shelf at our faculty. Maybe, one day, I will read them all.

And then I found it, one big dusty shelf at our faculty library, full of works of authors who question science as the one approach that will help humanity solve all of her problems. It's apparently not uncommon for scientist to loose their faith in science. Loose their faith as in: transcend the paradigm. They stop trying to prove themselves to the system.

For example: this is why, when you take a look just at Kauffmans (the biologist who worked on the adjacent possible) book titles, you see that he came to the same conclusion: the answers that can be found through traditional modern science are limited, and believing in science as the only good way of acquiring knowledge may limit humanity from going further.

The Origins of Order: Self-Organization and Selection in Evolution (1993)

His foundational work on self-organization in biological systems

Written for specialists, called "a landmark and a classic" by Stephen Jay Gould

At Home in the Universe: The Search for the Laws of Self-Organization and Complexity (1995)

Popular science version exploring how complex systems emerge from simple rules

Explores the idea that life may be inevitable rather than accidental

Investigations (2000)

Examines the emergence of autonomous agents and biospheres Reinventing the Sacred: A New View of Science, Reason, and Religion (2008)

Argues that complexity science can bridge the gap between science and spirituality Reinventing the Sacred by Stuart A.

Explores how natural creativity can be a source of meaning and wonder

Humanity in a Creative Universe (2016)

Further development of his ideas about creativity and emergence in complex systems

A World Beyond Physics (2019)

His most recent exploration of complexity theory and its implications

So, in the past few weeks, after p4, I realized that I had been doing it all completely wrong.

Each project I'd been analyzing forever, then try and give absolute answers to my teachers. I wanted to defend my project like a scientist, not learn from them. Doing so I designed very little, and made a lot of pretty images along the way. That got me high grades, but did I earn them? I did not design very well. The only limitation needed to make design for wicked problems viable: a time frame, I cannot deal with at all. I stay up multiple nights in a row for every design course I have taken. Each time I get rewarded for that. Each time it gets worse. I can't plan or multitask.

Yet now I know why, so maybe I can learn.

14.3 The position of architecture

Architects hold a special position within the current system: as design-based engineers, we operate in the discrepant space between the measurable and the immeasurable, the objective and the emotional, the scientific and the domestic. We frequently encounter situations where certain uncertain, hard-to-measure solutions intuitively feel much better than the measurable, 'certain' ones. We also struggle with this, but we're only rewarded when we suppress that feeling—because in our society, certain answers are valued more than uncertain ones. So we accept it as something inexplicable, and we don't question it: it's just the way things are.

If, like me, you approach architecture with a science mindset, and you believe in certain, perfect answers, you inevitably start to experience all sorts of paradoxes. But as far as I've been able to explore this with my limited abilities, it now seems that these paradoxes may at least partially be symptoms of the dominance of the science paradigm in our education system.

Moreover, our field is inherently interdisciplinary—we are trained to look broadly—and deeply contextual: unique solutions for each location. That gives us even more reason to train designers who can carefully engage with wicked problems, and who can reason in ways that make our solutions taken seriously. Of course, we'd be best equipped to do that if the dominance of the science paradigm were somewhat diminished. But maybe that's too ambitious.

14.4 thoughts

I don't have time to formulate this story anymore, but I conclude that the term Master of Science and University of Technology completely misaligns with what we learn here at this faculty.

And, for that matter, with what the role of architects could and should be in our time.

My paper is a mess and I know that. But science in this format is not very helpful anyway. This paper will have no impact, no one will read it. I'm better off taking a learning experience than create a product for a grade that I don't want anymore. Because what's the point of a prestigious grade if I have the feeling I did not earn it, because I did not learn how to design. I don't want a 9 for being a bad designer because I try to be a scientist.

in a way, my research was iterative too. I just started searching, going to people whom I thought could help me for answers, to test my hypothesis. These people I found anywhere: at university, in fieldwork, at home. For my hypothesis I found support in literature, and gradually went on to understand a system quite essential to my future: my own designing brain.

I learned a lot of valuable things here at Architecture, but most of all from all the other people I met this year. They showed me that not all solutions have to be technical, that systems-solutions are really a great idea.

15 discussion

If I look around me, I see more and more of my friends at the faculty and other engineering educations at this university, that are wondering how they can contribute, and then move on to work at harmful companies to fit in with the status quo.

So if I may make a very dramatic statement, and please criticize me if you don't agree:

We, the younger generations, are learning to function within a system that we intuitively feel is not right for our future.

Of course we see it. The world we grow up in is cracking at every seam. And so we make increasingly desperate leaps to squeeze ourselves into that mold. Then it suddenly doesn't seem so strange that I need alcohol, coffee, social media, and self-diagnoses like ADHD, imposter syndrome, perfectionism — and countless other distractions — just to live with myself.
If I think I have to provide a perfect answer, while deep down I already know I can't, how am I supposed to take responsibility for what I create? Then I *am* a fraud, aren't I? Isn't it then logical that I remain stuck in analysis, distracted, because my intuition tells me my analysis is too shallow to offer a complete answer? Isn't it natural that I start looking more broadly?
Being distracted, showing avoidance behavior — that's actually very natural. My intuition understands that my answer is incomplete. But with all the scattered fragments I find, I'm still unable to offer perfect answers to the questions being asked of me. No one ever has.
If I behave like an honest scientist who promises certainty, I cannot be an honest human being. Because I don't know for sure — and I never will. But after 27 years of education, I do know this: in its current form, it will not help me become a good

person. It doesn't help me answer the questions I instinctively want to ask.

These are intuitive questions like:

- How do I become a good architect? How can I take responsibility for my designs if I don't trust my own decision-making?
- What is actually wrong with the world, and how can I, as a person, contribute to making it better?

Because as an architect, you definitely have a serious impact on the world. You shape people's living environments — the space where their lives unfold is structured by your design. To do that, you also need materials that we *know* place a heavy burden on the planet.
I consciously view "the world" or "the Earth" as a whole. It is essentially a system in which everything is interconnected — if I move something here, it changes something there. That might sound vague, but that doesn't make it unimportant.

This responsibility, in my opinion, should lie with someone who is competent and trustworthy. But how can I be competent and trustworthy if I'm a bad scientist? How can I justify my own integrity to myself?

Graduating from this faculty is a deeply personal test: for a whole year, you are fully responsible for the process. Your teachers guide you, but you have to do it all yourself. That's a major trial — especially if, like me, you feel like a fake designer. Somewhere, I felt like this was the last chance to save myself. Maybe that's why all these questions came to the surface now. Maybe that's also why I accidentally tried to answer these exact questions.

The assignment is twofold: a research and a design. And in the research, I unconsciously kept trying to secretly disguise my intuitive, big questions as a "clear" research question with a neat little study.

My first question was:
What is the role of housing in the development of local communities that care for ecosystems?
But if you're a scientist and try to answer a question that actually needs to be addressed with intuition and subjective exploration — but you use stoic analysis and objectivity — then of course you're never going to get anywhere.

So just like with designing, I subconsciously kept expanding the question. That's what you do when the information isn't complete and you're trying to be a scientist.
That conflicted with the demand to "focus." But I still had to submit something now and then. So I'd spend weeks structuring, formulating, reasoning, trying to build a scientifically sound story with a traceable, logical answer.

But I couldn't. Not in integrity.
Because the methods I chose:

- Reading posthumanist speculative literature about the human–nature relationship

- Doing ethnographic research into people who, in their own context, do something good for nature
  ...these are not "scientific" in the conventional sense.

They cannot be performed by an objective, detached researcher. The literary works are not scientific, and ethnography requires a relationship with the system being studied.

Unconsciously, in my quest to be an "honest scientist," I started searching wildly for answers. Without a clear method — even though I had written one in my research proposal, I completely ignored it.

What I *did* do was constantly try to trace back the cause of an experience.
Because I was repeatedly told to focus — while I couldn't, because I didn't yet have all the variables, and couldn't give a "perfect" answer — my subconscious started resisting. I began procrastinating more and more:
Watching hours of YouTube videos about people doing good things for nature.
Reading endlessly about eco-villages, permaculture.
Learning about the context of my design by talking to people.

Maybe others feel the same. Precisely those who carry the integrity to **resist** the current systems. They sense these systems won't help them find the answers to the big questions of our time.

To develop myself properly, I would love to have a place where I'm allowed to investigate all the questions I instinctively want to ask. Whether through science or through feeling — preferably both.
After all, humans have always used both reason and experience to survive within the system they're part of.

That place must be one I can trust. A place that welcomes my experience, my criticism, my feelings, my wild leaps.
Can I trust education to help me? Can education be the **honest system** that helps humanity find its path forward? Can education be the place that helps me collect the kind of knowledge I need to make wise choices?

Right now, it gives me knowledge — but there's too much of it to make sense of. It's too detailed, to disciplinary. What I want is wisdom: a developed intuition to find the right knowledge.

Wouldn't it be good if education positioned itself as a space that helps young people develop both analytical skill and intuition to make good choices — rather than only performing stoic, hyper-specific analyses that only describe the past and present?

Is that really the best way?
I believe our best chance lies in helping all people work together toward a better future.

Because we live in a unique time. The influence of human activity on our global ecosystem is so profound that we can demolish it. For the first time, it's becoming nearly undeniable that humanity can only continue to thrive by pursuing its collective interest as a species. What is humanity without nature? A finite system. We must open ourselves up to nature again. In order to pursue our interests we must pursue the interests of all life on earth.

It's likely that can only happen if we start picking up the pieces and regenerate our ways of life. Our parents might live in more prosperity than we might ever, yet maybe we will be the first generation that adopts a global goal: to work on a future of wellbeing for all life on earth.

To me, the most reasonable reality is this: I must use my intuition, knowledge, and critical abilities to serve the common good of all life on Earth.

I can't give perfect answers — but through iteration, the world and I can learn to understand each other better and better.
I don't need distraction, or wealth for that. I feel I am doing

something good.
That, I think, is the most natural reason to be happy.

Science, education, governance, the digital world — these are all powerful and valuable systems that can help us build the future. But to do that, I think we must stop confusing these systems with **truth**. We must stop trying to just function inside them, or blindly believe in them.

We can start **using** the systems we've created — as tools — to apply our survival instinct, which I believe is almost a force of nature, toward the **greater good of life on Earth**.
To do this, we must make mistakes.
But we can learn.
So, over time, in an iterative way, maybe, we can teach ourselves — step by step — to live with nature.

When I stopped believing in science, I became able to use it, whenever I sensed I needed it. I will no longer try to prove myself, I can just work on solutions that I, with my critical thinking, personal intuition, and awareness of the limits of my knowledge, will make better over time.

16 conclusions

There was no knowledge gap, all the information needed to figure out why ecovillages are better solutions than solar panels was already out there, standing on the shelf since before I was born (1997)

With all of this new knowledge, a literal new way of thinking, I can draw some conclusions, answers to my questions:

What makes a good architect?

If you'd ask me now, a good architect is not only a good scientist, but much more:

a good architect uses:

- **Analytics** (science methods, critical thinking)
- **Emotion** (intuition, feeling, communication)
- **Knowledge** (from science, education, everywhere)
- **Iteration** (the creative, reflective trial and error process that naturally helps us to make good solutions)

to work on projects that are functional in the now, and work on a futures of wellbeing in for all life on earth.

How can I make good decisions?

If you'd ask me now, good decisions, as in good for the world, depend equally on skill and integrity:

By keeping integrity as a good person that is willing to put the wellbeing of life on earth in the future over their own prestigious achievements in the present.

And by working as a good architect.

What is actually wrong with the world, and how can I, as a person, contribute to making it better?

A problem I identified is that we are clinging to science a lot, and science provides us with small answers and measurable solutions. Yet maybe with this hyper-focus on specific solutions, we've forgotten to look at the grander scheme: at the system that causes the harm.

I can contribute in many ways, and I must not forget to look beyond my own disciplines: beyond architecture, beyond science. As a person I could address this issue right here, in education. Maybe I can raise my experience somewhere, see if I can make a change so that students after me will learn these things better. Maybe I shouldn't be an architect after all, and see where I can make the most impact.

And lastly: Why are ecovillages better than solar panels?

Because they function as small spaces in which the paradigms of our current system are less persistent, creating space for people to open up their mind to desirable examples of sustainability. Rather than solar panels, that are harmful to produce and only limit harm for a temporary time, their impact could lead us to futures of human wellbeing in balance with nature.

or at least, that's how I experienced ecovillages.

And to finish: possibly the best advice I heard this year:

In a podcast, the architect of Boschgaard, Cesare Peeren of SuperUse Studio, advises listeners to spend a year to read all the

books you ever wanted to read, if they ever can afford to take a year off.

I'd like to add: spend a year answering the big questions you have, read books, write, talk to people that amaze you, design: do a graduation project, but do it to learn, not for a grade.

Appendix A: Complexity and incentive to hide harms

As a result of an extensive chain of developments, human creations have, like nature, started to exceed our capacities of comprehension. An average human is in touch with so many different ideas, products, systems and technologies every day that it would be impossible to understand everything. Although it is in theory a good approach to 'question everything', this would in practice leave us to never get anywhere. Yet in the complexities of our daily lives we do loose track of the origins of the things in our lives. This comes into play when walking in the supermarket: when I would have to learn about the origin of every single item I find there: where it grew, the CO_2 that was emitted to get it to the supermarket, the fertilizes and pesticides that were used, the employment conditions of all the people involved in the production and transportation process etc., I would need a year just to buy a single pack of rice. The same is true for building materials.

This complexity also makes it easy to hide misdoings in production processes. Even though we think we have a lot of regulations to protect us from misdoings without every individual needing to know about it, our system is so complex that it's hard to keep up, even for governments and experts. For example, think about the large scale cover-up of PFAS emissions journalists from the television program Zembla recently uncovered. For a long time these chemicals ended up in our drinking water. Our water sanitation system, which is supposed to be among the most advanced in the world, does not remove this. Until recently, they did not even measure it. Another example that received a lot of attention is the presence of pesticides in our environments. Most humans did not consider this issue for decades, we learned it to be 'normal'. They have

been widely used on our foods for as long as most humans alive today can remember. Yet the large-scale influence on our bodies and ecosystems have only recently come to our attention: a very long feedback loop. By now our system is so dependent on it that most people believe that our food security depends on it. A last recent trend is the awareness about microplastics in tea. It appears that tea bags are made with microplastics which dissolve in hot water.

How do we navigate this system? I don't have the answer for that. I'm among the people that tries to think, tries to question, but gets lost all the time. This leads me to endless time wasted on not finding a definite answer after all. Trademarks attempt to address this issue, claiming expert assessment of products to alleviate the consumer or buyer of that burden. Yet a lot of trademarks are associated with deceptive language and greenwashing. For example: a bottle with a trademark saying 100% recycled and recyclable plastic, could in fact be produced without recycling any pre-used plastic products and consists of at least 25% 'virgin' plastic[63]. This means I'd still have to research the assessment strategies of all the trademarks involved with everything I use.

Appendix B: Report Visit Aardehuizen 14-12-2024

We started with coffee in the Middenhuis, where we met Gerard, Fransjan, and Ted, three residents of the Aardehuizen. We explained what our research entails.

The work we helped with involved digging up young trees in the pear orchard. The pear orchard used to belong to a farmer. The residents of the Aardehuizen had previously been in contact with the owner. When the owner passed away, and the land came into the possession of the farmer's three daughters, one of the daughters reached out to the Aardehuizen. She wanted to offer her part of the land for future-proof use. The pear trees were so dependent on pesticides that they became diseased and stopped producing pears after pesticide use ceased. Now the land is managed by the residents of the Aardehuizen, who are working to plant a food forest.

We dug up young trees (seedlings) of various species that do not fit into the food forest. These trees were temporarily heeled in to keep them alive. Later, they will be planted in locations where new trees are needed via the "Meer Bomen Nu" program. This is a beautiful example of how the Aardehuizen in Olst are having a broad impact.

About the relationship with the outside world:
It was mentioned that the community is often quickly perceived as a closed-off group by the surrounding environment, making it important to think carefully about this. Behavior that people in the area might find strange reflects on the entire neighborhood. For example, one resident had a new relationship and sometimes walked naked through the garden. Even if the residents of the Aardehuizen themselves do not have a problem with it, it is

something that needs to be discussed. This is because the residents of Olst could develop a negative perception of the entire group.

About the activities that arise from the Aardehuizen in the immediate vicinity:

- Ask for a map of the impact of the Aardehuizen (Fransjan).
  Many projects arise from the Aardehuizen, and other projects are supported. People from the surrounding area regularly help with volunteer activities in the landscape. Active communication is maintained with the municipality and local landowners to make agreements about land management.

Sustainability influences among residents:
Interest and knowledge about sustainability, ecology, and biodiversity are shared among residents. For instance, Gerard mentioned that he is very interested in birds and has recently started regularly writing emails to inform interested residents about bird activity in the neighborhood. This has already led to several residents purchasing binoculars.
It is emphasized that the residents try not to judge one another and only inspire each other toward more sustainable choices in a positive way.

Organization:
It is important to know and inspire people within the municipality. Having a few officials who truly support the project is helpful. The political climate also plays a significant role. Sociocracy is used to make collective decisions. Stubborn and determined people are needed to achieve this.

Self-building:
About the process of self-building and organizing the project:

Residents got to know each other through the self-building process. It saved costs, and few contractors are willing to take on such projects. Because of self-building, Gerard is now much less afraid to make changes to his house himself, even though he was not a handyman before. However, it was difficult to plan for all future residents to be present for the promised one day per week during construction.

Homeowners Association (VvE):
After construction, many houses had defects. However, not all residents wanted to solve these problems collectively, and some did not want to address them at all. As a result, the VvE was partially dissolved. Everyone who wanted to address the issues resolved them individually. For example, wooden columns that extended into the foundation began to rot. The defects in the houses are now resolved individually by the residents, who often help each other with practical tasks and repairs.
One drawback of private homeownership is that you are never guaranteed who will move into the neighborhood. It depends on to whom the current residents sell their houses.

Broad impact:
Two other neighborhoods in Olst have now followed the example of the Aardehuizen. The Olstergaard and another neighborhood are also working on sustainable building and communal facilities. A shared car system is being set up across these three neighborhoods. Thousands of volunteers stayed at the campsite during the construction phase and helped with building. According to the Aardehuizen residents, spreading knowledge and vision is very important. This is also part of their motto: "to inspire the world around us." The Aardehuizen residents try to make an impact through volunteer work in the area, as well as in their own professions. For instance, Fransjan has dedicated his career to food forestry as a researcher and

advisor. Gerard tries to promote sustainability in the workplace through his work on collective labor agreements for civil servants. Ted finds it important to keep the forests in the area clean and actively cleans up litter in the surrounding environment.

What stood out to me:
Each resident has a different reason for living in the Aardehuizen. Some are particularly interested in sustainability and being close to nature, others in communal living, and others still in sustainable food cultivation. I also noticed that the residents are relatively "down-to-earth." Making sustainable choices and improving the surrounding landscape came across as a practical and necessary insight. Living in a community is partly a means to this end. It is easier to make sustainable choices together.

Appendix C: Report Visit Boschgaard 15-12-2024

I spent the entire morning painting with resident Peter. Peter has lived in communal housing projects his entire life, particularly at Centraal Wonen Lismortel (Eindhoven). I spoke with Peter extensively about the socio-cultural aspects of communal living. Peter is a strong advocate for ultimate equality. Examples include abolishing inheritances and redesigning the housing market to prevent speculation with housing. He is actively involved in umbrella organizations related to communal living and had a lot to share about good ways to plan and maintain such projects.

- He suggests forming clusters of 8–12 people within larger groups, as this size is most effective for horizontal decision-making.
- Conflicts within the community are inevitable, but the most important requirement for residents is that they genuinely want to participate, which fosters a willingness to find solutions.
- Getting many headstrong people to work together is a challenge in itself.
- Umbrella organizations ensure that the homes never return to the market. The best model for these homes is communal rental ownership. This allows interest to be paid to those who lend money to the association while maintaining control over the selection of future residents.

Eugenie:

- Many people initially joined the project, but more dropped out over time.

- People who joined later were less committed to the values of Boschgaard.
- Concern that not everyone shares the same sustainable values.

Meindert: Positive experience living with a child in Boschgaard.

Self-building:

- In hindsight, more thought should have been given to urban mining.
- Organizing the construction shed was complicated (it was used for large materials, so everything had to be moved frequently).
- Collecting insulation materials was not the best choice in retrospect.
- Early frustrations about missing tools were resolved by forming a working group to oversee tools and materials. For example, it was important to always return items to the same place and to invest in high-quality new tools.

Organization:

- Dormant/invisible board: board members have the same level of power as other residents.
- Maintenance is organized collectively by the residents.
- Small working groups are allowed to make minor decisions independently (e.g., using Google Drive).

Residents:
Many residents come from a squatting background and have extensive experience communicating with authorities. It takes a

lot of time and effort to make such projects happen. It was helpful that Zayaz's director understood their idea and fully supported it. It took a long time to find the right people to talk to, especially since intermediaries sometimes obstructed progress. In hindsight, having people with more experience in municipal communication would have been beneficial, as this process was challenging.

Appendix D: Fieldwork Report – Visit with Bird Conservation Volunteer John Kleijweg on 31-1-2025

Location: Midden-Delfland region, The Netherlands

I spent a day in the field with **John Kleijweg**, a local bird conservation volunteer known for his deep knowledge of the rural landscape and his collaborative work with farmers. Our day offered valuable insights into community-led biodiversity efforts, particularly regarding meadow birds and owl conservation.

Background and Living Situation

John lives with his wife in Midden-Delfland. Two additional houses are being built on his property—one for his sister-in-law and one for his youngest son. Previously, he attempted to start a communal housing project on his land with ten friends, but there was not enough interest. However, he is now developing a tiny house initiative on a separate piece of land he owns. This project will be featured during the **Midden-Delfland Day** on June 21.

Conservation Work and Farming Collaboration

John previously worked for 20 years as a market gardener and has a solid understanding of farming life. This background allows him to communicate effectively with local farmers and win their trust. Through his work with **owls and meadow birds**, he gradually encourages farmers to adopt more wildlife-friendly practices—even if it's just on a few percent of their land.

He emphasizes that **visiting farms in person** is essential to understanding their context and constraints. “Farmers are the cheapest landscape managers,” he notes. John appreciates landscape planning concepts like wet zones in lower areas and

flexible land use in higher areas—ideas he encountered in the region's "masterplan."

Volunteer Network and Initiatives

John currently coordinates a **network of 25 volunteers**, though he acknowledges this is a small number for last-minute conservation efforts. During our visit, his group was installing **solar-powered pumps** in the Duif and Commandeurspolder to temporarily flood fields. These shallow wetlands attract species like the **black-tailed godwit**, which prefers nesting in wet meadows with low disturbance.

Ecological Knowledge and Local Insight

John shared detailed information on nesting preferences for different species:

- **Owls:** Prefer a southeast-facing balcony, protection from **stone martens** (via "marten locks"), and roofs that deter jackdaws (e.g., wave-shaped entrance covers). **Pollarded willows** are also important habitats.
- **Black-tailed godwits:** Require quiet meadows during breeding season. Fast-growing, protein-rich grass (stimulated by artificial fertilizers) is harmful to them. Delayed mowing and later manure application—especially using straw-rich manure—are beneficial.

We also discussed species like the **marsh harrier**, **common tern**, and **sand martin**, the latter of which had a colony disturbed by a nearby construction project.

Challenges and Reflections

John is skeptical of some **idealistic housing projects in rural areas**, describing them as "utopian." He also observed that

among the 50 farmers in the region, only 3 are organic, despite Midden-Delfland being a leader in sustainable farming in the Netherlands. For comparison, in **Scandinavia**, roughly 25% of farms are organic.

One striking example of **local efficiency** he gave was a the Kraaiennest bird sanctuary that cost €80,000. Done by his group, it would have cost millions in consultancy fees if led by external experts. His conclusion: **local knowledge** is invaluable—locals understand the land, animals, and people far better than outsiders ever could.

John strongly believes that **real change requires personal initiative**. While funding can often be found, someone must be willing to **take the lead** and make it happen.

Appendix E: Ethnographic researches

Participant	Role	Status
3 inhabitants of Aardehuizen Olst	Ecovillage inhabitants and nature protector	Particiation day conducted: harvesting young oak trees in food forest on 16-12-2024
5 inhabitants of Boschgaard, Den Bosch	Re-use housing cooporation inhabitants and squatting activists	Particiation day conducted: finishing works construction on 16-12-2024
12 inhabitants of Geworteld wonen, Rijswijk	Collective housing project with shared garden	Particiation day conducted: garden fertilization day and community lunch on 23-03-2025
Martin Visser	Secretary Midden-Delfland Association (*Secretaris Midden-Delfland Vereniging)*	Interview conducted at Midden-Delfland community centre on 13-01-2025
Frank Dietz	Midden-Delfland Association, Environment Working Group (*Midden-Delfland Vereniging, Werkgroep milieu*)	Interview conducted at Midden-Delfland community centre on 13-01-2025
Roel van Buuren	Organic dairy farmer	Interview over phone conducted on 18-03-2024

John Kleijweg	Bird Protector in Midden-Delfland	Participation day conducted: checking owl nesting boxes on local farms on 30-01-2025
8 members of Herenboeren Vlinderstrik	Sustainable cooperative farming establishment in Midden-Delfland	Particiation day conducted: planting blackberry bushes on 23-02-2025
A farmer and the chef de mission of Lenteland	Regenerative cooperative farming organization with 7 farms and financial feasibility intention	Spoken with after their documentary screening at De Groene Afslag on 26-03-2025
Roanne van Voorst	Writer, futures-anthropologist and ethnographic researcher	Interview conducted during walk in the forest on 29-03-2025
Pieter Parmentier	Initiator of erfdelen.nl: pioneer movement for people that want to collectively live on a repurposed farm.	Interview conducted over coffee on 02-04-2025
TU Delft Architecture student council	Assist students	Met 3 times in April and June 2025

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Notes

[1] Goldberg, *The New Executive Brain*.
[2] Many influential thinkers across the field of architecture and other social disciplines consider this to be true: Jacobs, *The Death and Life of Great American Cities*; Latour, *Reassembling the Social*; Lefebvre, Nicholson-Smith, and Lefebvre, *The Production of Space*. And of course the much quoted lines by Winston Churchill: "We shape our buildings; thereafter they shape us" Winston Churchill, speech to the House of Commons, October 28, 1943, quoted in Gavin Stamp, *The Memorial to the Missing of the Somme* (London: Profile Books, 1986).
[3] This issue is also addressed in the book "*Buying time for climate action: Exploring ways around stumbling blocks*" by J. W. Vasbinder and J. Sim (2021). It is part of a series by Para Limes, a research group that explores complex systems. In the book, Jan W. Vasbinder stresses that the efforts and agreements made by national and global governing institutions are proving to be too slow in the urgent matter of climate change. Politics tend to have difficulties to prioritize long-term societal benefits over short-term fixes (p. 1-2).
[4] Kruk, "Het Kanteljaar van Radicaal-Rechts."
[5] Beak, "Trump Orders a U.S. Exit From the World's Main Climate Pact."
[6] Stanway, "Current Climate Pledges Still Fall Way Short on Paris Goals, UN Body Says."
[7] On 5 November 2024, I attended a Pakhuis de Zwijger Special on the topic of Empowering Resilient Communities. Bart van den Hurk, co-chair of an IPCC working group, addressed the intentions of the 7th IPCC assessment report. The 6th IPCC report (2021) revealed to us that climate change is a certainty. The problem is very real, tangible and urgent. Yet current action seems insufficient. Van den Hurk recognized that the 6th report (weighing 29 kg's in print!) missed practical qualities needed to engage the average civilian.
[8] Intergovernmental Panel On Climate Change (Ipcc), *Climate Change 2021 – The Physical Science Basis*.
[9] "History."
[10] Meadows, Randers, and Meadows, *Limits to Growth*; Meadows, Meadows, and Randers, *Beyond the Limits*; Meadows, Randers, and Meadows, *Limits to Growth*.
[11] Herrington, "Update to Limits to Growth."

[12] Herrington.
[13] Rees, "A Note on Climate Change and Cultural Denial."
[14] Rees, "Overshoot"; Rees, "What's Blocking Sustainability?"; Rees, "A Note on Climate Change and Cultural Denial."

[16] Foley et al., "Solutions for a Cultivated Planet"; Rockström et al., "A Safe Operating Space for Humanity"; IPBES et al., "Summary for Policymakers of the Global Assessment Report on Biodiversity and Ecosystem Services."
[17] Intergovernmental Panel On Climate Change (Ipcc), *Climate Change 2021 – The Physical Science Basis*; Perkins, "Special Report on Renewable Energy Sources and Climate Change Mitigation."
[18] Steffen et al., "Planetary Boundaries."
[19] Yu et al., "Microplastics as an Emerging Environmental Pollutant in Agricultural Soils"; Lu et al., "Impacts of Soil and Water Pollution on Food Safety and Health Risks in China."
[20] MacAskill, *What We Owe the Future*, 4.
[21] MacAskill, 54.
[22] Posthumanism refers to a perspective that challenges traditional human-centered views by emphasizing interconnectedness among organisms and complex systems, aiming to disrupt hierarchies and boundaries between humans and other entities.
[23] Latour, *Down to Earth*; Latour, *Facing Gaia*; Latour, *Reassembling the Social*; Latour and Weibel, *Critical Zones*.
[24] Boztas, "Fancy Life in an Eco-Village? Welcome to the Hi-Tech off-Grid Communities." At the aardehuizen in Olst, the inhabitants spoke of a long waiting list of people wanting to move there. The same is true for Geworteld Wonen in Rijswijk, they also indicated that many inhabitants of the surrounding neighborhood frequently express how charmed they are by this living arrangement: they compliment on the garden that looks like an incredible place for children to grow up in etc. Pieter Parmentier, initiator of Erfdelen.nl pointed me at the list of 5000(!) people that contacted him because they were interested in living on a farm. In a survey he conducted, these people indicated to value nature with a 8.7/10, and sustainable living and building with an 8/10. Multiple ecovillage and cooperative housing projects report significant public interest and long waiting or interest lists. For example, ReGen Villages in Almere attracted over 1,200 people to its waiting list even before construction began ("The hi-tech eco village that lets nature do the work," The Guardian, July 12, 2016,

https://www.theguardian.com/sustainable-business/2016/jul/12/eco-village-hi-tech-off-grid-communities-netherlands-circular-housing-regen-effekt). The Aardehuizen in Olst regularly draws attention from those seeking sustainable housing, often necessitating sign-ups for open days and events (SG Delft, "Excursion: Aardehuis – Eco-Social Construction Site," https://sg.tudelft.nl/event/excursion-aardehuis-eco-social-construction-site). Cobb Hill CoHousing in Vermont operates with a formal waitlist due to strong interest in its community lifestyle ("Membership," Cobb Hill CoHousing, https://www.cobbhill.org/membership). In Amsterdam, the De Warren housing cooperative has received overwhelming interest for its 36 sustainable units ("Start bouw wooncoöperatie De Warren," Pieters Bouwtechniek, https://www.pietersbouwtechniek.nl/en/news/viering-start-bouw-van-wooncooperatie-de-warren-met-wethouder-laurens-ivens-en-gedeputeerde-zita-pels). Similarly, IEWAN in Nijmegen has a long list of potential future residents interested in joining its eco-housing community (European Commission, "IEWAN: Nijmegen's Social Housing Eco-village," https://environment.ec.europa.eu/topics/urban-environment/european-green-capital-award/inspiration/aarne-broekhoven-resident-iewan-nijmegens-social-housing-eco-village_en. Taken together, these cases show the widespread demand for intentional, sustainable living environments.

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[26] Puig de La Bellacasa, *Matters of Care*.
[27] Blachowicz, "How Science Textbooks Treat Scientific Method."
[28] Bhattacherjee, *Social Science Research*.
[29] Meadows and Wright, *Thinking in Systems*. p. 2
[30] Simon and Laird, *The Sciences of the Artificial*.
[31] written by claude.ai
[32] partially written by claude.ai
[33] Chappell, Meissner, and MacAskill, *An Introduction to Utilitarianism*.
[34] Lazari-Radek and Singer, *Utilitarianism*.
[35] Harris, "The Survival Lottery."
[36] Hare, *Moral Thinking*.
[37] Hare.
[38] Mill, *Considerations on Representative Government*.

[39] Bentham, *An Introduction to the Principles of Morals and Legislation.* Ch 17. n. 122.
[40] BENTHAM, *PANOPTICON.*
[41] Bentham and Crompton, "Offences Against One's Self." p. 389
[42] MILL, *SUBJECTION OF WOMEN (1869) BY JOHN STUART MILL (WORLD'S CLASSICS).*
[43] Singer, *The Life You Can Save.*
[44] Singer, *Animal Liberation.*
[45] MacAskill, *What We Owe the Future.*
[46] Meadows and Wright, *Thinking in Systems.* Chapter 6: Leverage Points-places to intervene in a system
[47] Waard, *Tuinen van overvloed.*
[48] https://www.cobbhill.org/voices-blog/2023/4/22/happy-earth-day-1
[49] https://donellameadows.org/archives/dear-folks-october-29-2000/
[50] https://donellameadows.org/archives/dear-folks-november-26-2000/

[51] *The "Adjacent Possible" – and How It Explains Human Innovation.*
[52] Kauffman, *The Origins of Order.*
[53] Loreto et al., "Dynamics on Expanding Spaces."
[54] Darwin and Mayr, *On the Origin of Species.*
[55] Wright and Wright, *Genetic and Biometric Foundations.*
[56] Johnson, *Where Good Ideas Come From.*
[57] Wellenberg and Zee, *Atlas van de Trekvaarten in Zuid-Holland.*
[58] *Will the End of Economic Growth Come by Design — or Disaster?*
[59] "Van Dale Online."
[60] https://www.tudelft.nl/over-tu-delft/strategie/vragen-over-strategische-agenda-2024-2030
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