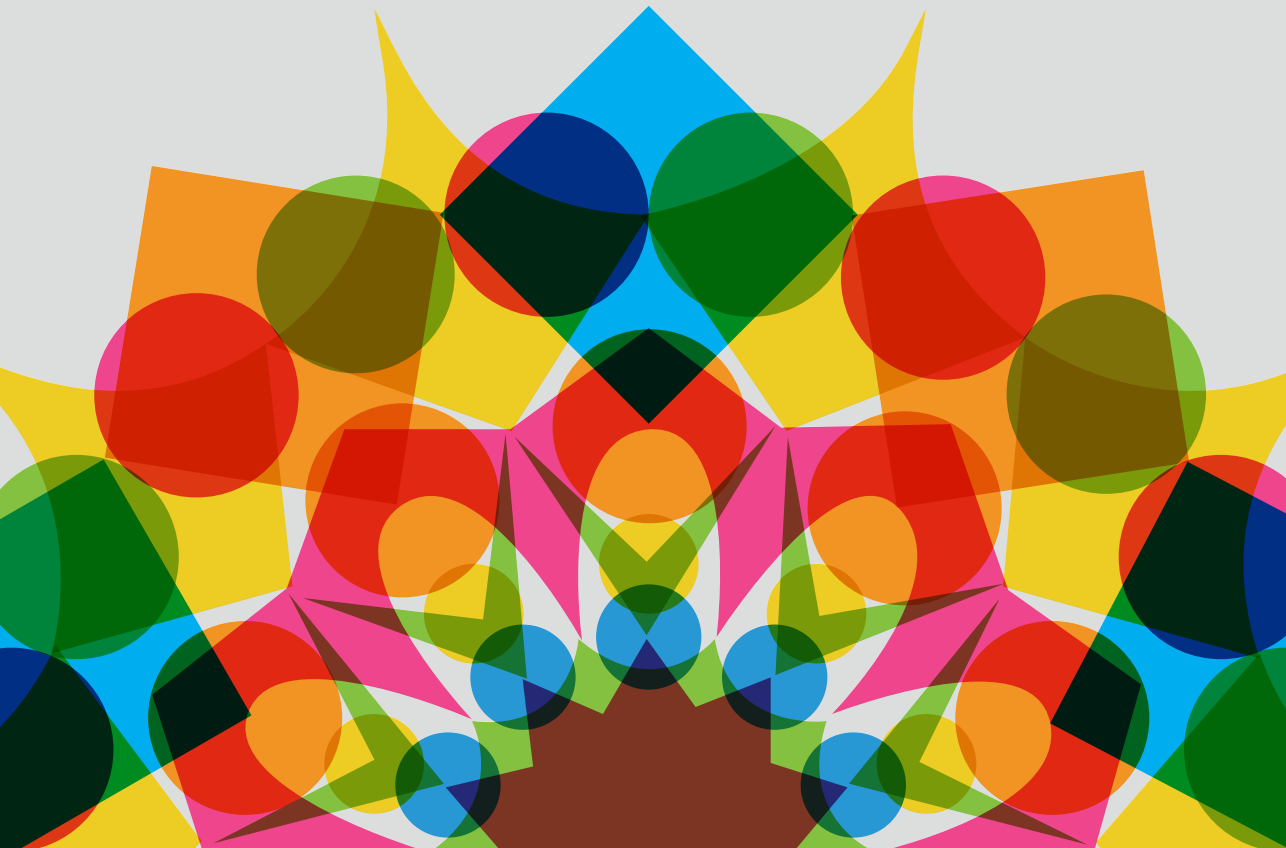
BEYOND MEAT AND "MORE!"

Exploring transformative pathways in societal transitions through design framing

Anna-Louisa Peeters



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Exploring transformative pathways in societal transitions through design framing

Dissertation

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Anna-Louisa PEETERS

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I am so clever that
sometimes I don't understand
a single word of what
I am saying.

Oscar Wilde

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Summary

In the face of growing social and environmental challenges, design is increasingly concerned with addressing complex systemic issues (Ceschin & Gaziulusoy, 2016). This dissertation explores how design can foster societal transitions with a dual focus. First, it develops transformative strategies for the plant-based protein transition, an urgent shift given its environmental, health, animal-welfare, and justice implications, and its cultural and behavioural complexity (Béné et al., 2020). Second, it investigates systemic breakdown, a 'forgotten half' of transitions often overshadowed by innovation (Hebinck et al., 2022), and delivers a research agenda around design for decline.

Theoretical background and knowledge gaps

This interdisciplinary dissertation convenes design research, transition studies, sustainable behavioural science, and food systems research. Transitions theory provided conceptual grounding, while design provided practice-oriented strategies and a human-centred approach. We studied reframing as a core design capability, extending from processes of framing to the content and logic of frames. Focusing on the consumer-side of systems, social practices were adopted as behavioural units of intervention. The 'value–action gap' was treated as a persistent barrier in sustainable consumption. Four themes of knowledge gaps structured the work:

- **Pluralistic approaches:** food systems research calls for pluralistic approaches to foster the protein transition; behavioural research has not tested pluralistic interventions to address the value–action gap; transitions research calls for actionable, participatory, human-centred methods.
- **(Re)framing:** design lacks a conceptualisation of frames in transition contexts; transitions research has focused on discourse rather than designed artefacts; food systems literature has limited insight into existing and novel frames in the protein transition.
- **Consumers in transitions:** transitions research typically does not treat consumers as active agents in transitions, while behavioural science has focused narrowly on individuals and on well-defined behaviours in

unambiguous contexts; both gaps call for systemic, practice-oriented approaches.

- **Systemic breakdown:** although decline and destabilisation are recognised in transition studies, prescriptive, human-centred approaches remain scarce. Design research has explored 'undesign' but largely without systemic context.

The research followed a pragmatist approach, balancing theory and practice through intermezzos. It employed primarily qualitative methods (interviews, case studies, research through design, thematic analyses), with one mixed-method experiment (Chapter 5).

Dissertation outline

The dissertation is structured into three parts that each address an overarching research question:

1. What does a transformative design frame comprise in the context of societal transitions?
2. What are novel and transformative avenues for design to foster the plant-based protein transition?
3. How might design support systemic breakdown in transitions?

Part One: Transformative reframing

Part One conceptualises transformative design frames. **Chapter 2** introduces a transdisciplinary model of a transformative design frame spanning transition strategy, systemic levers, behaviour change, and worldview across societal levels. Feedback from four design agencies confirmed its practical value for rationale-building and systematic reframing. The model subsequently guided later chapters, ensuring normative, behavioural, and multi-level considerations remained foregrounded.

Part Two: Reframing for the protein transition

Part Two applies reframing to the Dutch protein transition. **Chapter 3** analyses 62 consumer-oriented interventions and identifies eight prevalent pathways for design and policy, from meat mimicking to regulation and cultural change. It highlights the dominance of analogues, underused strategies, and novel pathways

for the transition. It also discusses implications for future frame analyses across fields and domains.

Intermezzo I translated the transformative pathways from Chapter 3 into MSc projects pursuing intervention portfolio approaches and inclusivity in practice, which yielded lessons about the effective assembly of complementary interventions and navigating consumer resistance.

Chapter 4 maps the eight pathways from Chapter 3 onto four scenarios for the protein transition developed by Freedomlab (2024). It reveals two pathways that are promising to pursue and explores the interplay between visioning and reframing.

Intermezzo II brings insights from previous chapters into public discourse through an actionable and accessible newspaper opinion piece calling for a cultural shift.

Chapter 5 tests a retail choice-architecture intervention combining multiple design frames to address the value–action gap. A web experiment (n=126) showed more sustainable meat purchasing but no significant value–behaviour alignment, sparking ethical reflection on nudging in transitions.

Part Three: Design for systemic breakdown

Part Three explores expert practices of systemic breakdown and proposes a new area for research and practice around designing for systemic breakdown in transitions. **Chapter 6** presents a 'Design for Decline' research agenda, based on interdisciplinary literature and 15 expert interviews. It identifies eight themes of transformative knowledge that are central to designing for systemic breakdown in transitions which need further exploration.

Intermezzo III reports explorations of Design for Decline in practice, including MSc projects, an art piece, and a keynote performance. These triggered reflection among diverse actors on exnovation, positionality, and agency in transitions.

General discussion and conclusions

On **pluralistic approaches in transitions**, the dissertation demonstrates design's ability to weave insights across fields, emphasising intervention portfolios over singular strategies. It calls for research into how such portfolios are assembled and governed, and for integrating additional disciplines such as political science and economics.

On **(re)framing**, the dissertation delivers a model of transformative design frames that integrates systemic, behavioural, and normative elements. It shows that transformative frames gain strength when tied to societal narratives and future visions, offering directionality in reframing. Future research should test the model in practice, explore the interplay between visioning and reframing, and replicate frame analyses in other domains such as energy, mobility, and fashion.

On **consumers in transitions**, the dissertation demonstrates their active role in shaping systemic change. Analyses revealed six promising pathways for the protein transition involving inclusivity, neophobia, animal reduction, regulatory measures, cultural change, and integrated portfolios. The dissertation also demonstrates that consumer interventions can both foster and hinder a transition at the same time, reflecting the complexity of systems change. Future research should examine impacts across consumer segments and include other actors such as farmers, producers, and retailers.

On **systemic breakdown**, this dissertation convenes interdisciplinary knowledge around deliberate systemic decline, revealing key patterns and gaps in existing research. Early engagements with this work in practice prompted deeper reflection, particularly on practitioner positionality and the tools required to navigate conflict and pain during transitional processes. The dissertation identifies collective mourning as an overlooked behavioural dynamic in transitions. To advance the field of Design for Decline, future research should build on and extend the agenda outlined in this dissertation.

Implications

For practice and policy, the transformative design frame model from Chapter 2 supports robust rationale-building and creative reframing. The protein transition pathways from Chapters 3 and 4 and the Design for Decline agenda from Chapter 6 offer actionable strategies and questions to integrate both build-up and breakdown in navigating transitions. The intermezzos demonstrate real-world applications of the dissertation insights and may inspire future empirical studies.

In education, reframing and the Design for Decline agenda can enrich design curricula, equipping students to engage with both innovation and exnovation. Transitions education can deepen its focus on normative orientation, reframing as a transformative practice, and deliberate systemic breakdown. Behavioural

science education can shift beyond individuals to practices and collective processes such as mourning. Food systems education can benefit from this dissertation' prescriptive 'pathways for change,' enhancing both practical and ethical dimensions in their curricula.

Samenvatting

Onder toenemende sociale en ecologische druk op maaschappelijke systemen richt design zich in toenemende mate op het aanpakken van complexe systeemvraagstukken (Ceschin & Gaziulusoy, 2016). Dit proefschrift onderzoekt hoe design kan bijdragen aan maatschappelijke transities, met een dubbele focus. Ten eerste worden er transformatieve strategieën ontwikkeld voor de plantaardige eiwittransitie, een urgente maatschappelijke verandering met oog op milieu, volksgezondheid, dierenwelzijn en rechtvaardigheid (Béné et al., 2020). Ten tweede wordt systemische afbouw onderzocht, de 'vergeten helft' van transities die vaak wordt overschaduwd door innovatie (Hebinck et al., 2022) en wordt een onderzoeksagenda rondom ontwerpen voor afbouw voorgesteld.

Theoretische achtergrond en kennislacunes

Dit interdisciplinaire proefschrift brengt ontwerpgericht onderzoek, transitiestudies, gedragswetenschappen en voedselsysteemonderzoek samen. Transitietheorie bood een conceptuele basis, terwijl design praktijkgerichte strategieën en een mensgerichte benadering inbracht. In dit onderzoek werd *reframing* bestudeerd als een kernvaardigheid binnen design, uitgebreid van processen van framing tot de inhoud en logica van frames. Met de focus op de consumentenzijde van systemen werden sociale praktijken beschouwd als gedragsmatige eenheden van interventie. De zogenoemde *value–action gap* (de afstand tussen onze waarden en ons gedrag) werd beschouwd als een hardnekkige barrière binnen duurzaam consumptiegedrag. Vier thema's van kennislacunes structureerden het onderzoek:

- **Pluralistische benaderingen**: voedseltransitieonderzoek pleit voor pluralistische benaderingen om de eiwittransitie te bevorderen; gedragswetenschappelijk onderzoek heeft nog geen pluralistische interventies getest om de *waarde–gedrag 'gap'* te overbruggen; transitieonderzoek vraagt om toepasbare, participatieve en mensgerichte methoden.

- **(Re)framing**: er ontbreekt in design een conceptualisering van frames binnen transitiecontexten; transitieonderzoek heeft zich primair gericht op discours in plaats van ontworpen artefacten in framing studies; de voedselsysteemliteratuur biedt beperkt inzicht in bestaande en nieuwe oplossingsrichtingen binnen de eiwittransitie.

- **De rol van consumenten in transities**: transitieonderzoek beschouwt consumenten doorgaans niet als actieve spelers binnen transities, terwijl duurzaam gedragsonderzoek zich veelal nauw heeft gericht op individuen in gecontroleerde omgevingen; beide lacunes vragen om systemische, praktijkgerichte benaderingen.
- **Systemische afbouw**: hoewel afbouw en destabilisatie worden erkend binnen transitiestudies, blijven transformative en mensgerichte benaderingen schaars. Ontwerpgericht onderzoek heeft onder andere concepten als 'undesign' verkend, maar grotendeels zonder dit in systemische context te plaatsen.

Het onderzoek volgde een pragmatische benadering, waarbij theorie en praktijk in balans werden gebracht door academische studies met intermezzo's af te wisselen. Dit proefschrift maakte voornamelijk gebruik van kwalitatieve methoden (interviews, casestudy's, 'research through design', thematische analyses), met één studie die gemengde methodes gebruikte (Hoofdstuk 5).

Opzet van het proefschrift

Het proefschrift is opgebouwd uit drie delen, die elk een overkoepelende onderzoeksvraag behandelen:

1. Wat omvat een transformatief ontwerpframe in de context van maatschappelijke transities?
2. Wat zijn nieuwe en transformatieve wegen voor design om de plantaardige eiwittransitie te bevorderen?
3. Hoe kan design systemische afbouw binnen transities ondersteunen?

Deel I: Transformatief reframen

Deel I conceptualiseert transformatieve ontwerpframes. **Hoofdstuk 2** introduceert een transdisciplinair model van een transformatief ontwerpframe, dat transitiestrategie, systeemhefbomen, gedragsverandering en wereldbeeld op verschillende maatschappelijke niveaus omvat. Feedback van vier ontwerpbureaus bevestigde de praktische waarde ervan voor het ontwikkelen van hun ontwerprationale en systematisch reframen als onderdeel van hun ontwerpproces. Het model diende vervolgens als leidraad voor de latere hoofdstukken, zodat normatieve en gedragsmatige overwegingen voortdurend

op de voorgrond bleven, evenals oog voor verschillende schalen van analyse (micro-meso-macro).

Deel II: Reframing voor de eiwittransitie

Deel II past reframing toe op de Nederlandse eiwittransitie. **Hoofdstuk 3** analyseert 62 consumentgerichte interventies en identificeert acht dominante paden voor design en beleid - van vleesimitatie tot regelgeving en culturele verandering. Het hoofdstuk belicht de dominantie van analoge producten, onderbenutte strategieën en nieuwe transitiepaden. Tevens bespreekt het de implicaties voor toekomstige frame-analyses binnen andere domeinen.

Intermezzo I vertaalde de transformatieve paden uit Hoofdstuk 3 naar masterprojecten die zich richtten op interventieportfolio's en inclusiviteit in de praktijk. Deze leverden inzichten op over het effectief samenstellen van complementaire interventies en het omgaan met weerstand van consumenten.

Hoofdstuk 4 koppelt de acht paden uit Hoofdstuk 3 aan vier scenario's voor de eiwittransitie, ontwikkeld door Freedomlab (2024). Het identificeert twee mogelijk kansrijke paden en verkent de wisselwerking tussen visieontwikkeling en reframing.

Intermezzo II brengt de inzichten uit eerdere hoofdstukken in het publieke debat via een toegankelijk opiniestuk in een dagblad, waarin wordt gepleit voor een culturele verschuiving binnen het Nederlandse voedselsysteem, ten behoeve van duurzaamheid en gezondheid.

Hoofdstuk 5 test een systeeminterventie in de keuze-architectuur van een online supermarkt, waarin meerdere ontwerpframes worden gecombineerd om de kloof tussen waarden en gedrag te verkleinen. Een online experiment (n=126) liet duurzamer aankoopgedrag van vlees zien, maar geen significante toenadering tussen waarden en gedrag, wat leidde tot een ethische reflectie op *nudgen* binnen transities.

Deel III: Design voor systemische afbouw

Deel III verkent bestaande literatuur en expertise rondom afbouw in transities. **Hoofdstuk 6** stelt gebaseerd op theorie en 15 expertinterviews een nieuw onderzoeksveld voor: Design for Decline. De studie identificeert acht kennisthema's rondom ontwerpen voor afbouw, gepaard met onderzoeksvragen.

Intermezzo III beschrijft verkenningen van Design for Decline in de praktijk, waaronder masterprojecten, een kunstwerk en een keynote-performance. Deze prikkelden reflectie bij uiteenlopende spelers over exnovatie, positionaliteit en handelingsvermogen binnen transities.

Discussie en conclusies

Met betrekking tot **pluralistische benaderingen** binnen transities toont het proefschrift aan dat design inzichten uit verschillende disciplines kan verweven, en het onderstreept dat interventieportfolio's transformatiever zijn dan enkelvoudige strategieën. Het pleit voor onderzoek naar hoe dergelijke portfolio's worden samengesteld en bestuurd, en voor de integratie van aanvullende disciplines zoals politicologie en thanatologie.

Met betrekking tot **(re)framing** levert dit proefschrift een model van transformatieve ontwerpframes op die systemische, gedragsmatige en normatieve elementen integreert. Het toont aan dat transformatieve frames aan kracht winnen wanneer zij verbonden zijn met maatschappelijke narratieven en toekomstvisies. Toekomstig onderzoek zou dit model in de praktijk moeten testen, de wisselwerking tussen visioning en reframing verder moeten verkennen, en frame-analyses kunnen repliceren in andere domeinen, zoals energie, mobiliteit en de mode-industrie.

Wat betreft **consumenten in transities** laat dit proefschrift zien dat zij systemische verandering in transities actief vorm geven middels hun sociale praktijken. De studies brachten bovendien zes vermoedelijk kansrijke paden aan het licht voor de eiwittransitie vanuit de consument gezien, welke gaan over regulering, culturele verandering, inclusiviteit, geïntegreerde portfolio's, neofobie, en het (gedeeltelijk) loslaten van dieren als menselijk voedsel. Het proefschift laat ook zien dat sommige interventies de transitie zowel kunnen bespoedigen als hinderen, wat de complexiteit van systeemverandering blootlegt. Toekomstig onderzoek zou de effecten binnen verschillende consumentsegmenten moeten onderzoeken en andere actoren, zoals boeren, producenten en retailers, moeten betrekken.

Ten aanzien van **systemische afbouw** heeft dit proefschrift interdisciplinaire kennis over (met name doelbewuste) systemische afbouw samengebracht en gestructureerd, wat in de praktijk reflectie en betrokkenheid heeft gestimuleerd. Het onderzoek identificeert acht cruciale kennislacunes. Tevens bespreekt het

collectieve rouw als een over het hoofd gezien gedragsmatig proces binnen transities. Toekomstige studies kunnen de onderzoeksagenda aanscherpen, volgen of uitbreiden om kennis over (doelbewuste) afbouw in transities verder te brengen.

Implicaties

Voor de praktijk bieden de raamwerken uit Hoofdstuk 2 en 6 ondersteuning bij het opbouwen van een sterke ontwerprationale, bij reframing, en bij ontwerpen voor afbouw in transities. Voor beleid bieden met name de eiwittransitiepaden uit Hoofdstukken 3 en 4 toepasbare strategieën voor het bevorderen van de eiwittransitie in Nederland, waarin oog is voor zowel innovatie als uitfaseren. De intermezzo's tonen bovendien inspirerende praktijkvoorbeelden die reflectie op de eigen praktijk stimuleren en handelingsperspectief bieden.

Binnen het onderwijs kunnen reframing en de Design for Decline-benadering ontwerpopleidingen verrijken door studenten te helpen zich te verhouden tot zowel innovatie als exnovatie. Transitieonderwijs kan zijn focus verdiepen op normatieve oriëntatie, reframing als transformatieve praktijk en doelgerichte systemische afbouw. Gedragswetenschappelijk onderwijs kan zich ontwikkelen voorbij het individu, richting praktijken en collectieve processen zoals rouw. Voedselsysteemonderwijs kan profiteren van de in dit proefschrift voorgestelde ontwerppaden voor de eiwittransitie, waarmee zowel de praktische als de ethische dimensies binnen curricula kunnen worden versterkt.

It's impossible
to have your eyes open,
and not have your
heart broken.

Gabor Maté

Preface

An afternoon at the slaughterhouse

I did not sleep well last night. I fear what I am going to see today. This will probably be the most difficult field research so far. I love animals deeply and enjoy eating meat. What is it like to see the direct connection between these two things for the first time? Although the idea is unpleasant, I do not hesitate for a moment about whether I should go. If I am going to play a role in the world of meat consumption, I need to know what that world looks like.

I have an appointment with the site manager at noon. After a bike ride, three trains, a bus, and a long walk, I finally arrive. At the gate, I fill out a form declaring I do not carry any animal diseases and am allowed to enter. On the way to the door, I hear a brief squeal. I recognise the sound from the farm I visited last week. I turn around and see a truck full of pigs backing in. Here we go.

The manager is already waiting. Steven Hoekstra (not his real name) firmly shakes my hand and offers me a cup of coffee. He is from the Achterhoek region, and I quickly notice he has a rural mentality. No excuses, no complaining. Actions, not words. Steven explains that they rarely allow people inside the slaughterhouse. Negative publicity has made them extremely cautious about opening their doors. I feel flattered to have been given this opportunity and wonder why I was granted it. I also feel guilty because I am here with a hidden agenda.

This slaughterhouse processes pigs, five thousand a day. Both males and females, all adults, and all the same breed. They process organic and conventional meat side by side. The many employees along the production line are on average fifty years old and have low levels of education. Steven says working in a slaughterhouse is something you either love deeply or want to quit after fifteen minutes. Apparently, there is no in-between.

After coffee we decide to head down to see the real work. I have to put on a white suit, boots, a hairnet, and a helmet. We will go from 'cold' to 'warm', meaning from 'clean' to 'dirty'. So we begin at the back of the line, where the meat is packed into trucks, and end with the live pigs being unloaded from a different type of truck.

Before entering the production hall, we must clean our hands and boots. Once they are clean, a gate opens to let us in. A heavy metal door leads us into a gigantic cold hall. It should not be warmer than seven degrees there, to keep the meat fresh longer. I see meat all around me. Conveyor belts carry smaller pieces and rib cages hang from ceiling rails, traveling via various routes to their destinations. Steven shows me how these rails can be directly connected to truck beds. The rib cages roll at high speed into a retailer's truck.

Further ahead, about twelve workers are trimming pieces of meat along a conveyor belt. Due to the machinery, it is too loud to talk, so most people wear earbuds with music. They are all in their own little bubble. Each worker cuts a specific part of the meat and throws it into their bin, after which the rest of the meat goes back on the belt to their colleague. Meanwhile, they constantly sharpen their knives, which quickly dull from such intensive use. They are all wearing chain mail to prevent injuries (I always thought those were reserved for knights).

We move on. In another corner, eight women are picking small white bits out of the meat. This is for the Japanese market, I am told. "The Japanese are very picky and do not like stringy bits in their meat." Once the meat is free of stringy bits, it is boxed and placed on a pallet. After the women have cleaned a thousand tons of meat, the bulk is shipped to Japan.

We slowly walk towards the starting point of the production process. I notice the meat around me increasingly resembles a pig, because fewer parts have been removed. Here, the carcasses are all halved, but there are no heads attached anymore. Each half hangs by a hind leg from the ceiling rail. Further ahead, one of the halves still has the head intact. It is kept whole, because in China they like pig heads.

We arrive at a control point. Using a measuring device, an independent party determines the fat percentage of each pig. This is automatically linked in a system to the pig's number and determines what final product the pig is suitable for. I am impressed by the administrative complexity of this process. Every piece of meat must be traceable.

We enter the 'warm' section through another heavy door. Here I get a blue coat to wear over my white suit. It is very warm. Almost thirty degrees, I think. It is humid and smells in a way that is new to me: the scent of the inside of a body with warm blood. I try breathing through my nose for a bit, but fearing I will throw up, I decide to breathe through my mouth for the rest of the tour.

We are in a dark room. Above and to the right, pigs that have just been slaughtered enter on rails, hanging upside down by their hind legs. I think the belt speed is about one pig every five seconds. Here, they are still whole and even have hair on their bodies. Their necks are slit, and you can trace their path by the trail of blood on the floor. The rails carry them past hot steam, which softens their skin and opens their pores. The hair is then shaved off, and the pigs make a turn to the left. There, they pass through a towering oven with large flames that singe off the remaining hairs. Then, a disinfectant spray is applied to the carcasses, and the pigs come out 'clean.' Their skin now looks like shiny plastic. This is the point where the animal becomes a product.

We move to the first cutting room, where the 'plastic' pigs enter one by one, hanging. Mostly men work here because it is physically demanding. The warm, wet, and stinking air makes me even more amazed by their daily work. They start between the legs; a worker makes the first incision. The pig continues along the rails, and a machine carefully opens the belly skin up to two-thirds of the torso. At this production speed, that step cannot be done manually. The intestines slowly spill out. I clearly recognise the picture of the abdominal cavity from biology books: small intestine, large intestine, kidneys, liver, stomach, lungs, and heart. It actually looks exactly like a human belly.

Various men remove the organs. They stand on platforms to be able to reach the pigs. The floor and walls are bright red, and the men themselves are literally covered in blood from head to toe. They wear long plastic aprons, and the scene reminds me of horror films. They look at me smiling, and I see pride in their eyes. Some of the organs end up on trays on a conveyor belt; others are hung on hooks. Every part of the animal is used. If not for direct human consumption, then for animal feed, medicine, brushes, or photo paper.

A machine saws the rear of the pig in half, right through the spine. The machine causes the carcass to vibrate violently, making the fatty pig body shake like from a firm massage. It is sawed through until only the head connects the halves. To catch the spinal cord, a worker uses a vacuum-like device that sucks it from the pig's back. The marrow ends up in a large tub where the salmon-coloured mush is collected. I look into the tub and see a pig's head floating in it. "What is that doing there?" I ask. "Oh, that one was probably rejected. We'll need to take it out," Steven replies.

We pass another inspection point where a government inspector checks the organs. Sometimes there is a lung or kidney lying on the floor. Those have been

rejected and accidentally dropped. Steven pointedly shows me the inspector's badge: "He's from the government, see?" It's clear he's trying to make a point.

For a moment, it seems the tour is over, so I ask where the slaughter takes place. That happens upstairs, and we will now go to see it. We walk up the stairs, and I feel both attracted and repelled by the idea of what I'm about to witness. I hear pig hooves trotting and some squealing. There they are. Five and a half months old. They look beautiful and healthy. They are herded with panels in a line towards a closed metal box. The pigs seem confused, but I do not think they realize what is coming. I want to pet them, but that feels wrong, so I hold back. They are pushed into the metal box six at a time by a mechanical barrier, like a drawer being closed. A man stands beside it to coordinate the process. The door closes and shortly afterward a door at the back of the same box opens. The six pigs appear one by one, unconscious, on a conveyor belt.

They are gassed with CO_2. That 'box' is actually a ten-meter-deep pit, Steven tells me. I forget to ask how it works exactly, overwhelmed by all the impressions. I look at the unconscious pigs and wonder whether they are dead or just asleep. Perhaps that does not matter, because soon after they are hung by one hind leg on hooks from the ceiling rail, and a deep cut is made in their throats to let them bleed out. If they were not dead yet, they are now. The bleeding pigs continue along the rails until they reach the point where their hair is removed. We have already seen that, so we are really done now.

We step outside through a metal door. The sun is shining. Fresh air. I feel a bit uncomfortable next to Steven, because I am thinking things he would likely dismiss as emotional nonsense. We pass a truck unloading pigs and I want to take one last look. The truck has three levels. One of the long sides has slits for ventilation. This is the first daylight most of these pigs have ever seen. The levels are unloaded one by one, dozens of pigs in a row. With noise and tools, the pigs are driven in the right direction by several men. The animals get agitated by the unfamiliar situation but seem to have no idea what is happening. One by one they disappear into the building, waiting in line for their fate.

We walk back to Steven's office. As we pass another truck, a pig looks at me through a slit in the side. I notice it has bright blue eyes. I did not know pigs could have brown, green, and blue eyes, just like us.

Once inside, we have another cup of coffee, and I express my gratitude for the tour. I try to remain as objective and professional as possible. Later I will decide

what I really think about all this. Steven gives me another firm handshake and gets back to business. I walk outside and look once more for live pigs in a truck. I want to see them, I do not know why.

But I decide it is enough now, and begin my long journey back to the city.

Photo from Vegan Australia

Positionality statement

The previous story recounts a transformative experience I had during my graduation project in 2014. Since that afternoon, I have come to see food as something sacred - an intimate, relational act that deserves far greater reverence in our society. I have not been able to eat meat or dairy carelessly since then.

Most people assume I am vegan when they hear about my work, but I am not. I still eat animals from factory farms at times, though now with a deep sense of guilt - guilt towards the countless animals exploited each day, and guilt towards the land sacrificed to sustain unnecessary livestock production. Beneath that guilt lies a quiet shame: shame towards myself for failing to live in alignment with my values, and shame towards non-human life for belonging to the most destructive species on this planet.

If I understand all this - intellectually and viscerally - yet still struggle to centre plants in my own diet, what does that mean? It may sound like a cliché, but it is also true: it is the system shaping my behaviour. The current configuration of our global food system - its practices, structures, and cultures - relentlessly channels us towards the production and consumption not only of animal products, but also of ultra-processed foods.

This dissertation is a systemic, action-driven, and spiritual response to the historical speciesist[1] crime of factory farming and to the erosion of our capacity to honour food. Rejecting the illusion of scientific objectivity, I acknowledge that my normative position has inevitably shaped this PhD - what I chose to research, how I approached it, and how I engaged with others.

A designer at heart, I undertook this work from a place of active hope: hope for the wellbeing of our land and other species, and for generations of humans yet to come. Becoming a mother in 2020 compelled me to leave a well-paid position as a design consultant to pursue this PhD, even though I had been content at the time. Perhaps, I thought, I could help make the world a better place through my

1 Speciesism is a bias that prioritizes the interests of one's own species over those of others, leading to the belief that humans are entitled to exploit non-human animals. The term was coined by English writer, psychologist, and animal rights advocate Richard D. Ryder in 1970.

profession - or at the very least, stop making it worse. I gave myself a year to see whether the path would suit me and once I got settled, I did not look back.

My years as a commercial designer, coupled with what I can only describe as an almost pathological commitment to harmony (in the broadest sense), kept me oriented towards impact and alignment with stakeholders throughout this journey. Two questions became my compass: Will this work contribute to the phase-out of factory farmed animals from our diets? And will it help us treat food - and those who produce and embody it - with deeper respect?

The result is a dissertation that is interdisciplinary and extends beyond the field of design. I believed I could be most effective by integrating design expertise with other knowledge domains, primarily transition studies, behavioural science and food system research. To reach academics, practitioners, and the wider public, I combined academic research with design and art projects in practice. I engaged with popular media, accepted interviews, and presented at design agencies and commercial organisations.

In doing so, I hope this work has contributed to the broader food conversation and to the various academic fields engaged with in this dissertation. If not, then at the very least, the past five years have been the happiest of my life. For that, I will always be grateful.

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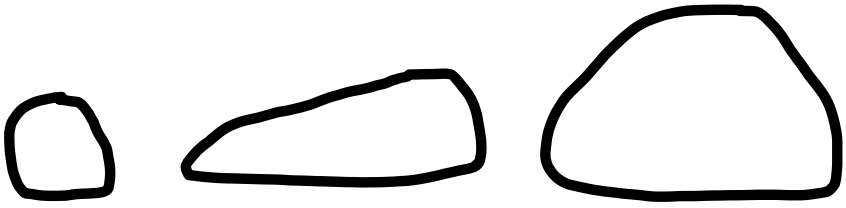


GENERAL INTRODUCTION

Chapter 1
General introduction

The motivation for this doctoral research is to explore how design might foster societal transitions. Specifically, this dissertation aims to offer transformative strategies for intervention in the plant-based protein transition, where faster progress is needed. Additionally, we[2] study deliberate systemic breakdown as an approach in transitions that is underexplored in both literature and practice.

This introductory chapter opens with describing the protein transition case in more detail. Following, we present the interdisciplinary theoretical background of the research, drawing on the fields of design research, transition studies, sustainable behavioural science, and food system research. We present knowledge gaps across four themes, followed by our contributions and research approach. The introduction closes with an outline of the dissertation and a summary of each study's research questions, methods, and outcomes.

1.1 The case of the protein transition

The shift towards plant-based diets is increasingly recognised as essential for achieving a just, sustainable, and health-supportive food system (Aiking, 2011; Fourat & Lepiller, 2017; Hartmann & Siegrist, 2017). Animal-based foods produce twice the greenhouse gas emissions of plant-based alternatives (Ritchie & Roser, 2019; Xu et al., 2021), have a high water footprint (De Boer et al., 2013) and occupy 80% of agricultural land use through livestock and feed production (Ritchie & Roser, 2024). At the same time, in comparison with plants, animals are relatively inefficient at converting resources into calories and protein (de Vries & de Boer, 2010; The Eat-Lancet Commission, 2019). Moreover, red and processed meats carry societal disease burdens; they are linked to cardiovascular diseases, diabetes, and gastrointestinal cancer (Lescinsky et al., 2022; Wang et al., 2024). Rising concerns about animal welfare and global agricultural injustices further challenge the current system (Béné et al., 2020; Vermeulen et al., 2020). Together, these factors underpin the growing call for a 'plant-based protein

2 'We' refers to the main author of this dissertation (Anna-Louisa Peeters) and the co-authors of the studies included.

transition': a dietary shift away from animal proteins towards predominantly plant-based sources (Dagevos & Onwezen, 2025).[3]

The protein transition is distinct for its deep cultural and emotional embeddedness, ethical complexity, and a focus on consumer behaviour. Sectors such as energy and mobility have seen more proactive government involvement (Kungl, 2015; Smink et al., 2015; Wesseling et al., 2015). Consequently, the protein transition has largely been directed by commercial interests. This highlights the need for a tailored approach that prioritises cultural and behavioural factors while strategically engaging with market dynamics.

While innovation is acknowledged as an effective means to accelerate the protein transition (Herrero et al., 2020), the persistent global demand for animal products highlights the need for pluralistic approaches to accelerate the transition in new ways (Caniglia et al., 2020). The research in Chapters 3-5 answers to this need with novel, concrete, and integrative areas of intervention for the protein transition.

1.1.1 Research consortium and scope

This research took place within the interdisciplinary research project 'Accelerating the Transition to Plant-Based Proteins', (partly) financed by the Dutch Research Council (NWO). The project was part of the larger national research programme 'Transitions and Behaviour'. The consortium consisted of three academic partners that contributed to the project with expertise from different fields: University of Utrecht (innovation studies and psychology), Wageningen University & Research (marketing and consumer behaviour), and Delft University of Technology (design, this dissertation). In addition, five (semi-)private consortium partners informed and sponsored the project: Unilever, Danone, the Dutch Centre for Nutrition (het Voedingscentrum), Freedomlab, and the Green Protein Alliance. Design was deemed suitable to connect the diverse perspectives on the protein transition in this project, as an integrative and

3 A critical note on delineating the '(plant-based) protein transition' as such, is that it negates the interconnectedness of proteins with other macro-nutrients in our diets. Some people therefore find the 'food transition' a more appropriate reference to the shift that is needed, which then also includes the change towards healthier diets, as well as a more just and resilient food system. However, this dissertation has mostly focused on the specific challenge in the food transition of collectively choosing plants over animals, so for clarity we use the term 'protein transition' to refer to this societal shift.

orchestrating discipline (van Arkel & Tromp, 2024). Indeed, TU Delft led a collaborative study involving all PhD candidates, integrating insights from the four featured disciplines (Chapter 4). Two other collaborations arose during the project, which are included in Chapter 4 (with Freedomlab) and intermezzo I (with Voedingscentrum).

This dissertation focuses on the Netherlands, where the government aims to shift the animal-plant protein ratio from 60 : 40 to 40 : 60 by 2050 (Aiking & de Boer, 2020). Demand for animal protein has barely declined in the Netherlands (and continues to rise globally), despite interest in meat and dairy alternatives (Freedomlab, 2024). We chose to primarily focus on this consumer demand side in the food system for several reasons. First, demand-side change represents a high-leverage point in systems transformation, enabling shifts in values and mindsets from which decisions and behaviours follow (Meadows, 2009).[4] Second, consumption patterns directly shape market signals, influencing what is produced and scaled (iPES-Food, 2016; Köhler et al., 2019). And third, design is traditionally user- and consumer-oriented (Norman, 2013), allowing us to draw upon extensive academic and practical expertise from this field when aiming to influence consumer demand.

1.2 Theoretical background

To contribute to the double goal of this interdisciplinary dissertation – 1) establishing transformative strategies for intervention in the protein transition, and 2) pursuing deliberate systemic breakdown by design – we draw on design research, transition studies, sustainable behavioural science, and food systems research. We present several concepts and frameworks from these fields that have been foundational for this doctoral research.

We first conceptualise *societal transitions* in this background section and how design has been engaging with them in recent years. We zoom in on *reframing* as a crucial capability of designers to identify novel ways to address the complex issues inherent to transitions. Since transitions ultimately involve people doing things differently (e.g. adopting a 'plant-forward' diet), we introduce the main concepts

4 Donella Meadows' seminal work on systemic leverage points outlines twelve places to intervene in a system, revealing that the most powerful and transformative changes often come from shifting mindsets, paradigms, and the goals of the system itself (Meadows, 1997).

of *behaviour and social practices* in transitions, as used in this dissertation. Finally, we present the state-of the-art knowledge around deliberate *systemic breakdown*.

1.2.1 Societal transitions

The protein transition is an example of a societal shift that can be considered desirable from the perspective of collective and long-term wellbeing. In transitions literature, societal transitions[5] are understood as all-encompassing shifts of socio-technical systems, leading to more just, resilient, and environmentally sustainable production and consumption patterns (Hebinck et al., 2022; Markard et al., 2012; Pel et al., 2020). Transitions typically unfold over multiple generations, and are studied within certain industries or domains, such as energy, mobility, or food and agriculture. However, societal systems are inherently linked to each other, so shifts in one domain always affect adjacent domains (Köhler et al., 2019).

In transitions literature, societal transitions are engaged with as concepts to be *understood* as well as *influenced*. Historical analyses of transitions have contributed significantly to the current understanding of how transitions unfold (for instance, the phase-out of the British coal industry: Turnheim & Geels, 2012). Notable frameworks have also supported transition analyses, such as Strategic Niche Management (SNM) (Kemp et al., 1998), the Technological Innovation System (TIS) framework (Hekkert et al., 2007), the Multi-Level Perspective (MLP) (Geels, 2002) and the X-curve (Loorbach et al., 2017). This dissertation makes most use of the holistic and less technology-oriented MLP (Chapters 2 and 3) and the X-curve (Chapters 2, 3, and 6). The MLP highlights how systemic change unfolds over time through interactions between *niche* innovations, dominant socio-technical *regimes*, and broader *landscape* pressures in society. Transitions occur when external pressures destabilise regimes, creating windows of opportunity for innovations to challenge, alter, or replace parts of the system (Geels, 2002; Geels & Schot, 2007). The X-curve framework is used to describe how transitions involve both the *build-up* of a more desirable system, as well as the *breakdown* of elements that have become redundant (Loorbach et al., 2017). As such, it highlights that in parallel with the introduction and dissemination of

5 In Chapter 3 we refer to societal transitions as *sustainability* transitions, which aligns better with some literature in transition studies. However, we prefer the term *societal* transitions, as it more holistically describes the all-encompassing shifts we are studying.

(technological) innovations, transitions involve systemic decline and phase-outs as well.

To not only analyse but also influence transitions, Transition Management is a notable and mature governance approach from the field of transition studies. The practice combines principles from transition studies with principles from evolutionary economics and participatory policy development (Loorbach & Rotmans, 2010; Rotmans et al., 2007). Transition Management aims to foster transitions by guiding innovation through iterative learning, stakeholder collaboration, and vision-led experimentation (Raven et al., 2010; Rotmans et al., 2001; Rotmans & Loorbach, 2009). Despite the maturity of Transition Management as a governance approach in transition studies, there is a persistent call for actionable knowledge (Hölscher et al., 2023) and inclusive, participatory approaches (Shove & Walker, 2007; Voß et al., 2009) that explicitly consider the human-dimension (López Reyes et al., 2020). For this reason, Chapters 2 and 3 provide actionable, interdisciplinary and human-centred knowledge in transition contexts, whereas Chapter 6 offers a research agenda to advance transformative knowledge around systemic breakdown in transitions.

1.2.2 Transition design

Transition design is another approach to influence transitions. It refers to a field of research and practice that combines transition studies with the more prescriptive and practice-oriented field of design. Transition design, or design for sustainability transitions,[6] has emerged as a distinct branch of design, focused on initiating and supporting societal transformations towards more desirable futures (Ceschin & Gaziulusoy, 2016; Gaziulusoy & Öztekin, 2019; Irwin et al., 2015). Positioned at the intersection of design studies, transition studies, systems thinking, environmental science, social sciences and the humanities (Gaziulusoy & Öztekin, 2019; Irwin et al., 2015), transition design is fundamentally

6 Two complementary bodies of research engage with design and transitions, referring to the discipline either as 'transition design' or as 'design for sustainability transitions'. The first was introduced by Terry Irwin in 2015, while the second is used most notably by scholar Idil Gaziulusoy. The key difference between their approaches is that Irwin is relatively normative and speculative, while Gaziulusoy is more analytical and theory grounded. In this dissertation, we use the term 'transition design' to refer to both strands of research.

transdisciplinary: it draws together diverse disciplines around a shared goal (McPhee et al., 2018).

Transition design is a relatively young field; empirical studies are steadily accumulating (e.g. Dahle, 2019; Gaziulusoy & Ryan, 2017; Goss et al., 2024; Miller & Baumber, 2025), though still limited in numbers (Miller, 2024). As such, for any research purpose, the body of empirical examples to contrast and compare with each other is still relatively small. This dissertation addresses that gap, by studying design in various transition contexts (Chapters 2 and 6) and more profoundly in the protein transition (Chapters 3-5).

1.2.3 Reframing

According to Irwin and colleagues (2020), transition design is grounded in four mutually reinforcing and co-evolving areas of knowledge, action, and self-reflection: visioning, theories of change, mindsets, and methods. Among these, visioning and theories of change intersect in a key design competence: reframing (Dorst, 2011; van Arkel & Tromp, 2024; van der Bijl-Brouwer, 2019). In design, reframing is understood as a 'diagnostic-prescriptive' practice through which problems are constructed and reconstructed to deepen understanding and uncover opportunities for creative action (Cross, 2006; Nielsen et al., 2025; Schön & Rein, 1994). Put differently, reframing is both a proactive and a reflective practice that establishes a novel perspective from which a problem can be approached (Dorst, 2019; Paton & Dorst, 2011).

Reframing is especially relevant in transition contexts for two reasons. First, design outcomes tend to improve when shaped through iterative processes of reframing (Lawson, 2006; Nielsen et al., 2025; Valkenburg & Dorst, 1998). This is particularly valuable for ill-defined, complex systemic challenges typical of transitions, as it allows for adaptation to evolving conditions and emerging insights. Second, reframing can help identify systemically transformative strategies for intervention that would otherwise not have been considered (Dorst & Watson, 2020; Irwin, 2018; Jerneck & Olsson, 2011; Mukherjee et al., 2020). For instance, in the protein transition a dominant strategy is the mimicking of meat and dairy with so-called plant-based 'analogues'. In the past years in the Netherlands, most attention and resources have been invested in this substitution pathway, diverging attention from potentially more transformative strategies (Bulah, et al., 2023b; van der Weele et al., 2019). As Chapters 3-5 demonstrate,

reframing can provide alternative and more strategic angles that might help prevent getting 'locked-in' to one such dominant pathway in this transition.

While design studies have explored reframing in complex contexts, most of these focus on the framing process or the designer's role in it (e.g. Dorst, 2015; Gaziulusoy & Ryan, 2017; Irwin, 2018; Lee, 2020; McGrail et al., 2015; van der Bijl-Brouwer, 2019). Few studies have focused on the content, structure and logic within the frames themselves. Notably, Kees Dorst developed a logical formula describing a design frame (Dorst, 2015), building on earlier work by Roozenburg (1993), who linked framing to abductive reasoning as a way of generating original and valuable solutions. We build on Dorst's formula in Chapter 2 by expanding it with interdisciplinary knowledge and tailor it to the context of societal transitions.

In Chapter 3, our design lens on frames also contributes to transitions literature on framing. Transition studies typically analyse frames in communication by studying discourse (e.g. Isoaho & Karhunmaa, 2019; Kriechbaum et al., 2023; Rosenbloom, 2018). In design, frames are considered to also manifest in the 'stuff' we design (Dorst, 2015; Hekkert & van Dijk, 2014). As such, examining the human-made environment in the protein transition (products, services, the retail environment, etc), can reveal solution directions that may not appear in language. As such, frame analyses of 'what people *say'* can be complemented by examining 'what people *make'* as well, as Chapter 3 indeed demonstrates.

1.2.4 Consumer behaviour in transitions

As mentioned in section 1.1.1., this dissertation explores the role of consumers in transitions. In prevailing transition frameworks, consumers are often portrayed as passive agents with predetermined roles (Randelli & Rocchi, 2017), rather than as active participants capable of shaping transition processes themselves (see e.g., Geels, 2011; Hekkert et al., 2007). Therefore, real-life routines and behaviours remain underexplored in transitions literature (Hargreaves et al., 2013; Upham et al., 2025). This dissertation responds to this by drawing upon complementary knowledge from sustainable behavioural science and social practice theory.

Literature on (design for) consumer behaviour typically adopts a micro-perspective, examining behaviour at the level of individuals (e.g. Michie et al., 2011; Niedderer et al., 2018; van Valkengoed et al., 2022). Social practice theory, on the other hand, looks at behaviour more systemically (Hargreaves, 2011;

Reckwitz, 2002). Social practices are promising units of design (Kuijer et al., 2013), particularly in transitions (Garduño García & Gaziulusoy, 2021; Irwin et al., 2020; Kossoff, 2015), because they involve routinized patterns of behaviour that are carried out by individuals but shaped by broader social, material, and cultural contexts (Shove et al., 2012). They consist of interconnected elements such as skills, meanings, materials, and rules that together form the way people do things in everyday life (Reckwitz, 2002). Examples of social practices are cooking meals, commuting to work, recycling or sorting waste, online shopping, and celebrating holidays.

As with societal transitions, different social practices are intertwined, meaning that a deliberate shift in one practice will have (un)intended consequences for adjacent practices (Shove et al., 2012). For instance, the introduction of the microwave oven as a feminist intervention in the 1970s not only allowed people (particularly women) to work more; it led to less cooking, altered diets, and the decline of family dinners (Tonkinwise, 2018).

To influence social practices with design, the sub-field of design for (sustainable) behaviour change (DfBC) can offer guidance (for instance, see Cash et al., 2020; Lilley, 2009; Michie et al., 2011; Niedderer et al., 2018). In acknowledgment of their complementariness, Chapter 2 presents a transdisciplinary theoretical model that integrates behaviour at both the individual level and the systemic level of practices, for the purpose of societal transitions.

In Chapter 5 we use design to address a specific knowledge gap in sustainable behavioural science around the incongruence between people's values and their actions (Blake, 1999; Schanes et al., 2018). The *value-action gap* explains that while we value the lives of animals, we still choose to eat them; a significant behavioural challenge in the protein transition (and in food consumption generally: Asif et al., 2018). Recent research highlights the importance of accounting for the 'situational context' as a variable that may influence the discrepancy between values and behaviour (Carrington et al., 2010; Sultan et al., 2020). Despite its widespread recognition, empirical studies exploring the value-action gap and ways to bridge it are limited (Chai et al., 2015). Novel to sustainable behavioural science, we evaluate a design intervention to address this behavioural challenge in a pluralistic way; it reshapes various aspects of consumers' context through ethical choice architecture to foster sustainable meat purchasing (Thaler & Sunstein, 2008).

1.2.5 Systemic breakdown in transitions

As we established earlier, systemic build-up and breakdown are interdependent in transitions. They shape one another in a dynamic, bi-directional way (Rinscheid et al., 2021; Turnheim & Geels, 2013). However, in both transition studies and design research, systemic build-up (through innovation) has been explored and valued significantly more than its counterpart: systemic breakdown (Coops et al., 2024; Hebinck et al., 2022). At the same time, the latter is considered a crucial "flip-side" of transitions (Köhler et al., 2019).

While transition studies increasingly offer descriptive knowledge around systemic destabilisation, decline , and phase-outs (e.g. Rinscheid et al., 2021; Turnheim & Geels, 2012; van Oers et al., 2021), the field lacks prescriptive work tailored to breakdown and has only recently started to explore the human-emotional dimension of letting go in transitions (Bogner et al., 2024). Design research, on the other hand, offers some concrete prescriptive and human-centred approaches to 'design away' or 'undesign' (Coombs et al., 2018; Pierce, 2012; Tonkinwise, 2014), yet these studies typically have not considered transition dynamics. A profound gap across transition studies and design research thus involves actionable and transformative knowledge to support systemic breakdown in transitions, which integrates the human experience. A few studies have responded to this gap recently (for instance, Coops et al., 2024 and Noëth et al., 2023). In this dissertation, Chapter 6 contributes to this same gap with the proposal of a novel area for research and practice around design for systemic breakdown in transitions, that is anchored in literature and expertise from design research and transition studies.

1.3 Knowledge gaps and interdisciplinary contributions

This doctoral research generates knowledge in four academic fields: design research, transition studies, sustainable behavioural science, and food system research. The dissertation clearly demonstrates the principle of 'guide and supply' in interdisciplinary research, as described by Balsiger (2004): one 'guiding' discipline calls for answers, which adjacent disciplines then 'supply'. Which of the four disciplines guides or supplies, varies per study in this dissertation (figure 1a).

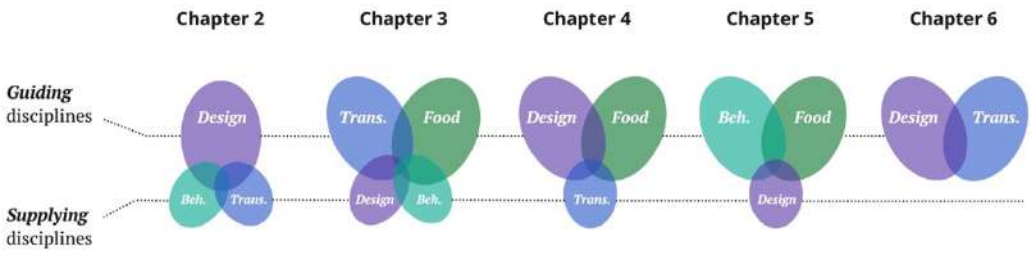


Figure 1a. How Chapters 2-6 are 'guided' and 'supplied' by the four academic fields in this interdisciplinary dissertation: design research ('Design'), transition studies ('Trans.'), sustainable behavioural science ('Beh.'), and food system research ('Food').

The ten knowledge gaps this dissertation addresses can be grouped into four themes (figure 1b):

- Pluralistic approaches to influence transitions
- (Re)framing
- The role of consumer behaviour in transitions
- Systemic breakdown

Figure 1b. The ten knowledge gaps addressed in this dissertation in the fields of transition studies, design research, sustainable behavioural science, and food system research. The coloured columns represent the 'guiding' disciplines where the gap is situated, and the dots that 'supplying' disciplines that provide (part of) a response.

1.4 Research method

This dissertation has the dual goal of identifying transformative strategies to foster the protein transition and exploring systemic breakdown as a deliberate approach in transitions. To support this, it is segmented into three parts, each driven by an overarching research question (figure 1c). The first part aims to conceptualise a transformative design frame, informing the second part, which seeks to identify strategies for intervention in the protein transition. The third part focuses on deliberate systemic breakdown.

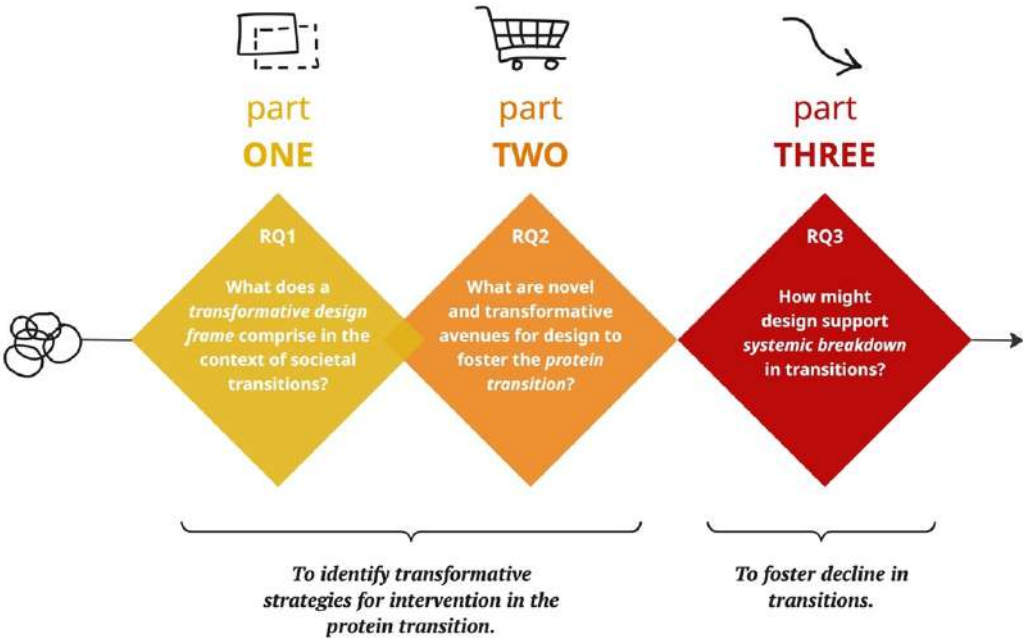


Figure 1c. The dual goal of this dissertation connected to the three parts of this dissertation and corresponding research questions.

This dissertation mostly reflects a *pragmatist* research approach. Pragmatism is a practical, action-orientated philosophy that prioritises solutions to real-world problems over philosophical consistency. It values pluralism in methods and perspectives, using whichever approach best addresses the research question (Morgan, 2014). Acknowledging the interdisciplinary character of transitions, the

studies from this research have been published in different fields, essentially following our intention to mobilise various academic communities. Moreover, since transitions truly occur 'out there', the scientific studies were complemented by experiments (projects) in practice. This back-and-forth between research and action, or thinking and doing, allows for knowledge development that is theoretically rigorous and practically relevant (van de Ven, 2007).

The profession of design is also positioned in a pragmatist way in most of this dissertation. We support the idea that 'diffuse design', as opposed to 'expert design', is applied by anyone driving change processes deliberately (Manzini, 2015). Positioning design this way, the research can bring actionable insights to policy makers, innovators, entrepreneurs, *and* professional designers.

Our research questions focus on *qualitative* dimensions: the content of design frames, pluralistic strategies for the protein transition, and how design can support systemic breakdown. These questions aim to capture the complexity, context, and meaning inherent in systemic change. Accordingly, all studies (except Chapter 5) employed qualitative methods such as interviews, case studies, research through design, and thematic analyses. Qualitative inquiry is particularly well suited to the early stages of transitions, where uncertainty is high and data limited. It enables exploratory, open-ended investigation and allows insights to emerge inductively, rather than being restricted by predefined variables or hypotheses (de Gooyert et al., 2024). Qualitative methods are also valuable for revealing micro-level dynamics of the narratives, frictions, and lived experiences that may signal where and how innovation can be seeded (Ceschin & Gaziulusoy, 2016; Hansmeier et al., 2021). At the same time, we acknowledge that quantitative approaches can be highly valuable for other types of research objectives.

1.5 Dissertation outline with sub-research questions

This doctoral research involves peer-reviewed studies as well as complementary projects in practice. Five academic studies are presented in separate chapters, while the work in practice is consolidated into three intermezzos (figure 1d).

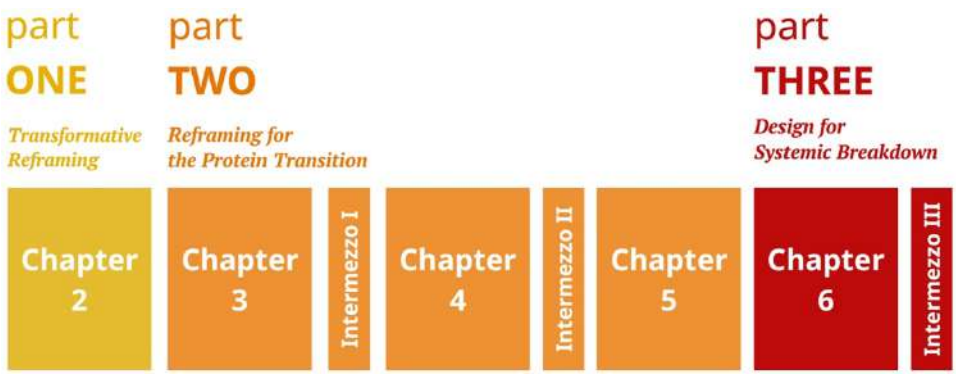


Figure 1d: outline of dissertation: chapters of peer-reviewed studies and intermezzos featuring projects in practice.

Following, we present the three parts of this dissertation with their corresponding chapters and intermezzos in detail, including their sub-research questions, used methods and key outcomes. An overview of all studies can be found in table 1a.

1.5.1 Part One: Transformative reframing

The first part of this dissertation lays the theoretical foundation for the rest of the research, conceptualising a design frame in the highly complex context of societal transitions. The main research question of this part was "*What does a transformative design frame comprise in the context of societal transitions?"*

Study 1: Conceptualising a transformative design frame

The first study (Chapter 2) conceptualises design frames in the context of societal transitions, integrating literature from transition studies, sustainable behavioural science, and design. We developed a theoretical model of a 'transformative design frame' and invited practitioners from three design agencies to review it as part of a *multiple-case study*. The study pursued two research questions:

- **Research question 1.1**: How well does the proposed model correspond with design frames from practitioners?
- **Research question 1.2**: How does the model support the development of (a) a transition design rationale and (b) the development of a reframe?

A *thematic analysis* of the feedback from the participants informed a revision of the model and provided insights around reframing for transitions in practice.

1.5.2 Part Two: Reframing for the protein transition

The second part of this dissertation focuses on (re)framing in the specific context of the protein transition. The main research question of this part was *"What are novel and transformative avenues for design to foster the plant-based protein transition?"*

Study 2: Status quo of design framing in the protein transition

Our second study (Chapter 3) establishes the status quo of design framing in the Dutch protein transition, through *expert interviews* and a *thematic analysis* of 62 interventions fostering plant-based diets. Combining transition studies and design research, the research question was:

- **Research question 2**: Which frames are prevalent in consumer interventions that foster the protein transition, and how can these further shape the intersection of design and transitions?

The study identified eight prevalent pathways[7] for design and policy in the protein transition, confirming the dominance of meat and dairy mimicking and highlighting its risks for the transition. Existing pathways involving (governmental) regulation and cultural interventions were deemed most transformative. Promising novel pathways involved inclusivity and the deliberate reduction of animal products (i.e. systemic breakdown). Another potentially transformative novel pathway concerned the diversification of design frames, which would lead to portfolios of interventions fostering the transition more effectively as a complementary set.

Intermezzo I: MSc graduation projects

Intermezzo I reports on three *MSc graduation projects* pursuing opportunities for design that were identified in the previous study, namely around inclusivity in the

7 In this study design frames are coined 'Transition Design frames' (TD frames), which are then linked to pathways for design in the protein transition. The definition of TD frames in this study overlaps partially with the conceptualisation of a transformative design frame in our first study (Chapter 3), but differs because of their distinct audiences; Chapter 3 caters to the design research community, whereas Chapter 4 primarily targets transitions scholars. Moreover, Chapter 3 and 4 were executed simultaneously, and the review process of Chapter 3 was finalized 6 months after the review process of Chapter 4; their content could only co-evolve partially.

protein transition and the diversification of design frames within one intervention portfolio. We highlight the lessons from these projects for this doctoral research.

Study 3: Reframing opportunities for the protein transition

The third study (Chapter 4) combines results from a *scenario study* from Freedomlab (a consortium partner) with results from our second study, by *mapping the prevalent design frames* in the Dutch protein transition onto the four scenarios. The research questions were:

- **Research question 3.1**: How might prevalent design frames foster future scenarios in the Dutch protein transition?
- **Research question 3.2**: Which novel opportunities for design emerge from mapping design frames onto the scenarios?

Results showed how current pathways (can) contribute to each of the scenarios, as well as two novel pathways for design to foster the transition: 'Stretching Horizons' (to help consumers overcome neophobia) and 'Gracious Goodbyes' (to support the decline of animal products in our diets). We also identified implications for the practice of reframing.

Intermezzo II: Opinion piece

Intermezzo II is an *opinion piece* for the Volkskrant, a Dutch newspaper, arguing the need for a culinary cultural shift to catalyse the protein transition in the Netherlands. It advocates for a new norm, where plants have become the heroes on our plates and animals play a supporting role. The piece translates academic insights from all previous chapters to an actionable narrative for the general public. It aims to inspire and mobilise various actors in the food system to contribute to this cultural shift, including policy makers, chefs, teachers, parents, influencers, and artists.

Study 4: Mitigating the value-action gap with design

The fourth study (Chapter 5) explores how design might help minimise the value-action gap, integrating the fields of sustainable behavioural science and design. The research question was:

- **Research question 4.1:** Can a redesign of choice architecture close the value-action gap and facilitate more sustainable meat purchase?

Applying *research through design*, we test a design intervention that applies a diversity of design frames in a *web-based experiment*. Following an *attrition analysis* and a *logistic regression analysis*, results showed the intervention was effective in fostering sustainable meat purchase. However, it did not significantly boost the congruence between people's biospheric values and their behaviours. The article closes with an ethical reflection on nudging for the purpose of societal transitions.

1.5.3 Part Three: Design for systemic breakdown

The third and final part of this dissertation delves into a reframing opportunity identified in Part Two: designing for systemic breakdown. It first develops a research agenda to support 'design for decline' in transitions and continues with practical explorations of its knowledge themes in the protein transition. The main research question of this part was "*How might design support systemic breakdown in transitions?*"

Study 5: An emerging area for research and practice - Design for Decline

The fifth study (Chapter 6) explores the reframing opportunity found in Chapters 3 and 5, involving deliberate systemic breakdown. Situated at the nexus of transition studies and design research, it was guided by the research question:

- **Research question 5:** How can design practices contribute to systemic breakdown in transitions, and what transformative knowledge is needed to advance this practice?

Following a *narrative literature review*, *15 expert interviews* with academics and practitioners, and a *thematic analysis* of the combined data, eight knowledge themes of designing for systemic breakdown were identified. These themes form the foundation of an emerging area of research and practice, termed *Design for Decline*. Each theme raises a set of theoretical and empirical research questions, suggested to be pursued in scholarship and practice.

Intermezzo III: Applying design for systemic breakdown

Finally, intermezzo III presents several projects that have navigated design for systemic breakdown in practice: two *MSc graduation projects*, an *art project* in collaboration with researchers from Wageningen Research, and a *theatrical keynote presentation* at the Plant FWD conference in 2025 in Amsterdam (which invited attention and feedback from various actors in the Dutch food system). Lessons

from these projects shed light on the opportunities and barriers surrounding (deliberate) decline in transitions, including specific insights for the protein transition.

intermezzo I ↓ *intermezzo II* ↓ *intermezzo III* ↓

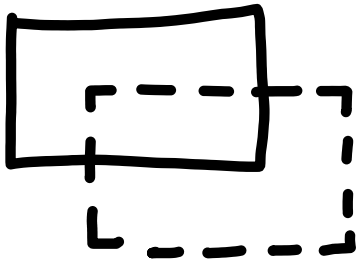
	Part One: Transformative reframing	**Part Two: Reframing for the protein transition**			**Part Three: Design for systemic breakdown**
	Chapter 2 **Transformative Design Frames**	*Chapter 3* **Framing for the Protein Transition**	*Chapter 4* **Transformative Design Strategies for plant-based diets**	*Chapter 5* **Designing for Value-Behaviour consistency**	*Chapter 6* **Design for Decline**
Domain(s)	Mobility, circularity, and landscape transitions	Protein transition	Protein transition	Sustainable food consumption	Multiple societal transitions
Fields of contribution	• **design** for transitions • transition studies • sustainable behavioural science	• **transition studies** • design for transitions	• **design** for transitions	• **sustainable behavioural science** • design (for behaviour change)	• **design** for transitions • transition studies
Research Questions	1.1 How well does our proposed model correspond with design frames from practitioners? 1.2 How does the model support the development of (a) a transition design rationale and (b) the development of a reframe?	2.1 Which frames are prevalent in consumer interventions that foster the protein transition? 2.2 How can this further shape the intersection of design and transitions?	3.1 How might prevalent design frames foster certain future scenarios in the Dutch protein transition? 3.2 Which novel opportunities for design emerge from mapping design frames onto the scenarios?	4.1 Can a redesign of choice architecture close the value-action gap and facilitate more sustainable meat purchase?	5. How can design practices contribute to systemic breakdown in transitions, and what transformative knowledge is needed to advance this practice?
Research Methods	• Multiple case study • Framework analysis	• Expert interviews • Thematic analysis	• Strategic foresight • Intervention mapping	• Research through design • Web-based experiment • Attrition analysis • Logistic regression analysis	• Literature review • Expert interviews • Thematic analysis

	Chapter 2	*Chapter 3*	*Chapter 4*	*Chapter 5*	*Chapter 6*
Results	Transdisciplinary model of a transformative design frame	• Eight prevalent pathways for design to foster the protein transition • Several opportunities for novel pathways	• Insight into implications of prevalent design frames • Two novel pathways for design to foster the protein transition	The introduced design intervention increases sustainable meat purchases, yet does not increase congruence between biospheric values and behaviour.	• Eight knowledge themes of design for systemic breakdown • Design for Decline research agenda
Theoretical contribu-tions	Empirical evidence on value of interdisciplinary research and systematic design framing	Theory around framing, influencing transitions, and the locus of design in transitions	Theory around the value of combining scenario studies with design framing	• Empirical evidence on the value of design for sustainable behaviour • Theory around nudging	Integration of multidisciplinary literature on systemic breakdown with study results
Implica-tions for practice	Model to guide reframing in practice	Actionable directions for policy and design	Actionable directions for design	Rationale and inspiration for the application of ethical choice architecture	Actionable directions for exploration to foster systemic breakdown
Output	• **Journal article in Contexts (2025)** • Conference paper at RSD12	• **Journal article in EIST (2024)** • Conference workshop at RSD10 (2021) • Conference paper at SCORAI 2023 • Poster presentation at SISA-4 (2024)	• **Conference proceeding at EFOOD24 (2024)**	• **Journal article in Cleaner and Responsible Consumption (2022)**	• **Submitted to She Ji** • Keynote presentation at Plant FWD conference (2025) • Featured in Dutch Design Week 2025

Table 1a: Overview of the empirical studies conducted in this doctoral research.

We don't see things as they are.
We see them as we are.

Anaïs Nin



PART ONE
TRANSFORMATIVE REFRAMING

Chapter 2
Transformative design frames: A transdisciplinary model to support designing for sustainability transitions

This chapter is previously published as:

Peeters, A., Tromp, N., Hekkert, P.P.M. (2025). Transformative Design Frames: A transdisciplinary model to support designing for sustainability transitions. Contexts: The Systemic Design Journal. Volume 3.

Abstract

Sustainability transitions are inherently comprised of wicked problems, requiring new systemic problem-solving approaches that transcend disciplinary boundaries. Design framing is a practice that lies at the core of problem-solving, as it connects a specific problem to a promising solution space. We contribute to transition design research by conceptualising a transformative design frame. Anchored in the fields of design, sustainable behavioural science, and transition studies, our transdisciplinary model is intended to support transition designers in their reasoning and to inspire the development of novel frames to help accelerate sustainability transitions. The model visually organises several building blocks of a design frame: Transition Case, Transition Strategy, Systemic Levers, Behaviour Change, and Worldview. To evaluate our model in various transition design contexts, we held review sessions with three Dutch design agencies, followed by a framework analysis of their responses. The results informed a revision of the model and demonstrated that the model supports designers in building a stronger design rationale, which the designers expected to benefit stakeholder alignment and mobilisation in transition contexts. After engaging with the model, participants intended to adopt a more comprehensive and systematic framing approach in future projects. To bring the model to a higher level of maturity, opportunities for further research involve applying it in practice. As such, we can examine more thoroughly how the model might support reframing and explore which combinations of its components could be most transformative.

2.1 Introduction

Pressing societal challenges, such as climate change, racial injustice, the depletion of natural resources, and malnutrition, are inherently complex and dynamic; they require new systemic problem-solving approaches (Irwin, 2018; Jensen et al., 2019; Loorbach, 2022; Norman & Stappers, 2015). In design, framing lies at the core of problem-solving, as it connects a specific challenge to a promising solution space (Dorst, 2015; Schön, 1984). Exemplifying successful design framing for the transition to a circular economy, the Greek island of Tilos adopted a fresh perspective on waste management, especially appealing to its older generations: "No rubbish, like the good old times" (Fahey, 2023). The chosen frame informed an orchestration of new consumption and disposal practices among its citizens, successfully resulting in the first zero-waste-certified island globally (Polygreen, 2023). This study examines such design frames. Design essentially involves the transformation of an existing situation into a preferred one (Simon, 1996). Over the last two decades, design has evolved into a generative discipline being consulted for highly complex and systemic issues, such as sustainability transitions (Ceschin & Gaziulusoy, 2016; Irwin et al., 2020).

We define sustainability transitions as long-term, multi-dimensional, and fundamental transformation processes through which established sociotechnical systems shift to more sustainable, just and resilient production and consumption patterns (Hebinck et al., 2022; Markard et al., 2012; Pel et al., 2020). Transitions typically unfold over several generations and involve a broad range of actors. They are characterised by deep systemic changes resulting from technological, social, organisational, and institutional innovations (Ceschin & Gaziulusoy, 2016; Markard et al., 2012). Design plays a significant role in sustainability transitions, as it facilitates socio-material outcomes with lasting structuring effects on society and people (Prendeville et al., 2022). By introducing infrastructures, technologies, tools and other components, design can foster behaviours (Tromp & Hekkert, 2019) and, ultimately, lifestyles (Irwin, 2015) that are socially and environmentally favourable.

Design for sustainability transitions, or transition design, has emerged as a specialised field of systemic design, which aims to catalyse and accelerate societal shifts towards more desirable futures (Ceschin & Gaziulusoy, 2016; Gaziulusoy & Öztekin, 2019; Irwin et al., 2015). At the scientific cross-section of multiple fields, transition design is inherently transdisciplinary because it integrates

complementary disciplines towards a shared purpose (McPhee et al., 2018), i.e. to foster sustainability transitions. In this paper, we adopt the term 'transition design' to describe the field to which our work contributes, which was introduced by Terry Irwin in 2015. While we draw inspiration from her foundational frameworks and concepts, we also incorporate elements from other scholars who have explored the liminal shores of sustainability transitions and design.

Transition designers typically propose long-term, all-encompassing strategies (Irwin, 2018). However, by "scaling long" (Lake et al., 2022), they risk misalignment with stakeholders' short-term practical needs (Irwin, 2018). To address this, we introduce a transdisciplinary model of a design frame to support transition designers with the development of a robust design rationale and to guide their exploration of transformative frames, i.e. reframing. We define 'transformative' as having the potential to challenge or alter societal regimes, such as dominant cultures, practices, and structures (Loorbach et al., 2017). Our model adopts a pluralistic, action-oriented approach, as today's socioecological challenges are so complex that they require an interweaving of different cultures of reasoning (Caniglia et al., 2020; Fitzpatrick et al., 2024).

To date, several studies have examined design framing in highly complex contexts (e.g., Dorst, 2015; Gaziulusoy & Ryan, 2017; Irwin, 2018; Lee, 2020; McGrail et al., 2015; van der Bijl-Brouwer, 2019), though most emphasise the process of framing or the roles of designers in it. Our work complements this literature by examining the frames themselves and their composition in the distinct context of sustainability transitions.

We specifically examined our model in relation to 'expert design,' practised by people who have been professionally trained as designers (Manzini, 2015). We invited three design agencies to review our theory-based model by plotting the frames from their transition design projects onto the model during review sessions. The outcomes of these plotting exercises informed a revision of the model. By using and reflecting upon the model in real design projects (not this study), its practical value can be determined and inform further improvements.

Our first research question was, *"How well does the proposed model correspond with design frames from practitioners?"* This refers to the relevance of the chosen components of a design frame in transition contexts, as well as the relationships between them. Our second research question was two-fold: a) "How does the model support the development of a transition design rationale?" referring to the

reasoning behind a design frame, and b) "How does the model support the development of a reframe?"

This paper is structured into six sections. We first present our conceptual understanding of a design frame and introduce our initial model, integrating theory from several academic fields. Next, we present our framework analysis method and materials, followed by the findings from the review sessions. We then reflect on the outcomes, present an informed revision of the model, and discuss implications. The paper concludes with final thoughts and an invitation to readers.

2.2 Theoretical Foundation: Design Framing

Framing in design is a reflective practice involving the construction and reconstruction of how a problem is understood to gain new insights and opportunities for creative intervention (Cross, 2006; Schön & Rein, 1994). In other words, design framing is "the creation of a (novel) standpoint from which a problematic situation can be tackled" (Dorst, 2011, p. 525). The way a designer frames a problem can significantly shape the outcome; it determines which aspects of the problem are prioritised, informing the development of potential solutions (Lawson, 2006; Schön, 1984).

Though most studies on framing in design examine the process of framing, this paper focuses on the frames themselves. We build on work from design scholar Kees Dorst, who states that a design frame involves the desired *outcome* of an intervention as well as the *working principle* that helps achieve it (Dorst, 2015). For instance, a desired outcome might be that consumers understand the environmental impact of disposable plastic bags, which could be achieved through the working principle of playful communication about the environmental issues surrounding plastic bags. An intervention based on this design frame could be a live display at the entrance of a supermarket showing how much CO_2 was saved by customers bringing their own bags this year. As this example shows, design frames guide the creation of solutions; they are not the solutions themselves.

While after-the-fact design frames may seem fixed, they take shape in a dynamic way. The assumed problems and solution spaces co-evolve as a designer gains more insights while engaging with their design challenge (Dorst & Cross, 2001; Irwin et al., 2020a; van der Bijl-Brouwer, 2019). In fact, design outcomes have

been shown to improve when they have followed iterations of reframing (Lawson, 2006; Valkenburg & Dorst, 1998). Especially for the ill-defined, complex systemic problems in transitions, an iterative approach to framing accommodates changing conditions and new information.

The way frames are captured and communicated by designers varies significantly. Metaphors and analogies are especially suitable to convey a working principle (Casakin, 2007; Lockton et al., 2019). For example, framing a system like a garden helps designers focus on growth, maintenance, and care. Narratives and scenarios, on the other hand, can reveal critical aspects of a problem and highlight potential solutions by framing the issue within a realistic, time-bound context (Börjeson et al., 2006; Carroll, 2003; Gaziulusoy et al., 2013). Personas, which are fictional characters created to represent different user types, help prioritise and scope problems, challenge assumptions, guide decisions, and tailor solutions to specific groups of people (Miaskiewicz & Kozar, 2011). Sketching diagrams and visual models can also be applied to "assist problem structuring through solution attempts," to "enable identification and recall of relevant knowledge," and to "handle different levels of abstraction simultaneously" (Cross, 2006, p. 37).

In the pursuit of meaningful design solutions, frames are inherently value-laden (Haase & Laursen, 2019; Paton & Dorst, 2011). The subjective nature of practitioners, encompassing normative understandings, mental frameworks, guiding principles, and biases, determines their positionality and influences how they frame a situation (De Coen et al., 2023; Irwin, 2018; Lawson & Dorst, 2009; Prendeville et al., 2022). Consequently, design frames are inevitably political; their outcomes shape society in the long term (Prendeville et al., 2022, p. 72). This futuring aspect of framing is emphasised in transition design to facilitate the collective imagination of desired long-term scenarios and pathways to get there (Irwin, 2018; McGrail et al., 2015).

Dimensions of a Transformative Design Frame

In our conceptualisation of a transformative design frame, we aim to distinguish its building blocks (table 2a). Informed by the literature review, we can establish that design frames comprise five dimensions:

1. *selective lenses*, involving what is considered relevant and what is not
2. *problem diagnosis*, establishing the issue that needs to be resolved
3. *future prescription*, directing towards envisioned outcomes
4. *theories of change*, involving the working principles by which the identified problems could be resolved
5. *subjective judgments*, following the positionality of the practitioner(s)

For a transdisciplinary exploration of these dimensions, we consulted several bodies of academic knowledge. Transition design integrates design studies, systems thinking, environmental science, transition studies, psychology, sociology, anthropology, economics, communication science, and political science (Gaziulusoy & Öztekin, 2019; Irwin et al., 2015). Besides literature on (transition and systemic) design studies, we have chosen to consult sustainable behavioural science and transition studies to arrive at our theoretical conceptualisation of a design frame, as collectively, they draw upon most of the bodies of knowledge underlying transition design (Grin et al., 2010; Steg & Vlek, 2009). In doing so, the literature does not serve as a comprehensive review but as a pragmatic theoretical base to inform our design frame model.

Selective Lenses

Frames involve selective choices about which elements to emphasise and focus on (McGrail et al., 2015). Two notable types of selective lenses are applied across transition studies: sustainable behavioural science and transition design.

The first lens addresses the angle from which a system in transition is viewed. Transition studies often analyse sociotechnical systems 'from outside,' utilising widely adopted frameworks such as the Multi-Level Perspective (MLP) (Geels, 2002) and the Technological Innovation System (TIS) (Hekkert et al., 2007). In contrast, sustainable behavioural scientists examine systems 'from within,' focusing on the psychological perspective of the people within these systems (e.g., Gifford & Nilsson, 2014; Van Valkengoed et al., 2022). Transition design combines both approaches, integrating external observations with the experiential understanding of being part of the system.

A second selective lens involves sociological scales. In sustainable behavioural science, sociological levels of analysis vary from the personal level, focusing on individual behaviours (e.g., van Valkengoed et al., 2022), to the group level,

focusing on social practices (e.g., Shove et al., 2012). The latter (macro) perspective is believed to be most suitable to bring about systemic change (Chater & Loewenstein, 2022). In transition studies, the Multi-Level Perspective is frequently used to understand transformative changes in sociotechnical systems (Geels, 2002). The MLP framework distinguishes three interacting levels: the landscape, the regime, and the niche. The landscape (macro-level) encompasses broad societal trends, whereas the regime (meso-level) involves the dominant practices, structures and cultures. Radical innovations and small-scale experiments occur in niches (micro-level) that can challenge or alter the regime if they align with landscape developments (Geels, 2002). In transition design, the MLP is also used (Ceschin, 2014), though a more practical way to see the interconnectedness of different sociological levels is exemplified by the 'Domains of Everyday' framework (Kossoff, 2015). This framework distinguishes households, neighbourhoods, cities, regions, and the planet as distinct levels of community, each with typical characteristics and needs yet inherently dependent on the others. The framework values and visualises diverse forms of scale, which is understood to "help to reduce the possibilities of harm caused through narrow goals" (Lake et al., 2022, p. 4).

Reflecting upon both lenses in design, designers traditionally focus on interactions and experiences at the micro-level of individual users and the short-term (e.g., Dorst & Cross, 2001; Hekkert & van Dijk, 2020). Today, systemic (transition) designers are explicitly relating individual, meaningful interactions to long-term value for society (McGrail et al., 2015; Tromp & Hekkert, 2019; van der Bijl-Brouwer, 2019).

Problem Diagnosis

Due to their complex, dynamic, and networked nature, sustainability transitions comprise wicked problems (Leach et al., 2010; Letiche & Boucaud, 2024). Drawing from design studies, core paradoxes or 'deadlocks' are considered essential starting points of a design frame (Dorst, 2015), highlighting the dilemmas that make it so difficult for actors to move forward. The primary stakeholders involved, including their concerns and relationships, are also key in the problem frame to overcome potential barriers to resolution (Dorst, 2015; Irwin, 2018; McGrail et al., 2015). In sustainable behavioural science, explicit attention is paid to psychological, social, and structural factors impeding people from adopting or maintaining desired behaviours (Kwasnicka et al., 2016; Steg & Vlek, 2000). Transition studies complement this by considering institutional,

economic, technological, cultural, and power-related barriers for the transition to unfold (Avelino et al., 2023; Kemp et al., 1998).

Problem diagnosis also involves the setting of boundaries, which can be temporal (e.g., 10- or 50-year horizons), geographic (e.g., suburb, city, region, etc.), demographic (e.g., the Dutch population, intensive dairy farm owners, etc.), and industry-related (e.g., mobility, energy, healthcare, etc.) (McGrail et al., 2015). In addressing sustainability transitions, some scholars and practitioners also 'call a transition by its name' (e.g., the *plant-based protein transition*, Peeters et al., 2024). The choice of popular terms such as these implies some shared understanding of the wicked problem (and solution directions) involved.

To better understand current challenges and inform future governance, transition scholars frequently draw on historical lessons (e.g., Turnheim & Geels, 2013). In transition design, mapping the historical evolution of a problem has also been shown to reveal "zones of opportunity" (Irwin et al., 2021, p. 31). 'Deconstructing' a problematic situation is especially relevant for visioning (Hekkert & van Dijk, 2014; Tromp & Hekkert, 2019), which is further elaborated in the next section.

Drawing from systemic design, techniques like gigamapping (Sevaldson, 2011) and synthesis mapping (Jones & Bowes, 2017) suit the exploration and capturing of a system's highly complex (problematic) status quo, resulting in actionable references for stakeholders during projects.

Future Prescription

In the framing of solution directions, both design and transition studies acknowledge that a long-term future vision is of central importance, as they provide actors with the needed directionality (Dorst, 2015; Grin et al., 2010; Irwin, 2018). Though sustainable behavioural scientists generally focus on feasible strategies for the short-term, they do envision lasting lifestyle changes, such as energy conservation (e.g., turning off the lights, Steg & Vlek, 2009), eco-friendly consumption (e.g., following a plant-based diet, Vermeir & Verbeke, 2006), and green home practices (e.g., installing solar panels, Wilson & Dowlatabadi, 2007).Moreover, sustainable behavioural scientists advocate for proper measurement of behaviour change over time, to be able to assess and steer behavioural interventions (Steg & Vlek, 2009).

To imagine transition pathways towards envisioned futures, a popular approach is backcasting (Quist & Vergragt, 2006). Backcasting is central to transition management and involves collaborative visioning, setting interim objectives, and learning and evaluating continuously (Rotmans et al., 2001). This 'multi-term design attitude' has been deemed appropriate for transition designers as well (Ceschin, 2014), including practising vision-led backcasting (Irwin, 2018) and exploring future scenarios (Garduño García & Gaziulusoy, 2021; Gaziulusoy et al., 2013).

Demonstrated in the commonly used X-curve framework from transition management, transition pathways either involve the build-up of a new, 'better' version of a system or the breakdown and phase-out of (parts of) the system (Hebinck et al., 2022; Loorbach, 2014; Turnheim, 2023). The latter is often overlooked when considering pathways for change, though scholars are increasingly advocating for deliberately fostering phase-outs and letting go in transitions (Adams et al., 2021; Bogner et al., 2024), also by design (Coops et al., 2024; Noëth et al., 2023). As such, whether a frame proposes the build-up of new structures, practices, or cultures, or otherwise their breakdown, is of strategic importance (Loorbach, 2010).

Theories of Change

The tactical nature of a frame involves the theory of change it proposes. Change mechanisms are the 'hows' to achieve desired design outcomes (Dorst, 2015). Irwin's (2018) Transition Design Framework acknowledges that there are many fields from which theories of change can be drawn in transition design. We highlight the theory of leverage points, as it is foundational to transition design and social practice theory, which is also acknowledged by transition studies and sustainable behavioural science as a key approach to systemic change. We also elaborate on behavioural determinants as practical levers of change, which can be designed for at the individual level.

The theory of leverage points was introduced by Donella Meadows (Meadows, 1997). They are considered phenomena in a system where "the least effort yields the biggest impact" (Murphy, 2022, p. 2). Meadows presented a typology of systemic levers in a hierarchy of transformative power (Meadows, 2009), which Irwin and colleagues (2020a) have translated for designers into three meta-level areas of increasing impact. These include changing the design of the products themselves, changing consumption patterns, and changing lifestyles. Similarly

practical, Kania et al. (2018) categorised Meadows' leverage points into structural change (through altering policies, practices and resource flows), relational change (influencing relationships and power dynamics), and transformative change (shifting mental models).

Social practice theory is a systemic approach to behaviour change, which finds its roots in sociology (Reckwitz, 2002). As noted in the introduction, sustainability transitions essentially require an adaptation of lifestyles, which comprise a variety of human behaviours (Frehner et al., 2021; Irwin, 2015). Social practices, such as driving a car or cooking a meal, are routinised behaviours consisting of three interconnected elements: materials (objects, tools), competencies (skills, know-how), and meanings (cultural and symbolic significance) (Shove et al., 2012). Practices exhibit inertia, making them resistant to change, but they can transform when new elements are introduced, or existing elements are modified (Shove et al., 2012) or through design (Tonkinwise, 2015).

Complementary to this practice-oriented approach, sustainable behavioural science typically regards behavioural determinants as levers of change, such as the role of habits (Steg & Vlek, 2009; van Valkengoed et al., 2022), motivational determinants (e.g., awareness, risk perception, and self-efficacy), and contextual factors (e.g., the physical infrastructure, availability of products, and social environment). Michie et al. (2011) have consolidated such behavioural factors in a pragmatic model called the Behaviour Change Wheel, categorising 16 behavioural interventions and policies by their type of behavioural effect, fostering people's capabilities, opportunities, or motivations. Also drawing from sustainable behavioural science, Niedderer et al. (2018) argue that design interventions can either target people's cognition or their environment. The phase of the desired behaviour change is another dimension to consider, ranging from awareness to behaviour maintenance (Kwasnicka et al., 2016; Niedderer et al., 2018).

Subjective Judgments

Every frame arises from a view of the world and humanity and is thereby never neutral; it represents certain values and biases (Coyne, 1985; Hekkert & van Dijk, 2011). The inevitable subjective judgments that are made by the people involved in the development of a frame provide it with its 'colour.' One's positionality (e.g., gender, educational background, ethnicity, family history, cultural context, etc.) particularly informs judgements (Stacey, 2024) as well as (material) outputs

(De Coen et al., 2023). Sustainable behavioural scientists highlight how worldviews shape what individuals notice and how they interpret information (Gifford & Nilsson, 2014), as well as how our values and beliefs drive the selection of solutions that are considered acceptable and ethical (Stern, 2000). Transition studies also discuss how ontological perspectives influence the understanding and management of sociotechnical transitions; different ontological assumptions lead to different analytical frameworks and policy recommendations (Geels, 2010). As such, inclusive and reflexive governance that considers diverse perspectives is crucial for effective transitions (Scoones et al., 2015; Smith et al., 2005).

In other words, the variety of factors leading to subjective judgements in frames all derive from a certain worldview. We accept the definition of a worldview as "a set of presuppositions which we hold about the basic makeup of our world" (Sire, 2004). There are several frameworks, methods and tools that can facilitate a reflection on worldviews (Fitzpatrick, 2023; Sienra et al., 2017), mapping worldviews (De Witt et al., 2016), and developing a worldview as part of the design process (Hekkert & van Dijk, 2014). While everyone holds a unique worldview, typologies of worldviews can also serve as practical references when designing for transitions. For instance, a discussion on the contrasting approaches to societal development of 'green growth' (OECD, 2011) alongside 'degrowth' (Kallis, 2011) can facilitate a fruitful reflection on subjective lenses between actors in the process of framing.

Key dimensions	Units of analysis	Examples of frameworks, methods and tools	Component in design frame model
1. Selective lenses	Geographical, temporal, and sociological scales	Multi-Level Perspective, Domains of Everyday	Macro-Meso-Micro scales
2. Problem diagnosis	Core paradoxes, actors, behavioural barriers, socio-technical systemic barriers, problem boundaries, transition 'title'	Sustainable Development Goals, Multi-level perspective	Transition Case
3. Future prescription	Visions, transition pathways, scenarios, interim objectives	Vision-led Backcasting, X-Curve	Transition Strategy
4. Theories of change	Systemic leverage points, social practices, human behaviour	Theory of Leverage Points, Social Practice Theory, Behavioural Determinants	Systemic Lever, Behaviour Change
5. Subjective judgments	Biases, values, perceptions, assumptions	Green Growth vs De-Growth, Vision in Product Design	Worldview

Table 2a. Building blocks of a transformative design frame

From Frames to Interventions

Frames in design are typically translated into concrete interventions with an intended (behavioural) effect (Dorst, 2011; Tromp & Hekkert, 2019; van der Bijl-Brouwer, 2019). Design interventions can be products, services, campaigns, social platforms, policies, activistic provocations, documentaries, books, and more. The strategies for intervention, or pathways for change (i.e., design frames), that are identified in transition studies and sustainable behaviour literature are typically not as tangible. They mostly involve suggestions for policy making (Kern et al., 2019), information provision, facilitating commitment or goal setting, providing feedback or incentives, and altering choice architecture (van Valkengoed et al., 2022). While such strategies propose effective change mechanisms, they cannot be applied 'as is' to the real world; they need to be embodied in design interventions to have any effect. Transition studies and sustainable behavioural science allow significant room for practitioners with potentially limited contextual and transition insight to interpret the strategies and translate them into the interventions that people would interact with in practice. This comes at the risk of interventions being developed that either do not resonate with the targeted actors or that do not foster a transition pathway as intended.

Transformative Design Frame: Initial Model

Design frame components were synthesised based on the five dimensions (table 2a) and arranged logically (figure 2a). Table 2b shows an example of a design frame underlying an intervention in the plant-based protein transition. The initial model went through various iteration cycles by the authors over the course of three years. While we attempted to develop it systematically, we embraced logical reasoning and intuition equally in our creative process (Cupchik et al., 2024). Moreover, our positionality as design researchers is inevitably reflected in our synthesised model (De Coen et al., 2023). Therefore, we do not consider our model as definitive but introduce it as a living and evolving reference for transition designers in practice.

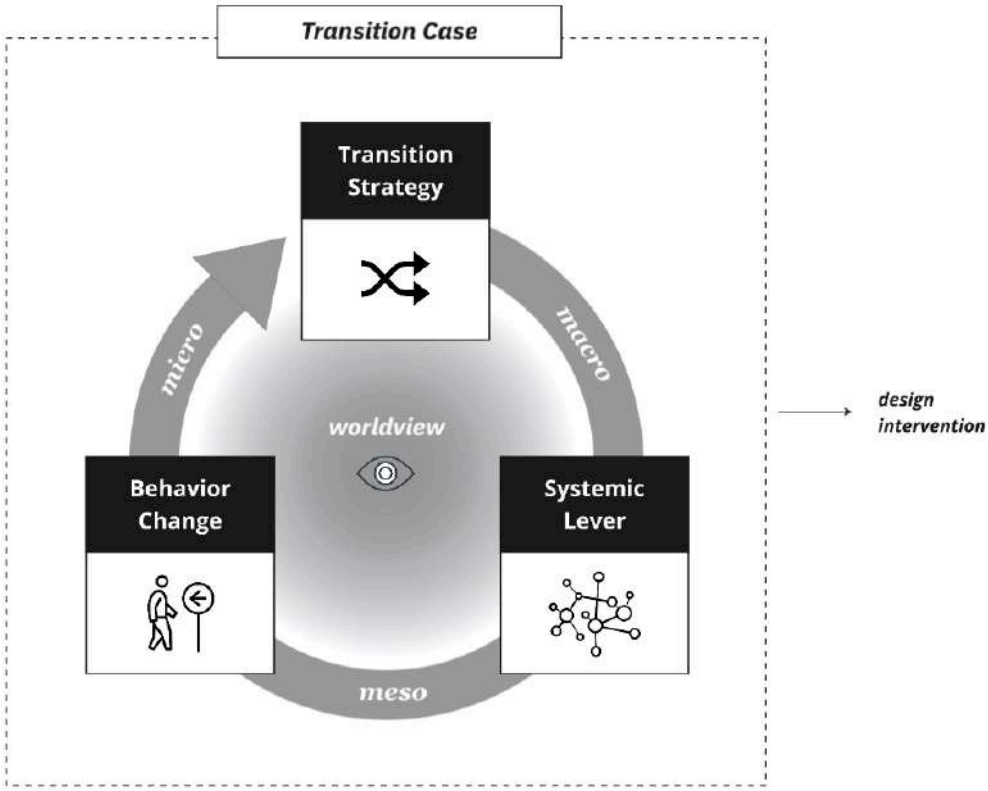


Figure 2a. The initial version of the model of a transformative design frame.

The design frame components in our initial model are *Transition Case*, *Transition Strategy*, *Systemic Lever*, *Behaviour Change*, and *Worldview*. We sought to connect a strategic system perspective (Transition Strategy and Systemic Lever) to a human perspective (Behaviour Change). We also integrated three levels of analysis relevant to transition design: *macro* (focusing on society as a whole, on a longer term and across geographical boundaries), *meso* (institutions, organisations and other groups) and *micro* (examining individual actors' everyday local behaviours in the short term) (Ritzer & Stepnisky, 2007). We positioned these levels in the arrow, moving from Transition Strategy (macro-level focus) to Systemic Lever (meso-level focus) to Behaviour Change (micro-level focus), representing a sequential consideration of these perspectives.

At the root of the design frame, we integrated problem diagnosis and scoping in the Transition Case component, visualised as the backdrop underlying the other

frame components. At the top of our design frame model, 'leading the way,' we integrated the directional and future-oriented aspects of a design frame into the Transition Strategy component. Theories and levers of change are represented by two other components in the design frame model: Systemic Levers and Behaviour Change. We positioned the subjective Worldview component in the background since it informs all other components of a design frame.

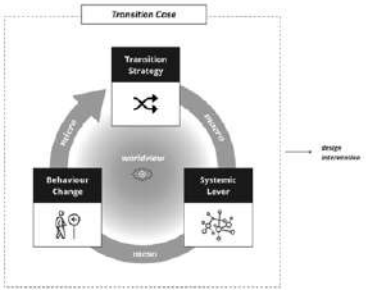
	
Design Frame Components	**The Beyond Burger:** **a plant-based burger from Beyond Meat**
Transition Case Goal, scope, problem definition	Fostering the *plant-based protein transition* in the Global North. Challenge: consumers do not want to alter their eating practices, due to neophobia and ingrained habits.
Transition Strategy Approach to foster a more just and sustainable future system	*Building up* a new, more sustainable system through a '*fit and conform' strategy*: maintaining existing eating practices, while altering dominant structures of the food system.
Systemic Lever Mechanism by which the system is shifted	New *resource flows*: alternative protein sources and infrastructures for production; and modifying *power dynamics*: redistributing power from animal farmers to food innovators and processors.
Behaviour Change Mechanism by which behaviours are influenced	*Matching* existing behaviours with a technological innovation, and applying *communication and marketing* to 'make plant-based sexy'.
Worldview A selective view on the world and on humanity	Aligns with the Green Growth movement, valuing technological innovation, a free market, globalisation, and convenience.

Table 2b. An example of the design frame underlying a plant-based burger is a food transition intervention.

2.3 Method and Procedure

Qualitative Multiple-Case Study

One research question of this study was to review the composition of the proposed design frame model (RQ1), as well as its potential to support the development of a strong rationale (RQ2a) and a novel frame (RQ2b). A qualitative multiple-case study was conducted to pursue these questions. Expert designers from four agencies in the Netherlands participated in separate three-hour review sessions, each addressing a transition they had been working on. The review session with the first agency served as a pilot to test the setup and materials of the session. We chose the framework analysis method, which is suitable for reviewing a pre-developed unit of analysis (the design frame model) with specific questions (Srivastava & Thomson, 2009). This qualitative method serves to organise and interpret the outputs of the three review sessions in a systematic way by plotting them on pre-defined themes. The eight themes of analysis were the model's key components and our research questions (table 2c).

Design Frame Model	Worldview
	Transition Case
	Transition Strategy
	Systemic Lever
	Behaviour Change
Research Questions	RQ1: How well does the model correspond with design frames from practitioners?
	RQ2a: How does the model support the development of a design rationale?
	RQ2b: How does the model support the development of a reframe?

Table 2c: The eight themes in the framework analysis.

We adopted several selection criteria for the participating agencies and their cases (Table 4). The agencies did not have to be explicitly known for transition design expertise since this term is not yet commonly used in practice in the Netherlands.

Instead, agencies were considered for inclusion if they addressed complex sustainability challenges through design or innovation, which we consider to be the core of designing for transitions. We sought at least one agency with established reframing expertise (Reframing Studio), as they would be able to provide rich reflections on the model and its potential relevance for transition design.

Regarding the cases, diversity was sought to involve publicly and privately funded design projects, as a commercial agenda could potentially influence the framing of the designers. In the pilot case, two cases were commercial, and two were publicly funded. We also aimed for diversity between the sustainability transitions addressed by each of the agencies, to be able to review the model in different transition contexts, informing on the robustness of the model. Therefore, each case was set in a distinct domain. Lastly, we sought variation regarding the behavioural approach within the transition design projects, to be able to explore the relationship between transitions and behaviour from different angles.

One of the cases (Muzus) demonstrated an explicit behavioural approach in their framing, whereas in the other cases, behaviour was approached more implicitly. Table 2d shows that one of the participating design agencies involved in-house designers; they were employees of a commercial organisation (Louwman). The other design teams worked in design consultancy, being hired by other organisations for their expertise and outside perspective.

The selected cases were deemed suitable for the review sessions if they inarguably encompassed a sustainability transition, defined as a systemic shift towards a more just and sustainable future within a certain domain or industry. Participants were expected to have a profound understanding of relevant social, technological, cultural, political and economic factors at play within their chosen domain. Also, participants were expected to have identified a design frame prior to the session, preferably within a recent project, as their framing would still be easy to retrieve from their memory.

The units of observation were the agencies' design frames. Outputs from the designers were considered to represent a design frame if they proposed a deliberate and elaborate strategy for intervention in text and images. The documents presenting their frames were unique per case since each agency has a different way of working and communicating. This meant that some of the cases'

frames were relatively abstract, while others were more detailed. As such, the chosen units of observation for the cases ranged from a single concrete innovation to sets of design directions.

Agency	Expertise	Case	Unit of observation
Livework Studio Pilot, excluded from analysis	Service design for sustainable futures (consultancy)	Transition towards sustainable housing construction (commercial project)	One of three innovation directions
Reframing Studio	Reframing and design for societal challenges (consultancy)	Dutch landscape transition (public project)	One of eight narratives / frames
Louwman	Mobility solutions (in-house designers)	Transition towards shared mobility (commercial project)	One innovation
Muzus	Social design (consultancy)	Transition towards a circular economy (public project)	Set of five personas / frames

Table 2d: The participating design and innovation agencies of the study.

Research Procedure

The research procedure is depicted in figure 2b. We approached several Dutch agencies through our personal networks. Prior to each review session (a separate session for each of the four agencies), we did 45-minute intake video calls to provide background information on the study and to discuss cases for inclusion. We selected the most suitable case in line with the inclusion criteria. We invited the agencies to share digital materials, such as project reports and client presentations, for additional insight into the case. A pilot review session with Livework Studio informed minor improvements of the model and session setup. Each of the three following review sessions had the same agenda, duration, material support, and version of the design frame model (figure 2a). Participants plotted their case and chosen frame on elaborate canvases of the model. Thereby, the outputs of each session aligned with the analysis themes.[8]

8 The research materials of this study comprise large and detailed PDF documents. These can be provided by the primary researcher upon request.

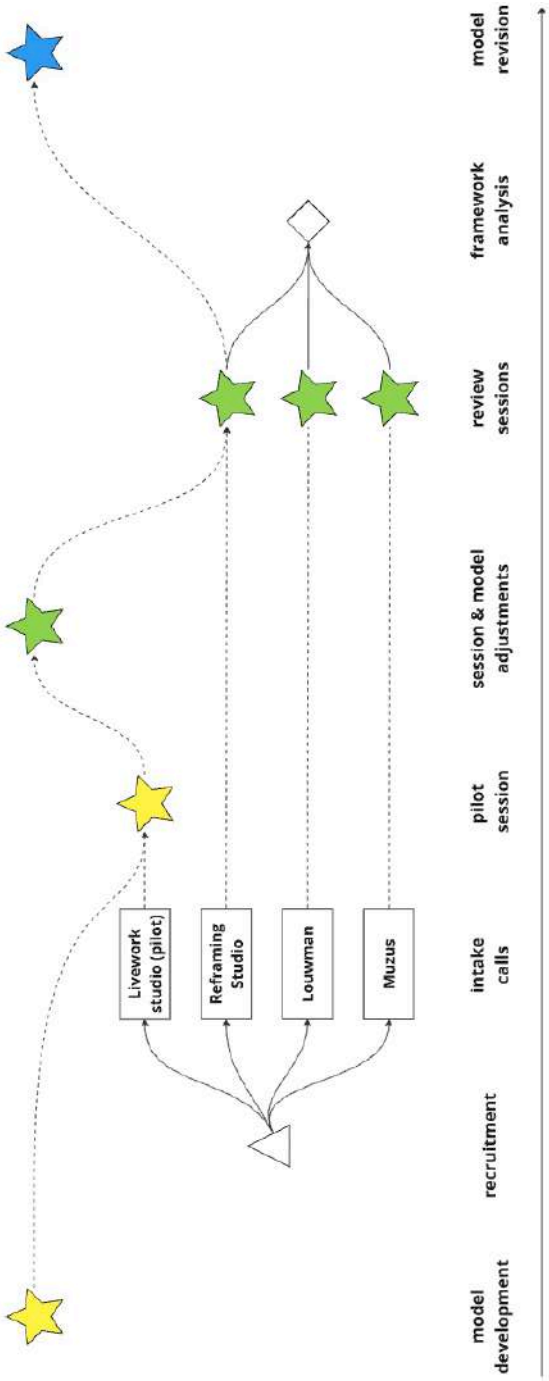


Figure 2b. Research procedure.

One review session took place at TU Delft, and the others were held at agency offices. Two participants took part in each session. With consent from the participants, the sessions were audio recorded and photographed (figure 2c). For alignment between the facilitator and participants, the sessions opened with an introduction and a short discussion of the agency's case. After familiarisation with the design frame model, participants were invited to plot their design frame by filling out the printed canvas together. When clarification was required or progress needed to be streamlined, the facilitator would guide discussions. After plotting their frame, participants reflected upon the exercise, the model, and reframing opportunities through a structured group interview captured by the facilitator on separate canvases. The review session was closed with a final group reflection.

Figure 2c. Pilot review session with Livework Studio.

After the review sessions, all outputs were digitised in a Miro whiteboard and organised along the themes of the framework analysis. During two data analysis sessions between the researchers, we examined the results of each theme and speculated about their relevance in relation to the research questions. Findings were collaboratively structured in Miro.

2.4 Three Transition Design Cases

Case 1: Reframing Studio and the Dutch Landscape Transition

The first case involved the Dutch 'landscape transition,' introduced by designers from Reframing Studio. Reframing Studio was invited by the Dutch Ministry of Infrastructure and Water Management to develop narratives, or frames, around water safety for the year 2100. The Netherlands is faced with the great challenge of rising sea levels resulting from climate change, while much of the land sits below sea level. Moreover, human activity is causing subsidence in large regions of the country, mainly because the soils in these areas are highly compressible. While the groundwater level is already being kept artificially low and water barriers like dikes are well in place, these solutions are not expected to suffice in the next century. The Dutch government seeks novel perspectives on the highly complex issue of 'the water is coming.' As depicted in figure 2d, Reframing Studio developed eight narratives together with knowledge institute Deltares, each representing a different way to navigate the transition towards a landscape and a society facing more water, more often. The eight narratives represent eight distinct frames; they are each comprised of a set of driving values, unique infrastructural approaches to deal with the water, corresponding behaviours, mindsets and lifestyles, societal power structures, and examples of concrete products, services and other interventions fitting the narrative.

We chose one narrative for the review session, shown in figure 2e. The 'Amphibian Narrative' represents a frame that acknowledges the fact that some parts of the Dutch land and infrastructures may temporarily or permanently be inaccessible due to high water levels. As a response, the amphibian narrative promotes adaptable nomadic lifestyles, where people collaborate to adjust themselves to constantly changing living circumstances. Behaviours associated with this lifestyle demonstrate resilience, collaboration, minimalism, and flexibility. Examples of design interventions that illustrate the amphibian narrative are mobile amphibian tiny houses, rain boots at every doorstep, ad hoc civil infrastructure, and floating neighbourhoods. Although we isolated the amphibian narrative for the exercises during the review session, Reframing Studio frequently referred to the seven other narratives, given that they are all inherently connected.

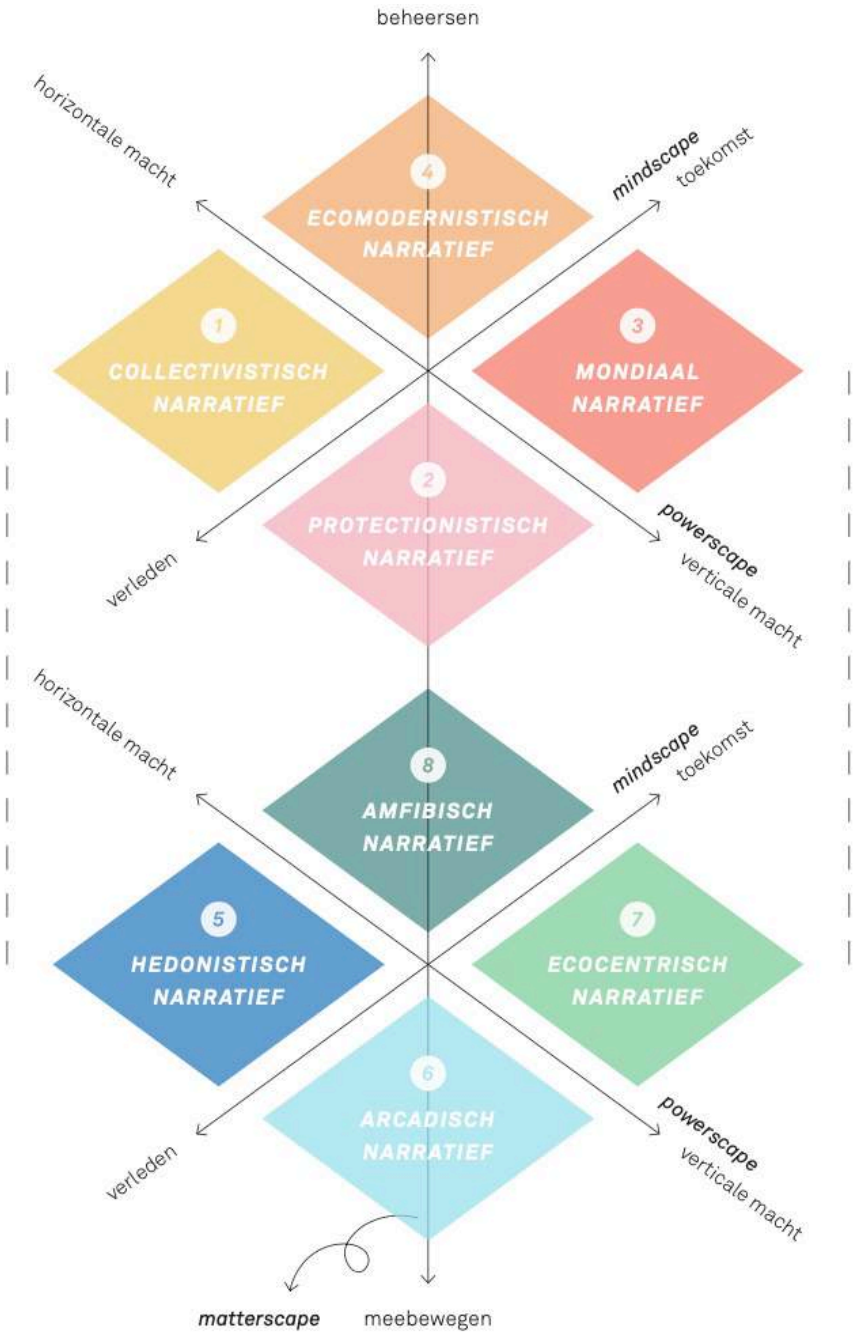


Figure 2d: Eight narratives, or frames, developed by Reframing Studio to navigate the Dutch landscape transition.

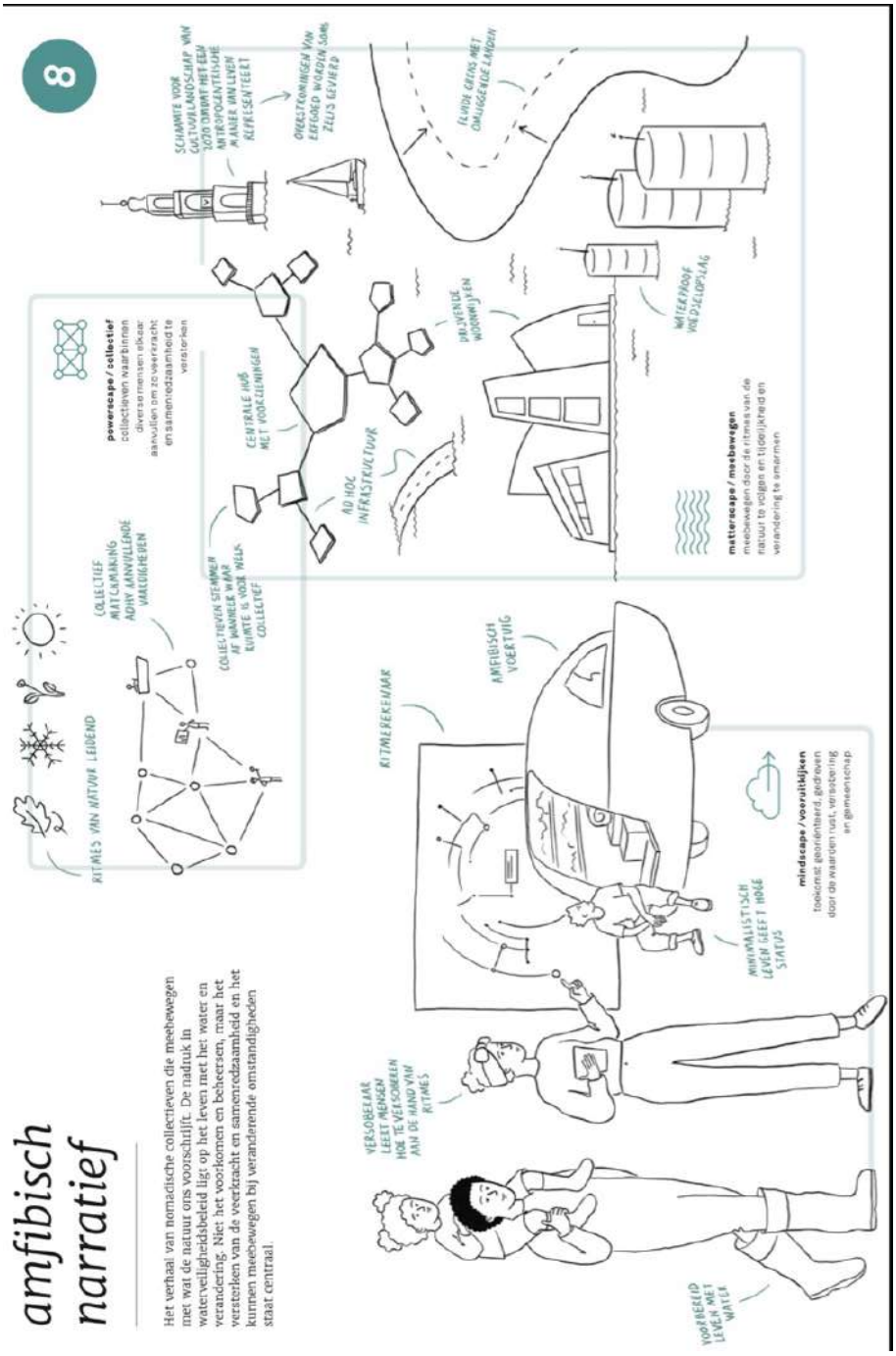


Figure 2e. The 'Amphibian Narrative' of Reframing Studio was chosen for the review session.

Case 2: Louwman and the Transition Towards Shared Mobility

Our second case involved the mobility transition, introduced by designers from Louwman. Louwman is a Dutch commercial mobility partner connecting car manufacturers to consumers. To expand their portfolio, Louwman explores business models and innovation directions that are in line with the mobility transition. One of the innovation pathways in the mobility transition involves a movement away from private car ownership towards shared mobility solutions. A barrier to adoption involves the anonymity of the co-users of a shared vehicle, resulting in trust issues between consumers and people more easily leaving behind a dirty car for the next user.

As a response to this social insight, Louwman developed *Amigo*, a product-service system offering shared mobility in a novel way to the Dutch market (figure 2f). Amigo leases electric vehicles to one main tenant, who can share the vehicle with friends, neighbours, and acquaintances of their choice. Such 'close community sharing' was expected to solve the issue of mistrust among consumers. If Amigo were to be implemented at a large scale, it would also imply fewer vehicles in need of parking spots, less traffic on the roads and a more affordable, and thereby accessible, mobility system for all. Louwman decided to launch Amigo in 2020.

Figure 2f: The Amigo proposition from Louwman.

However, after a pilot phase and one iteration of their service, they chose to end the project and take it off the market in 2022. While struggling with common shared mobility implementation issues, like people's fear of not having a car available in case of an emergency, the deciding factor of this termination was the undesirable scenario where one of the users in a group would step out, resulting in the others in the group having to pay a higher monthly fee for the service. Although the Amigo innovation was recently 'archived,' Louwman was keen to learn from this case, which is also why they agreed to analyse their framing in the review session for this study.

While Amigo is a tangible innovation, it is the manifestation of a frame. The Amigo frame assumes sustainability issues associated with personal mobility, as well as a spatial pressure surrounding traffic and parking, are best addressed by the sharing of private electric vehicles between a close community of consumers. As such, consumers can continue enjoying private mobility, yet in a way that supports the environment and our collective well-being. Values underlying the frame are a free market, technology, environmental sustainability, convenience, privacy, and collectivism, as well as individualism.

Case 3: Muzus and the Transition Towards a Circular Economy

Our third transition design case involves the transition towards a circular economy, introduced by designers from the social design agency. Muzus. In 2020, Muzus was asked by the municipality of Rotterdam to support them on their journey towards becoming "a circular city by 2030," which fits within the transition towards circular economies. Their transition goal involved using 50% less natural resources by 2030 and standardising circularity as a benchmark within the organisation. Despite their concrete sustainability goal, the municipality lacked insight into several challenges surrounding their intended transition, one of them being their citizens' drivers and barriers for the adoption of circular behaviours. Circular behaviours would include recycling, reusing, repairing, refurbishing, and reducing. Familiar with Muzus' expertise, the municipality asked them to provide a deeper understanding of their citizens' needs, as well as concrete proposals for interventions to facilitate the desired circular behaviours. With a research and design brief scoped around citizen behaviour, Muzus gathered insights into the diverse city's population through qualitative research and synthesised five elaborate personas to represent distinct ways in which citizens' behaviour change can be supported throughout the life cycle of a product: purchase, use, and disposal.

Contrary to popular belief, the personas do not represent demographic segments of the population. Instead, they each present a unique and situational citizen mindset, meaning that a citizen might identify with one persona when they are looking for a product for their newborn baby and with another one when they are separating their household waste, for instance. Thereby, in light of this study, each persona represents a deliberate strategy for intervention and can thereby be regarded as a distinct frame.

An example of one persona is depicted in figure 2g, the 'Down-to-Earth Supporter,' which assumes an existing physical, social and informational environment of citizens can create friction for circular behaviours. To address this, the frame proposes an alignment of the various elements that make up the citizen's environment, as well as providing acknowledgement when a citizen performs the desired circular behaviour. For instance, to ensure citizens can properly throw away their household waste, the municipality should empty the public waste bins well in time. Another example of an intervention that fits this frame is the provision of a financial reward for bringing broken electronic

devices to a collection point to be recycled. During the review session, the Muzus participants preferred to consider all five personas in the exercises instead of isolating one, as the five frames were inextricably linked. Therefore, they plotted all five frames onto the canvases, using coloured stickers to represent each one.

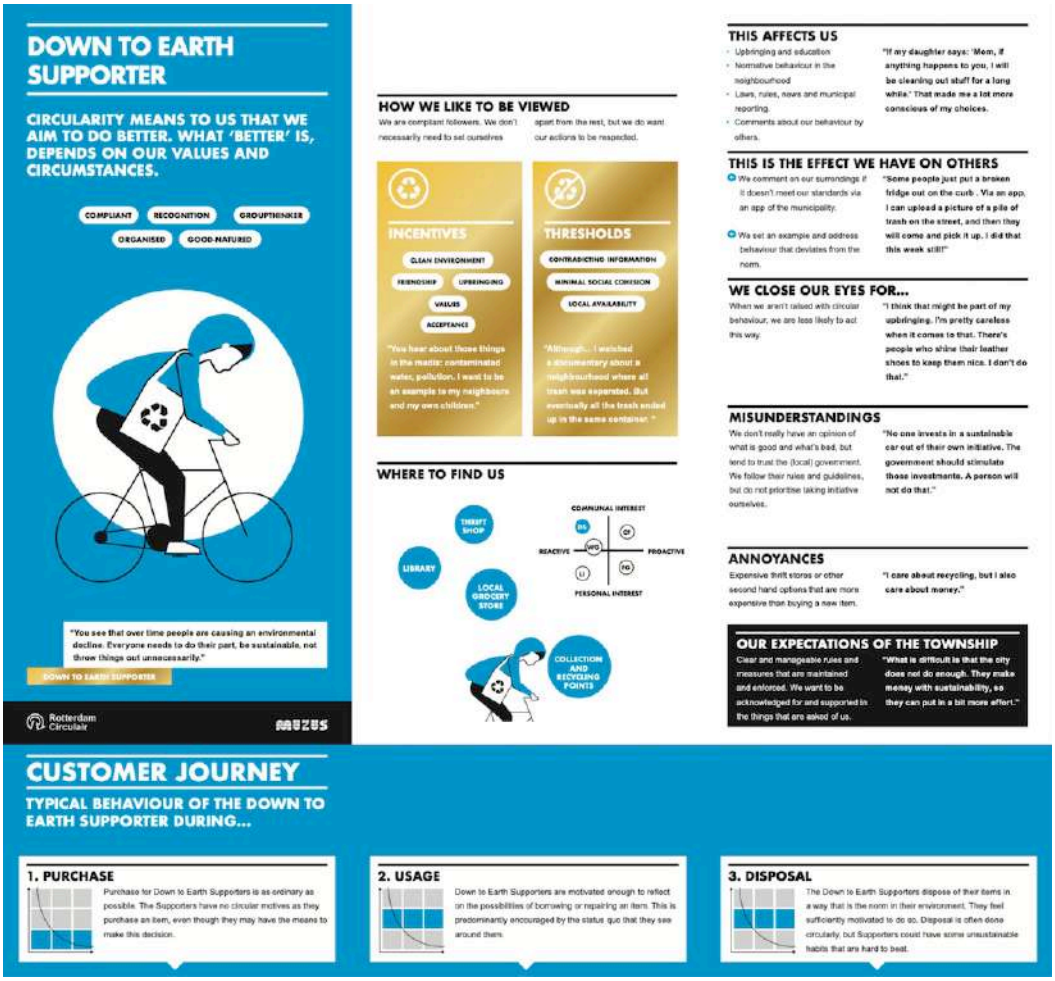


Figure 2g. The 'Down-to-Earth Supporter' frame from Muzus (high-resolution image can be provided upon request)

2.5 Findings

Plotting Design Frame Components

In this section, we present how the plotting exercises unfolded per design frame component, followed by the agencies' reflections on the model's composition (RQ1) and its supportive value for design reasoning and reframing (RQ2).

Worldviews

Across the cases, we found that each frame represented a distinct worldview. This became especially apparent in the cases of Reframing Studio and Muzus, who each developed a *set* of frames, demonstrating that each frame referred to a unique combination of presuppositions and values. For instance, the 'Down-to-Earth Supporter' persona from Muzus assumes that the environment of the citizen carries the main responsibility for the adoption of circular behaviours, whereas the 'Frugal Go-Getter' persona assigns agency and responsibility to citizens themselves. At the same time, these personas both view circular behaviours to be desirable in the first place, exemplifying some overlap in worldviews as well.

Another topic of discussion surrounding worldviews in all three review sessions involved whose worldviews they were. When Louwman examined the worldview demonstrated by the Amigo concept, they realised Amigo primarily reflected values that are dominant in the market, which currently calls for convenience and favours technology-oriented solutions such as Amigo. At the same time, the concept of Amigo reflects the personal biases of the initiator of Amigo, by assuming that consumers have access to a social network and have an entrepreneurial mindset. Reframing Studio stressed the importance of designers being conscious of such biases and maximising objectivity during framing by being reflexive and postponing judgements.

Transition Case

For Louwman and Muzus, identifying their transitions was relatively straightforward - respectively, these were the mobility transition and the transition towards a circular economy. Both agencies remarked that the transitions had not been an explicit part of their framing. Reframing Studio, on the other hand, was quite aware of their transition context and demonstrated that their case touched a variety of domains that are in transition simultaneously:

housing, energy, mobility, food and agriculture, healthcare, politics and governance, and urbanisation. They assigned this networked complexity to the fact that their project focused on landscapes, which connect various sectors and industries. Even though the term is not commonly used, they decided to refer to their project domain as the 'landscape transition.'

Regarding transition goals, which were mentioned on the printed canvas, Muzus identified macro-level objectives that are inherent to the transition towards circular economies (a balanced production-consumption system that does not require additional natural resources), meso-level objectives of the municipality ("A circular city in 2030"), and the micro-level objectives represented by each persona (for instance "keeping our neighbourhood clean"). Reframing Studio struggled to distinguish between different objectives within their case and expressed the intention to articulate them more precisely in future projects. Both Muzus and Reframing Studio raised questions about whose objectives they were as well.

Transition Strategy

Reflecting upon the X-curve framework (Hebinck et al., 2022), both Reframing Studio and Louwman noted that their projects primarily focused on the build-up of something new, whereas Muzus realised that their frames both support new practices and cultures (e.g., "to start maintaining the products you already own"), as well as the letting go of non-circular behaviours (e.g., "quitting the daily use of plastic sandwich bags").

The X-curve also helped articulate the progression of the respective transitions. For instance, Muzus highlighted that some innovations or policies, such as the repeal of free plastic bags in supermarkets, have already been implemented across the Netherlands, indicating the advancement of the transition towards a circular economy. However, despite consumers' intentions, circular behaviours are still not the norm, implying the transition has not yet 'crossed' the centre of the x-curve. In the case of Reframing Studio, their 'landscape transition' is in its infant stage; while there is some awareness in Dutch society of the increasing threat of water, participants found that the urgency of the transition is currently only felt by some parts of the Dutch government and a small group of technological innovators and knowledge institutes.

Discussing the approach to different time scales in their transition design projects, Louwman adopted a short-term focus as they were pursuing a business

opportunity. Muzus did not consider time scales as part of their framing, yet they aligned with the targets and vision set by their client for 2030. Following these reflections, both Louwman and Muzus remarked that they would have wanted to zoom out more than they had. Reframing Studio, on the other hand, demonstrated thorough temporal considerations within their case. They highlighted the value they encountered in doing an extensive historical analysis of their project as well. For instance, they found that showcasing the large transformations that have happened in the past helped to put seemingly radical future scenarios into perspective. By considering history, "the future becomes softer" for the stakeholders involved in the project.

Systemic Levers

The Systemic Lever component sparked the least amount of discussion, questions, and reflection during the review sessions. All three agencies noted that the levers on the canvas were straightforward and familiar to them, and a variety of these levers were incorporated in their frames, yet not explicitly. What stood out for Louwman and Muzus was that their frames purposely did not imply policy adjustments. They acknowledged being limited by feasibility requirements in the short term, and their frames reflected the policies that were currently in place. Reframing Studio's frame did imply policy adjustments, which was acceptable for their client since their project focus extended to the year 2100. However, Reframing Studio did note that conversations with governmental actors about short-term policy changes that would need to be made to realise the landscape transition in the long term were extremely difficult to have due to short-term political agendas conflicting with the long timelines of transitions.

Behaviour Change Mechanisms

Behaviour change was approached differently by each of the three agencies. As the Muzus project was centred around changing citizen behaviours and their frames had been translated into concrete design interventions, the participants were articulate about the variety of ways to influence behaviours.

Louwman, on the other hand, also had a concrete design intervention that was Amigo, yet had not considered behaviour change mechanisms explicitly as part of their framing process. They struggled to make these mechanisms explicit during the review session since their intervention involved various kinds of users. They wanted to articulate a distinct behaviour change strategy for each of these actors, and the model did not support that. Similarly, Reframing Studio was not

able to plot their frame onto the behaviour change component in the model since their frame involved a variety of users, yet also did not extend to concrete design interventions implying specific behaviours. Instead, they focused on an extremely long-term frame involving novel lifestyles and practices, relating to behaviour in a more abstract way. The participants noted that concrete individual behaviours only become relevant in their framing as soon as specific design interventions are developed.

Answering the Research Questions

Composition of the Model

Examining the model's composition, we reflect on the relevance of the chosen components as well as the relationships between them. All participants reflected most elaborately on their Transition Case and Transition Strategy, implying that these might carry relatively more weight than the other components within their frames. The Transition Strategy and Systemic Lever were often discussed interchangeably, implying their partial theoretical overlap. Participants were invited to position the three main components (Transition Strategy, Systemic Lever, and Behaviour Change) above the Transition Case and Worldview components, and this overlay was not challenged by them. We find this suggests the relationship between components positioned in the foreground and the background was visualised appropriately in the model.

The positioning of the micro-, meso- and micro-levels of analysis in the model did not correspond with the agencies' frames. Especially Reframing Studio demonstrated that these three levels can be seen *within* each of the three main components. For instance, regarding behaviour change, they highlighted that they considered behaviour at the level of lifestyles (macro), practices (meso) and individual interactions (micro) within each of their frames. In fact, they continuously 'hopped' between these levels of analysis, the model components, time scales, and geographical scales, demonstrating that their line of reasoning also did not follow the arrow in the model.

When asked what they missed in the model, Reframing Studio mentioned the role of design. They wondered how this model of a frame might differ from a model policymakers might propose. They suggested that as part of the framing, design plays a role in visioning, in helping stakeholders empathise with other actors, and in translating abstract strategies into concrete interventions with meaning in people's daily lives.

The Louwman participants missed a deep consideration of the variety of actors in the design frame model. Although actor mapping was included in the Transition Strategy component, they felt it was underemphasised. Moreover, the model did not facilitate the formulation of bespoke behavioural strategies for each type of actor. Similarly, Muzus missed the ability to highlight power structures through a multi-actor perspective (Avelino & Wittmayer, 2016) in the model.

Supporting a Rationale and Reframing

After engaging with the design frame model, all participants remarked that the model could help strengthen their current design reasoning. In their experience, the main value of the design frame model could be attributed to its systematic nature, supporting a rationale that is more comprehensive and persuasive. For instance, Reframing Studio, who were still involved in follow-up projects surrounding the landscape transition, expected a more explicit and systematic rationale to help align stakeholders in their complex network of actors. More specifically, they intended to discuss the various goals that underlie the project, as well as their chosen transition strategies and specific behaviour change mechanisms.

Both Louwman and Muzus had finished their respective projects, yet they speculated about how they would have adjusted their rationale if they had the opportunity. Louwman identified a missed opportunity to engage multiple departments within their organisation by incorporating a transition strategy in their design framing and referring to the Sustainable Development Goals (United Nations, 2023). Muzus noted that much of their scoping, and thereby their framing, was done during the briefing stage with the municipality, resulting in their relatively narrow focus on citizen behaviour. Even though the assignment was in line with their core expertise, Muzus lamented that they had not challenged the municipality to broaden their view on the transition towards becoming a circular city.

Regarding reframing, the review session provided limited time to explore novel frames for the respective cases. However, the participants' remarks about strengthening their current design rationales all informed intentions for future framing activities and other projects they were involved in. Another inspiration that was drawn from the review session by the Muzus participants was the notion that multiple frames can be pursued simultaneously, as they each hold

complementary value. They intended to present a multiplicity of pathways in several other projects they were currently working on instead of advising on one 'best' way forward.

2.6 Discussion: Revising the Model

Regarding our first research question, the three cases suggested several modifications to improve the composition of the model, which informed the revision in figure 2h.

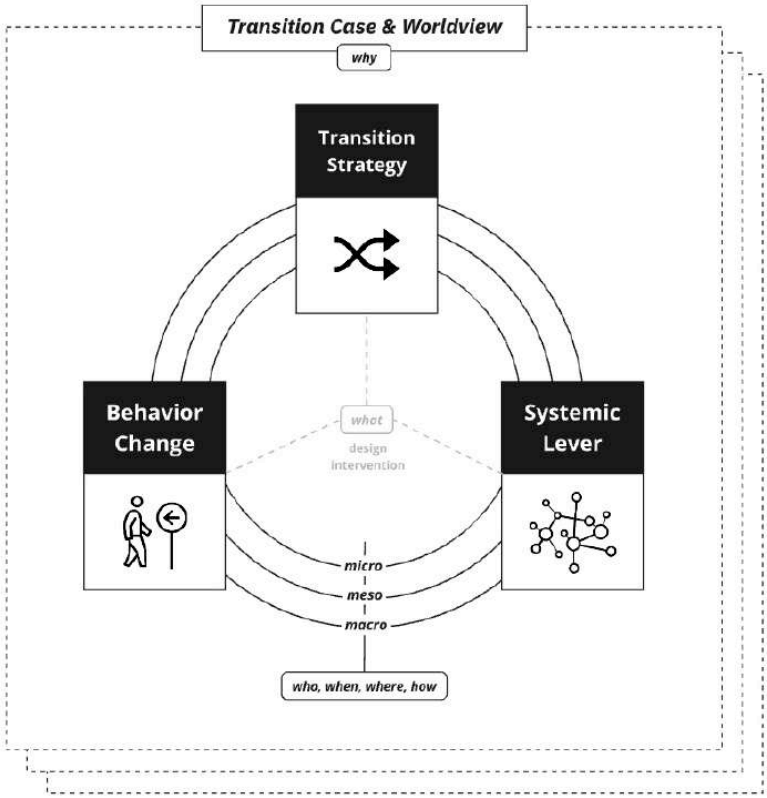


Figure 2h: Revised model of a transformative design frame.

The cases demonstrated the relevance of the frame components and confirmed the logic of their composition. The Transition Case and Worldview represent factors *underlying* the Transition Strategy, Systemic Levers and Behaviour Change components. Positioning the Transition Strategy at the top can be deemed especially appropriate, given that during each review session, participants assigned the most weight to this part of their frame. Despite their partial

theoretical overlap, we have kept the Transition Strategy and Systemic Lever components separate since the first has a strategic nature and the second is tactical.

The main adjustments to the model involved its relation to design, the positioning of the different levels of analysis, and a stronger emphasis on actors. Following participants' desire to include design into the model, we have chosen to integrate designers' ability to translate a frame into concrete interventions, as mentioned previously. For this reason, we have added 'design interventions' at the centre of the revised model. However, we have made it grey instead of black because the design intervention itself is, per definition, not part of the frame; it is the manifestation of the frame. Another distinct quality of a frame in design is its ability to inspire concrete action. This was especially apparent in the Muzus case; each persona provided specific directions for design. While this motivating character of a design frame is difficult to capture in our model, it is worth mentioning this distinct quality in relation to our study.

Another adjustment to the model involves the macro-, meso-, and micro-levels of analysis. While we initially regarded the Transition Strategy, Systemic Levers, and Behaviour Change to each represent one of these levels, the cases demonstrated that they all touch upon each level.

A transition strategy may indeed include multi-level considerations of geography (where to intervene globally, regionally and locally), time (aligning long-term visions with short- and medium-term action), and actors (society at large; institutions, organisations and other groups; specific actors). The same is true for systemic levers; they include transformative levers, such as macro-level mental models, as well as relational levers, such as meso-level institutional power structures, and structural levers, such as micro-level procedures and guidelines. Behaviour change can be approached at the level of lifestyles (macro), practices (meso) and individual interactions (micro) as well. As such, we have repositioned the levels of analysis to connect to all three main components in the model.

With respect to the sequence of model components, we found that the arrow in our initial model did not represent the rationales provided by the participants on their cases, nor did the participants desire to adhere to such a sequence. Indeed, the three main components do not need to be considered nor communicated in a particular order, so the arrow was removed from the model.

To put more emphasis on actors, we have added 'who' to the model, appropriately connecting it to all levels of analysis. The review sessions also demonstrated the importance of making the purpose of the design interventions explicit (*why*), as well as *where* to intervene and through what types of change mechanisms (*how*). The notion of time scales and vision-led backcasting was highlighted as well (*when*). We have included these terms in the model and consider the design intervention resulting from the frame to be the manifested *what*.

Lastly, we found that it is not uncommon for designers to develop and pursue multiple frames simultaneously, as Reframing Studio and Muzus demonstrated. We have duplicated the dotted outline of the model several times, showing the potential coexistence of multiple frames or *frame portfolios*.

Discussing the second research question about the degree to which the model was supportive of developing a design rationale and a novel frame, we found a confirmation of the rationale and a rebuttal of the novel frame. All participants stressed that their rationale could become stronger by applying the model to their initial frame. Especially the systematic nature of the model and the linkage of a transition strategy to the systemic and behavioural change mechanisms seemed to contribute to the robustness of their rationale, which they expected to benefit the persuasiveness of their frame in stakeholder collaborations.

In the pursuit of a reframe (from the second research question), the model provided inspiration for the exploration of alternative pathways for design in their cases, yet only in a broad sense. Participants were able to articulate the components they intended to pay more attention to in future projects but did not see concrete directions for reframing at the time of the review session. This might firstly be explained by the creative endeavour that reframing is, which involves generative techniques requiring a variety of inputs that are not captured in a model like the one we have developed. Secondly, the limited support of the model in reframing could be related to the setup of the review session. In the 3-hour timeframe, during which the participants were to absorb new theory and plot their initial frame as well, their ability to articulate an entirely new frame may have been too much to expect within the single session. Also, the projects of all three cases had either already been finished or entered a new stage, which implied there was not a practical call for a novel frame, potentially making the act of reframing seem redundant. We see an opportunity for future research to explore

the supportive potential of the model in reframing, inviting practitioners to develop novel frames exclusively.

A distinct difference was noted between the relatively visionary and proactive transition design case from Reframing Studio and the more incremental and opportunistic cases from Louwman and Muzus. Whereas Reframing Studio's landscape transition represents a predevelopment phase, the other two transitions (shared mobility and circular economies) are already in their take-off or acceleration phases (Rotmans et al., 2001). What this demonstrated in terms of framing was that Reframing Studio's frame was relatively abstract, proposing radical systemic and lifestyle changes, yet their frame was not specific enough to inspire concrete design activities. Louwman and Muzus, on the other hand, did not integrate an explicit long-term transition perspective in their frames, though they did provide specific directions for action. This suggests that depending on the stage of a transition, a design frame's appropriate level of radicality and specificity varies.

2.7 Conclusion

Contributing to the field of transition design, a specialised field that draws on systemic design, we conceptualised a transdisciplinary model of a transformative design frame tailored to the context of sustainability transitions. Through this model, we aim to support transition designers in developing a strong rationale and in pursuing reframes. Reviewing the model with three design agencies informed adjustments to the model, aligning it better with design frames found in practice. The designers confirmed that the model could help strengthen their current design rationales by making them more explicit and comprehensive, which they expected would help align and mobilise stakeholders. After engaging with the model, they also expressed the intention to approach framing more systematically in future projects. For reframing, they intended to adopt a broader, more holistic perspective, linking abstract transition concepts to concrete systemic and behavioural change mechanisms. We see an opportunity for future research to examine whether the model might indeed support the creative pursuit of novel frames. Another promising direction for further research involves determining which combinations of components are especially transformative since this study did not shed light on this. Lastly, while the design frame model is rooted in literature and has been reviewed by three design agencies, its true value for designers can only be realised through practical application. We warmly

invite readers to adopt and refine our model in their practice. In doing so, we can collectively advance the concept of a transformative design frame, ensuring its evolution reaches a high level of maturity.

Eat food. Not too much.
Mostly plants.

Michael Pollan

PART TWO
REFRAMING FOR THE PROTEIN TRANSITION

Chapter 3
Framing for the protein transition: Eight pathways to foster plant-based diets through design

This chapter is previously published as:

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Abstract

The scale at which our society is currently consuming meat and dairy is urgently unsustainable and unjust, which has led to calls for a protein transition. Plant-based diets can be fostered by design interventions, yet their effect depends on the framing that is chosen. A 'transition design frame' (TD frame) comprises of a societal-behavioural issue, a change mechanism and a worldview, and is embedded in design interventions. The aim of this qualitative study was to understand which TD frames are currently prevalent in existing consumer interventions that challenge the food regime, thereby accelerating the protein transition, to identify opportunities for reframing and find novel avenues to foster the transition. This interdisciplinary work explores framing through an 'artificial' lens, looking at human-made interventions in a transition context, to complement the discursive lens that is common in transitions literature. We collected 62 existing consumer interventions and held eight in-depth interviews with experts. Through a thematic analysis we arrived at a set of eight TD frames through induction: *(1) Tasty Doppelgangers, (2) Silent Steering, (3) Gentle Guidance, (4) Be the Transition, (5) Shifting Meaning, (6) Cracking the Discourse, (7) Changing the Rules of the Game* and *(8) Beyond the Anthropocene*. We discuss the implications of the dominance of the *Tasty Doppelgangers* (characterised by the 'meat analogues') for other pathways in the protein transition. Some TD frames fundamentally disrupt the cultures underlying the food regime, suggesting that these might have more transformative power than other TD frames. Reframing opportunities revolve around inclusivity, system breakdown and the integration of multiple TD frames into single interventions. We find that the artificial lens that is common in the design field helps elucidate frame types that have not previously been identified in transitions literature by studying discourse alone.

3.1 Introduction

Environmental challenges worldwide like biodiversity loss, land scarcity, water depletion and the rising impacts of climate change often involve complex multi-sector dynamics (Béné et al., 2020; de Boer & Aiking, 2011; Springmann et al., 2018; Vermeulen et al., 2020; Weinrich, 2018). In several of these issues, the meat and dairy industry has been found a profound contributor, leading to calls for a protein transition: shifting the production and consumption from animal proteins to plant-based proteins (Aiking, 2011; Fourat & Lepiller, 2017; Hartmann & Siegrist, 2017). Societies increasingly recognise the benefits of adopting plant-based diets as a way to shift towards more sustainable food systems, specifically for the benefit of the environment, animal welfare, public health and justice within agricultural economies (Béné et al., 2020; Vermeulen et al., 2020; Weinrich, 2018).

Various strategies are used to foster the protein transition. For instance, a popular strategy is to offer plant-based imitations of meat and dairy products as a way for individuals to adopt alternative products, whilst respecting their current food practices as much as possible (Bulah et al., 2023b; Tziva et al., 2020). Another strategy is to confront individuals with the exploitation of the environment and animals for the production of meat and dairy as a way to combat persisting collective ignorance about it (Harguess et al., 2020; Kranzbühler & Schifferstein, 2023). These examples demonstrate how diverse ways of framing take place in the context of the protein transition, illustrating varying perspectives on the issue and different pathways to navigate the transition.

The first strategy, characterized by mimicking, has been increasingly adopted and is gaining a relatively high amount of attention in the protein transition (Bulah, et al., 2023a; Bulah, et al., 2023b; Mylan et al., 2019; Tziva et al., 2020), overshadowing and blocking other pathways towards a more just and sustainable food system (Bulah et al., 2023b; Pyett et al., 2023; van der Weele et al., 2019). This study aims to elucidate the alternatives to mimicking, expanding the solution space in the protein transition. We specifically look at the frames that are embedded in consumer interventions that currently foster plant-based diets, to identify opportunities for *re*framing, and as such, identify new avenues to foster the transition through design.

In recent years, design is increasingly being acknowledged as a valuable complementary approach to transition management with the aim to accelerate

societal transitions (Loorbach, 2022; Öztekin & Gaziulusoy, 2020). This study serves the ongoing interdisciplinary quest to explore how the scientific fields of transitions and design may complement each other. The leading research question in our study is:

'Which frames are prevalent in consumer interventions that foster the protein transition, and how can this further shape the intersection of design and transitions?'

Consumer interventions can be seen as resources that are mobilized in transition contexts (Avelino, 2017). We define consumer interventions as technological, social, organizational and institutional innovations with a behavioural impact on consumers (Ceschin & Gaziulusoy, 2016; Irwin & Kossoff, 2017). While a focus on consumers is typical to the design field, it can serve as a fresh angle to understand transition dynamics. In dominant frameworks in the literature on transitions to date consumers have been largely understood as a 'passive agents' with 'predetermined roles' (Randelli & Rocchi, 2017) instead of individuals who may actively shape transitions processes (see e.g., (Geels, 2011; Hekkert et al., 2007). In this study, we view consumers as individuals who hold power to steer transitions and identify the variety of ways in which they can be involved.

In transitions literature framing is typically studied in communication, focusing on discursive dynamics among actors (Isoaho & Karhunmaa, 2019) and their associated consequences for the diffusion of (technological) innovations (Kriechbaum et al., 2023; Lee & Hess, 2019; Rosenbloom, 2018; Sovacool & Axsen, 2018) as well as for the visioning of novel pathways for a transition (Jensen, 2012). Previous studies on frames in the protein transition have also focused on the discourse surrounding the transition (Maluf et al., 2022; Morris et al., 2018; Tziva et al., 2023), or on innovation strategies and pathways for the transition (de Bakker & Dagevos, 2012; Pyett et al., 2023). To our knowledge, this study presents a first attempt to studying framing in transitions through an *artificial* lens, i.e., by looking at the frames that are embedded in a broad variety of concrete interventions, which constitute the man-made context of a societal transition.[9] We explore the value of this artificial angle in frame analysis in transitions by examining what people *do*, complementing the discursive angle that has been deployed extensively already, which primarily considers what people *say*. Through this lens, we aim to identify diverse types of frames in the protein

9 We use the term artificial to refer to things that are not naturally occurring, but instead are created or constructed by human beings.

transition that are typically not brought to light in societal transitions through discourse analysis.

This paper is structured accordingly: in section 3.2 we lay out the theoretical foundation of the study by providing an overview of existing literature on framing, transitions and design, and we introduce the concept of a 'transition design frame'. Our qualitative research method and materials are presented in section 3.3. Section 3.4 describes the results: eight transition design frames prevalent in the protein transition. In section 3.5 we reflect upon the implications of the results for further research and practice. Finally, in section 3.6 we present our conclusions and contributions.

3.2 Theoretical background

Societal transitions are commonly defined in the literature on transitions as multi-dimensional, and fundamental transformation processes through which established socio-technical systems shift to more sustainable, just and resilient production and consumption patterns (Hebinck et al., 2022; Markard et al., 2012; Pel et al., 2020). Societal transitions are characterized by deep systemic changes that are fostered by modifications in the technological, social, and institutional structure of an existing system (Ceschin & Gaziulusoy, 2016; Markard et al., 2012). They are often scoped within certain industries - such as the food and agriculture industry in the case of the protein transition - yet they are often inherently linked to one another due to their systemic nature (Köhler et al., 2019).

Locus of Design in Transitions

Design is increasingly seen as a valuable complementary discipline to transition management (Loorbach, 2022; Öztekin & Gaziulusoy, 2020). Transition management is a prominent framework in the literature on transitions. Its origins link back to the early 21st century when the framework was introduced as a new theory for the governance of sustainability transitions (Rotmans et al., 2001). The transitions management framework is derived from core ideas in transitions literature relating to the need to move away from unsustainable socio-technical systems, which are predominately characterized by incumbent actors with 'vested interests'. Such incumbents reinforce undesirable mechanisms of 'lock-in' and 'path dependency' (Loorbach, 2010, 2022). Moreover, transitions management focuses on how governance processes can be influenced to foster transitions to more desirable modes of both consumption and production (Loorbach, 2010;

Rotmans & Loorbach, 2009). The urgency and analytical strength to challenge existing powers that is associated with transition management, combined with the creative and mobilizing power of design, make room for a 'designing transition logic' (Loorbach, 2022). Indeed, transitions can be considered technical, political and creative design challenges (Gaziulusoy & Öztekin, 2019).

Defining design, we make a distinction between design as a process, and design outcomes. Design as a process essentially refers to the act of transforming an existing situation into a preferred one (Simon, 1996) through man-made interventions. As such, *"schools of engineering, as well as schools of architecture, business, education, law and medicine, are all centrally concerned with the process of design"* (Simon, 1996, p.111). In the context of societal transitions, we find it appropriate to adopt this broad understanding of design, whereby any actor who actively participates in the development of interventions with the intention of bringing about transformative change, can be considered a design practitioner.

Key to design processes is 'reframing' (Bijl-Brouwer, 2019; Dorst, 2015; Fokkinga et al., 2020; D. A. Schön, 1984; Stompff et al., 2016), referring to the act of *"shifting one's thinking into a different system and structure of concepts, language and cognitions"*. Reframing is recognised as a valuable instrument in approaching transition challenges (Jerneck & Olsson, 2011) as it evokes redefinitions of problems, exposing solution spaces that would otherwise not have been considered (Dorst, 2017; Dorst & Watson, 2020; Irwin, 2020; Jerneck & Olsson, 2011; Mukherjee et al., 2020; Paton & Dorst, 2011).

Regarding the outcomes of design processes, design was originally only associated with the development of physical artefacts, yet the discipline is increasingly being applied to address complex, systemic, multi-sector issues, through technological, social, organizational and institutional innovations (Ceschin & Gaziulusoy, 2016; Irwin & Kossoff, 2017; Norman & Stappers, 2015). Thereby, the outcomes of design processes are diverse. Today, designed interventions can be products, services, campaigns, educational programmes, policies, public spaces, retail environments and more. Designed interventions can be physical, digital, or a combination of both. Similarly, they can be stand-alone or networked. While we choose to focus on consumers in this study, designed interventions can be targeted at any system actor, including producers, innovators, service providers and even non-humans. Designed interventions can serve to support the interaction between actors as well. A commonality amongst

design interventions is that they facilitate or steer human behaviour and can be developed with a particular behavioural influence in mind. The fields of 'Design for Sustainable Behaviour' and 'Transition Design' specifically aim to support sustainable lifestyles (Ceschin & Gaziulusoy, 2016; Lockton et al., 2008; Niedderer et al., 2016) – an aspiration that is aligned with societal transitions.

To understand where design 'happens', we refer to the Multi-Level Perspective (MLP) (Geels, 2002b). The MLP examines how transitions to new socio-technical systems unfold through the interaction between several analytical levels, namely the niche, regime, and the landscape. The niche serves as a 'protective space' in which innovations are shielded from the wider selection environment and nurtured until they are able to compete on the mainstream market. The regime refers to the stable structures in a socio-technical system and encompasses the dominant values, rules, policies, user expectations, and technologies of the current system. The landscape comprises the wider context in which transitions unfold (Geels, 2002b). Positioning consumer interventions in the MLP, their development and deployment occur both within niches as well as in the established regime. Thereby, consumer interventions that have the potential to challenge, alter or replace parts of the regime, exert their influence on the transition either 'from the outside' in niches or 'from within' the regime (Loorbach, 2022; Mattioni et al., 2022). The type of influence such interventions exert, depends on their underlying framing.

Framing in Transitions

As stated by Goffman in 1981, '*frames are a central part of a culture and are institutionalized in various ways'* (Goffman, 1981). Frames are quite fundamental to the way we relate to each other and to the natural world around us, as they help us make sense of situations and guide our responses to them (Dorst, 2015; Schön, 1984). Frames can manifest in words, images, phrases and other creations, such as innovations (Dorst, 2015; Druckman, 2001), presenting a selection of reality and potentially creating new realities (Borah, 2011; de Bruijn, 2011; Entman, 1993). As such, the effect of distinct frames on people's choices and behaviours can differ significantly (Druckman, 2001; Kahneman & Tversky, 1979, 1984).

Put simply, frames connect problems to solution directions. As previously mentioned, framing in transitions literature is typically approached from a discursive angle, examining the problem-solution 'packages' that are advocated

for by actors within a certain transition context (Isoaho & Karhunmaa, 2019; Kriechbaum et al., 2023; Lee & Hess, 2019; Rosenbloom, 2018; Sovacool & Axsen, 2018). Moreover, framing involves the construction of narratives and storylines which often favour a particular solution direction over others. Frames are usually induced from written documents such as media content, with words and phrases as the units of observation. Distinct to frames in transition contexts is the consideration of various temporal and spatial scale levels, as societal transitions inherently involve systemic challenges. For instance, Kriechbaum et al. (2023) unpack the evolution of frames in the energy transition in Austria, by examining how the leading frame involving biogas shifted to a frame favouring the diffusion of biomethane. As these frames revolve around energy sources that are to be used for at least several decades and beyond the borders of Austria, they hold meaning of a large temporal and spatial scale. Similarly, Sovacool and Axsen (Sovacool & Axsen, 2018) lay out a typology of functional, symbolic and societal frames in the mobility transition, demonstrating the relevance of a historical perspective on frames in the present, as well as the value of these frames across cultures worldwide. These examples demonstrate how macro-level considerations, focusing on society as a whole, are common in framing analyses in transitions. At the same time, individuals' everyday actions, interactions, and subjective experiences at the micro-level are commonly examined in design (Ritzer & Stepnisky, 2007). As behaviour change at a micro-level can ultimately lead to shifts at the macro level, we have integrated these intimately connected perspectives into our conceptualisation of a 'transition design frame' in section 2.3.

Transition Design Frame

The unit of analysis in this study is a 'transition design frame', or TD frame, integrating framing theory from transitions and design literature. To describe the foundation of the TD frame concept, we first shed light on the origin of a frame. Frames were introduced in sociology to explain human behaviour in social contexts. Since its introduction in sociology (Bateson, 1972), frames have been explored widely in several fields and are typically studied from two angles; either sociologically, focusing on frames in communication, or psychologically, focusing on frames in individuals' minds (Borah, 2011). Merging this dual nature of frames, Schön and Rein regarded a frame as "a diagnostic-prescriptive narrative, based on perceptions, underlying structures of beliefs, and selective appreciation" (Schön & Rein, 1994). In other words, a frame is the connection

of a certain issue to a specific kind of solution direction and arises from a particular view of the world and humanity. Thereby, frames are never neutral (Coyne, 1985).

Building on Schön and Rein's concept of a frame, design scholar Dorst's logical formula (2015) explains the role of a frame in abductive reasoning in design. He perceives a frame as a way to hypothesise about potential mechanisms (*the how)* to achieve a desired result (*the outcome)*, which helps conceptualising the design intervention (*the what*), see figure 3a.

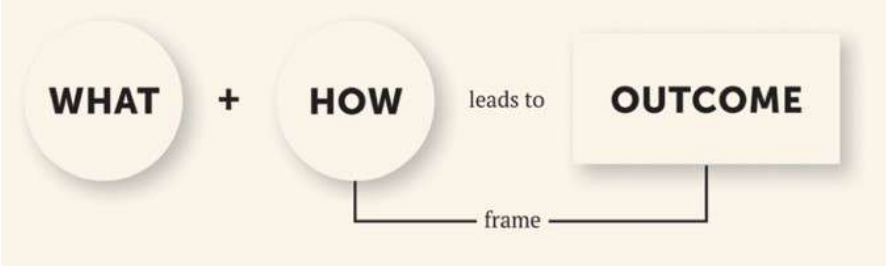

Figure 3a: logical formula describing a frame (from Dorst, 2015)

Given its relevance for design, we have expanded Dorst's notion of a frame to suit societal transitions. In a TD frame, the *what* refers to an intervention, for instance a tangible product or a service. The *how* refers to the change mechanism by which the intervention exerts effect on people, which stems from a worldview and is characterized by a behavioural influence at a micro level. For instance, in a worldview where libertarian paternalism is justified for the purpose of environmental sustainability (Thaler & Sunstein, 2008; Veetil, 2011), nudging can be considered an appropriate behaviour change strategy. The *outcome* in the formula refers to the actual systemic change resulting from the intervention, i.e. 'transition impact', which connects individual behaviour at a micro-level to societal value at a macro-level (Ritzer & Stepnisky, 2007). For instance, a desired outcome of an intervention could be that consumers choose plant-based products in the supermarket instead of animal products, supporting lifestyle patterns with positive implications for society in terms of the environment and animal welfare. In short, a societal-behavioural issue combined with an *artificial* solution direction makes a TD frame (table 3a).

	Transition Design Frame	
What	**How**	**Outcome**
design interventions	behaviour change mechanism + worldview	(societal-behavioural) transition impact

Table 3a: Conceptualisation of a Transition Design Frame, the unit of analysis in this study.

3.3 Material and Methods

With this study we aim to provide a first attempt to analyse existing consumer interventions as manifestations of their underlying framing. We chose to identify the TD frames in a way that is similar to the use of 'frame packages' in discourse analysis (see e.g., (Candel et al., 2014; Tziva, 2022; van Gorp, 2007). In our case, the frame package, or unit of analysis, is the TD frame. Each TD frame comprises a societal-behavioural issue (reflecting the effect, or *outcome,* of the intervention) and a change mechanism (reflecting the solution direction and worldview, or the *how*).

While discursive frame analyses typically deploy quantitative methods, we have chosen for a qualitative approach. When the units of observation are words and phrases – as is the case in discourse analyses – a quantitative approach is appropriate and meaningful when seeking to identify the relative prevalence of each frame. The units of observation in our study are consumer interventions, which are diverse along many dimensions and thereby difficult to compare to one another in terms of their relative prevalence. Therefore, we seek to merely elucidate the TD frames that can currently be found in practice and evaluate them qualitatively.

Interventions in the Protein Transition

Our primary source of data was a set of 62 consumer interventions. To contextualise the TD frames and understand their role in the transition, we interviewed eight experts. We deliberately chose a wide range of types of interventions, to account for the various ways in which the food regime (Mcmichael, 2009), can be influenced. The 62 consumer interventions included in this study were: products; services; product-service systems; packaging designs; retail environments; educational and social programmes; exhibitions; books;

policies, such as food subsidies and consumption regulations; campaigns; consumer guidelines; games; organized challenges; activistic provocations, such as petitions; artistic speculations; and digital media such as podcasts, websites, blogs, vlogs and television shows. We limited the set of interventions to 'end products', as those are generally the outputs of design practitioners and we seek to find opportunities *for design* in the protein transition. This means, for instance, that the technology behind plant-based meat products is not considered a consumer intervention, while the Beyond Burger is. Similarly, the well-known EAT Lancet principles of a healthy and sustainable diet are not included in this study, while a restaurant menu based on these principles is.

The consumer interventions met various selection criteria. All interventions either promote plant-based protein consumption, demote animal-based protein consumption, or do both. We have chosen to focus on interventions that have been rolled out in the Netherlands, where the protein transition is well underway (Aiking & de Boer, 2020b). Interventions were included if they inarguably fostered more plant-based diets. For instance, the Heerenboeren circular farming initiative does not necessarily promote a vegan diet, but it does facilitate consumption patterns that are 'plant-forward'. We sought diversity in terms of the societal-behavioural issues the interventions addressed and the change mechanisms they applied, the two components of a TD frame. Meat and dairy analogous products were included in the set, but special attention was paid to identifying other kinds of interventions, as we seek to find avenues in the protein transition that differ from the mimicking of animal-based products.

To ensure no important examples were missed, we collected the consumer interventions through various sources: overviews of innovations contributing to the protein transition in the Netherlands, as identified by established Dutch innovation hubs (The Impact Hub Amsterdam, n.d.; The Protein Community, n.d.), expert interviews that were part of this study, and an internet search with a wide range of search terms. Three examples of consumer interventions can be found in table 3b. The full list as well as a visual overview of the interventions are included in appendices 3A and B.

Consumer intervention	Creator	Manifestation	Source
Herenboeren urban circular farm	Herenboeren	product-service system	herenboeren.nl
Original Fondue: plant-based cheese fondue	Willicroft	product	willicroft.com/original-fondue
The Game Changers	James Cameron	documentary	gamechangersmovie.com

Table 3b: Three examples of consumer interventions included in this study.

Expert Interviews

Eight experts were consulted through a 60-minute semi-structured interview. The interviews served various purposes: 1) to get a deeper understanding of the protein transition, informing the role of the consumer interventions in the transition, 2) to 'fact check' the first insights derived from the preliminary set of consumer interventions, and 3) to identify additional consumer interventions for inclusion in the study.

Indicated through preliminary desktop research, the participants were identified as experts with a great deal of industry knowledge and therefore could provide a substantiated reflection on the protein transition and the influence of consumer interventions in this transition context. The experts were selected with the aim for diversity regarding their position in the food system. The list of experts can be found in table 3c. All interviews were conducted by the primary researcher, of which six via Zoom and two in person. The interviews were recorded with consent from the participants and supported by an interview guide, which is included in appendix 3C. Directly after the interviews they were transcribed with Microsoft Word software.

	Role	Organisation
1	VP R&D	Food innovation: insect proteins
2	Sociologist	Knowledge institute: university
3	Food transition expert	Consultancy: food and education
4	UX manager	Food processor: dairy products
5	Farmer and business owner	Dairy Farm
6	Marketing manager	Door innovation: meat analogues
7	Food artist	Independent
8	Protein transition ambassador	Network organisation: connecting partners in food system

Table 3c: List of experts included in the study.

Thematic Analysis

After collecting approximately 40 consumer interventions and speaking with the first three experts, the primary researcher held a workshop at the Relating Systems Thinking and Design conference (RSD10) in Delft, the Netherlands. During this 90-minute exploratory workshop, twelve conference participants analysed four distinct consumer interventions, which are included in appendix 3A: the Herenboeren urban circular farming initiative, the Beyond Burger, the Do-It-Yourself-Chicken and the vegetarian meal box of Hello Fresh. The workshop served as a form of methodological triangulation; the participants helped with determining how to systematically identify the two components of a TD frame, namely the specific societal-behavioural issues an intervention addresses and the change mechanisms it applies, including the underlying worldview.

Next, three more interviews with experts were held and approximately 20 interventions were added to the study's collection. All six interviews were coded by the primary researcher with MaxQDA software. The first set of codes was directly aligned with the interview questions, which revolved around the components of a TD frame. After familiarization with the interventions and the interviews, the data was then grouped into emerging themes - each unique in their problem-solution combination, i.e. framing. This inductive approach resulted in several preliminary TD frames. Each TD frame was captured in a new

code. Two more interviews were conducted and coded to further deepen the understanding of the emerging TD frames. The set of consumer interventions was refined so that each intervention represented a unique combination of framing and manifestation type (e.g. product, service, campaign, etc.), as the latter correlates with behavioural influence. This meant that if two similar educational programmes were included in the set, one of them was eliminated from the set. Yet, there are three books in the set that each show different framing (for instance, one of them aims to inform its readers, while another aims to inspire and yet another aims to create awareness), so they each remained in the set. The refinement of the set resulted in the final collection of 62 consumer interventions.

Throughout the entire period of data collection and analysis, a regular review of the emerging TD frames by cross-disciplinary research partners and by the co-authors was conducted to critically check against potential biases and interpretations of the primary researcher. After multiple rounds of constant comparison, discussions and refinement of the TD frames, we arrived at the final set of eight TD frames, as presented in the next section (Results).

3.4 Results

Following the thematic analysis of the consumer interventions and expert interviews, eight TD frames emerged from the data (table 3d): 1) *Tasty Doppelgangers*; 2) *Silent Steering*; 3) *Gentle Guidance*; 4) *Be the Transition*; 5) *Shifting Meaning*; 6) *Cracking the Discourse*; 7) *Changing the Rules of the Game*; and 8) *Beyond the Anthropocene*. All TD frames target the same actor in the system, namely the consumer, and are unique in terms of their behaviour change mechanism. From a transitions perspective, however, the typology that resulted from the analysis shows variety along a few dimensions. For instance, some TD frames involve technological innovations, while others do not. Similarly, some are supportive at the initial phase of the transition, while others may be more effective once the transition has progressed further.

In this section each TD frame will be described and supported by existing literature on transitions and consumer behaviour. As presented in section 2.3 (Transition Design Frame), each TD frame comprises a societal-behavioural issue and a change mechanism with an underlying worldview. To relate the TD frames to the protein transition, we also shed light on the impact of each TD frame on the structures, cultures and practices that make up the current food regime (Loorbach,

2014; Mcmichael, 2009). With structures we refer to institutional, economic, physical, and regulatory settings. Cultures revolve around discourses, shared beliefs, values, perspectives, and paradigms. Practices involve daily routines, behaviours, actions, choices and habits (Silvestri et al., 2020).

TD Frame	Change mechanism	Impact on protein transition		
		structures	cultures	practices
Tasty Doppelgangers	supporting existing consumption patterns with a convenient, sustainable alternative	**x**		
Silent Steering	supporting consumers discretely with responsible choice architecture	**x**		
Gentle Guidance	giving the conscious consumer a helping hand			**x**
Be the Transition	showing everybody can be a changemaker, by joining a movement		**x**	
Shifting Meaning	celebrating plants as meaningful and appealing sources of protein		**x**	**x**
Cracking the Discourse	challenging the status quo through public provocation	**x**	**x**	**x**
Changing the Rules of the Game	modifying food supply through coercion and regulation	**x**		
Beyond the Anthropocene	restoring our connection with nature, through alternative food networks	**x**	**x**	**x**

Table 3d: overview of the TD frames and their impact on the protein transition.

Tasty Doppelgangers

The *Tasty Doppelgangers* TD frame assumes that consumers are reluctant to change their diets. Due to ingrained habits (Kahneman, 2003), neophobia (Faria & Kang, 2022), or both, they want to continue eating as they do. To help these consumers shift to plant-based diets, this TD frame relies on the principle of 'learning by analogy' (Hoek et al., 2011), building on existing consumer knowledge to support learning (Gregan-Paxton et al., 2002). As a consequence, such interventions incorporate plant-based analogues, i.e., products similar to meat and dairy in terms of cultural food appropriateness, appearance, structure, origin, and taste, and share the same goal or script (van der Meer et al., 2023) to meet consumer expectations (Tziva et al., 2020) and which require no or only little adjustments of habits and routines, which can be difficult to change (Onwezen et al., 2020). Thereby, the *Tasty Doppelgangers* facilitate incremental change, as opposed to more radical change (Mugge & Dahl, 2013). This TD frame stems from a worldview appreciating technological innovation, a free market, global ambitions and 'champion products', such as the Beyond Burger (Lang & Heasman, 2015). From a transition perspective, this TD frame can be linked to what Smith and Raven (Smith & Raven, 2012) deem a 'fit-and conform' strategy in which actors aim to reproduce existing practices linked to main-stream consumption and production, to support the diffusion and adoption of their innovations. As shown in figure 3b, this TD frame has led to a plethora of novel product innovations deploying a meat resemblance strategy (Bulah et al., 2023a; Bulah et al., 2023b; Hoogstraaten et al., 2023; Tziva et al., 2020). While *Tasty Doppelgangers* purposely do not try to disrupt eating practices or cultures, they do challenge existing structures by increasing the demand for alternative resources and infrastructures, particularly within the meat and dairy value chains.

Figure 3b: Examples of interventions based on the Tasty Doppelganger TD frame (from left to right): ***plant-based milks*** *from Alpro;* ***'minced mushrooms'*** *from retailer Albert Heijn; the* ***Beyond Burger*** *from Beyond Meat;* ***seaweed bacon*** *by Seamore.*

Silent Steering

The *Silent Steering* TD frame focuses on unconscious behaviours, as consumers are heavily influenced by the retail environment. Most food environments currently still promote animal-based products, pulling consumers towards these options. Discretely supporting them to make different dietary decisions, *Silent Steering* intervenes by altering the choice architecture (i.e. the environment in which a decision is made) to steer behaviour in a certain direction, without prohibiting any choices (Thaler & Sunstein, 2008). As such, this frame focuses on the consumers' context (Bucher et al., 2016), rather than on motivating or empowering consumers via their cognition (Niedderer et al., 2018). Consumer interventions can make sustainable options more attractive by convenience or ease (Vandenbroele et al., 2020), by making plant-based proteins the new norm, by making them more accessible, by presenting them as the most popular option, and by providing discounts, thereby nudging desirable behaviours (Thaler & Sunstein, 2008). In the protein transition, nudging has been be able to influence eating habits positively (Verplanken & Whitmarsh, 2021), e.g., through reversing the default from meat to vegetarian or plant-based, reducing the portion sizes (Meier et al., 2022), or through increasing the availability and visibility of plant-based options in the supermarket (Coucke et al., 2022). However, whether the effect lasts after the intervention has been removed is often unclear (Meier et al., 2022). Consumer interventions based on this TD frame are quite prevalent in the protein transition (see figure 3c). The *Silent Steering* TD frame directly challenges existing regime structures, such as pricing

models, physical infrastructures in retail environments, and institutions affiliated with the meat and dairy value chains. Food practices, such as grocery shopping, are also impacted by *Silent Steering* interventions, while eating cultures remain untouched by this TD frame.

Figure 3c: Examples of interventions based on the Silent Steering TD frame, from left to right: ***increased shelf space*** *for plant-based products at a large Dutch retailer;* ***discounts for the plant-based hot dog*** *at IKEA;* ***sustainable menu design****, promoting vegan and vegetarian options over animal-based dishes, from restaurant Le Nord in Rotterdam, the Netherlands.*

Gentle Guidance

The *Gentle Guidance* TD frame focuses on conscious behaviour change by addressing peoples' rationality. Consumers are considered engaged agents regarding their dietary change (de Bakker & Dagevos, 2012). This TD frame resonates with flexitarian consumers (Gonera et al., 2021) who are willing to adjust their food practices yet still need to learn what a responsible diet entails or how to prepare plant-based meals. *Gentle Guidance* consumer interventions offer information and practical guidance to support plant-based cooking, i.e., so-called 'boosting' interventions to foster consumers' competences through changes in skills, knowledge or decision tools (Hertwig & Grüne-Yanoff, 2017). The assumption underlying boosting techniques is that effects persist, even after the intervention is removed (Hertwig & Grüne-Yanoff, 2017). When collecting consumer interventions for this study, it was not difficult to find examples based on this TD frame (figure 3d). From a transition perspective, the *Gentle Guidance* TD frame primarily challenges existing food cultures by transforming eating practices, such as grocery shopping and cooking. *Gentle Guidance* also impacts structures in the food system, by empowering retailers and (knowledge) institutes like the Dutch Centre for Nutrition to steer consumption patterns.

Figure 3d: Examples of interventions based on the 'Gentle Guidance' TD frame. From left to right: Vegan cookbook 'Plenty' by Yotam Ottolenghi; ***'Doe de Voedselafdruk'****, a quiz from the Dutch Centre for Nutrition for consumers to learn about the environmental impact of their diet; the* ***Hello Fresh vegetarian meal box*** *with recipes; vegan cooking show* ***'Vlees noch Vis'*** *from 24Kitchen.*

Be the Transition

The *Be the Transition* TD frame addresses the fact that consumers find it difficult to change their lifestyles for a larger purpose, such as the environment, animal welfare or their own health, by themselves (figure 3e). Consumers may not always recognise their role in the protein transition (van den Boom et al., 2023). Regarding pro-environmental behaviour, perceived efficacy is indeed an important determinant (Gifford, 2011; van Valkengoed et al., 2022). The *Be the Transition* TD frame has a social character, emphasizing the power of the collective and tempting people to embrace the identity of a changemaker. The social perspective of joining a movement can help consumers feel empowered to make a change and feel part of a community (Reicher et al., 2022), thereby boosting the perceived effect of their own behaviour (Cojuharenco et al., 2016; Jugert et al., 2016). The increase of flexitarians may indicate such a movement (Sparkman & Walton, 2019). Regarding the protein transition, *Be the Transition* primarily disrupts existing food cultures, indirectly influencing eating practices and structures.

*Figure 3e: consumer interventions based on the 'Be the Transition' TD frame. From left to right: the **'Nationale Week zonder Vlees'** (national meatless week) campaign; the Netflix documentary **'Game Changers'**, where celebrities and athletes promote a vegan lifestyle; an **Oatly advertisement** addressing consumers as heroes if they were to eat plant-based breakfasts.*

Shifting Meaning

The *Shifting Meaning* TD frame focuses on the issue of consumers regarding meat and dairy as essential and meaningful elements of their meals. Shifting towards a more plant-based diet is often perceived by consumers as though something is being taken away from them. *Shifting Meaning* assumes that true change happens by influencing beliefs and is thereby a relatively radical change strategy (Mugge & Dahl, 2013). In this TD frame, food is recognised as a cultural phenomenon with social and spiritual meaning (Anderson, 2005). The role of 'meat as a centrepiece' is released (Elzerman et al., 2013), allowing a repositioning of traditional protein sources such as legumes and nuts (van der Meer et al., 2023). Through *Shifting Meaning*, plant-based foods and eating practices are demonstrated as meaningful, tasty and fun. Interventions based on this TD frame (figure 3f) can be difficult to implement and scale, since they challenge deeply rooted and highly diverse beliefs surrounding food (Anderson, 2005). The impact of the *Shifting Meaning* TD frame on the food regime evidently lies in its disruption of cultures and practices, indirectly impacting its structures.

Figure 3f: Consumer interventions based on the 'Shifting Meaning' TD frame. From left to right: ***The Dutch Cuisine****, a collective of restaurants cooking with local and seasonal products, using 80% plant-based and 20% animal-based products; the* ***'Wortel Schieten'*** *initiative by het Eetschap, bringing citizens with various immigration backgrounds together to share and experience each other's culture's plant-based dishes; the* ***Vegan Junkfood Bar****, a restaurant chain presenting plant-based fast food as trendy and fun;* ***Farm Fundamentals****, a product line by designer Floris Meijer which translates the remnants of agricultural life into new everyday products.*

Cracking the Discourse

The *Cracking the Discourse* TD frame focuses on how people 'strategically ignore' their cruelty towards the environment, animals and public health (Onwezen & van der Weele, 2016), in order to sustain animal protein consumption. This TD frame addresses consumers' cognitive dissonance, referring to thoughts not being in line with behaviour, i.e. we love animals, yet still farm, slaughter and consume them; also known as the 'meat paradox' (Bastian & Loughnan, 2017; Pyett et al., 2023). Assuming that eating animals at an industrial scale is a form of speciesism (Singer, 2009), *Cracking the Discourse* promotes forceful measures to bring about change. The public is confronted about the irresponsible reality of the food system in a provocative or shocking way, to open up the debate and create room for alternative futures (figure 3g). By evoking empathy for animals, disgust about eating meat, and by making cognitive dissonance salient, *Cracking the Discourse* consumer interventions can indeed reduce the willingness to eat meat (Harguess et al., 2020; Kranzbühler & Schifferstein, 2023), yet also provoke resistance due to their aggressive nature. The *Cracking the Discourse* TD frame fosters the protein transition by criticizing the food regime as a whole: its structures, cultures and practices.

Figure 3g: Consumer interventions based on the 'Cracking the Discourse' TD frame. From left to right: the Vegetarian Butcher's activistic gesture of a ***request for a meat subsidy*** *for their plant-based meat analogues; a* ***campaign against the dairy industry*** *by the Dutch 'Animal & Rights' foundation; Lady Gaga's provocative* ***meat dress****; the* ***'Tosti Fabriek'****, a Dutch speculative consumer intervention where they set up a grilled cheese and ham sandwich production site in the middle of Amsterdam (with live animals being raised and slaughtered on site for its cause).*

Changing the Rules of the Game

The *Changing the Rules of the Game* TD frame assumes that current food related regulations and policies sustain animal protein consumption. Without coercive measures and governmental influence, animal-proteins will continue dominating the food system and thereby also our diets. To facilitate the protein transition, well-informed public and private authorities, such as governmental actors, retailers and schools can therefore regulate the market. While *Changing the Rules of the Game* interventions may not be perceived by consumers as such, the commonality amongst them is that an authority has made a decision for them, fundamentally restricting a free market and thereby consumers' freedom of choice. *Changing the Rules of the Game* relates to the strategy of regime change 'from within', namely by actors that are already part of the dominant regime, as opposed to change brought about by niche actors (Mattioni et al., 2022). Rules, laws and market regulations from authorities can indeed set change in motion (de Boer & Aiking, 2021). Authority-based legitimation is also a form of recategorizing: what was morally accepted becomes 'wrong', whereas what was marginal now becomes standard (e.g. successful change in rules around smoking; de Boer & Aiking, 2021). Coercive measures often include norm-related information that have backfiring effects in terms of autonomy and resistance (de Boer & Aiking, 2021), by consumers as well as other actors in the system. To overcome potential resistance, a combination of both pricing and information nudges may enforce effects (Vellinga et al., 2022). A meat tax is an example of a promising policy tool

(Broeks et al., 2020), which has not been implemented in the Netherlands yet. The impact of this TD frame on the protein transition lies in its disruption of dominant system structures, indirectly influencing food cultures and practices (figure 3h).

Figure 3h: Consumer interventions based on the 'Changing the Rules of the Game' TD frame. From left to right: a ***100% vegetarian canteen*** *at the faculty of architecture of the Delft University of Technology; a* ***prohibition of meat commercials*** *in public spaces by the Dutch municipality of Haarlem;* ***subsidised fruit at primary schools, subsidised*** *by the Dutch government.*

Beyond the Anthropocene

The *Beyond the Anthropocene* TD frame stresses that consumers have lost touch with nature and how it nourishes us, leading to the intensification of consumption patterns and the exploitation of natural resources (figure 3i). *Beyond the Anthropocene* assumes that we are part of nature; we should not aim to master it (Lang & Heasman, 2015). Our connection with nature can be restored through hands-on collaboration between producers, consumers and our natural environment, characterized by tailored, local food practices, a transparent supply chain and an extensification of consumption patterns (Lang & Heasman, 2015). Connectedness to nature is indeed observed to be positively correlated with environmental attitudes and pro-environmental behaviours (Lee et al., 2015). *Beyond the Anthropocene* also implies increasing one's effort to obtain food. Research shows that people value products more if they invest more time or effort to create or obtain a product (Ilyuk, 2018; Norton et al., 2012). People who cook a meal themselves, value their meal more (Dohle et al., 2014; Radtke et al., 2019). *Beyond the Anthropocene* challenges the food regime as a whole, proposing an economy that is driven by qualitative growth instead of quantitative growth (Capra & Henderson, 2009), thereby valuing relationships and meaning over profits and power (Jackson, 2021). In doing so, it is difficult for interventions based on the *Beyond the Anthropocene* TD frame to be viable in the current capitalistic food regime.

Figure 3i: Consumer interventions based on the 'Beyond the Anthropocene' TD frame. From left to right: ***Rechtstreex****, a platform for consumers to buy fresh produce from local farmers directly;* ***Herenboeren****, a circular farming initiative, connecting farmers to citizen members who live nearby, producing mostly plant-based products;* ***edible plant-picking walks*** *organized by De Brede Moestuin.*

3.5 Discussion

Transcending the Doppelganger

In line with expectations, each expert highlighted the dominance of meat and dairy analogues in the protein transition during their interview, and consumer interventions based on this frame were indeed easiest to find. Resonating well with the current food regime, *Tasty Doppelgangers* serve as effective steppingstones for consumers in transitioning to more plant-based diets. The interviews elucidated that the Dutch government hardly intervenes in consumption patterns in the Netherlands, allowing the market to shape the food system, resulting in the ubiquity of these analogous products. One expert with a large entrepreneurial network in the protein transition in the Netherlands, illustrates this as follows:

> *"And that is also something that the Dutch government simply does not want to get involved in. ... So the government has sometimes tried campaigning, also on this theme. But then of course you quickly get a reaction like, 'yes, but you are not going to determine what I eat!'." (Participant 1F – protein transition ambassador, Pos. 145146)*

Governments have shown to intervene more proactively in other transitions, such as the energy transition and the mobility transition, accelerating and shaping these transitions significantly through measures such as subsidies, feed-in tariffs, and even taxing dominant regime technologies (Kungl, 2015; Smink et al., 2015; Wesseling et al., 2015). The interviews suggested that this reluctance of

governments to influence the protein transition can be linked to vested interests of powerful actors in the food system, who benefit from maintaining the status quo. The particularly strong cultural and spiritual value associated with food (Anderson, 2005) may also fuel challenges surrounding dietary interventions by authorities. Several interview participants stressed that without heightened regulation of consumption patterns, especially surrounding pricing, we can expect the *Tasty Doppelgangers* to continue being the dominant transition pathway. One of the experts highlighted the potential risk of such a scenario:

> *"And to what extent is there also the risk of a premature lock-in? And that is, of course, certainly the case around the substitution transition path. It suppresses, as it were, the veganism movement, which actually started in the last century." (Participant 1B - sociologist, Pos. 74-75)*

A premature lock-in into the substitution path indeed raises several concerns. Firstly, *Tasty Doppelgangers* are generally less healthy (Consumentenbond, 2020) and less environmentally sustainable (van der Weele et al., 2019) than unprocessed sources of plant-based proteins, such as beans and nuts. Yet, more noteworthy is the notion that they support a continuation of high consumption patterns, which is a core issue not only in the protein transition, but also in other societal transitions (Almaraz et al., 2022; Sandberg, 2021). To avoid a premature lock-in, our study highlights the call for market regulation by actors with some form of authority in the food system, such as policy makers and retailers, essentially referring to the *Changing the Rules of the Game* TD frame. In doing so, the food system is not only driven towards a highly technological and market driven future state, but more balanced states are also fostered, potentially benefiting other societal transitions as well.

In contrast with the *Tasty Doppelgangers* and the *Changing the Rules of the Game* TD frames, we notice that TD frames *Shifting Meaning*, *Cracking the Discourse* and *Beyond the Anthropocene* fundamentally challenge the collective beliefs that are associated with the food regime. By questioning the role of animals in our diets, these TD frames advocate for a food system that is 'plant-forward' while also fostering a new relationship between humans and other animals. In doing so, these three TD frames most strongly disrupt our cultures, which is considered a deep systemic leverage point (Gaziulusoy et al., 2021; Leadbeater & Winhall, 2020, 2021) and a strategic lever in fostering transitions (Loorbach, 2010). One of the experts, a food artist from Hong Kong residing in the Netherlands, referred to this cultural change mechanism as well:

"He got a lot of inspiration from China, Japan and Korea and there's a huge belief that certain plants have [a] medical function. … If [you] want to implement more healthy eating, I think the first step is to implement [a] belief. Maybe not only in the medical way, also from [a] different perspective." (participant 1H – food artist, Pos. 161165)

Interventions challenging the very foundation of our food system resonate less with the current food regime, implying more radical forms of change. Nevertheless, they are promising avenues to pursue from a transition perspective, since they transcend specific behavioural situations and can influence the complete set of consumer practices surrounding food and eating. We see an opportunity for future research to explore implementation strategies for such transformative interventions to support deep shifts in food cultures across society.

Opportunities for Reframing

At this point in the protein transition, nearly all interventions that we found resonate with consumers who are already willing or able to make a change, regardless of the underlying framing. Literature indeed suggests that healthy diets, characterized by more fruits and vegetables, are more accessible to - and accepted by - consumers with a higher socioeconomic position (Giskes et al., 2010; Maguire & Monsivais, 2014). Consumers with little financial, physical, or cognitive room to change their diet, are only supported through *Silent Steering* and *Changing the Rules of the Game*, TD frames that could be applied more in the transition. Even though the spread of ideas and technology across society relies heavily on social capital (Rogers, 2003), implying that the majority of consumers will follow eventually, we see an opportunity to accelerate the diffusion of 'plant-based as the norm', by developing a novel TD frame explicitly focusing on inclusivity.

Similarly, we noticed that nearly all interventions focus on fostering new, 'better' diets, disregarding the simultaneous need to let go of existing dietary patterns. In line with the x-curve framework that is commonly referred to in transitions literature, the build-up of a new system is inherently connected to the breakdown of an existing one (Hebinck et al., 2022; Loorbach, 2022). Building on the *Shifting Meaning* TD frame, we see room for interventions that explicitly support consumers to deal with 'transition pain', letting go of the belief that meat and dairy can be abundant commodities.

Besides the inclusivity and system breakdown gaps, we see a different kind of reframing opportunity. Some interventions in our study fit multiple TD frames, indicating that they apply a variety of change mechanisms to foster a specific type of consumer behaviour. For instance, to stimulate the purchase of 'veggie dogs', IKEA has deployed a true pricing intervention. As depicted in figure 10, IKEA promotes their veggie dog (*Tasty Doppelganger*) at a lower price than the animal-based hotdog (*Changing the Rules of the Game*) and emphasizes this price difference visually as well (*Silent Steering*). By combining three behavioural change mechanisms, the chances of consumers purchasing a veggie dog are increased. We hypothesise that such 'rich' interventions are more effective and can be pursued more intentionally in the context of the protein transition. As a type of reframing, a combination of multiple TD frames can be integrated into single interventions.

Figure 10: IKEA's true pricing intervention, demonstrating multiple frames (Tasty Doppelgangers, Changing the Rules of the Game and Silent Steering). Photo taken at IKEA Delft, the Netherlands in January 2023.

When combining TD frames, it is important to consider that some frames are complementary to one another, while others are at odds with each other. For instance, we found that *Silent Steering*, characterized by nudging, and *Gentle Guidance*, where boosting is applied, are often effectively used together (Harguess et al., 2020; Peeters et al., 2022). On the contrary, *Tasty Doppelgangers* and *Beyond the Anthropocene* clearly compete with each other due to the very different

worldviews underlying them (Lang & Heasman, 2015; Mann, 2019). A food transitions expert elucidated the tension between these worldviews:

"These are fundamentally different views, so either 'we have to keep innovating, because that makes us more sustainable, then we get more money and then we can...' or you say 'no, we have to consume less, because...' That's really the crux of the discussion." (Participant 1C, Pos. 199)

We see an opportunity for further research to explore interactions between the TD frames when integrating them into one intervention or into a portfolio of interventions, informing which combinations can be deemed especially transformative in fostering plant-based diets.

The Value of Design in Transitions

Our frame analysis in the protein transition served as an empirical case to reflect upon the value of design in transitions research. In line with our hypothesis, we found that a 'designerly' focus on *artificial* manifestations as the units of observation, has helped identify several pathways that have not been referred to in previous research on frames and strategies in the protein transition (see e.g., Pyett et al., 2023; Tziva et al., 2023). This could be explained by the notion that designed interventions come in very diverse forms, thereby including, but also looking beyond technological solution directions that are reflected in discursive content.

This study also showed that transitions theory can help understand and govern design in transition contexts, namely by identifying which design pathways best suit certain phases of a transition and by explaining why some may be more effective than others. Thereby, transitions literature can elucidate what might be needed to increase the chances of certain solution directions to come to fruition. For instance, Kriechbaum et al (2023) have highlighted the importance of narratives to improve the link between a frame and changing landscape developments; when the resonance of a frame is enhanced by connecting it to the wider socio-technical context, its legitimacy increases and therefore may result in wider adoption. In the context of this study, their finding suggests the potential of strengthening the narratives surrounding TD frames that are more desirable from a transition perspective – for instance those that do not involve mimicking. Similarly, Lee and Hess (Lee & Hess, 2019) show that environmental arguments often lose from consumer-economic arguments, insinuating that it

might be strategic to stress the consumer-economic benefits of interventions that foster desirable pathways, or at least to be discreet about the environmental drivers behind them, to avoid potential opposition. This would be especially applicable to the *Beyond the Anthropocene* TD frame, whose environmentalist narrative often evokes resistance, thereby 'losing ground' to other frames.

This study deliberately focused on consumers as active change makers and 'individuals', a perspective that is common in the design field yet not as much in transitions research to date. The TD frames indeed highlighted the variety of ways in which system transformation can be brought about through one specific type of actor, connecting individuals' behaviour at the micro-level to societal impact at the macro-level. However, since societal transitions involve a complex interplay of multiple actors, we acknowledge the value of a follow-up study targeting several other actors in the food system as well.

Lastly, the eight TD frames resulting from this study represent types of pathways for design that might be prevalent or otherwise aspirational for societal transitions in other domains as well. For instance, in the mobility transition we see *Tasty Doppelgangers* in the form of electric cars as well, with similar lock-in related concerns as we find surrounding the meat and dairy analogues in the protein transition (Sovacool, 2017). Similarly, there are initiatives challenging our views on the entire concept of mobility (Sovacool & Axsen, 2018), which can be associated with the *Shifting Meaning* TD frame. We see an opportunity for further exploration of the generalizability of the TD frames we have found in the protein transition, to serve design efforts in other societal transitions as well.

3.6 Conclusions

This study looked at 62 consumer interventions in the Netherlands that foster plant-based diets, to identify TD frames that are prevalent in the protein transition and to explore the value of design in transitions research. Supported by expert interviews, we identified eight TD frames, each unique in their approach to societal-behavioural issues surrounding the adoption of plant-based diets, connecting micro-level behaviours to macro-level systemic shifts. We confirmed that the *Tasty Doppelgangers* TD frame, characterized by the so-called meat analogues, is currently dominating the transition. Without pursuing other TD frames more deliberately, this might lead to a premature lock-in and a future food system that is highly market driven and technology heavy. We found that some TD frames challenge the food system fundamentally by challenging

cultures, indicating that they might have more transformative power. We see opportunities for reframing around inclusivity, system breakdown and combining multiple frames into single interventions.

Approaching frame analysis in a transition context in a practice-oriented 'designerly' way, has shown complementary value to the common focus on discourse in transitions research, by taking human-made consumer interventions as the units of observation. This artificial angle is technology-agnostic and exposed pathways in the transition that have not been discovered through discourse analyses to date. At the same time, the analytical lens of transitions research helped elucidate how potentially more desirable pathways for design might be fostered moving forward.

This study focused on the case of the protein transition, with an emphasis on consumer behaviour. We see an opportunity for further research on TD frames in the context of other societal transitions and considering different types of actors, to further shape this intersection of transitions and design

Intermezzo I: Reframing opportunities

This intermezzo chapter summarises three MSc graduation projects that were informed by ongoing research in this dissertation and, in turn, informed it. The first two projects from Mariska Graat and Evelijn Savalle pursued a design opportunity to foster transitions more effectively, as identified in Chapter 3, namely the *diversification* of design frames (Graat, 2022; Savalle, 2023). Both projects focused on the transition towards healthier diets, for a socially challenged neighbourhood in Rotterdam (Mariska Graat) and for vocational secondary-school students (Evelijn Savalle). The third graduation project from Daniek Dieben identified another reframing opportunity in Chapter 3: *inclusivity* in the protein transition (Dieben, 2023). Most interventions fostering plant-based diets in the Netherlands resonate with a so-called 'oatmilk elite'; they misalign with the daily reality of most Dutch consumers. Daniek Dieben unpacked several types of resistance among consumers towards plant-based eating.

Diversification in the food transition

MSc graduation project 1/5: "Healthy Hillesluis: Designing interventions for a healthier food environment in a low-SEP neighbourhood"

Commissioned by the municipality of Rotterdam and in response to poor dietary health, Mariska Graat addressed the systemic barriers sustaining an unhealthy food environment in low-income neighbourhood Hillesluis (Graat, 2022). Her solution combined a community cooking programme, *De Familiekeuken*, with healthy food-inspired street art, engaging families and local actors to foster healthier, more accessible and appealing food practices (figure Ia).

With a focus on the local food context in Hillesluis, Mariska's project highlighted aspects of *justice* in dietary transitions. Her specific case demonstrated the unequal distribution of the availability, accessibility, affordability and acceptability of healthy foods across society, calling for approaches that are tailored to local circumstances and sensitive to cultural differences. These insights were integrated in the opinion piece in Intermezzo II. Mariska's work also confirmed the reframing opportunity found in Chapter 3 focusing on inclusivity in the protein transition, which is explored in the MSc graduation project 3/5, by Daniek Dieben.

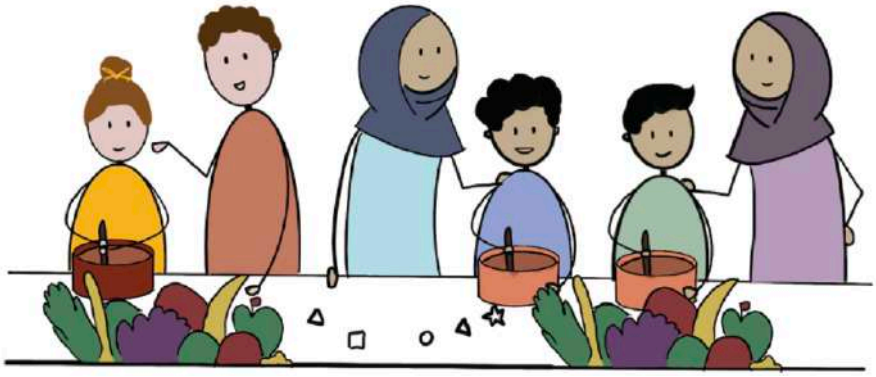

Figure Ia. An impression of 'De Familiekeuken', the concept by Mariska Graat (2022).

MSc graduation project 2/5: "Towards a healthier young generation: A strategy to stimulate VMBO students to make healthy dietary choices"

To address unhealthy eating habits among vocational secondary-school students in Rotterdam (also commissioned by the municipality), Evelijn Savalle explored how to make healthy food socially appealing (Savalle, 2023). Her co-created and integrated solution includes a school food festival, *Eat to your Beat*, and a street art–driven online challenge, *Eat Smart, Play Hard.* Both interventions aim to make healthy eating feel fun, tasty, and 'cool' (figure Ib).

Evelijn's project demonstrated the strength of *integrating* interventions into existing structures when aiming to foster a transition, increasing their acceptability and feasibility. She adopted social media in her concept, which VMBO students use frequently, and integrated the festival into the school curriculum. By doing so, the interventions can still be disruptive in nature, but they do not require an (unrealistic) pivot of eating practices. This insight was passed on and integrated in all following graduation projects that took place alongside this dissertation.

Following recent contact with the municipality of Rotterdam, both graduation projects from Mariska and Evelijn have inspired some actions (e.g. seeking certain partnerships) and a shift in mindsets (e.g. embracing experimentation) towards a healthier food environment in Hillesluis, in other neighbourhoods and arounds schools. However, a full implementation of these systemic concepts in practice has remained cchallenging for the municipality, given the larger network of stakeholders involved. For this dissertation, it has highlighted the importance of *vision-led backcasting* (a technique central to transition design: Irwin, 2018) for such concepts to come to fruition. As such, backcasting has been integrated into Chapters 2 and 6.

Figure Ib. The 'Eat to your Beat' and 'Eat smart, play hard' concept by Evelijn Savalle (2023).

Inclusivity in the protein transition

MSc graduation project 3/5: "Including the unwilling and the unable in the Protein Transition: Designing an intervention to involve consumers with a low socioeconomic position"

To support a more inclusive protein transition, Daniek Dieben designed a solution for low-SEP consumers resistant to plant-based eating (Dieben, 2023). Commissioned by the Voedingscentrum, her concept Spaar je vol is a savings campaign that rewards shoppers with easy, healthy vegetarian meal boxes. It fosters joyful social adoption without relying on nutrition literacy (figure Ic).

Daniek's work confronted us with our own privileged and culturally biased *positionality* in the context of the protein transition. Indeed, as (co)authors of the work in this dissertation, we identify with that 'oatmilk elite' (whether we like it or not). This graduation project helped us realise how little we know about the majority of Dutch consumers' aspirations and concerns around food. As such, Daniek inspired us to adopt a humbler attitude during the rest of this doctoral research, with an increased sensitivity towards pluralities and justice in transitions. This sensitivity also motivated the choice to conduct the research reported in Chapter 6, focusing on designing for systemic breakdown, as phase-outs in transitions are inherently intertwined with injustice.

Figure Ic. The 'Spaar je Vol!' concept from Daniek Dieben (2023).

Chapter 4
Transformative design strategies for plant-based diets: opportunities for the Dutch protein transition

This chapter is currently in press as a conference proceeding:

Peeters, A.L (2024). Transformative design strategies for plant-based diets: opportunities for the Dutch protein transition. EFOOD24, november 7-10, Elisava, Barcelona.

Abstract

Pressing societal challenges such as climate change, biodiversity loss, increased concerns for animal welfare, and public health, have been linked to the amount of animal proteins in our diets. These complex issues have led to the call for a 'plant-based protein transition', implying a shift away from animal proteins towards plant-based proteins. This paper expands and diversifies opportunities for design to foster the protein transition, building on two preceding studies – one involving four scenarios for the Dutch protein transition for the year 2035, and one presenting eight design frames which each foster the transition in a distinct way. A design frame is understood as a strategy for intervention, which proposes a solution direction for a societal issue. For instance, a design frame could involve the mimicking of meat and dairy products (solution direction) to help consumers eat more sustainably without having to change their eating practices (societal issue). Designers embody their chosen framing in concrete products, services and other (behavioural) interventions. We summarise the two studies in this paper and continue by mapping the frames onto the scenarios. The mapping revealed that the scenarios provide directionality for the frames. We also find that designers can play a crucial role in fostering scenarios beyond ecomodernism. In every scenario, the design frames can be tailored to actors other than consumers as well. Two opportunities for new design frames emerged, one supporting people in letting go in transitions, and one helping people embrace new types of food and eating experiences. We warmly invite researchers and practitioners to experiment with the findings from this paper.

4.1 Introduction

The food system in transition

In the pursuit of a just and sustainable food system that supports public health, transitioning towards plant-based diets has globally been recognised as a necessary direction for change (Aiking, 2011; Fourat & Lepiller, 2017; Hartmann & Siegrist, 2017). While global greenhouse gas emissions from animal-based foods are twice those of plant-based foods (Xu et al., 2021), livestock and feed production still account for 80% of agricultural land use (Ritchie & Roser, 2024). At the same time, animals convert resource inputs to caloric and protein outputs much less efficiently than plants do (The Eat-Lancet Commission, 2019). Moreover, various chronic diseases have been linked to the consumption of red and processed meat products (Béné et al., 2020). Lastly, increasing concerns for animal welfare are putting additional pressure on the system, as well as untenable injustices across agricultural economies (Béné et al., 2020; Vermeulen et al., 2020; Weinrich, 2018). Collectively, these statistics and macro developments have led to the call for a 'plant-based protein transition', referring to our collective dietary shift away from animal proteins towards mostly plant-based proteins.

In this paper, we build on two preceding studies examining the protein transition in the Netherlands. The Dutch government has set the ambition to flip the animal protein : plant protein ratio from 60:40 to 40:60 by the year 2050 (Aiking & de Boer, 2020). While the variety and popularity of meat and dairy substitutes are rapidly increasing, the demand for animal proteins in the Netherlands is hardly decreasing, and globally it is still growing (Freedomlab, 2024). This calls for pluralistic perspectives to help accelerate the protein transition in novel ways (Caniglia et al., 2020). In this light, the discipline of design is increasingly considered promising to navigate such transitions, as these are riddled with complexities (Ceschin & Gaziulusoy, 2016; Loorbach, 2022).

The first study we build on in this paper involved four explorative scenarios for the Dutch protein transition in the year 2035 (Freedomlab, 2024). Based on technological and geopolitical developments, these scenarios are likely to unfold (simultaneously, to varying degrees of dominance). They are intended to serve as speculative references for policy makers, designers and other actors shaping the future of our food system. The second study involved an analysis of current design interventions in the Netherlands fostering plant-based diets (Peeters et

al., 2024). Eight 'transition design frames' emerged from the set of interventions, which each represent a distinct pathway for design to stimulate Dutch consumers to eat 'plant-forward'.

Connecting the two studies, our contribution is twofold. First, we determine how the eight design pathways from Peeters et al. might foster each of the four scenarios from Freedomlab. As such, the scenarios become more actionable for practitioners. Second, we explore opportunities for novel pathways through the lens of the scenarios, to help diversify the portfolio of design interventions fostering the protein transition in the Netherlands. Our paper is structured as follows. The next section presents the theoretical background relevant to both studies. The following section summarises the scenario study from Freedomlab, and the next section the transition design frames from Peeters et al. The frames are then connected to the scenarios and followed by speculations about novel pathways for design. The final section concludes the paper.

4.2 Theoretical Background

Designing for transitions

Traditionally, design was a discipline with the singular purpose of developing physical artefacts like chairs, cars, and washing machines. Over the past three decades, design has outgrown the medium of artefacts and is increasingly being applied to responsibly improve processes, experiences, and even societal systems (Ceschin & Gaziulusoy, 2019). In response to the dynamic and networked global challenges we are currently facing, transition design has emerged as a specialised field of design research and practice. Transition design seeks to initiate and accelerate systemic transformations towards more favourable futures (Ceschin & Gaziulusoy, 2016; Gaziulusoy & Öztekin, 2019; Irwin et al., 2015).

Societal transitions are a central phenomenon in transition design. Transitions are long-term, multifaceted, and deep transformation processes that enable established socio-technical systems to evolve into more sustainable, equitable and resilient patterns of production and consumption (Hebinck et al., 2022; Markard et al., 2012; Pel et al., 2020). The domain of food and agriculture is currently undergoing several transitions, the plant-based protein transition being one of them.

Visioning for transitions

Central to transition design is the envisioning of new lifestyles in future scenarios at a macro-level, followed by backcasting to the present to inform the development of transformative design interventions at the micro-level (Gaziulusoy et al., 2013; Irwin, 2018). As such, future scenarios provide directionality for practitioners to identify pathways for design that are in line with long-term ambitions. As future scenarios per definition have not 'come true' yet, multiple scenarios can co-exist and no single one is 'correct' (McGrail et al., 2015). They serve as a reference and can continuously be adjusted, expanded, or discarded.

Scenarios can be predictive, explorative, or normative. Predictive scenarios revolve around *what will happen*, while explorative scenarios present *what can happen* and normative scenarios involve *how a specific target can be reached* (Börjeson et al., 2006). The study by Freedomlab, which we build on in this paper, presents explorative scenarios, intended to examine situations or developments that are considered possible, typically from multiple perspectives.

Framing for transitions

Design interventions are the outputs of a design process; they are manifestations of underlying design frames. Framing is a core competence of designers. It involves connecting a problematic issue to a promising solution space (Dorst, 2015). Framing typically takes place during the initial phase of a design process, though frames usually evolve as design interventions are developed (Dorst & Cross, 2001; van der Bijl-Brouwer, 2019).

Design frames can be seen as 'deliberate strategies for intervention' (Prendeville et al., 2022), providing actionable perspectives on a design challenge. For example, to address the issue that many consumers want to spend limited time cooking meals, providing them with healthy ready-made dishes could be an appropriate direction for design. A collective neighbourhood kitchen offering freshly cooked meals from one cook to multiple households could be an alternative way to address the same issue. As these examples demonstrate, each design frame represents a pathway for design that fosters a certain kind of future. Thereby, design frames are never neutral (Coyne, 1985); they are inherently normative. As such, applying a certain design frame increases the likelihood of particular scenarios to unfold instead of others.

In sum, scenarios can provide directionality in design framing; they help decide 'which way to push the system' by design. For this reason, we seek to connect the design frames from Peeters et al (2024) to the explorative scenarios from (to be published).

4.3 Four scenarios for the protein transition

Freedomlab is a Dutch thinktank for future scenarios, assisting public and private decision makers in navigating uncertainty (Freedomlab, n.d.). Freedomlab performed a scenario study for the Dutch protein transition "to break away from established interests and ideas and explore new, sometimes unexpected and unforeseen, ideas that can contain valuable insights and perspectives" (Freedomlab, 2024). Following a trend analysis of relevant technological, societal and geopolitical developments, they prepared a framework with four explorative scenarios for the year 2035, in which the Dutch protein transition has unfolded in different ways. The scenarios vary along two 'dimensions of uncertainty': technological innovation (high-tech vs. low-tech) and geopolitical orientation (globalisation vs. regionalisation). Based on these two dimensions, four quadrants with unique scenarios emerged (figure 4a): Ecomodernism (high-tech + globalisation), Resilient Network (low-tech + globalisation), Small Earth (low-tech + regionalisation), and Regional Innovation (high-tech + regionalisation).

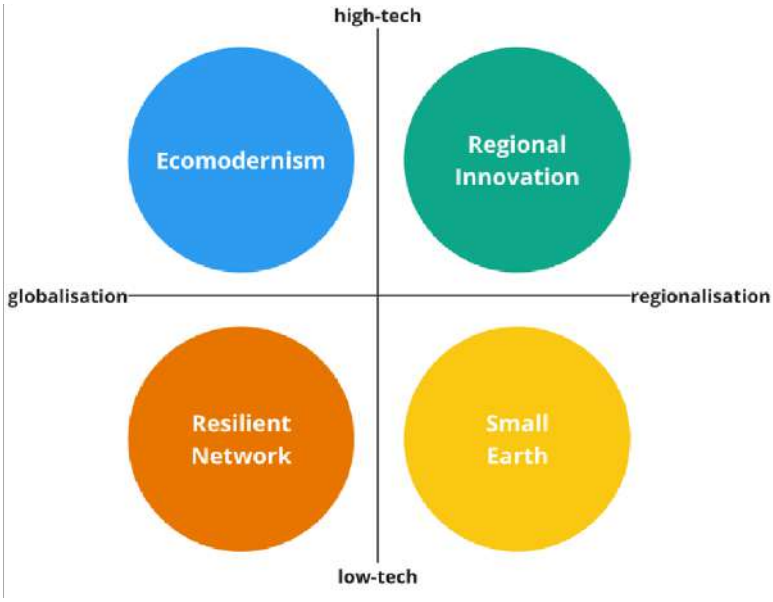

Figure 4a: The four scenarios for the protein transition in the Netherlands from Freedomlab.

Freedomlab presented the framework with the four scenarios to a diverse group of 21 Dutch food system experts during a scenario planning workshop, which I also attended. Following a discussion, they divided the group of experts into four groups. Each group explored and detailed one scenario, presenting this to the others at the end of the workshop. Freedomlab captured the outputs, elaborated them, and presented them in text in the report referred to in this study. The four scenarios are summarised next.

Scenario 1: Ecomodernism

The *Ecomodernism* scenario is characterized by high-tech solutions and a further globalised market:

"By 2035, the Dutch landscape has transformed from traditional farms to ***industrial sites*** *producing* ***meat alternatives*** *on a massive scale for domestic and export markets. Technological breakthroughs have made these alternatives cheap and high-quality, enabling a seamless protein transition with* ***minimal cultural resistance****. The remaining animals are now luxury items for the elite. A self-reinforcing cycle of innovation and policy has driven this shift, supported by ambitious government goals and substantial investments. The food sector is now dominated by* ***large multinationals****, with significant mergers between Big Food and Big Tech. This shift has boosted the Dutch economy, though small and medium-sized enterprises (SMEs) benefit little. Large industrial parks provide employment, but the decline of traditional farming is still felt.* ***Globally, the benefits and burdens are unevenly distributed****, with developing countries facing challenges in modernizing their economies and food supplies."*

Scenario 2: Resilient Network

The *Resilient Network* scenario proposes low-tech solutions in a globalised world:

"By 2035, the Dutch diet has shifted its focus to ***plant-based whole foods****, with meat replaced by legumes and soy in meals from* ***cuisines from all over the world****. This change, driven by global crises like rising meat prices, climate change, and livestock diseases, was cultural as well as practical. The Dutch now prioritize high-quality food and* ***fair compensation for global producers****. The transformation was aided by international cooperation and trade, ensuring food security. Technological solutions fell short, prompting investment in diverse kinds of plant-based diets over new tech. Knowledge sharing and plant breeders' rights support global crop development.* ***International food cooperatives*** *lead this shift, instead of multinationals. The Netherlands, reinventing itself from an intensive livestock farming nation to plant-based pioneers, now promote sustainability and cooperation, enhancing* ***global food security and stability****. This scenario emphasizes justice, international collaboration, economic vitality, and a celebration of different cuisines."*

Scenario 3: Small Earth

The *Small Earth* scenario advocates for regional and low-tech solutions:

"By 2035, the Dutch diet reflects the ***seasons and local agriculture****, with shops offering a variety of locally grown produce while imported goods are rare.* ***Animal products are scarce*** *and expensive, leading to healthier and more local eating habits. This shift is driven by climate change, geopolitical unrest, and healthcare pressures, leading to measures like a* ***meat tax and true pricing****. The collective consciousness now sees the unsustainability of abundant exotic foods and cheap animal proteins.* ***Agriculture reconnects with the earth****, focusing on polycultures and traditional crops, shifting from export to serving the domestic market with sustainability and health as priorities. Education promotes food science and planetary health, while digital platforms and local markets strengthen* ***producer-consumer bonds****. This transition demands a* ***societal paradigm shift****, supported by the government, though resistance remains from those unwilling to change."*

Scenario 4: Regional Innovation

In the *Regional Innovation* scenario, technological solutions are celebrated, while focusing on a local market:

"By 2035, the Netherlands is leading in sustainable plant-based protein production, transitioning from intensive livestock farming to ***innovative, ecological practices.*** *This shift, driven by climate change, animal welfare, and social justice issues, led to a strategic re-evaluation of food supplies and closed borders to foreign investments and imports. Dutch farmers now focus on* ***regenerative agriculture and high-tech protein production****, sharing innovations globally. The new food system emphasizes local production, biodiversity, and soil quality, with* ***the Netherlands serving as an innovation hub****. This transformation improves resilience, health, and fairness in the food system, positioning the Netherlands strategically in international relations. Despite challenges, it offers economic growth and sustainability,* ***reducing reliance on imports*** *and* ***enhancing food sovereignty****. A decentralized digital infrastructure supports global knowledge sharing, benefiting farmers worldwide, though monetizing this expertise becomes challenging."*

4.4 Eight transition design frames to foster plant-based diets

The second study we look at in this paper, which I did with five interdisciplinary academic partners (Peeters et al. 2024), involved a thematic analysis of 62 design interventions currently fostering plant-based diets in the Netherlands. Its purpose was to determine the status quo of the designed environment in which consumers make their dietary decisions, to identify opportunities for design. The design interventions ranged from products to services, policies, campaigns, public spaces, educational programmes, retail environments, and more. From the set of interventions, we identified eight design frames (table 4a). In transition contexts, a design frame is conceptualised as a societal-behavioural issue (for instance, 'many consumers do not know how to cook plant-based meals'), connected to a behavioural strategy (for instance, empowering the consumer by providing information and guidelines). In other words, a design frame connects a societal problem to a tangible solution, and behaviour plays a key role in both. The eight design frames are summarised next.

Design Frame	Change Mechanism
Tasty Doppelgangers	supporting existing consumption patterns with a convenient, sustainable alternative
Silent Steering	supporting consumers discretely with responsible choice architecture
Gentle Guidance	giving the conscious consumer a helping hand
Be the Transition	showing everybody can be a changemaker, by joining a movement
Shifting Meaning	celebrating plants as meaningful and appealing sources of protein
Cracking the Discourse	challenging the status quo through public provocation
Changing the Rules of the Game	modifying food supply through coercion and regulation
On to the Ecocene	restoring our connection with nature, through alternative food networks

Table 4a: Eight design frames in the protein transition.

Tasty Doppelgangers

The *Tasty Doppelgangers* design frame addresses consumers' reluctance to change their diets due to habits and neophobia, by introducing plant-based products that resemble meat and dairy in appearance, taste, and cultural appropriateness (figure 4b). This pathway supports incremental dietary changes, requiring minimal adjustments to habits. The *Tasty Doppelgangers* design frame values technological innovation, free markets, and global ambitions, exemplified by 'champion products' like the Beyond Burger.

Figure 4b: Examples of interventions based on the 'Tasty Doppelganger' design frame (from left to right): plant-based milks from Alpro; 'minced mushrooms' from retailer Albert Heijn; the Beyond Burger from Beyond Meat; seaweed bacon by Seamore.

Silent Steering

The *Silent Steering* design frame leverages the retail environment to influence unconscious consumer behaviours (figure 4c). It alters the choice architecture to discreetly guide consumers toward plant-based options without restricting choices. The pathway of 'nudging' focuses on the consumer's context rather than their cognition, making sustainable options more convenient, accessible, and attractive. Strategies include making plant-based proteins the default, reducing meat portion sizes, and increasing visibility and availability of plant-based foods. *Silent Steering* can challenge existing pricing models, retail infrastructures, and institutions in the meat and dairy value chains.

Figure 4c: Examples of interventions based on the 'Silent Steering' design frame, from left to right: increased shelf space for plant-based products at a large Dutch retailer; discounts for the plant-based hot dog at IKEA; sustainable menu design, promoting vegan and vegetarian options over animal-based dishes, from restaurant Le Nord in Rotterdam, the Netherlands.

Gentle Guidance

The *Gentle Guidance* design frame focuses on conscious behaviour change by considering consumers as engaged agents in their dietary changes (figure 4d). It resonates with flexitarian consumers willing to adjust their food practices but needing guidance on plant-based meal preparation. This 'boosting' approach enhances understanding of plant-based diet benefits and promotes self-efficacy through information and practical guidance. Design interventions based on this design frame improve skills, knowledge, and decision-making tools, with effects persisting even after the intervention is removed.

Figure 4d: Examples of interventions based on the 'Gentle Guidance' design frame. From left to right: Vegan cookbook 'Plenty' by Yotam Ottolenghi; 'Doe de Voedselafdruk', a quiz from the Dutch Centre for Nutrition for consumers to learn about the environmental impact of their diet; the Hello Fresh vegetarian meal box with recipes; vegan cooking show 'Vlees noch Vis' from 24Kitchen.

Be the Transition

The *Be the Transition* design frame recognises that consumers struggle to change their lifestyles for broader purposes like the environment, animal welfare, or health, often failing to see their role in the plant-based protein transition (figure 4e). This design frame highlights perceived outcome efficacy, the belief that individual actions can effectively address societal issues. Joining a movement helps consumers feel empowered and part of a community, boosting their environmental self-identity as well. Design interventions based on *Be the Transition* support behaviour change by encouraging consumers to see themselves as changemakers.

Figure 4e: Consumer interventions based on the 'Be the Transition' design frame. From left to right: the 'Nationale Week zonder Vlees' (national meatless week) campaign; the Netflix documentary 'Game Changers', where celebrities and athletes promote a vegan lifestyle; an Oatly advertisement addressing consumers as heroes if they were to eat plant-based breakfasts.

Shifting Meaning

The *Shifting Meaning* design frame addresses consumers' perception of meat and dairy as essential, meaningful meal components (figure 4f). It recognises food as a cultural phenomenon with social and spiritual significance. This culture-oriented design frame encourages reflection to release the notion of 'meat as a centrepiece' and reposition traditional protein sources like legumes and nuts as the 'heroes on our plates'. *Shifting Meaning* portrays plant-based foods as meaningful, tasty, and enjoyable, positively influencing attitudes towards plant-based diets. It aims for deep-rooted belief changes, making it a relatively radical strategy.

Figure 4f: Consumer interventions based on the 'Shifting Meaning' design frame. From left to right: The Dutch Cuisine, a collective of restaurants cooking with local and seasonal products, using 80% plant-based and 20% animal-based products; the 'Wortel Schieten' initiative by het Eetschap, bringing citizens with various immigration backgrounds together to share and experience each other's culture's plant-based dishes; and Tommy Tomato, a service offering vegetarian meals to primary schools, including education on vegetables.

Cracking the Discourse

The *Cracking the Discourse* design frame addresses how people ignore their cruelty towards the environment, animals, and public health to continue consuming animal protein (figure 4g). It tackles cognitive dissonance, known as the 'meat paradox,' by presenting industrial animal consumption as a moral issue of 'speciesism'. This pathway leads to provocative design interventions evoking negative feelings about farming and eating animals. As such, they make the public aware of the food system's irresponsibility and stimulate debate for alternative futures. Due to their confrontational and aggressive nature, these interventions can provoke significant resistance.

Figure 4g: Consumer interventions based on the 'Cracking the Discourse' design frame. From left to right: the Vegetarian Butcher's activistic gesture of a request for a meat subsidy for their plant-based meat analogues; a campaign against the dairy industry by the Dutch 'Animal & Rights' foundation; Lady Gaga's provocative meat dress; the 'Tosti Fabriek', a Dutch speculative consumer intervention where they set up a grilled cheese and ham sandwich production site in the middle of Amsterdam (with live animals being raised and slaughtered on site for its cause).

Changing the Rules of the Game

The *Changing the Rules of the Game* design frame posits that current food regulations sustain large-scale animal protein consumption (figure 4h). It advocates for regulatory measures by authorities, such as governments, retailers, and schools, to facilitate the plant-based protein transition. These (policy) interventions often restrict free market choices, with authorities making decisions on behalf of consumers. These coercive measures, such as introducing a meat tax, can enforce changes, although they typically face resistance from incumbent stakeholders holding power in the food system.

Figure 4h: Consumer interventions based on the 'Changing the Rules of the Game' design frame. From left to right: a 100% vegetarian canteen at the faculty of architecture of the Delft University of Technology; a prohibition of meat commercials in public spaces by the Dutch municipality of Haarlem; subsidised fruit at primary schools, subsidised by the Dutch government.

On to the Ecocene

The *On to the Ecocene* design frame emphasizes that consumers have become disconnected from nature, leading to intensified consumption and resource exploitation (figure 4i). This design frame encourages personal responsibility for societal impacts, viewing humans as part of nature rather than its masters. *On to the Ecocene* promotes restoring our connection to nature through local food practices, transparent supply chains, and reduced consumption patterns. It fosters pro-environmental behaviours, encouraging active participation of 'prosumers' who both produce and consume. This ecocentric pathway favours

qualitative growth over quantitative growth, prioritizing relationships and meaning over profits, but faces challenges in the current capitalistic food regime.

Figure 4i: Consumer interventions based on the 'Beyond the Anthropocene' design frame. From left to right: Rechtstreex, a platform for consumers to buy fresh produce from local farmers directly; Herenboeren, a circular farming initiative, connecting farmers to citizen members living nearby, producing mostly plant-based products; edible plant-picking walks organized by De Brede Moestuin.

4.5 Connecting frames to scenarios

This paper connects the four scenarios from Freedomlab (2024) to the eight design frames from Peeters et al. (2024). In doing so, we seek to make the scenarios actionable and to diversify the opportunities for design to foster plant-based diets. After thorough consideration of each study and their underlying theories, we plotted the eight design frames onto the four scenarios (figure 4j). The next sections discuss the insights that emerged.

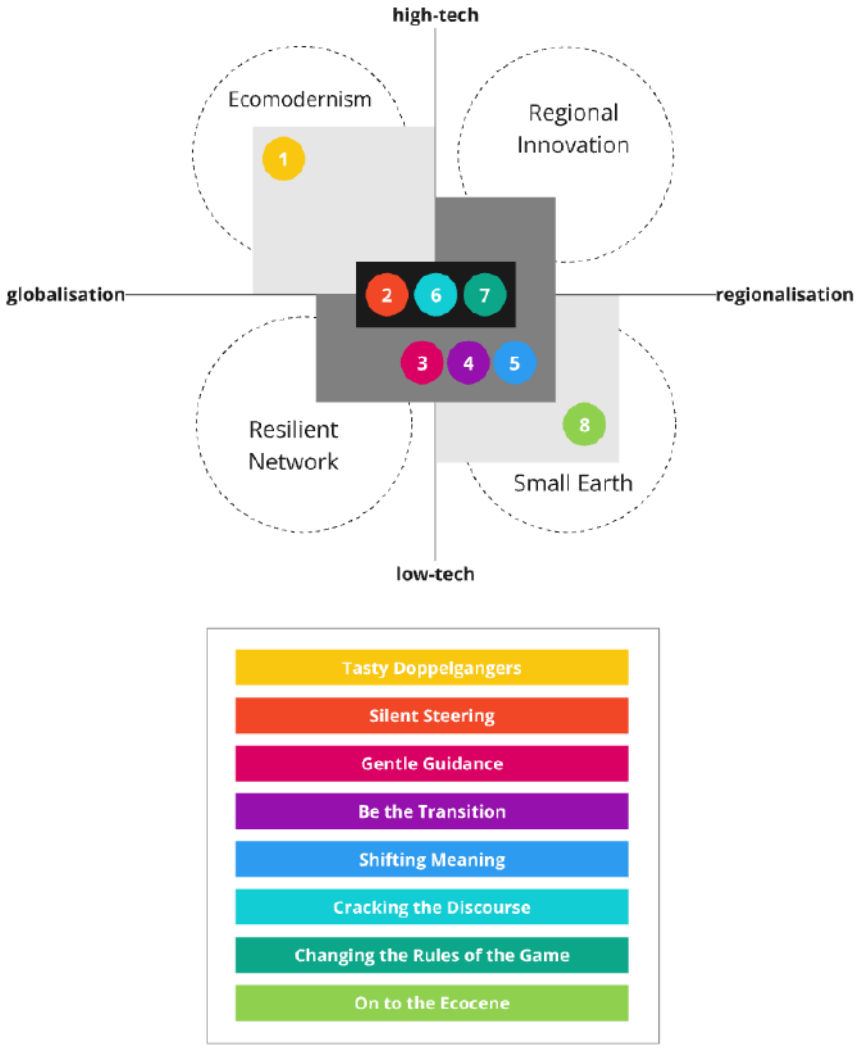

Figure 4j. Mapping of the design frames from Peeters et al (2024) onto the four scenarios from Freedomlab (2024) for Dutch the protein transition.

Directionality of design frames

Plotting the design frames on the scenario quadrants, we notice that governmental regulation (*Changing the Rules of the Game*) and consumer nudging (*Silent Steering*) are applicable to any scenario. However, while the mechanism of change is similar in each scenario, the *directionality* of the regulations and nudges

would differ in each scenario. For instance, in the *Ecomodernism* scenario, appropriate regulations might involve the subsidising of cultured meat innovations. In contrast, the *Small Earth* scenario would call for higher import taxes to benefit local food systems, for instance.

Similarly, in the *Resilient Network* scenario consumers would be nudged by retailers to try out a whole food plant-based meal from a cuisine they are unfamiliar with, while nudges in the *Regional Innovation* scenario would foster consumer choices for locally processed novel foods. The same notion applies to the other design frames that are applicable to multiple scenarios (see figure 4j): while their change mechanisms are similar in each scenario, their directionality is distinct for each one.

Design framing for other system actors

The design frames from our preceding study were tailored to consumers, though we see an opportunity in each scenario to extend them to other food system actors as well. For instance, in the *Regional Innovation* scenario, the *Shifting Meaning* design frame could help food innovators shift their view of innovation from being a way to get ahead in a global market, towards seeing innovation as a meaningful contribution to a resilient local ecosystem.

Similarly, in the *Small Earth* scenario, the *Gentle Guidance* design frame could enable 'prosumers' (individuals who both produce and consume) to become 'seasonally literate' through the provision of education. In the *Resilient Network* scenario, international food corporations might gladly adopt the identity of global knowledge traders through the *Be the Transition* design frame, which would invite them to 'join the movement!'.

Transcending ecomodernism by design

We find that the *Ecomodernism* scenario matches seamlessly with the *Tasty Doppelgangers* design frame, which is characterized by large multinationals and food innovations mimicking meat and dairy. Since our current food system aligns most strongly with the *Ecomodernism* scenario (Freedomlab, 2024), it is highly plausible that the future of our food system will continue being dominated by meat and dairy analogues as the centrepieces on our plates.

Alarmingly, a recent elaborate study in Dutch supermarkets has shown that the rise in sales of meat analogues was not accompanied by a significant decrease in sales of their animal-based reference products (Witlox, 2024). In other words,

the plant-based 'substitutes' did not actually substitute animal products as intended – instead, people purchased them *in addition to* animal products – at least in this retail context. Moreover, analogous products are typically less healthy and less sustainable than low- and non-processed plant-based protein alternatives such as legumes, nuts, and tofu. As such, we can establish that to diversify and ultimately alter the course that we are currently on, we need to explore how we might design 'away from' the *Ecomodernism* scenario.

Figure 4j shows that design frames 3-6 and 8 each advocate for paradigmatic shifts - in moderate (*Gentle Guidance*) or radical (especially *Cracking the Discourse* and *On to the Ecocene*) ways - thereby fostering the other three scenarios. They release the cultural fixation on animal(like) products in our diets by proposing new ways to relate to the food system and the food on our plates.

In the *Resilient Network* scenario, international food corporations might gladly adopt the identity of global knowledge traders through the *Be the Transition* design frame, which would invite them to 'join the movement!'.

System breakdown to allow space for the new

Transitions theory has highlighted the need to consider system build-up (innovation) as much as system breakdown (exnovation), as they are intimately connected (Hebinck et al., 2022). Only by properly dismantling and phasing-out the practices, structures and cultures that are not serving us anymore, there is space for more desirable alternatives to become mainstream. Still, system breakdown is often overlooked (Adams et al., 2021). Reflecting on the design frames, *Cracking the Discourse* is the only frame that deliberately destabilises the status quo, by emphasizing what we ought to *stop* doing (farming and slaughtering animals for our food). Where *Cracking the Discourse* says 'less animals', the other design frames emphasize 'more plants'. By openly criticizing our current food system, *Cracking the Discourse* creates the space needed for any of the four scenarios from Freedomlab to unfold.

A design frame supporting system build-up as well as breakdown, is *Changing the Rules of the Game*. As mentioned earlier, decisive measures from authorities can create the needed regulatory context for each of the scenarios to come to fruition. Thereby, both *Cracking the Discourse* as well as *Changing the Rules of the Game* are essential design frames for the transition to proceed in any direction.

Reframe opportunity 1: 'Gracious Goodbyes'

Considering system breakdown, what none of the design frames do, is supporting people in emotionally letting go of routines, behaviours, and ideas surrounding a transition (like closing a dairy processing plant or eating a meat every day). Such subtractive processes have shown to cause 'transition pain' (Bogner et al., 2024) and facilitating spaces to let go can ease the process significantly (Coops et al., 2024). A speculative design intervention presenting a rare inspiring example is 'Farm Fundamentals' by designer Floris Meijer (figure 4k). To raise awareness for Dutch dairy farms shutting down and to ease the transition, he designed a continuously growing product line that translates the remnants of agricultural life into new everyday products.

Figure 4k. The 'Farm Fundamentals' product line by Floris Meijer.

A novel design frame, for instance *'Gracious Goodbyes'*, might therefore involve focusing on emotionally supporting actors throughout the 'deanimalisation' of our diets. Exploring this strategy further, practitioners could experiment with interventions beyond speculative and small-scale designs, boosting the strategy's impact on the protein transition. And as these interventions help streamline the phasing-out of practices we have grown attached to, people will be better able to embrace any 'plant-forward' future scenario.

Reframe opportunity 2: 'Stretching Horizons'

Both the *Resilient Network* scenario as well as the *Regional Innovation* scenario assume consumers are open to unfamiliar kinds of food. For the *Resilient Network* scenario to unfold, consumers are expected to embrace different cuisines. This involve dishes that are traditional elsewhere (e.g. an Indian lentil-coconut curry), though locally they may be considered exotic, which can induce a sense of 'neophobia'. Neophobia is also a challenge in the *Regional Innovation* scenario. This scenario values technological innovations, extending its interest beyond mimicking (i.e. the *Tasty Doppelgangers* design frame) towards radically different concepts. For instance, modelling protein molecules through AI or experiments with precision fermentation and cellular agriculture, might lead to entirely novel kinds of food and eating experiences.

In the context of the protein transition, overcoming neophobia is a challenge on its own, which the design frames from our previous study do not address explicitly. This calls for a design frame that supports consumers to 'stretch their food and eating horizons'.

Interventions following a *'Stretching Horizons'* design frame could present entirely novel kinds of foods and practices in such a way that they would allow consumers' internal 'consumption portfolio' to expand. As such, what they used to consider as abnormal could become acceptable and even desirable and could eventually get absorbed in their own food culture. Speculative designs like 'Culinair Cellulair' by food designer Chloé Rutzerveld (figure 4l) exemplify valuable experiments in shaping the new meaning of such original food experiences (Rutzerveld, 2023). It would be interesting to further conceptualise *'Stretching Horizons'* as an additional design frame, enriching the collection of strategies currently pursued by designers.

Figure 4l. The 'Culinair Cellulair' project by Chloé Rutzerveld.

4.6 Conclusion

This paper built on two studies in the context of the Dutch plant-based protein transition, connecting design frames to explorative scenarios for the year 2035. The four scenarios varied along the dimensions of high-tech and low-tech, as well as globalisation and regionalisation. The eight design frames represent distinct strategies for intervention. Mapping the design frames onto the scenarios, we found that the scenarios provide directionality for the design frames: depending on the scenario, the frame gets a different 'colour'. Given several risks associated with the *Ecomodernism* scenario, we also found that designers are particularly needed to foster scenarios deviating from that scenario. In every scenario, the design frames can be tailored to other actors than consumers as well.

Two opportunities for new design frames emerged by reflecting on the previous studies jointly. First, *'Gracious Goodbyes'* could be a design frame supporting people in letting go of unsustainable practices and routines in the protein transition. Second, a *'Stretching Horizons'* design frame could help people to embrace new types of food and eating experiences, overcoming neophobia. We extend a warm invitation to researchers and practitioners to experiment with the findings from this paper.

Intermezzo II
Opinion piece Volkskrant

To translate findings from all previous chapters into a message that can reach the hearts and minds of the general public, this chapter presents an opinion piece in the Volkskrant from 3 October 2024 (figure IIa). It unpacks the risks of the Tasty Doppelgängers in the transition towards a healthier and more sustainable food system, and advocates for a deliberate culinary cultural shift, driven by the government, chefs, schools, parents, influencers, and creatives. It closes with concrete calls to action for these food system actors.

Opinie & Debat

DUURZAAMHEID

Vleesvervangers? Aan tafel moeten planten heldenrol krijgen, en dieren een bijrol

Een houdbaar voedselsysteem komt er niet met nóg betere vleesvervangers, maar met een evenwichtiger eetcultuur. Laat chefkoks en scholieren ons leren hoe je lekker kunt koken met ingredienten als bonen, linzen, noten, zeewier en tofu.

Bied maaltijdbonen aan die standaard plantaardig zijn, en stop niet het stunten met dierlijke producten

Figure IIa: Impression of the original article in Dutch

Meat substitutes? Plants should be the heroes on our plates, with animals in a supporting role

"Vegetarian? No problem, we have delicious veg burgers with vegan cheese on the menu! Oat milk in your coffee?" Increasingly, the Dutch catering industry is welcoming the plant-loving customer. Animal-imitating products are encouraged for the purpose of sustainability and animal welfare. However, these so-called 'meat and dairy analogues' are no cure in the transition to a sustainable food system. In fact, they are standing in the way of solutions that are more sustainable and healthier. It is time for a shift in our food culture, without losing our identity.

Substitution as the answer

All figures say the same: reducing livestock can greatly reduce climate emissions, restore nature and limit animal suffering. Enter the meat substitutes, which fit seamlessly into our existing eating habits. They are healthier and more sustainable than animal products and, what is more, they are good business. What we are forgetting, however, is to look at the consequences of these meat, dairy, egg and even fish 'analogues'. Our fixation on animal-based ingredients upholds the issues in our food system.

Problems disguised as a solution

First of all, the increased sales of processed (meat) substitutes in supermarkets have not yet been accompanied by a similar decrease in their animal counterparts. While slightly less meat is being eaten, it seems that we are simultaneously consuming more substitutes alongside meat, while we already consume too much protein on average. Although they are more sustainable than animal products, substitutes are far less sustainable than minimally processed plant-based alternatives, such as beans, lentils, nuts, seaweed and tofu, because of the way they are produced. Also, imitation products are often relatively salty and fatty, making them less healthy than basic alternatives. In short, we eat more than we need, and we eat too many processed foods. Substitutes keep these habits in place.

Cultural agility

We need a deep shift in our food culture. In order for us to prefer a meal with chickpeas in tomato sauce over a steak, we need to change our worldview and our stories about food. History shows us that this is possible, and quickly too. Our food

culture is constantly evolving. For instance, we have been eating potatoes in the Netherlands since the 16th century, pizza and 'pasta Bolo' since the 1970s, and we have only been putting avocados on our sandwiches since the 1990s. And do not forget: meat was exceptional until the 1950s because it was costly, and rightly so. 'Fixed cuisines' do not exist. People are incredibly agile in what they eat, as long as it is tasty, affordable and not too complicated.

Concrete solutions

With the help of systematic support, our cultural agility can be streamlined. Three groups play an essential role here.

First, we have powerful stakeholders like the European Union, national governments, banks and supermarkets. Help the food transition - together with farmers - by finally charging the true price for food. When environmental impacts are factored in, plant-based is considerably more affordable than animal-based. In the supermarket, beans and nuts should be given a prominent place instead of that dusty canned food aisle somewhere in the back. Meat and fish can become delicacies. Offer meal boxes that are plant-based by default and stop promoting animal products.

Secondly, there is a role to play for food role models. Chefs and caterers, help us get over our fear of the new, or 'neophobia', by letting us taste other dishes and ingredients in a safe and playful way. Put plant-based options at the top of the menu. Schools, teach children where our food comes from and how to cook delicious meals with plants. Parents, pay attention to eating habits at home. Peanut butter instead of lunch meat on one sandwich already makes a difference.

Finally, writers, designers and social media influencers can play an important role. Because we need a new narrative in which plants are our heroes and animals play a valuable, circular supporting role. Motivated by concern for future generations: 'plant-forward', with some animal proteins occasionally. Then we will start to see dishes like a lentil stew in a different light, while we can still enjoy a Dutch 'stamppot met rookworst' - in moderation.

We will not achieve a sustainable food system with even better meat substitutes, only with a balanced food culture. And this is within our reach.

Chapter 5
Designing for value-behaviour consistency: ethical choice architecture to stimulate sustainable meat purchase

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Abstract

Many of our daily behaviours, e.g., our choice for transportation and our consumption behaviours, need to change in the light of the pressing sustainability issues we are facing. Yet, while many people value the environment, they do not always engage in the behaviours that are in line with these values, representing the so-called 'value-action gap'. This paper argues that the value-action gap can to a large extent be explained by a choice architecture which promotes unsustainable behaviours. Therefore, we present a redesign of choice architecture in the context of meat consumption, to stimulate people to act in line with their values. Our experimental study shows that such a redesign leads to a significant increase in sustainable behaviour, without conflicting with people's values. This opens the discussion on how we design the architecture for such choices and adds granularity to the moral debate about nudging.

5.1 Introduction

We need to change our behaviour substantially in order to counteract many of the pressing issues we face today. Our modern lifestyle, characterised by the transportation modes we use, the food we eat, the clothes we buy and how we manage household chores, has been leading to plastic islands in the oceans, polluted air, soil degradation, the wrecking of natural habitats, threatening species that we depend on for our ecological resilience and carbon emissions leading to our pressing climate crisis (IPBES, 2019; IPCC, 2021) . To reduce these problems, we need to change our behaviour; we need to use less energy, produce less waste, and consume more sustainably.

Our food system is one of the key areas in need of fundamental revision, as stressed in the United Nations' Sustainable Development Goals (United Nations, 2016). Meat consumption is an exceptionally large contributor to greenhouse gas emissions and a transition towards diets containing more sustainably sourced proteins is crucial (De Krom et al., 2020; Ministerie van Landbouw, 2020; Visschers & Siegrist, 2015; Weinrich, 2018). Conceptually, the necessity of such a sustainability driven transition is not difficult to argue for, especially since many people endorse biospheric values, which means they care for nature and the environment (Bouman et al., 2021; de Groot & Steg, 2008). In general, the stronger people's biospheric values, the more likely they are to engage in pro-environmental behaviour. Nevertheless, people often do not act in line with their biospheric values. For example, despite having strong biospheric values, people may sometimes buy unsustainable meat products.

This incongruence between what people consider important and what actions they engage in is studied as the attitude-behaviour gap (Vermeir & Verbeke, 2006), the intention-behaviour gap (Carrington et al., 2010), or the value-action gap (Blake, 1999; Schanes et al., 2018). This gap is understood as the result of various potentially interacting factors yet attempts to empirically study the gap and how to close it are scarce (Hassan et al., 2016; Thøgersen & Ölander, 2002).

Attitude, intention and values are bordering concepts yet fundamentally differ from each other. Values are commonly referred to as "desirable transsituational goals, varying in importance, that serve as guiding principles in the life of a person or other social entity" (Schwartz, 1994). The values one holds are

therefore relevant in any behavioural context, unlike attitudes and intentions. People's values logically influence their attitude towards specific behaviour - considering it favourable or unfavourable- and their intention to act accordingly. In reality of course, people have multiple potentially competing values in any given situation. Hence, one's attitude towards a specific behaviour, combined with individual and situational factors such as multiple values, behavioural control and the subjective norm regarding that behaviour, together determine the person's intention to perform that behaviour (Carrington et al., 2010; Fishbein & Ajzen, 1975; Salmivaara et al., 2021; Vermeir & Verbeke, 2006). This study focuses on the relationship between values and behaviour, leaving attitude and intention out of scope.

This study proposes the idea that people may find it difficult to act in line with their values since the 'choice architecture', referring to the design of the environment in which these actions take place (Thaler & Sunstein, 2008), in fact fosters unsustainable behaviour. The research question of this study was 'Can a redesign of choice architecture close the value-action gap and facilitate more sustainable meat purchase?' As a result of a close collaboration between researchers from the fields of industrial design engineering and psychology, this study reports on the effect on sustainable meat purchase by 'Tomorrow's Menu,'[10] a consumption platform exclusively designed for the experiment.

The rest of the paper is structured as follows. The next section describes the theoretical background for the study and presents two hypotheses. We then provide a detailed description of Tomorrow's Menu, the design intervention used for the study, followed by the set-up of the research. Next, the results are reported by providing descriptive statistics and the regression analyses, followed by a discussion on the outcomes, the hypotheses, implications for practice, limitations of the study and future research. The final section concludes the study.[11]

5.2 Theoretical background

Biospheric values serve as guiding principles in one's life (Bouman et al., 2021; de Groot & Steg, 2008; Schwartz, 1992). People with strong biospheric values

10 Designed by Anna-Louisa Peeters and more elaborately explained by Tromp & Hekkert (2019).
11 Due to their large file sizes, research materials can be shared by primary researcher upon request.

base their decisions to engage in particular actions on the consequences of their behaviour for nature and the environment and are more likely to have pro-environmental preferences and intentions, and thus act pro-environmentally (Steg & de Groot, 2012). Biospheric values are shown to relate to a range of pro-environmental preferences and actions, including acceptability of climate change policies (Nilsson et al., 2004; Steg et al., 2011), sustainable consumption (Thøgersen & Ölander, 2002) , environmental activism (Steg et al., 2011), pro-environmental behaviour (Schultz & Zelezny, 1998), preference for restaurants serving organic food (Steg, Bolderdijk, et al., 2014), and donating money to an environmental rather than a humanitarian organisation (de Groot & Steg, 2008) . In food purchase intention however, these values have shown to be less powerful in guiding behaviour (Asif et al., 2018). Hence, we speak of a value-action gap in this context.

As a strategy to close the value-action gap, behavioural interventions often provide information, assuming it will activate deliberate processing of information and stimulate adjacent sustainable behaviours when biospheric values are endorsed. However, increasing awareness about sustainability to stimulate matching behaviours has shown to have limited effect (Asif et al., 2018; Emberger-Klein & Menrad, 2018; Osbaldiston & Schott, 2012; Spaargaren et al., 2013). In the last decades, the role of unconscious processing in how people make choices has been argued to be larger than we often think (Bargh & Chartrand, 1999; Dijksterhuis et al., 2005). Many consumer behaviours are habitual, driven by unconscious processes, and as such, prone to bias and contextual priming (Tversky & Kahneman, 1974).

Recent studies into the value-action gap argue that it is key to include the 'situational context' as a variable that may influence this gap (Carrington et al., 2010; Sultan et al., 2020). These studies indicate that the value-action gap cannot be solely explained from a cognitive psychological perspective. The retail context and the way products are branded may affect the extent to which consumers' biospheric values are salient and thereby influence whether consumers purchase products that are in line with these values. Hence, we need a better account of the contextual factors, e.g., brand image, the physical store, social surroundings, to explain more accurately why people who consider the environment important, do not act upon it. Specifically, we argue that in order to close the value-action-gap, interventions need to target both 'System 1' and 'System 2' thinking, a distinction of decision-making processes introduced by (Stanovich & West,

2000). System 1 thinking is characterised by quick, automatic, associative and often habitual decision-making, where people rely on contextual cues and heuristics. System 2 thinking refers to analytical, rule-based and relatively slow decision-making, where people process information thoroughly and consciously (Kahneman, 2003; Stanovich & West, 2000).

In 2008, Thaler and Sunstein put forward the concept of 'nudges', referring to the settings surrounding our daily choices and how a setting could be altered to increase better choices from a health, sustainability or wellbeing perspective, without forbidding any options (Thaler & Sunstein, 2008). Nudges generally focus on what can be called 'the low hanging fruit' in our democratic and social welfare systems. These nudges are often not much more than a change of the logo, the adding of a sentence, or reordering of information, for instance to increase tax compliance (Antinyan & Asatryan, 2019) or improve healthcare services (Last et al., 2021). However, to study nudging more profoundly, the concept of 'choice architecture' which Thaler and Sunstein build upon is far more suitable. It allows us to consider multiple interacting contextual factors that steer consumer behaviour at once, like price promotion, choice overload, branding, product placement, and more. Reflecting upon a conventional retail context in which food purchases take place, i.e., the supermarket, several of such contextual factors explain why we argue the choice architecture is dominant in steering purchase choices by mainly engaging consumers' automatic System 1 thinking.

First, in driving our daily choices, including what we eat, our biosopheric values are continuously in competition with other values relating to costs, enjoyment, and more (Renner et al., 2012; Salmivaara et al., 2021; Steptoe et al., 1995; Yamoah & Acquaye, 2019) For example, buying organic meat may benefit animal welfare, but is relatively expensive. Since the retail context is designed to promote products that are on discount, one's value for money is made more salient than one's value for the environment. On top of this, the effect of purchasing decisions on costs are directly experienced, while implications for the environment are indirect and intangible. Therefore, currently, the retail context may push biospheric values to the background and therefore people are less likely to act in line with their biospheric values.

Second, the moment of shopping and the corresponding mindset people are in at that moment can explain the influential role of System 1 thinking. Many people do groceries after a long day of work, or together with young children, and such

situations indicate a low capacity to engage with deliberate decision-making processes (Baumeister, 2002; Muraven & Baumeister, 2000). Driven by automatic processes instead, people will be more affected by their social and physical environment (Bargh & Ferguson, 2000). It exemplifies how consumers' System 2 type of decision-making gets overruled by their System 1 (Kahneman, 2003; Stanovich & West, 2000).

Third, our complex contemporary production and consumption systems with all the economic, social and environmental interdependencies they represent on a global scale, has made it difficult for consumers to understand what a sustainable choice entails (Weinrich, 2018). We have trouble discounting accurately in complex matters, such as sustainable food consumption, characterised by probable and delayed outcomes (Green & Myerson, 2004). Our limited rationality in this regard underscores the influential role of the environment in which we make our consumption choices. Hence, we need to consider the choice architecture (Thaler & Sunstein, 2008) of our consumption more profoundly in understanding how to transition to more sustainable lifestyles, while acknowledging the dominance of System 1 thinking (Stanovich & West, 2000) in a conventional retail context.

This study focuses on the role of Dutch consumers in the sustainability challenge surrounding meat consumption. While there is an increasing awareness among consumers that meat consumption is generally not sustainable, it is still the norm in the Netherlands to eat meat on a daily basis (Onwezen et al., 2019). While we know that many people endorse biospheric values (Bouman et al., 2021; de Groot & Steg, 2008), the majority of Dutch consumers does not behave accordingly in the context of meat consumption, providing evidence of a clear gap between values and behaviour (Bot & Keuchenius, 2018; Rood et al., 2014; van Rossum et al., 2011). There is promising evidence that nudges in the retail environment towards sustainable choices can be effective, for instance in fostering the purchase of meat substitutes by presenting them more visibly and next to similar meat products in the butchery (Vandenbroele et al., 2021), engaging the System 1 decision-making process. However, to our knowledge there is no empirical evidence of interventions profoundly engaging both System 1 and System 2 thinking. This study presents the effort of unpacking the potential of engaging both decision-making processes through ethical choice architecture.

Systemic design intervention: Tomorrow's Menu

In the current study, we introduce a systemic design intervention to foster the consumption of more sustainably sourced meat products, by closing the value-action gap of consumers. Specifically designed for this experiment, the design intervention intentionally engages both System 1 and System 2 decision-making processes (Stanovich & West, 2000)

Based on System 2 thinking, Tomorrow's Menu supports a well-considered decision around which meat products to purchase, by relocating this moment of choice from the retail context to consumers' living rooms. At home, people generally have more discretionary time than they do in a retail environment, which is associated with a significant reduction of the value-action gap (Chai et al., 2015). The platform offers consumers memberships to farm types which produce meat in a way that is in line with their personal values, by providing them with transparency around production circumstances so they understand what a sustainable purchase entails.[12] As members, they pay a fixed price per kilo of meat to the corresponding farmers. At the retailer, consumers receive a significant discount on the meat products within their membership, supporting purchase decisions in accordance with their values. This nudge acknowledges the dominance of System 1 thinking in the retail context, where competing values are more salient, and the capacity to engage System 2 thinking is often low.

The platform and its effect on sustainable purchases as well as congruence between values and actions is studied in a web-based experiment. Based on the presented theoretical background and the absence of empirical evidence of meat consumption behavioural interventions which appeal to both System 1 and System 2 decision-making processes, the following hypothesis is formulated: *H1: Tomorrow's Menu increases sustainable meat purchase.* As many people value the biosphere (Wang et al., 2021), we expect the design intervention to help close the value-action gap as well. Based on this, the second hypothesis is formulated: *H2: Tomorrow's Menu facilitates meat consumers to act in line with their biospheric values.*

12 A critical note on sustainability of the design intervention in this chapter, which fosters the consumption of 'more sustainable' meat products. From a transition perspective, Tomorrow's Menu can be seen as a *reinforcive* intervention, sustaining the norm of frequent meat consumption. Progressive insight from this doctoral research would therefore likely have led to a fundamentally different intervention. However, the study still carries valuable lessons around reframing and influencing consumer behaviour through choice architecture.

5.3 Materials and methods

Tomorrow's Menu in detail

Tomorrow's Menu, from here on referred to as TM, aims at fostering the consumption of meat products which have been produced in a sustainable manner. Meat products are considered sustainable when their production has limited or no negative consequences for public health, animal welfare and/or the climate.

TM is a platform which connects consumers to farmers directly, by offering three types of memberships that allow consumers to become a member of a particular farm type for a monthly fee. Choosing a membership implies a discount at the retailer for all the products that come from this particular farm type. The three farm types distinguished by TM all sustainably produce meat products but vary in the degree of their effect on the sustainability aspects mentioned earlier. As sustainability is a highly complex and layered aspect of meat consumption, the meat products are categorized into these groups. This categorization implies a simplification of their actual impact on the multitude of sustainability dimensions but is considered appropriate as it makes the complexity comprehensible for consumers (figure 5a).

The three sustainable farm types have been named 'Aqua', 'Mint' and 'Lime'. These names were chosen to be as neutral as possible, so as not to influence consumers' reflection on their own values regarding the varying approaches to meat production of these farm types. The colour-themed names were considered appropriate, as they could correspond with a visual design and could thereby be easily recognizable in the retail environment as well, supporting consumers to behave in line with their values.

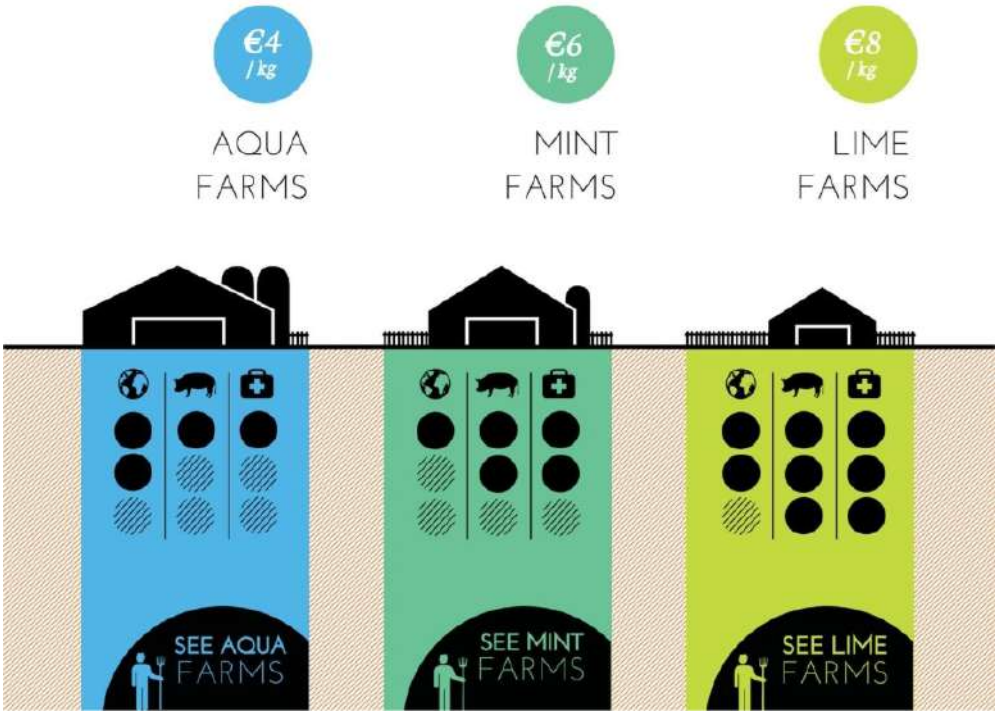


Figure 5a: The three memberships of Tomorrow's Menu: Aqua, Mint and Lime. They vary in terms of their sustainability impact on the environment, animal welfare and public health. Lime products can be considered the most sustainably produced across all three sustainability pillars, followed by Mint and Aqua.

When visiting the website, consumers are offered a self-assessment, posing questions to understand their values and resulting in a suggestion for one of the three memberships. For each farm type the sustainability aspects of its farming principles are explained, allowing consumers to explore which membership resonates most with their personal values. Each membership comes with a different price per kilo of meat. The meat products are distinguishable on the shelves through product labelling corresponding with the farm types (figure 5b). After being registered as a member you receive a membership card with which you can claim your discount at the retailer's cash register (figure 5c). With a membership, the price to be paid at the retailer becomes similar to the price of the cheapest product in its category (i.e., a variable discount). As such, in this redesign of the choice architecture the role of monetary incentives to choose unsustainably in the context of the retailer is accounted for.

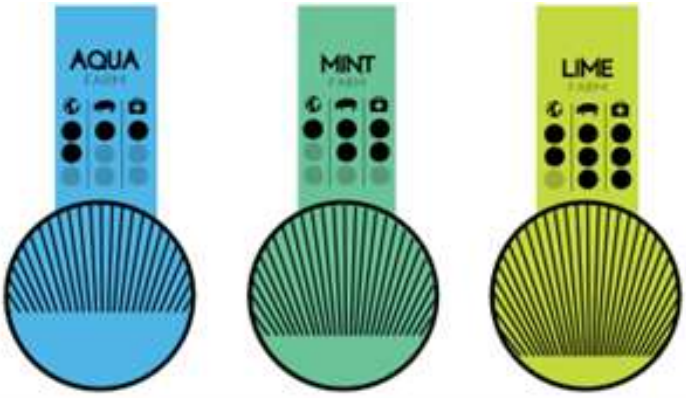


Figure 5b: Product labelling at the retailer for each membership.

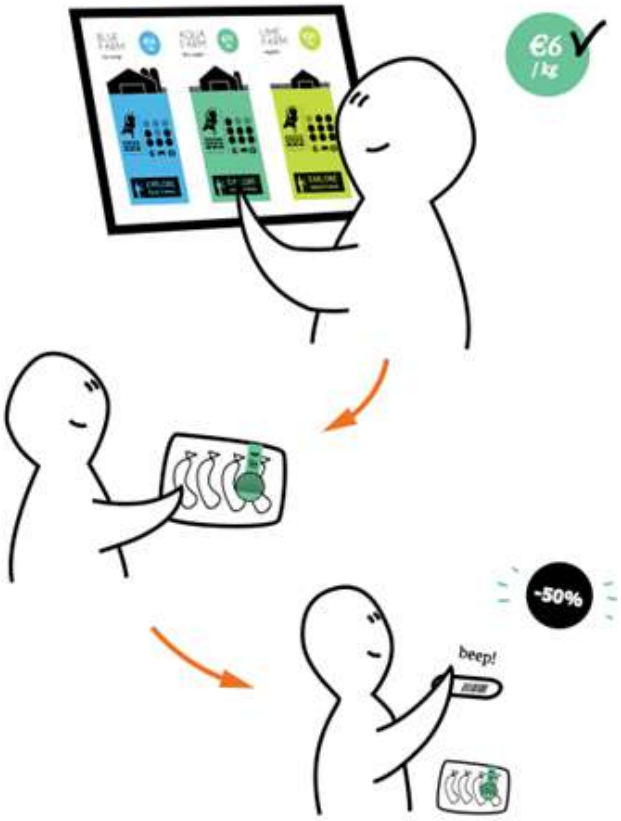


Figure 5c: The use of the Tomorrow's Menu service: selecting a membership, purchasing a meat product from that farm type, and receiving a discount at the retailer's cash register.

By allowing consumers to take a large part of their purchasing decision at a self-chosen moment at home, and by guiding (or nudging) the actual purchase at the retailer through recognizable labels on products for each farm type, people are expected to behave more in line with their values and choose more sustainable products than they would do in the current context of the retailer and without such a membership. As such, through a redesign of the choice architecture TM aims to close the value-action gap for consumers.

Web-based experiment

TM was tested with participants in a web-based experiment. The aim was to test the effect of TM on the meat purchase (hypothesis 1) as well as on the congruence between values and behaviour (hypothesis 2). This is visualized in the conceptual framework in figure 5d. Regression analyses and a Chi square test were used to test the hypotheses.

The digital prototype of TM consisted of screenshots from the website, which were designed with Adobe Illustrator, and surveys set up in Qualtrics. The regression analysis was executed in SPSS.

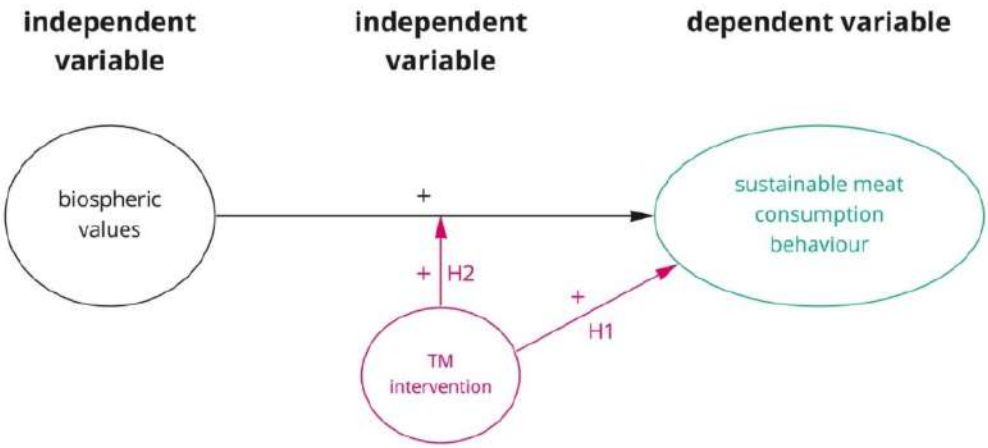


Figure 5d: building blocks of the two hypotheses: TM will increase sustainable meat purchase (H1) and facilitate meat consumers to act in line with their biospheric values (H2).

Participants and procedure

We invited people to participate in the online study via social media and e-mail. There were no selection criteria, as all Dutch consumers are within the target group of the study. Therefore, the intention was to reach as many people as possible and to have diversity across participants in terms of their age, background, level of education and place of residence. These background variables were integrated in the first survey.

The study was introduced as an experiment to study consumer behaviour. Participants were incentivized to complete the entire study with a chance to win 2 tickets to an amusement park or a museum. They were allowed to withdraw from the study at any moment without any consequences. The timeline of the study is shown in figure 5e.

A power analysis assuming a medium effect size and a power of .80 showed that we needed 158 participants. In total 261 participants started to fill out the questionnaire at t0 of which 210 finished the questionnaire. Of these 210 participants, 131 started filling out the final questionnaire at t3 and 126 completed all the steps (52%). The profiles of the 126 participants were spread well in terms of gender (65% female and 35% male) and age (age ranged from 18 to 71, M = 35, SD = 14), yet almost all were relatively highly educated (39% finished a bachelor's degree level, 50% a master's degree, only 10% finished vocational training or lower) and lived in an urban environment (94%).

To randomize participants across conditions, they were sorted alphabetically and split into two groups: one TM group (67%) and one control group (33%). This unequal division was chosen for a research purpose beyond the scope of this study. Participants in the TM group were consulted three times over the course of three weeks, to engage with the platform and to complete a digital shopping assignment. The control group was consulted only once, with the shopping assignment.

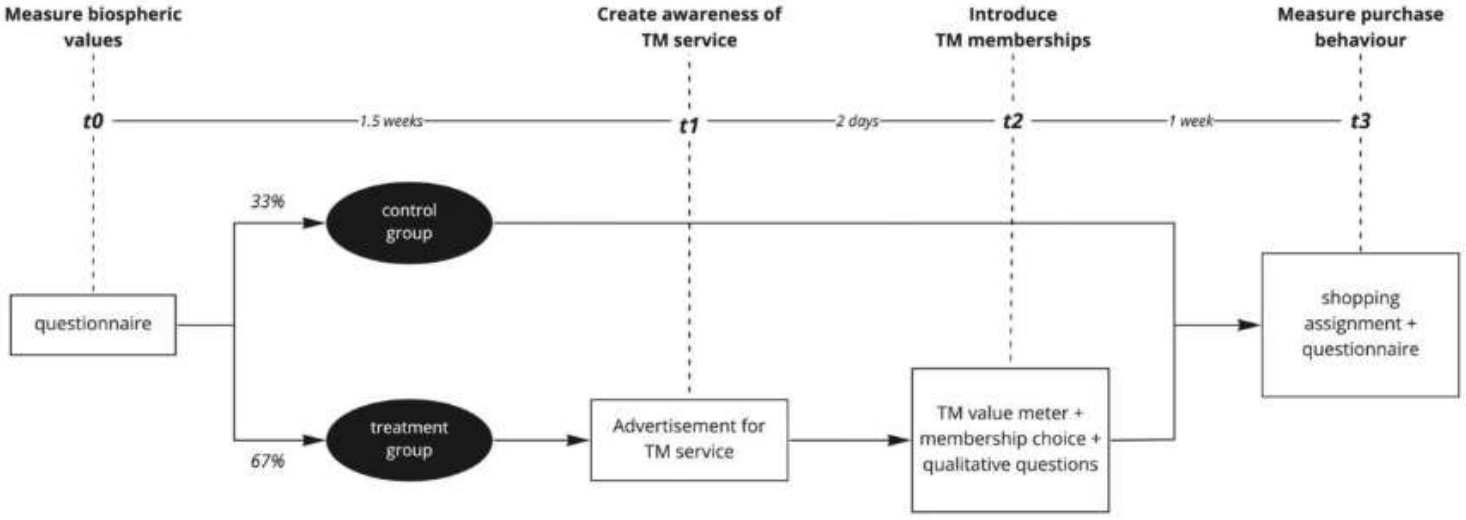


Figure 5e: The set-up of the study. The TM group was twice the size of the control group, since two versions of the advertisement at t1 were tested for purposes outside of this study. Since the effect of the two versions of the advertisement did not differ significantly from one another, both sub-groups in the TM group have been combined for this study.

When people were willing to take part in the study, they could click on a link that would directly lead them to the questionnaire of t0. They were asked for several personal details and an e-mail address for the next parts of the experiment to be sent to. They filled out 16 questions concerning their personal values. This questionnaire also contained questions on self-identities, but they are not used for the present study. To avoid the effects of priming, we left a certain amount of time in between each consultation. At t1 (one and a half weeks after the first questionnaire) the TM group received a short video advertisement of TM to create awareness of the service. At t2 (two days later) the same group was introduced to the online platform of TM, where they first had the opportunity to make their biospheric values salient through a 'personal value meter' (i.e. a self-assessment tool), which would help them identify their sustainability values and their relation with various farm types. Participants could freely choose a membership ('Aqua', 'Mint' or 'Lime') but were asked to do so only if they would also do this in real life. In the TM group, 77% was willing to purchase a membership at t2. In case they did not want a membership, they were asked why, which could provide insights about the quality of the design of TM. At t3 (one week later), both the TM group and the control group received the shopping assignment in which they were asked to select products from the retailer. This questionnaire also contained questions on self-identities and other pro-environmental behaviour, which were not used for the present study.

Measures

Biospheric values, t0

Participants filled out a value questionnaire measuring their altruistic, egoistic, biospheric and hedonic values (Steg et al., 2014). Participants rated the importance of each value as a guiding principle in their life on a Likert scale from -1 ('opposed to my values') to 7 ('extremely important'). The biospheric value orientation was measured with four items ('Respecting the Earth: harmony with other species', 'Unity with Nature: fitting into nature', 'Protecting the Environment: preserving nature' and 'Preventing Pollution: protecting natural resources'). The internal consistency of the biospheric value scale was .83 (M = 4.40, SD = 1.33).

Meat purchase, t3

In the final shopping assignment, participants were asked to imagine they would have guests over that evening but still needed three products from the retailer: meat, chocolates and wine. In total they had 12.50 Euros to spend at the retailer on these products, minus a variable amount in the case they had chosen a membership at t2. There were four choices of meat the participants could choose from, which differed in price and impact on sustainability. One of the options was the cheapest and most unsustainable meat product. The other three options matched the different TM membership product categories ('Aqua', 'Mint' and 'Lime'). For all participants each meat product is displayed with the label of the corresponding membership as well as the discount that is given to their members. With the applied member discount, a TM meat product has the same price as the unsustainable meat product.

To make the choice more realistic and to force participants to make a trade off, they also had to spend their money on wine and chocolates (a higher price corresponding with a higher quality of the wine and chocolate). We measured whether people purchased the unsustainable meat product or one of the three sustainable options.

Sustainability and incongruence

The sustainability of the meat purchase is seen as a binary variable. Behaviour is considered incongruent when someone with biospheric values averaging 1 ("I find it important") or higher purchases an unsustainable meat product from a 'White farm', or when someone with an average biospheric value of 0 ("I do not find it important") or lower purchases a sustainable product from an 'Aqua', 'Mint' or 'Lime' farm. Incongruence indicates the presence of a value-action gap. In total 10 participants selected the unsustainable meat option (8%), while 116 participants chose one of the sustainable meat options (92%).

5.4 Results

Attrition analyses

Attrition analyses showed that participants who dropped out at t3 did not differ from participants who only filled out the questionnaire at t0 with regard to biospheric values ($t(208) = -1.24$, $p = .22$). Furthermore, we did not find differences between participants in the TM and control group at t0 ($t(208) = -$

.90, p =.37). This suggests that random assignment to conditions was successful. We also did not find differences in biospheric values between the TM and control group at t3 (t(111) = -.58, p =.56), suggesting that participants who dropped out did not differ between the TM and control group.

Likelihood of choosing more sustainably

The chosen meat product significantly differs between participants from the TM group and control group ($\chi 2$ (1) = 11,49, p < .001, w = .30). As can be seen in figure 5f, participants in the TM group chose the unsustainable meat product significantly less (1%) than participants in the control group (18%), which supports our first hypothesis (H1: Tomorrow's Menu increases sustainable meat purchase). There were no significant differences in choosing the sustainable meat option between the two different TM groups ($\chi 2$ (3) = 2,84, p = .42): in the Aqua, Mint and Lime groups 0% chose the unsustainable meat option. Among the participants who did not choose a TM membership 5% chose the unsustainable meat option, but this was not significantly different between groups.

Congruence between values and behaviour

We conducted a logistic regression to test if TM strengthens the relationship between biospheric values and meat purchase, closing the value-action gap. The likelihood ratio statistic is 52.19. Neither biospheric values (B = 1.02, p = .09), TM (B = -.95, p = .76), nor their interaction (B = .63, p = .29) are significantly related to meat purchase when all variables are included in the model. Therefore, we did not find support for our second hypothesis (H2: Tomorrow's Menu facilitates meat consumers to act in line with their biospheric values).

We also tested the relationship between biospheric values and meat purchase, without controlling for TM. Logistic regression shows that people with stronger biospheric values are more likely to choose the sustainable meat option (b = .50, p = .04).

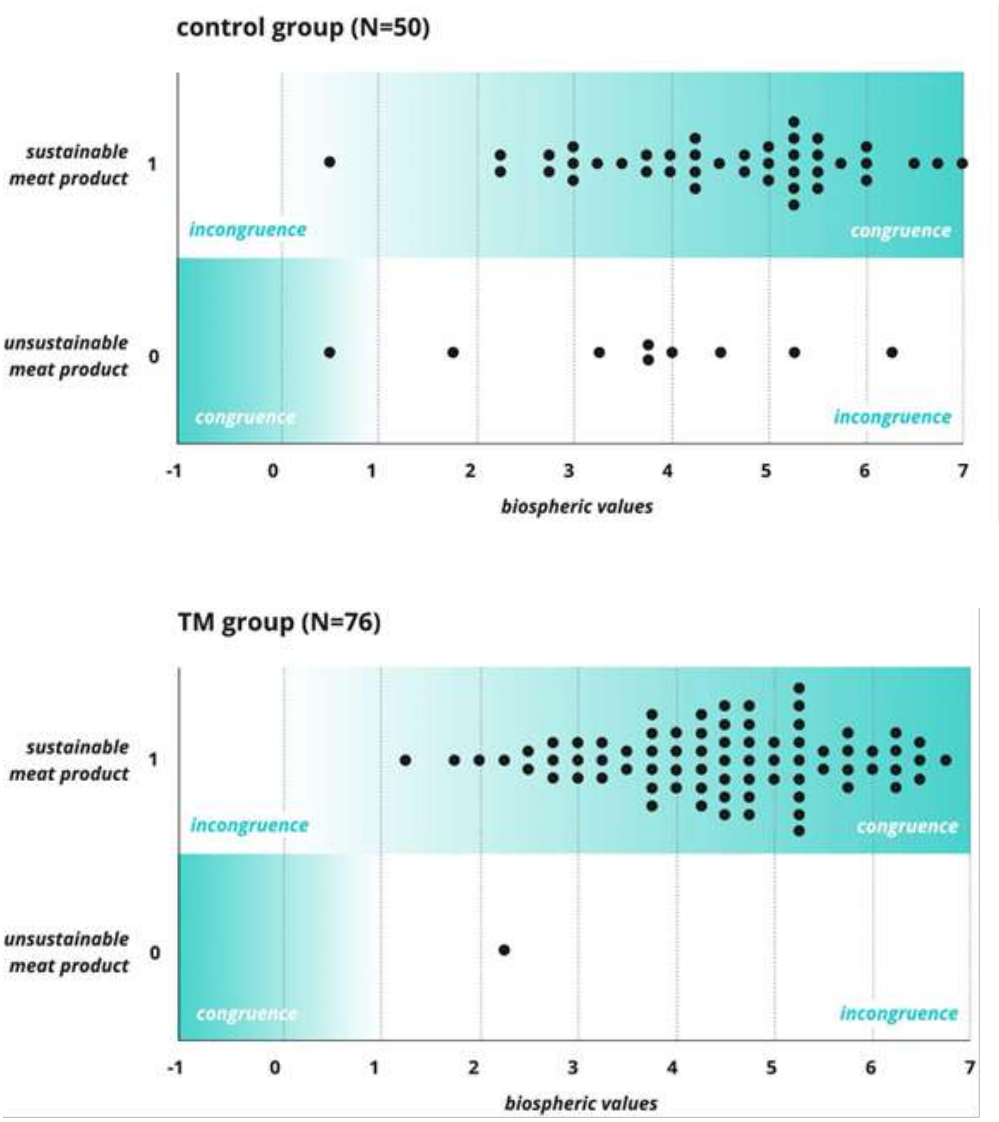


Figure 5f: Biospheric values and meat purchase of each participant in both groups. The coloured spaces represent congruence between values and consumption behaviour, while the white spaces represent the occurrence of a value-action gap.

5.5 Discussion

The main aim of the study was to better understand how the choice architecture in a retail context can be redesigned to close the value-action gap, while fostering sustainable behaviour. Specifically, we aimed to test if choice architecture can strengthen the influence of biospheric values on meat purchase and thereby promote sustainable meat consumption.

The study has shown that TM increases sustainable purchasing of meat, confirming our first hypothesis (H1: Tomorrow's Menu increases sustainable meat purchase). We found that a change of the choice architecture can promote sustainable meat purchases. Our findings are in line with previous research which shows that changing the context can promote sustainable behaviour (Varotto & Spagnolli, 2017). Our intervention consisted of two parts, namely shifting the moment of choice and a cue to remind people of their choice at a later point in time. The moment of choice was placed outside of the retail environment and participants were asked to reflect on their values. That way, participants are less likely to be focused on costs, which is strongly emphasized in the retail context. Instead, by reflecting upon their values, people may be more likely to consider the environment when choosing a product. This part of the intervention was aimed at System 2 thinking (Stanovich & West, 2000). Furthermore, we provided participants who chose a TM membership with a cue at the retailer to remind them of their membership, which was aimed at System 1. We did not test the importance of the cue that targeted System 1; future research is needed to deepen our understanding of this component of the choice architecture.

The study also showed that the large majority of participants consider our natural resources and animal wellbeing to be important, which is in line with recent literature (Bouman et al., 2021; de Groot & Steg, 2008). However, the effect of TM on the congruence between values and behaviour was not significant, thereby not supporting our second hypothesis (H2: Tomorrow's Menu facilitates meat consumers to act in line with their biospheric values). We did not find that biospheric values were more strongly related to meat purchase when people were exposed to our intervention. Our findings suggest that asking people to reflect upon their values before choosing their product and reminding them of their choice in the supermarket does not make them act more in line with their biospheric values. These findings could be explained by the fact that there was not much of a value-behaviour gap in our sample.

Another explanation for the lack of significance of the effect of TM on value-behaviour congruence (H2), could be that TM's significant effect on consumption behaviour for people with high biospheric values is mediated by other factors that we did not measure, e.g., social norms or knowledge. By offering three kinds of memberships, we may have framed having a membership as 'the norm', and by communicating about the production principles of farmers, including images, we may have increased people's knowledge of meat production. These mediating factors could have affected meat purchase decisions. In line with previous studies that showed weak effects of values on behaviour (Thøgersen & Ölander, 2002) or stronger effects of other factors on behaviour (Carrington et al., 2010; Salmivaara et al., 2021; Vermeir & Verbeke, 2006), a "multi-layered, multi-factorial, approach" (Flynn et al., 2009) is needed to better understand the effect and mechanisms of TM.

The use of nudges, including changing the choice architecture, to stimulate behaviours that impact people's "health, wealth, and happiness" positively (Thaler & Sunstein, 2008) has been contested from an ethical perspective (Mitchell, 2005; Veetil, 2011). Nudging implies an entity, i.e., a person or an institute, defines what is 'good' for people without having a mandate for it or asking for consent and as such, can become paternalistic. Our study sheds a different light on this discussion. First, we argue that conventional retail environments present a choice architecture in which it is difficult for people to act in line with what they consider important. In the current retail setting we (i.e., policy makers, system designers, retail designers, brand developers, etc.) have actually designed the context in which people are nudged to act unsustainably, installing and supporting the value-action gap. Second, we argue that we can redesign the choice architecture in a way that does justice to both what people value and how they are naturally inclined to act. Choice architecture can make people engage in deliberate processing, thereby making them reflect on their values and helping them understand sustainability aspects of the products they consider purchasing. Subsequently, the choice architecture can help them follow through and act more in line with what they find important. Indeed, we found that nobody with weak biospheric values bought sustainable meat. As such, we do not paternalize people by introducing TM; instead, we do justice to how people are while engaging them in complexity at the same time.

Regarding the complex societal transitions we need to engage in, it is our intention to open up the discussion on interdisciplinary and even

transdisciplinary research based on our study. No single discipline can explain the complex matters we are facing today (e.g., social inequality, climate change, poverty, political indifference) and no single discipline is capable of 'solving' them. Our study has been an investigation into the complementary value of environmental psychological research and design research in studying the value-action gap. Whereas scholars in psychological research are often concerned with systematically unpacking phenomena through psychological variables and their relationships (e.g., value, attitude, intention, behaviour, norms, etc.), design researchers often take an integrative approach in understanding how to change a phenomenon, potentially building on a variety of theories, to then develop interventions to change the phenomena and test their effectiveness. Our study is an attempt to integrate disciplines to do more justice to the complexity of a phenomenon, i.e., the value-action gap in meat consumption, while making use of the strengths of both disciplines. These complementary strengths have generated novel insights into both our understanding of the value-action gap and our strategies to close it. Such collaborations are needed to learn how to better understand and deal with complex societal issues.

Implications for practice

This study shows it is worth looking at choice architecture in order to support people with their decision-making. Exemplified by TM, moving the product choice from the retail environment to a different spacial and temporal context, accompanied by a corresponding product membership, can promote sustainable choices. This choice architecture is applicable beyond meat consumption.

In the control group there were more people with strong biospheric values buying unsustainable meat products than in the TM group. This implies that the implementation of TM increased the predictability of consumer choices in the TM group, namely a larger part of the group chose a sustainable option. It could therefore be interesting for retailers to implement interventions with a similar choice architecture (not necessarily involving sustainability, but also other product characteristics) to support their business operations.

5.6 Limitations and future research

Limitations

Participants in this study were not representative of all Dutch consumers. While there was a spread in age and gender, almost all were relatively highly educated and lived in an urban environment. This may have influenced the results. The key limitation is that people included in this study generally scored high on biospheric values.

This study made use of an online, survey-based simulation. This controlled environment comes with the risk of participants potentially not answering in full honesty and does not include contextual factors from real-life shopping, such as having to pay actual money, being confronted with social norms and their past behaviours. Also, participants in the TM group were forced to consider the service of TM, i.e. they could not ignore it, while in the real world they could.

Next to the discussed factors surrounding individual consumers, such as their biospheric values, their understanding of the products they consider purchasing and choice architecture, consumer behaviour is also influenced by social practices (Reckwitz, 2002; Spaargaren, 2011). In decision-making, consumers act in accordance with collective routines, such as home cooking, grocery shopping and barbequing. Collective values embedded within these social practices can conflict with consumers' personal values, subsequently influencing their behaviour in another direction. Social practices have not been considered in this study but do play a role in behaviour change and the adoption of behaviour change interventions.

Future research

Ruepert et al., (2017) have found that contextual factors may particularly promote sustainable choices among people with moderately strong biospheric values. To better understand the effectiveness of TM, we suggest a follow-up study with a more heterogenous sample regarding people's biospheric values. Including a manipulation check by a repeated measure of these values, would allow for a mediation analysis. Also, we suggest including other measures like knowledge, past behaviour, and social norms. Further analysis of different consumer segments could shed an even more nuanced light on the effect of TM as well, since such segments have shown to be driven by different sets of values (de Boer et al., 2017; Flynn et al., 2009; Gonera et al., 2021).

Additionally, this study did not test the importance of the cue that TM memberships got in the retail environment (engaging System 1), to help them act in line with the values around meat production, which they had reflected upon earlier (engaging System 2). For a follow-up study we suggest an explicit focus on the System 1 and System 2 components of choice architecture, to better isolate their distinct functions in sustainable consumption behaviour and to further inform how to effectively design choice architecture.

A follow-up study with this particular intervention would also require the inclusion of scales to measure values which TM could compete with (e.g., hedonic values). From an ethical perspective, it would be important to measure whether people would engage in sustainable behaviours while having low biospheric values. A recent study by Babutsidze & Chai (2018))investigating the effect of social learning on closing the climate value-action gap, showed promising results regarding ethical nudging. They found that people with strong concerns for the environment were more likely to act in line with their values as a result of their intervention, while people who did not value the environment as much, were not 'tricked' into performing sustainable behaviour.

As this study exemplifies, future research focusing on the deliberate design of choice architecture fostering any kind of sustainable behaviour, would provide more integrated insights if it were approached in an interdisciplinary way.

5.7 Conclusions

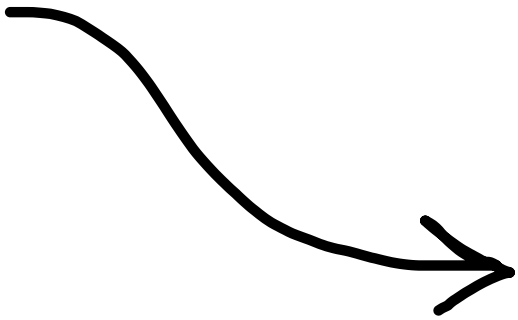
The purpose of this study was to better understand whether an ethical redesign of choice architecture could facilitate more sustainable meat consumption and close the value-action gap. Following a web-based experiment consisting of surveys and a digital prototype of consumption platform Tomorrow's Menu, results confirm that a reconfiguration of the decision-making process can support consumers with moderate to high biospheric values in behaving more sustainably.

This study demonstrates the necessity to reconsider our environment and explore how we could redesign it to support and strengthen human moral decision-making in purchasing practices. People care for the environment and animal welfare, yet these values get overruled in high-pressure contexts like the supermarket. Rather than nudging people into morally superior decisions, this study supports the idea that it is possible to design a retail environment that does

justice to both the values and the human tendencies of consumers. This study exemplifies that we can do so while still respecting human beings as moral decision-makers.

When we let go of
what we are, we become
what we might be.

Lao Tzu



PART THREE
DESIGN FOR SYSTEMIC BREAKDOWN

Chapter 6
Design for Decline: Proposal for a new area of research and practice

This Chapter is currently under review at a peer-reviewed journal:

Peeters, A.L., de Koning, J.I.J.C., Daalhuizen, J.J. (2026) Design for Decline: Proposal for a new area of research and practice (under review).

Abstract

Societal transitions involve not only the creation of new practices, structures, and cultures, but also the deliberate reduction and dismantling of unsustainable ones. Transition studies and design research have largely focused on innovation and system build-up, far less attention has been given to how to manage and design for decline, loss, and breakdown as integral components of systemic change. There is a need for transformative knowledge on 'Design for Decline' and when and how it contributes to transitions. In this paper we bring together existing knowledge on systemic breakdown to identify gaps and explore expert practices to address this need. We use a narrative literature review to draw together current perspectives on systemic breakdown across transition studies and design. We then draw on 15 in-depth interviews with experts from academia and practice engaged in processes of systemic breakdown, to explore how design for decline is practiced across multiple domains. Through thematic analysis of the data, eight areas of transformative knowledge were synthesised. These thematic areas are discussed in the context of existing scholarship to identify key research questions, forming a research agenda around Design for Decline.

To Know the Dark

To go in the dark with a light is to know the light.
To know the dark, go dark. Go without sight,
and find that the dark, too, blooms and sings,
and is travelled by dark feet and dark wings.

- Wendell Berry (poet, philosopher, writer and farmer)

6.1 Introduction

As ecological, social, and geopolitical crises intensify, and systems once assumed stable begin to unravel, the urgency of societal transitions becomes increasingly apparent. Transformative change, however, demands more than the invention and diffusion of sustainable alternatives. It also requires the deliberate challenging and dismantling of incumbent structures that lock societies into unsustainable and unjust trajectories (Rinscheid et al., 2021; Tonkinwise, 2014; Turnheim & Geels, 2013). In everyday terms, this imperative manifests in collective efforts such as reducing air travel, shifting dietary patterns, curbing demand for fast fashion, or quitting smoking - practices that entail not only adoption but also reduction and withdrawal.

Within transition studies, intentional systemic breakdown has gained recognition as a necessary, though historically under-theorised, dimension of transformation (Köhler et al., 2019). Turnheim and Geels (2013) conceptualise deliberate regime destabilisation - the multi-dimensional weakening of dominant practices, institutions, and cultural norms - as a crucial counterpart to innovation. Similarly, scholarship on policy mixes emphasises that transitions require elements of "creative destruction," whereby support is actively withdrawn from unsustainable technologies and practices alongside the nurturing of alternatives (Kivimaa & Kern, 2016). Increasingly, scholars argue that making space for new regimes requires the fragmentation, erosion, and phasing-out of existing ones (Feola, 2019; Shove, 2012). While such work establishes the structural and governance dimensions of decline, it provides comparatively limited insight into

how actors might intentionally engage with and navigate processes of systemic breakdown in practice.

Design research has also begun to converge on similar insights around systemic breakdown, though from different entry points. Concepts such as "unmaking," "undesign," and "designing away" propose that intentionally dismantling existing artefacts, infrastructures, and norms can open pathways towards more sustainable futures (Coombs et al., 2018; Fry, 2005; Pierce, 2012; Tonkinwise, 2014). Lindström and Ståhl (2020), for example, demonstrate how unmaking established practices can prepare the ground for alternative modes of thinking and making. Akama's (2018) engagement with the Japanese concept of *ma* (間) - the generative space in between things - further highlights the potential of absence, withdrawal, and pause as valuable forces in design (Akama, 2018). Such perspectives challenge dominant imaginaries of continuous growth and accumulation (Adams et al., 2021). Yet, despite these contributions, design scholarship has not systematically articulated how its methods and practices might support systemic breakdown within broader transition dynamics.

Taken together, transition studies and design research suggest that subtraction and destabilisation are as critical to transformation as innovation and addition. However, these conversations have largely evolved in parallel. Transition studies offer macro-level explanations of regime dynamics, destabilisation, and reconfiguration, but often lack detailed accounts of practice-level intervention. Design research, by contrast, provides methodological insight into how interventions disrupt entrenched norms and practices at the micro-level (e.g. Daalhuizen & Cash, 2021; Tromp & Hekkert, 2016; van Arkel & Tromp, 2024; van der Bijl-Brouwer, 2019), yet frequently under-specifies the systemic contexts within which such interventions unfold. What remains insufficiently understood is how design practices might intentionally contribute to systemic breakdown, and under what conditions such contributions support transformative transitions.

This study addresses that gap by examining how systemic breakdown is conceptualised and enacted in practice. Drawing on expert interviews and thematic analysis, it explores areas of knowledge that are relevant for design to foster decline in ways that contribute to transformative change. In doing so, the paper responds to calls within transition studies for more actionable approaches to the deliberate unmaking of untenable regimes (David, 2017), while situating design practices such as "designing away" (Tonkinwise, 2014) within a broader

socio-technical context. The central research question guiding this study is: *"How can design practices contribute to systemic breakdown in transitions, and what transformative knowledge is needed to advance this practice?"*

The paper proceeds as follows. The background section presents relevant scholarship from transition studies and design research on systemic breakdown to establish the conceptual foundations of systemic breakdown. The methods section then outlines the qualitative approach, including 15 expert interviews and thematic analysis. The results identify eight areas of transformative knowledge, which are subsequently articulated as a 'Design for Decline' research agenda and positioned in the field of transition design in the discussion. The paper concludes by summarising the study's key contributions and outlining directions for advancing Design for Decline as an emerging area of research and practice.

6.2 Background on systemic breakdown in transitions

Positioning design in transitions

Societal transitions are conceptualised as long-term, multi-dimensional, and profound transformation processes in which established sociotechnical systems evolve towards more sustainable, just, and resilient modes of production and consumption (Hebinck et al., 2022; Markard et al., 2012; Pel et al., 2020). Such transitions generally extend across multiple generations and engage a wide constellation of actors. They are marked by deep-seated systemic change driven by interrelated technological, social, organisational, and institutional innovations (Ceschin & Gaziulusoy, 2016; Markard et al., 2012; Prendeville et al., 2022). Within this context, design plays a critical role by shaping socio-material outcomes that exert enduring structuring effects on both society and everyday practices (Prendeville et al., 2022). Through the development of technologies, infrastructures, narratives, relationships, and other systemic components, design can enable and steer behaviours and, over time, contribute to the adoption of more socially and environmentally sustainable lifestyles (Irwin, 2015).

Build-up versus breakdown

While transitions have been shown to go through certain phases, they do so in a non-linear and non-teleological way (Köhler et al., 2019). The X-curve framework (figure 6a) describes how societal transitions equally involve the build-up of new practices, structures, and cultures, as well as the breakdown of

existing ones (Hebinck et al., 2022). System breakdown and build-up are in a bi-directional relationship; they mutually shape each other (Rinscheid et al., 2021; Turnheim & Geels, 2013).

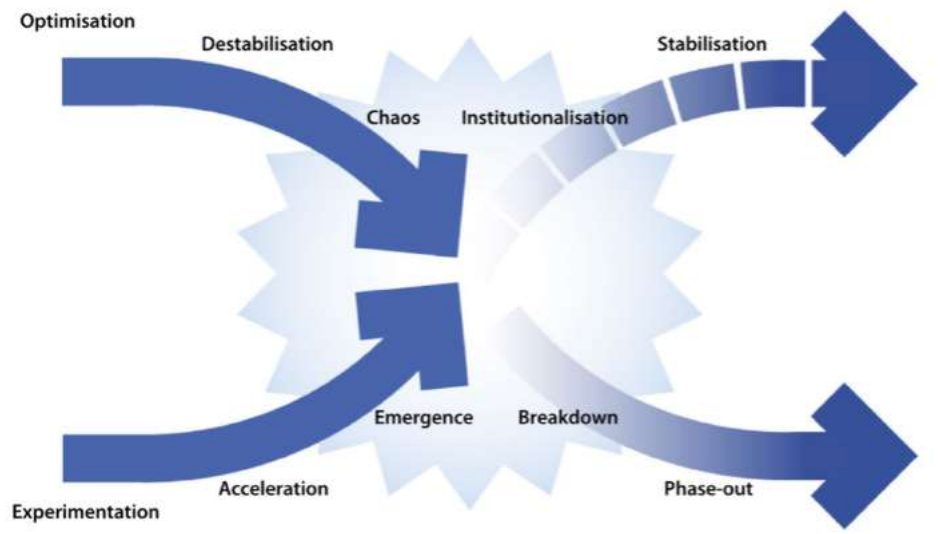


Figure 6a: The X-curve presenting the patterns of build-up and breakdown in transitions from Hebinck et al., (2022).

Both transitions and systemic breakdown rarely remain confined to a single domain, region, species, practice, structure, group, or individual. For instance, at the macro-level, disruptions in one sector often cascade across interconnected systems through feedback loops, resource dependencies, and shared infrastructures (Geels, 2002; Meadows, 2008). A collapse in the energy sector, for example, is likely to ripple into food production, global supply chains, and financial markets. At the meso-level, the elimination of (aspects of) one social practice can similarly disrupt adjacent practices (Shove, 2012). Prohibiting smoking around schools, for example, may also unintentionally remove meaningful social interactions among co-workers. Engaging with systemic breakdown therefore requires acknowledging fluid boundaries and recognising that every intervention entails trade-offs.

Systemic breakdown can take place through active pursuit or passive development. Intentional discontinuation could be actively pursued to simplify

a system, to manage risks, to create space, or to allow for systemic recovery (van den Elzen et al., 2024). At the same time, systems also crumble unintentionally, for instance due to changes in adjacent systems or unexpected societal developments like pandemics, political shifts, and climate change. With its countless moving parts, systemic breakdown can only be controlled to a limited extent, highlighting the importance of transformative knowledge to navigate it.

Conceptualising breakdown

A range of theoretical concepts offers guidance for developing a deeper understanding of systemic breakdown. Table 6a provides key references and definitions for each of these concepts. Across transition research and design studies, they constitute a dense conceptual field concerned with how socio-technical systems weaken, erode, and are actively dismantled. While these concepts differ in their normative orientation, degree of intentionality, and depth of systemic intervention, they are more often complementary than mutually exclusive. Taken together, they signal a shift away from transition strategies centred on technological substitution and innovation towards approaches that explicitly engage with reduction, loss, and breakdown.

Table 6a. Guiding concepts and definitions based on cited literature related to systemic breakdown.

	Breakdown concept	Definition	Field	Key references
C-1	**Sufficiency**	The need to reduce the volume of material, energy and resource consumption.	Transition Studies	Sandberg (2021)
C-2	**Degrowth**	Intentional downscaling of production and consumption to enhance ecological and social well-being.	Transition Studies	Kallis et al. (2018)
C-3	**Decline**	A measurable trend and a socio-material process of scaling down of production and/or use of a product or process.	Transition Studies	Koretsky et al. (2023)
C-4	**Destabilisation**	Process of weakening or eroding existing socio-technical regimes, which creates openings for change.	Transition Studies	Turnheim & Geels (2013)
C-5	**Discontinuation**	A rather actively pursued exit from a socio-technical regime.	Transition Studies	Koretsky et al. (2023)
C-6	**Deinstitutionalisation**	The erosion of established rules, norms, and practices within institutional systems.	Transition Studies	Novalia et al. (2022)
C-7	**Exnovation**	Purposeful removal or phasing-out of obsolete or harmful technologies or practices.	Transition & Design Studies	Heyen et al., (2017); Noëth et al., (2023)

C-8	**Creative Destruction**	Displacement of old systems through innovation-led transformation.	Transition Studies	Kivimaa & Kern (2016)
C-9	**Dismantling**	A broad and deliberate process of destabilising, breaking down, or removing infrastructures, institutions, cultural meanings, and practices.	Transition Studies	Turnheim (2023)
C-10	**Phase-out**	A planned, policy-led process of gradually ending the use of a technology, product, or practice.	Transition Studies	Rinscheid et al. (2021)
C-11	**Unlearning**	Letting go of dominant knowledge, habits, and routines to enable new ways of thinking.	Transition Studies	van Oers et al. (2023)
C-12	**Transition pain**	Unpleasant emotions resulting from expected or perceived losses in phase-outs.	Transition Studies	Bogner et al. (2024)
C-13	**Unmaking**	Dismantling existing structures, norms, or practices to make space for alternatives.	Transition Studies & Design Research	Feola (2019); Song et al. (2024)
C-14	**Reduction**	Decreasing the amount, intensity, or size of practices or processes, without completely phasing it out	Transition Studies	van den Elzen et al. (2024)
C-15	**Undesign**	Reversing or undoing existing systems or technologies by design.	Design Research	Coombs et al., (2018); Pierce (2012)
C-16	**Non-design/refusal**	Choosing not to design as a political or ethical stance against harmful systems or overproduction.	Design Research	Akama et al., (2023); Tunstall (2023)

C-17	**Elimination design**	Completely removing a product or service for sustainability	Design Research	Fry (2005)
C-18	**Ma (間)**	The (intentional) empty space in between things	Design Research	Akama (2018)

Table 6a. Guiding concepts and definitions based on cited literature related to systemic breakdown.

Sufficiency (Sandberg, 2021) and *degrowth* (Kallis et al., 2018) function as normative orientations rather than operational processes. Both challenge growth-based paradigms and foreground absolute reductions in material and energy throughput. Degrowth is more explicitly political and systemic, calling for a reorganization of economic and social systems, whereas sufficiency is often framed more pragmatically from the ecological concept of planetary boundaries, limits, needs, and restraint. These perspectives do not describe how change unfolds; rather, they justify why processes such as phase-outs, dismantling, or exnovation are necessary.

Process-oriented concepts differ in how descriptive or prescriptive they are. *Decline* (Koretsky et al., 2023) describes measurable reductions in production or use that may occur unintentionally, while *reduction* (van den Elzen et al., 2024) denotes deliberate but partial scaling down of harmful systems without full elimination. Other descriptive concepts focus less on removal and more on the weakening of dominant structures, cultures and practices (regimes). *Destabilisation* (Turnheim & Geels, 2013) and *deinstitutionalization* (Novalia et al., 2022; Sandberg, 2021) describe processes through which dominant socio-technical alignments, rules, and norms erode, creating openings for change without determining its direction.

Concepts focused on full elimination such as *discontinuation* (Koretsky et al., 2023) and *phase-outs* (Rinscheid et al., 2021) involve purposeful decisions to end practices or technologies, often through governance and policy. *Elimination design* (Fry, 2005; Tonkinwise, 2014) poses a similar imperative: "the elimination, by design, of the unsustainable" (Fry, 2005). *Exnovation*[13] (Heyen et al., 2017; Noëth et al., 2023) and *undesign* (Coombs et al., 2018; Pierce, 2012) foreground the removal of harmful or obsolete elements and critique innovation-centred transition frameworks for neglecting exit dynamics.

Dismantling (Turnheim, 2023) and *unmaking*[14] (Feola, 2019; Song et al., 2024) emphasise deliberate breakdown across material, institutional, and cultural

13 Conceptualising *exnovation*, transition studies emphasise transition dynamics and regime change (Heyen et al., 2017), while design research focuses on designer agency and intervention, often with less attention to systemic transition processes (Noëth et al., 2023).

14 In transition studies, *unmaking* is conceptualised as a macro-level strategy aimed at creating space for radical alternatives through the dismantling of dominant socio-technical and capitalist configurations (Feola, 2019). Design research frames unmaking at a micro level as a practice-based and experiential process, involving the dismantling of objects, values, habits, and forms of knowledge (Song et al., 2024).

dimensions. Both acknowledge that sustainability transitions require irreversible loss and the active undoing of infrastructures, meanings, and routines. *Refusal* or *non-design* (Akama et al., 2023; Tunstall, 2023) extend this more radical stance by deliberately opting out of overproduction and unsustainable innovation. By contrast, *creative destruction* (Kivimaa & Kern, 2016) remains ambivalent: while it aims for the displacement of unsustainable economic structures, it often assumes innovation-led substitution and can conflict with sufficiency and degrowth agendas when reductions in overall throughput are not explicitly addressed.

Finally, concepts such as *unlearning* (van Oers et al., 2023) and *transition pain* (Bogner et al., 2024) foreground cognitive and emotional dimensions of systemic breakdown, highlighting that exits and dismantling are socially and psychologically demanding.

All the above concepts surrounding systemic breakdown represent distinct functions and modalities of *decline* (Koretsky et al., 2023), thereby encompassing the current range of systemic breakdown processes discussed in the literature.

Types of interventions fostering systemic breakdown

At an operational level, several concrete interventions are known to support the reduction or elimination of technologies and other system elements. These interventions can be regarded as the instruments used in deliberate systemic breakdown approaches such as exnovation, phase-outs, and unmaking (the prescriptive concepts in figure 6b). The following types of interventions are drawn from both transition and design studies (and sometimes adjacent fields). They typically focus on the material or financial structures sustaining untenable practices, the cultural meanings associated with them, the emotions associated with letting go, or a combination of these. To illustrate these interventions while maintaining conciseness, we describe a selection here. The full list can be found in appendix 6A.

Structural interventions

Transition studies identify a range of structural interventions aimed at nurturing systemic breakdown. These include regulatory and policy instruments such as *bans, standards,* and *moratoria* (Heyen et al., 2017; McDowall & Underthun, 2025; Turnheim & Geels, 2012), *carbon pricing* and the *removal of subsidies* (Rosenbloom & Rinscheid, 2020), *stakeholder commissions* (Brauers et al., 2020), *phase-out mandates* (Trencher et al., 2022), and legal mechanisms such as *treaties* and *litigation* (Setzer

& Higham, 2022). Collectively, these interventions shape decline through regulatory, market, institutional, and legal pathways.

From a design research perspective, James Pierce's (2012) concept of *undesign* offers a more operational lens, detailing interventions such as *inhibition* (limiting access), *erasure* (removal), and *foreclosure* (preventing future use). More broadly, structural interventions can be understood as efforts to 'change the rules of the game' (Peeters et al., 2024), often relying on command-and-control measures (Trencher et al., 2022) that may provoke resistance from incumbents, consumers, or users.

Design literature also highlights more voluntary forms of structural intervention. *Disowning*, for example, seeks to dematerialise unsustainable practices by reducing ownership (Cheng, 2016; Tonkinwise, 2014). Servitising occasionally used commodities, such as cars or lawnmowers, can significantly reduce material throughput and spatial requirements (Cheng, 2016). *Convergent design* represents another structural replacement strategy at the product level, combining multiple functions into a single artefact, as exemplified by the smartphone (Tonkinwise, 2014).

Cultural interventions

Pierce (2012) argues that a *replacement* intervention can also be approached culturally, through symbolic substitution, like offering emotional gestures instead of physical gifts. Similar forms of cultural reframing are also discussed in transition studies (Bogner et al., 2024). By targeting cultural meanings more deeply, *restoration* functions as an elimination strategy that can help revive older, more sustainable alternatives (Pierce, 2012; van den Elzen et al., 2024) —for example, by promoting high-quality woollen clothing over fast fashion. Another cultural approach to elimination involves *vilifying communication*, which seeks to promote dissociation from harmful products or practices (Tonkinwise, 2014). The Dutch public *plofkip* ('exploding chicken') campaign launched by Wakker Dier in 2012 illustrates how such stigmatizing strategies can reshape public perception and ultimately contribute to policy change (NOS, 2023).

Emotional interventions

Recent studies emphasise the need for emotional support in transitions, particularly in relation to processes of systemic decline (Bogner et al., 2024; van Oers et al., 2023). *Spaces for Letting Go* can support people in engaging with deep

and often difficult emotions associated with phase-outs in transitions-in-the-making (Coops et al., 2024). These multi-dimensional spaces - encompassing physical, mental, and temporal dimensions - facilitate the unlearning of routines and practices to which people have become attached (van Mierlo & Beers, 2020). A crucial factor in navigating loss during transitions is the perception of justice: people need to experience a sense of fairness in how decline is managed (Bogner et al., 2024). In this context, grief or divestment rituals can offer guidance, drawing inspiration from culturally embedded practices such as the Japanese *KonMari* method or the Mexican *Day of the Dead* (Chamberlin & Callmer, 2021; Roster, 2014). In addition, acknowledging loss and providing practical support are considered essential in phase-out processes—for example, offering guidance and expertise to animal farmers who must close their businesses due to a lack of succession (van den Elzen et al., 2024). Financial compensation can further help mitigate negative impacts related to the perceived loss of possessions, employment, or security (Nacke et al., 2024).

This review of concepts and interventions from transitions literature and design research demonstrates the breadth of existing knowledge related to systemic breakdown, with most contributions focusing on intentional forms of decline. To translate these insights into more actionable, transformative knowledge that links micro-level practices with macro-level ambitions, this study complements the literature with empirical insights from expert practitioners and scholars who have engaged with systemic breakdown extensively. The following section outlines the data collection and analysis methods used to distil core research themes surrounding design for systemic breakdown.

6.3 Method and procedure

Sampling

We conducted 15 in-depth interviews with experts. Selection of experts was guided primarily by their substantial engagement with systemic breakdown, evidenced through multiple years of experience or pioneering contributions to the field. We aimed to balance practitioners and academics, including individuals who bridged both roles. In line with the discussed literature, participants were selected from both design and transitions or transformations research, or combinations of these areas, with an approximately even distribution across these disciplinary perspectives. Diversity in cultural background, age, and gender

was prioritised; however, despite including experts with Japanese and Australian affiliations, the sample remained predominantly Eurocentric (13 of 15 participants). Finally, interviewees were selected based on the cases they were actively working on, to capture a wide range of domains and industry contexts.

A list of potential participants was initially compiled based on the reviewed state-of-the-art literature - particularly its authors - as well as the professional networks of the study's authors, all of whom are active academics in design, with a specific focus on systemic and transition design. This initial pool was subsequently expanded through a snowball sampling approach, drawing on references within the literature and recommendations from the first selected interviewees. Suggested participants were added to a preliminary list and prioritised according to the established selection criteria. The final number of experts was determined by the point at which the primary researcher conducting the interviews reached data saturation, resulting in a total of 15 participants. Table 6b presents an overview of the participants, including their names, areas of expertise, and the cases proposed for discussion, while Figure 6b illustrates two aspects of the diversity of their profiles.

	Name	Role	Expertise	Case
1	**Cameron Tonkinwise**	Professor of Design Studies at the University of Technology Sydney	Sustainable Design; Transition Design; Design Philosophy	Aging population
2	**Elizabeth Shove**	Emeritus Distinguished Professor of Sociology at Lancaster University	Social Practice Theory; "The Shadowy side of Innovation"	UK canal system
3	**Frida Bengtsson**	Head of Greenpeace Sweden	Activism in practice; Sustainability Science (PhD)	Global overfishing
4	**Yoko Akama**	Associate Professor of Design at RMIT University	Design for Complexity; More-than-Human Futures; 'Ma'(間)	Design education
5	**Sanne Kistemaker**	Founder of social design agency Muzus (based in Delft, the Netherlands)	Social Design; Transition Design	Cigarette smoking
6	**Marije van den Berg**	Independent Researcher, Author (of i.a. "Stop strategy for organisations"), Organisational Consultant	Change Management; Public Sector; Phase-outs in practice	Bureaucracy in healthcare
7	**Chris Julien**	Activist with Extinction Rebellion; Author (of i.a. "Everyday Activism"); PhD Researcher in Decolonial Ecology	Science Philosophy; Activism in Practice	Fossil industry
8	**Joe Macleod**	Founder of design agency AndEnd, Design Consultant, Author (of i.a. "Endineering")	Customer Lifecycle Endings; Design Consultancy	Material consumption
9	**Derk Loorbach**	Professor of Socio-Economic Transitions at Erasmus University Rotterdam; Director of DRIFT	Socio-Economic Transitions	Animal consumption
10	**Giuseppe Feola**	Associate Professor of Social Change for Sustainability at Utrecht University	Socio-Ecological Transformations; Degrowth, Social Movements	Peasant movement in rural Colombia

11	**Kristina Bogner**	Assistant Professor of Sustainability Transitions at Utrecht University	Justice, Power and Emotions in Transitions; Transition Pain	Multiple domains
12	**Suzan Christiaanse**	Postdoctoral Researcher at Rijksuniversiteit Groningen; Founder of Placelift	Spatial Development; Cultural Geography; Social Practice Theory; Rural Environments	Facility decline in rural areas in the Netherlands
13	**Femke Coops**	Designer and PhD Researcher in Transition Design at the Eindhoven University of Technology	Transition Design; Letting go in Transitions; Emotions in Transitions	Multiple domains
14	**Floor van den Elzen**	Advisor and Researcher at DRIFT	Systemic Breakdown; Phase-outs in the Public Sector	Urban sustainability transitions in Amsterdam
15	**Puck Siemerink**	Social Designer and Researcher at ScrollScrollScroll; Independent Design Consultant	Social Design; Concept Development; User Experience Design	Smartphone use by youths

Table 6b: List of experts consulted for the study.

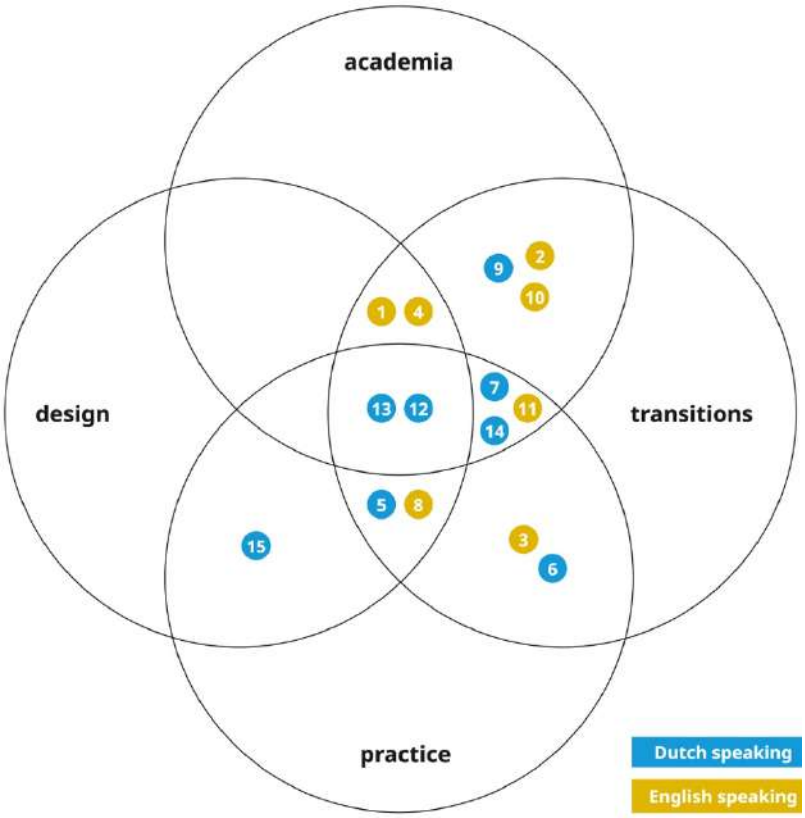


Figure 6b: Participant profiles and language of their interview.

Data collection

Experts were approached by the first author via email or LinkedIn with an invitation to participate in the study. Upon agreeing to take part, participants were asked to propose a specific project or domain (for example, 'smartphone use' or the 'protein transition') that would serve as the case study for their interview.

Seven interviews were conducted in Dutch and eight in English. All interviews took place online via Microsoft Teams and lasted approximately 60 minutes. With participants' consent, the interviews were recorded and transcribed using the same software. Each interview opened with a brief introduction by the primary author, followed by the participant introducing themselves and their proposed case.

The interview was structured around four thematic clusters: (1) the relationship between build-up and breakdown; (2) the systemic manifestation of breakdown across scales; (3) the implications of breakdown for individual behaviour; and (4) concrete interventions that may enable or accelerate systemic breakdown in practice. This structure builds on earlier work by the first author and colleagues (Peeters et al., 2025), which argues that design approaches become transformative - capable of challenging or destabilising dominant regimes - when they explicitly engage with transition strategies, systemic leverage points, and behaviour change dynamics, and subsequently integrate those in designed interventions (Peeters et al., 2025).

To facilitate reflection, the interview was supported by visual prompts derived from the same body of work. The X-curve (Hebinck et al., 2022) was used to explore dynamics of build-up and breakdown over time; the iceberg model (Kania et al., 2018) to examine structures, relations, and underlying paradigms in processes of systemic change; and the COM-B model of behaviour change (Michie et al., 2011) to reflect on the behavioural mechanisms implicated in breakdown processes.

Finally, participants were invited to speculate on the effects of interventions aimed at systemic breakdown and to reflect on the personal lessons they had drawn from working with processes of decline. The full interview guide is provided in appendix 6B.

Data analysis

First, the interview transcripts were verified for accuracy. The primary researcher then organised the transcripts in Atlas.ti according to the 20 questions in the interview guide, a process that also supported initial familiarisation with the data.

The first phase of thematic analysis followed an inductive approach, aimed at identifying research themes relevant to designing for systemic breakdown in transitions, in line with the first research question. This initial coding phase resulted in the identification of five preliminary themes.

These five emerging themes were subsequently discussed by all authors during a two-hour analytical session, leading to further refinement. A second round of coding followed during which three additional themes emerged. The authors reconvened for a 90-minute session to refine the resulting eight themes and to reach consensus on their scope, content, and titles.

From thematic analysis to research agenda

The eight themes derived from the interview analysis were subsequently integrated with insights from the literature to formulate theoretical and empirical research questions for each theme. These questions were iteratively refined through three rounds of discussion among the authors until collective agreement was reached.

6.4 Results

Drawing on insights from the literature and the thematic analysis of expert interview data, we identified eight themes central to designing for systemic breakdown, collectively framed under the umbrella of Design for Decline (Figure 6c). Each theme corresponds to a distinct theme that emerged as particularly significant in understanding and engaging with processes of systemic breakdown.

Figure 6c: Eight themes of transformative knowledge around design for decline.

Theme 1: Decline as part of change

Across the interviews, participants demonstrated a plural and nuanced understanding of decline, drawing on diverse experiences from design practice, policy, research, and activism. [15] Many described decline as an inherent yet insufficiently acknowledged aspect of societal change, noting that it is rarely addressed explicitly in their professional contexts.[16] This absence was observed across the public sector, private organisations, and academia. Participants pointed to dominant Western perspectives that prioritise growth, continuity, and innovation, leaving little room for endings, loss, or withdrawal. Several interviewees contrasted this with alternative cultural perspectives that recognise the value of erosion, decay, 'composting', and (symbolic) death associated with decline, which they felt were largely absent from mainstream design and transition practices.

Theme 2: Attachment to the status quo

Experts consistently described attachment to the status quo as a major source of resistance within transition processes. They identified a wide range of attachments, including attachments to the comforts of modernity, established routines and practices, professional and personal identities, entrenched power structures, and broader perceptions of stability and security.[17] Several participants pointed to deeply embedded and especially harmful ideological attachments in contemporary societies, particularly those arising from capitalism, patriarchy, and colonialism. Moreover, participants emphasised the risk of failing to explicitly address what needs to be reduced or phased out during transitions. When such processes remain unacknowledged, interviewees noted that systems tend to revert to previous configurations. At the level of everyday practice, this

15 "So we've actually got more of a flickering patchwork of comings and goings, of practices and histories and traditions and material infrastructures and so on, rather than a complete switch-off." *Elizabeth Shove*

16 "We have built up such a culture in business, consumer culture, which is almost blind to acknowledging that there's an end and a place. Obviously, everyone thinks there's endings, but with it, we don't look at it as a place to be present or do activity or create an experience." *Joe Macleod*

17 "The objects are extended ego and when the objects are taken, you suffer mourning for your own self in that way… Because "who am I if I can't do that?" *Cameron Tonkinwise*

was described as individuals falling back into established behavioural patterns, even after moments of disruption or experimentation.[18]

Theme 3: Practitioner agency and positionality

Across the interviews, most non-design experts raised questions about the agency and positionality of practitioners within transition processes. Participants reflected on the assumption that practitioners can intentionally steer change, noting that this stance often overlooks the fact that they are themselves embedded in, and implicated in, the systems they seek to transform or dismantle.[19] Three interviewees explicitly challenged what they described as a "God-like" identity within design, calling attention to perceived overconfidence in control and authorship.[20,21] In addition, two participants observed that explicit reflection on their own normativity - clarifying what they were working towards or "fighting for" in transition contexts[22] - both fostered a sense of purpose and enabled more authentic collaboration with others involved in the process.

Theme 4: Conflict in transition processes

Several experts emphasised the importance of conflict and disagreement in processes of decline and transition. Rather than viewing conflict solely as an obstacle, interviewees described it as something that can be recognised, valued, and in some cases deliberately fostered. Two activist experts in particular highlighted the strategic role of what they referred to as "curated conflict,"

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18 "The moment you don't explicitly look at 'what do we want to quit' or 'what do we want to do differently,' you're just not going to quit it completely. And if you are going to quit or partially quit, then not in a good way. *Floor van den Elzen*

19 "There's probably just as much, perhaps even more, that happens alone and silently and invisibly and, I mean, you're sort of trying to get a sense of that when somebody shares a story." *Yoko Akama*

20 "That doesn't mean that change doesn't happen. It's happening all the time, but in ways that are somewhat unpredictable, somewhat uncontrollable, and all of us are caught up in those flows and we're contributing to them as well. That's where this idea of the illusion of control, I think, is quite powerful." *Frida Bengtsson*

21 "It's not something you design at a table, right, and say, oh, yeah, 'now we all do this'. It's also organic, and because it's participatory, because there's hundreds and thousands of people involved in assemblies, in meetings, in ceremonies, et cetera." *Giuseppe Feola*

22 "So, my theory of change and my motivation for doing this is that for me, there are certain things that are unnegotiable. For instance - and these are not my opinions in the first place - but these are international law, for instance, that every human being has the same basic fundamental human rights." *Kristina Bogner*

noting that targeting specific systemic tipping points[23] and deliberately involving powerful actors could make conflict more effective in enabling decline. Participants described conflict as creating the conditions for critical conversations that are otherwise difficult to initiate, especially when reductions or the dismantling of existing systems and practices are at stake.[24]

Theme 5: Participatory approaches to decline

Experts unanimously highlighted that decline and systemic breakdown are deeply social processes that depend on trust and social solidarity. Several participants noted that people often rely on others' experiences to find the confidence to change, [25] for instance when giving up private car ownership in favour of shared mobility. Interviewees further stressed that those affected by decline should have a voice in decisions about how reductions or phase-outs are implemented. Experts suggested that involving affected actors in such processes can help prevent resistance or backlash.[26] They also observed that when decline is addressed in participatory ways, losses tend to become more acceptable, increasing the likelihood that people will support or even actively advocate for change.[27]

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23 Reflecting on his activism against the fossil industry, *Chris Julien* argues that "you have to initiate a feedback loop that is going to reinforce itself at some point, so that it is unstoppable. That's the dynamic of a tipping point. A feedback loop that is going to strengthen itself where the inhibiting factors fall away or decrease in strength, shifting the system's state." For instance, in the fossil industry, large fossil-heavy companies receive tax benefits ("fossil subsidies"). Attacking this economic pattern publicly has created societal awareness and increased pressure on the entire fossil industry.

24 Social design practitioner *Puck Siemerink* reflected on the importance of openly expressing disagreement, drawing on her experience of designing for the reduction of smartphone use among youths: "I do think you need people who really say, 'We're not doing it, that's it!" ... I mean, somebody has to say the extreme. And we probably won't end up at that extreme, but somewhere below it."

25 "Different people are at different points of their journey. So, in seeing other people talk about these things as opposed to just me alone is a really is a really important part of it." *Yoko Akama*

26 "My solution is, 'whatever the problem, community is the answer.' So, as people, that complexity of the world, you're in that. And we all have little subsystems together to sort of organize that, and we've been able to do that for 60,000 years, so we have to rely on that as well." *Marije van den Berg*

27 "They took much more time, involved the village much more and didn't kind of run off with an idea themselves.... And in the end, everyone there was also very positive. People were still sorry that the sports hall was closing, but they were able to explain it very well." *Suzan Christiaanse*

Theme 6: Pain and loss in transitions

All participants emphasised that decline entails loss, which is often accompanied by pain and the need for mourning, particularly when the loss is involuntary. Experts described this emotional dimension as closely linked to attachment (theme 2), and as a key reason why systemic breakdown is experienced as unsettling and difficult to engage with. Interviewees with facilitation experience stressed that processes of letting go require substantial time and dedicated space,[28] as well as emotional intelligence[29] and a deliberate interplay between private sensemaking and collective reflection.[30] One participant described a well-facilitated letting-go process as ultimately generating a sense of liberation and renewed capacity to move forward.[31] Overall, participants underscored that emotional dynamics are central to how decline unfolds in practice.

Theme 7: Plural phase-out interventions

Across the interviews, experts noted that phase-out processes involve the consolidation of new norms that have gained socio-political support during earlier stages of decline.[32] While phase-outs were widely understood as primarily policy-driven, interviewees emphasised that additional forms of support are often needed once a phase-out is initiated. Participants highlighted the importance of practical, structural, cultural, and emotional forms of assistance to help actors adjust to changing conditions and stabilise emerging system configurations. Experts with a design background identified phase-outs as sites

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28 "You just have to have a space where people totally shut off for a while, where no one walks in during the session either, because it's pretty personal stuff." *Femke Coops*

29 "It is important not to take up too much emotional space. To present painful issues to people in a very honest way. It is also important to mention that they are painful and that it is difficult, and to leave a lot of room for the listener to relate to them." *Chris Julien*

30 "A lot of the work I do is trying to meet people where they are. So depending on their level of comfort, but also how much they trust you to and trust one another, really, because it's always a group work to be vulnerable. Letting go or unlearning is a form of vulnerability, cause you're surrendering something." *Yoko Akama*

31 "And many people tell me right after the process, but I also interview them like weeks later, months later … it gives them a bit of inner peace… They said the situation did not change at all, but how I feel about it changed a lot. So how I'm able to continue, how I'm able to build my life from here changed." *Kristina Bogner*

32 "So, for me it's always been important to say, "if this is the practice we want to change or stop, what is then the regulation that can do that in the end?" And trying to make sure that industry advocate for the same solution." *Frida Bengtsson*

of intervention. One participant, for example, described designing a large, soft stuffed cigarette as a boundary object to facilitate conversations about quitting smoking, complementing national ambitions to achieve a "smoke-free generation" by 2035. Several interviewees affirmed the value of embedding such design interventions within existing institutional and community structures as part of a broader phase-out strategy. [33] Overall, the interviews suggest that without these complementary forms of support, the phase-out of practices and norms risk remaining fragile and contested.

Theme 8: Post-decline futures

Across the interviews, experts emphasised that designing for decline must also engage with the creation of attractive alternatives; appearance and disappearance cannot be navigated separately in transitions. Participants highlighted the importance of making radically different futures – for instance, those without private car ownership - both imaginable and desirable.[34] Several experts pointed to immersive and experiential techniques, including living labs, storytelling, and virtual reality, as ways to help people envision "the other side" of a transition.[35, 36] Such approaches were described as lowering the threshold for change and introducing conditions for what participants referred to as "transition fun" and joy.[37] Overall, experts suggested that envisioning appealing post-decline futures can help counterbalance the experience of loss and make processes of reduction more engaging.

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33 "So that helps us to insert the work that we're doing into every single part of our school." *Yoko Akama*

34 "Or simply making it visible—just showing that it exists—because many of those alternatives are framed around what *isn't* there. So it's 'you don't eat meat', which isn't an attractive proposition at all; instead, you just eat something enjoyable." *Derk Loorbach*

35 "And so we just need to give ourselves these buffers to do unlearning and learning and to do transitioning and to see what our bodies feel like on the other side of a transition." *Cameron Tonkinwise*

36 "If you look at social design, what I very much believe in is that we can use that design power, so to speak, that 'making power' also for shaping change, so actually making tangible a new future that we may not yet be able to imagine." *Sanne Kistemaker*

37 "And that kind of learning, that's where staff actually do get really excited. That's where we all become learners again." *Yoko Akama*

6.5 Discussion: An emerging research agenda

Contrasting and comparing the literature and interview data, several gaps of transformative knowledge appear. Although the emerging research agenda is interdisciplinary, it is primarily directed at the field of design.

For each of the eight themes, three research questions are proposed: two theoretical questions and one empirical question. The first theoretical question addresses descriptive knowledge about processes of decline within transitions, while the second focuses on knowledge related to the discipline of design. The third question is empirical and examines the practice of designing for decline in relation to each theme. Table 6c presents an overview of the themes and research questions.

Future research on theme 1: Decline as part of change

The experts reinforced and extended existing literature that identifies decline as an overlooked and undervalued dimension of societal transitions (e.g. Coops et al., 2024; Köhler et al., 2019; Tonkinwise, 2014). The participants' observations mirror critiques that transitions research and design practice tend to foreground emergence and innovation, while marginalising processes of breakdown, ending, and loss. The contrast drawn by interviewees between dominant Western perspectives and alternative cultural understandings - such as those emphasising transitional or "in-between" spaces (Akama, 2018) - highlights the role of worldviews in shaping how decline is perceived and acted upon. Taken together, the literature and interview findings point to a need to expand collective awareness of, and literacy around, systemic breakdown within both design and transition processes. This gives rise to several research questions:

- What worldviews embrace decline as part of change and how do they influence decision-making?
- What constitutes a design mindset in which breakdown is recognised as an integral part of change?
- Which (design) tools and approaches might support such a paradigmatic shift among researchers and practitioners?

Future research on theme 2: Attachment to the status quo

The interviews aligned with literature that conceptualises attachment as a key mechanism through which systems reproduce themselves and resist change, particularly within transitions informed by attachment theory and critical perspectives (e.g. Coops et al., 2024). The range of attachments identified by participants corresponds with scholarship that situates resistance not only at the level of individual behaviour, but also within routines, identities, power relations, and dominant ideologies (e.g. Feola et al., 2021; Wijsman & Feagan, 2019). The observed tendency towards reversion and behavioural fallback resonates with transition studies on lock-in and path dependency, underscoring the persistence of existing configurations when attachments are left unaddressed (Unruh, 2000). Taken together, these insights suggest that recognising and, where possible, actively addressing attachments may open productive pathways for fostering transitions. Research questions emerging within this theme include:

- What are the key types of attachment that hinder specific transitions?
- What attachments does the field of design hold that prevent moving away from the status quo?
- How might such attachments be acknowledged and addressed through design?

Future research on theme 3: Practitioner agency and positionality

The experts raised an issue that has received limited attention in design literature on decline in transitions, yet is closely connected to broader debates on agency, reflexivity, and power in transition studies (e.g. Avelino, 2017; Wittmayer & Schäpke, 2014). The interview data problematises design's longstanding orientation towards intentional change-making (Simon, 1996), highlighting tensions between aspirations to control and the reality of embeddedness within socio-technical systems. The critique of a "God-like" design identity points to a need for greater reflexivity regarding practitioners' roles, limits, and responsibilities when engaging with systemic breakdown. Furthermore, the reported value of explicitly articulating normative positions suggests that reflexive practices around agency and positionality may support more constructive collaboration in transition contexts. Together, these insights indicate that engaging with decline may require not only new tools and strategies, but also a reconsideration of how practitioners understand their own influence,

identities, and ethical commitments. This raises important questions for future research:

- In which ways, both directly and indirectly, can researchers and (design) practitioners influence transitions?
- How might designers transcend their identity as 'change makers', to foster decline effectively?
- At what points in the practice of designing for decline can reflection on agency and positionality be meaningfully integrated?

Future research on theme 4: Conflict in transition processes

Experts echoed transitions literature that frames conflict and disagreement as inevitable features of societal change (Feola, 2019; Hess, 2023), as well as design research traditions that deliberately contest dominant practices, such as critical and speculative design (Coombs et al., 2018; Pierce, 2012) and practices of refusal or non-design (Akama et al., 2023). The interview insights extend this body of work by foregrounding conflict not only as resistance or disruption, but as a potentially generative force in enabling decline and reduction. Taken together, the literature and empirical findings suggest that conflict may play a more central role in designing for decline than has thus far been acknowledged within design research. This raises the following important questions for future research:

- What are the dynamics of conflict and disagreement in transitions that should be considered when designing for decline?
- How can design actively support curated conflict in transitions?
- When designing for decline, which capabilities are required to initiate, navigate, and resolve conflict?

Future research on theme 5: Participatory approaches to decline

The interviews align with literature that frames transitions as inherently social processes shaped by collective meaning-making, trust, and solidarity (e.g. Feola et al., 2021). The interview data also resonates with research on transition pain, which highlights the importance of democratic participation in mitigating resistance and fostering acceptance of loss (Bogner et al., 2024). While design has a strong tradition of participatory and co-creative practices, the combined insights from the literature and interviews point to a gap when it comes to

participatory approaches for reduction, phase-out, and letting go. This suggests a need to reorient participatory design beyond co-creation towards methods that explicitly engage plural perspectives on sacrifice, loss, and decline, thereby exploring what might be termed 'co-destruction'. Key questions for future research include:

- How can practices or structures that need to be reduced or phased out during transitions be identified in inclusive and participatory ways?
- Which processes, tools, and materials can support dialogue among actors with a plurality of perspectives on sensitive issues involving sacrifice and loss?
- What design capabilities are required to effectively navigate participatory processes when designing for decline?

Future research on theme 6: Pain and loss in transitions

Experts' accounts aligned with scholarship on transition pain (Bogner et al., 2024) and Spaces for Letting Go (Coops et al., 2024), both of which conceptualise decline as a process marked by loss, mourning, and emotional processing - particularly where injustice is perceived. One interviewee explicitly echoed theoretical arguments that decline can open up possibilities for renewal in transitions (e.g. Turnheim & Geels, 2013), namely through carefully facilitated processes of letting go. At the same time, the relative absence of emotional perspectives on decline within design research becomes evident. Although some studies address emotional divestment and practices of letting go (Chamberlin & Callmer, 2021; Coops et al., 2024; Roster, 2014), the combined insights from the literature and interviews suggest that design knowledge on how to navigate pain and loss in transition processes remains underdeveloped. In particular, existing design research tends to focus on individuals letting go of physical products in their households; it rarely engages with decline as a systemic phenomenon. This gap raises several questions for future research, including:

- Where, when and what kinds of pain surface in the process of decline in transitions?
- What design capabilities are needed to navigate pain and loss in transitions?

- Which processes, tools and materials might support letting go in transitions?

Future research on theme 7: Plural phase-out interventions

The interviews align with conceptualisations in the literature that understand phase-outs as policy-led processes unfolding after periods of destabilisation and aimed at institutionalising new norms (Rinscheid et al., 2021; Hebinck et al., 2022). Participants confirmed that policy measures tend to be most effective when they follow substantial socio-political buy-in. At the same time, they emphasised that regulatory instruments alone are rarely sufficient and may require complementary forms of intervention. Interviewees highlighted the importance of practical, structural, cultural, and emotional support. This emphasis resonates with broader transition scholarship that underscores the need for multi-dimensional intervention (van den Elzen et al., 2024). Taken together, the literature and empirical insights point to a complementary role for design in phase-out processes, especially in stabilising emerging norms and addressing needs that extend beyond formal regulation. This suggests important avenues for future research with questions such as:

- How can combinations of different types of interventions support institutionalisation across scales?
- How can policy development and design processes be meaningfully integrated in the context of phase-outs?
- What types of design interventions could complement policy measures to support phase-out processes?

Future research on theme 8: Post-decline futures

Experts' accounts resonate with transitions scholarship emphasising the interdependence of build-up and breakdown in transitions (Rinscheid et al., 2021; Turnheim & Geels, 2013), underscoring that decline cannot be addressed without attention to emerging alternatives. While visioning and futuring are well established within design research (e.g. Dunne & Raby, 2013; Lockton & Candy, 2019; Yu, 2025), little attention has yet been paid to imagining futures in contexts where people have (un)willingly sacrificed something they valued. The participants' emphasis on making post-decline futures desirable suggests that futuring practices may play a crucial role in sustaining motivation during

processes of reduction. Emerging work on engaging with "lost futures" and "emerging hopes" in sustainability transitions (Lockton & Coops, 2025) further indicates that imagining futures after loss may function as both memorialisation and collective reorientation. Together, the literature and interview findings point to the need for further research into the role of attractive alternatives in decline, pursuing questions such as:

- What role do attractive alternatives play in processes of decline within transitions?
- How does applying the lens of loss or sacrifice affect futuring practices in design?
- Which tools, materials, processes, and design capabilities best support imagining futures after loss?

Design for Decline theme	Research questions
1. **Decline as part of change**	• What worldviews embrace decline as part of change and how do they influence decision-making? • What constitutes a design mindset in which breakdown is recognised as an integral part of change? • Which (design) tools and approaches might support such a paradigmatic shift among researchers and practitioners?
2. **Attachment to the status quo**	• What are the key types of attachment that hinder specific transitions? • What attachments does the field of design hold that prevent moving away from the status quo? • How might such attachments be acknowledged and addressed through design?
3. **Practitioner agency and positionality**	• In which ways, both directly and indirectly, can researchers and (design) practitioners influence transitions? • How might designers transcend their identity as 'change makers', to foster decline effectively? • At what points in the practice of designing for decline can reflection on agency and positionality be meaningfully integrated?
4. **Conflict in transition processes**	• What are the dynamics of conflict and disagreement in transitions that should be considered when designing for decline? • How can design actively support curated conflict in transitions? • When designing for decline, which capabilities are required to initiate, navigate, and resolve conflict?

5. **Participatory approaches to decline**	• How can practices or structures that need to be reduced or phased out during transitions be identified in inclusive and participatory ways? • Which processes, tools, and materials can support dialogue among actors with a plurality of perspectives on sensitive issues involving sacrifice and loss? • What design capabilities are required to effectively navigate participatory processes when designing for decline?
6. **Pain and loss in transitions**	• Where, when and what kinds of pain surface in the process of decline in transitions? • What design capabilities are needed to navigate pain and loss in transitions? • Which processes, tools and materials might support letting go in transitions?
7. **Plural phase-out interventions**	• How do actors affected by phase-out processes experience them, and which needs emerge once a phase-out has been initiated? • How can policy development and design processes be meaningfully integrated in the context of phase-outs? • What types of design interventions could complement policy measures in supporting and facilitating phase-out processes?
8. **Post-decline futures**	• What role do attractive alternatives play in processes of decline within transitions? • How does a lens of loss or sacrifice shape futuring practices in design? • Which tools, materials, processes, and design capabilities best support imagining futures after loss?

Table 6c. Eight research themes of Design for Decline and corresponding research questions.

Situating Design for Decline

Rather than proposing a new discipline or a prescriptive methodology, Design for Decline is advanced as a lens that centres dimensions of transition that are typically marginalised in both transition studies and design research: decline, loss, sacrifice, and intentional dismantling. Positioned as an early-stage scoping effort, this work lays the conceptual groundwork for a longer-term, mixed-methods agenda for research and practice. This positioning constitutes the study's primary conceptual contribution. For transition studies, Design for Decline responds to calls for more actionable and practice-oriented engagement with decline and regime destabilisation (David, 2017). For design research, the contribution lies in challenging the field's dominant orientation towards creation and innovation, and in legitimising destruction and exnovation as central sites of design inquiry, responsibility, and practice (Coops et al, 2024; Tonkinwise, 2014).

Central to Design for Decline are research themes which together address both mindset-related and procedural dimensions. This combination is crucial for developing actionable design approaches, as it explicitly links practitioners' orientations, assumptions, and values to concrete ways of intervening in practice (Daalhuizen & Cash, 2021).

To situate the eight research themes within the field of transition design, we draw on Irwin's (2015) framework of four mutually reinforcing areas: *Visions for Transition*, *Theories of Change*, *Posture and Mindset*, and *New Ways of Designing*. As illustrated in Figure 6f, Design for Decline does not introduce new tools or methods; rather, it reorients attention across all four areas by extending the scope of transition design from imagining and building futures to also engaging with endings, reduction, and relinquishments.

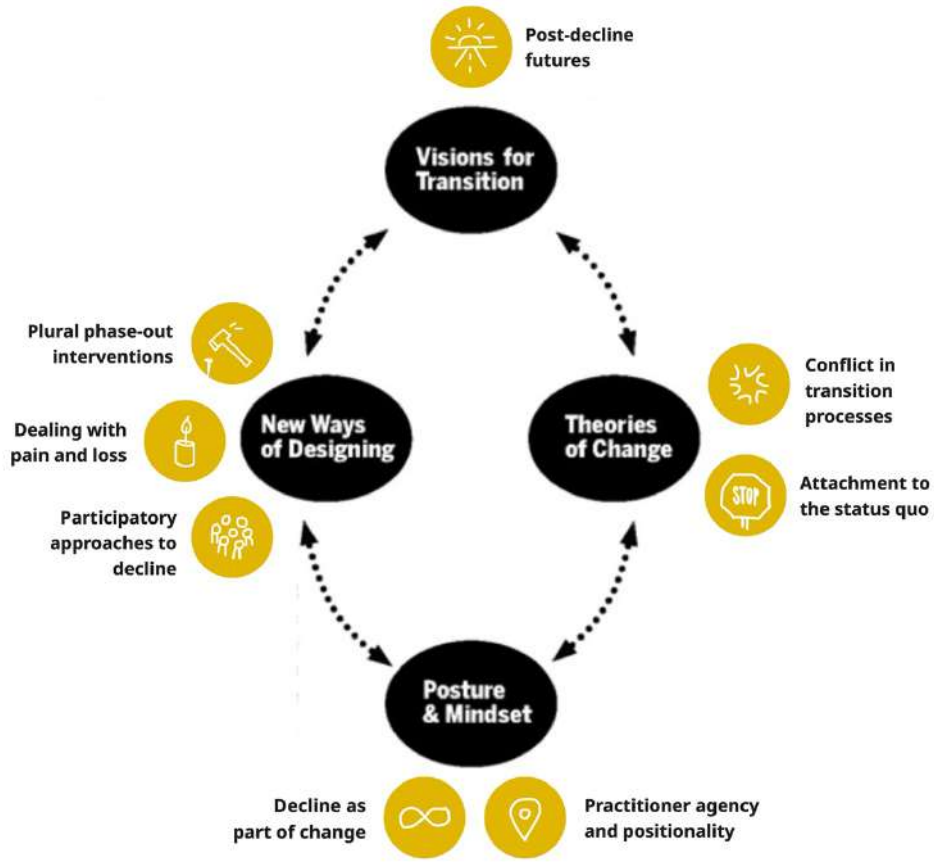


Figure 6f: The eight research themes of Design for Decline in relation to Irwin's Transition Design Framework (2015).

One dimension not explicitly addressed in Irwin's (2015) framework concerns the roles designers adopt in transition contexts. The research themes of Design for Decline point to the need to reconsider these roles. Prior design research has identified a plurality of positions designers may assume in exnovation processes, including process facilitators, sense-makers, and devil's advocates (Noëth & Moons, 2024). Design for Decline may extend this role repertoire, particularly in relation to engaging with conflict and navigating pain during transitions. Crucially, designers must resist expectations of becoming Jacks of all trades, as such positioning risks superficial engagement in contexts that demand deep expertise, emotional labour, or political accountability. The multiplicity of roles involved in systemic breakdown underscores the need for ongoing reflection and

negotiation between designers and their collaborators regarding 'who wears which hat when'. How these roles are distributed, combined, or sequentially embodied throughout a design process remains an open question and warrants further practice-based research.

Limitations and positionality

This study is shaped by the positionality of its authors - three white, progressive, Dutch(-Brazilian) academics with backgrounds in design - and by the profiles of the interviewed experts, many of whom shared similar socio-economic and cultural positions and expressed a normative orientation towards systemic breakdown. As a result, the perspectives presented here are inevitably partial and reflect a predominantly Eurocentric framing of decline and transition.

Rather than claiming universality, this work is intended as an invitation: to provoke researchers and practitioners to interrogate systemic breakdown within their own socio-cultural, political, and geographical contexts. Perspectives notably underrepresented in this study - including those of communities in the Global South, actors facing involuntary decline, and Indigenous or non-Western epistemologies of endings - are likely to challenge, extend, or fundamentally reconfigure the themes outlined here. Engaging such perspectives is a critical task for future research on Design for Decline.

6.6 Conclusion

This paper has argued that designing for systemic transitions requires engaging with breakdown as much as with build-up. Transformative change involves not only introducing alternatives, but also deliberately reducing entrenched practices, structures, and cultures. In response, we proposed Design for Decline as a coherent area of inquiry integrating insights from transition studies, design research, and practitioners' experience with decline. The resulting research agenda suggests eight themes of transformative knowledge, that structure this emerging field and expose significant theoretical and empirical gaps.

By foregrounding decline as a legitimate dimension of transition, this study offers an interdisciplinary reference for those working on systemic change and invites engagement with decline not as failure, but as a necessary and generative condition for transformation. Ultimately, we invite readers to support the transcendence of a persistent collective innovation bias and to foster decline in transitions with openness to the darkness it entails.

Intermezzo III
Exploring Design for Decline

This chapter describes several explorations of systemic breakdown in transitions in practice: a collaborative art project, two MSc graduation projects and a theatrical keynote presentation about exnovation in the protein transition. The latter concludes with feedback and reflections from food system actors on 'deanimalising' our diets, a topic that has shown to be highly sensitive, yet full of opportunities for design.

'Dismantling': an object symbolizing deliberate decline in transitions

To communicate a research report on systemic breakdown (De Roo et al., 2025) to policymakers more effectively, Nina de Roo and her colleagues sought an accompanying object or experience to complement the written document. We created a physical artefact using 'leftover' materials from the four practices discussed in the report (Figure IIIa). Artist Josephine Beijer was recruited via LinkedIn to assemble these materials into two portable objects, which can travel with us to venues where we present our respective work on systemic breakdown (Figure IIIb).

Beyond supporting the report, the artefact functions as an art piece at conferences, workshops, and seminars, contributing to placing deliberate decline on the agenda. Its presentation at recent events such as the Dutch Design Week suggests that the object can help make the abstract notion of systemic breakdown more tangible. Audience responses indicate that the artefact often serves as a conversation starter. For example, at the *Feeling through the Cracks* seminar about emotions in transitions, organised by Utrecht University early December 2025, participants expressed interest in developing a similar object tailored to the energy transition, pointing to its potential to support difficult conversations among stakeholders navigating that domain.

Figure IIIa. Left: collected materials from four phased-out practices in the Netherlands: mink farming (glove), laying hen battery cages (rack), pulse fishing (cylindrical electrode), and gas extraction in Groningen (brick from a home damaged by the earthquakes caused by the extraction, which is currently being demolished). Right: the sketch of their assembly into an object.

Figure IIIb. The final 'Dismantling' art piece, made from materials of the four phased-out practices.

MSc graduation projects: breaking down food practices

Despite the uncharted territory that designing for systemic breakdown still is, two MSc graduation students embarked on a journey of exnovation in practice alongside this doctoral research. Mayra Cöp explored how we might 'undesign' unhealthy snacking habits by young students (Cöp, 2025). Graduation student Inés Bernal Leal also developed an intervention portfolio, in her case to 'deanimalise' our food system at the TU Delft campus (Bernal Leal, 2025). Both students had inspiring journeys pioneering exnovation, contributing significantly to the academic field of design as well as the practice of both clients.

MSc graduation project 4/5: "Undesigning Snack Habits: An intervention portfolio for MBO students"

To promote healthier eating among MBO students, Mayra Cöp explored how to reduce unhealthy snacking through social influence (Cöp, 2025). Commissioned by the Ministry of Health, she applied a systemic exnovation lens and designed *Stoptober*: a month-long campaign with peer-driven interventions including school-wide promotions, canteen nudges, Snapchat filters, and group discussion materials (figure IIIc).

Like the student projects in Intermezzo I, Mayra's work demonstrated the value *of integrating interventions* in existing structures: Stoptober is an existing campaign to support quitting smoking, Snapchat is already popular among the target group, and the physical materials can all be used in the existing school structures. Mayra's decision to include in-class materials was directly informed by insights gained during this dissertation (Chapter 6). Moreover, her reflections on exnovating in practice revealed that existing design methodologies were not challenged in the process of designing something away. Instead, the exnovation lens was an inspiring and actionable perspective within existing methods; it mainly invoked a *heightened awareness* of perspective at important moments in the design process.

Figure IIIc. Intervention portfolio 'Stoptober'

MSc graduation project 5 / 5: "Designing for Systemic Goodbyes: Deanimalising Our Diets to Foster the Protein Transition"

To support WWF-NL's goal of reducing animal-based food consumption, Inés Bernal Leal explored how systemic design could drive change on the TU Delft campus (Bernal Leal, 2025). Her research revealed six interconnected barriers rooted in narratives, norms, and infrastructure. In response, she designed seven interventions rooted in the value of *care,* fostering reflection, emotional connection, and gradual cultural shift (figure IIId).

Inés' journey proved to be as educational for us as mentors as it was for her as a practitioner. By engaging with exnovation in practice, she gained deeper insight into several knowledge themes of Design for Decline identified in Chapter 6. Her work highlighted:

- how dominant worldviews among project stakeholders often fail to recognise decline as an inherent and valuable dynamic in transitions (Theme 1: *Seeing decline as part of change*);
- the emotional burden practitioners may experience when encountering resistance during transition processes (Theme 2: *Attachment to the status quo*); and
- the limited agency of an individual designer within complex transition contexts (Theme 3: *Agency and positionality*).

This last insight also motivated us to include a positionality statement in the preface of this dissertation.

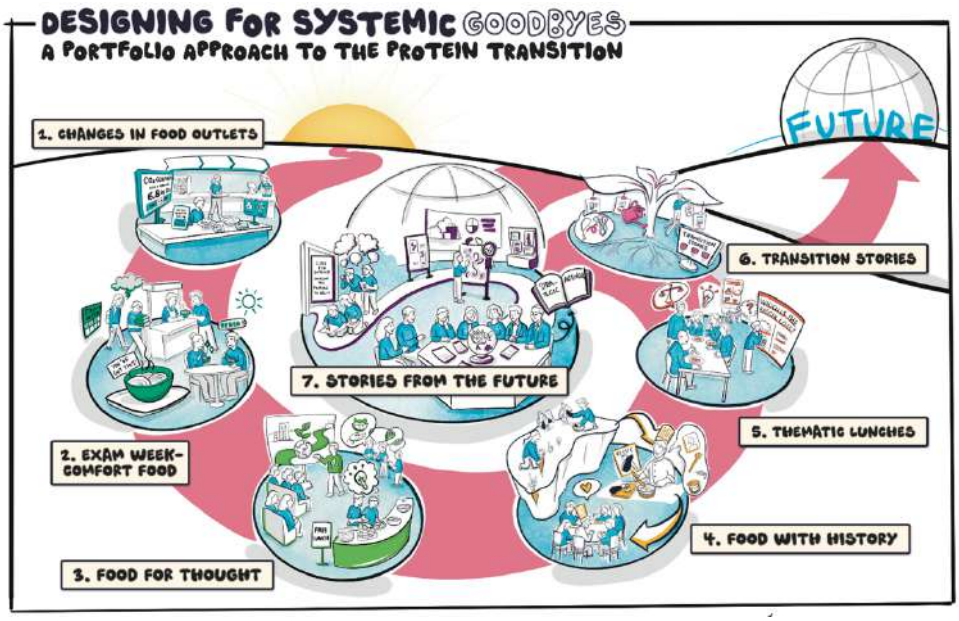


Figure IIId. Intervention portfolio, deanimalising the local food environment at the TU Delft campus (Bernal Leal, 2025)

Reflection by the author: Systemic breakdown *in the protein transition*

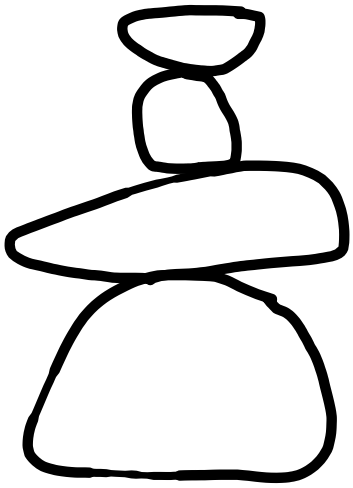
Returning to the protein transition, this final section reflects on interactions between food system actors and myself around the phase-out of factory-farmed animals from our diets. A key moment in these exchanges was a presentation I delivered at Theatre Amsterdam during Plant FWD 2025, a Dutch conference on the protein transition attended predominantly by industry actors. The presentation introduced the concept of exnovation, drawing on historical precedents and examples of creative interventions engaging with deliberate decline in other domains. It concluded with fifteen seconds of complete silence and darkness in the theatre, during which the audience could see only an altar with three candles illuminating a carton of factory-farmed milk - a symbolic farewell to a practice that no longer serves society (photo below).

This immersive and speculative closing ritual prompted numerous requests for interviews and collaborations, suggesting that reframing the transition through the lens of systemic breakdown resonates strongly with diverse actors.

At the same time, subsequent conversations revealed that pursuing deliberate decline demands considerable courage. This was particularly evident in commercial contexts, where embracing decline implies adopting novel business models centred on qualitative, service-oriented forms of growth rather than quantitative, material expansion. While such shifts are technically feasible, they require long-term investments that many organisations may find difficult to make, both financially and culturally.

Discussions at other networking events further indicated that letting go of structures, cultures, and practices associated with excessive animal consumption generates different forms of 'transition pain' across the system. For a dairy farmer, this may involve discontinuing a family tradition that has long been central to their identity. For a policymaker, it may require unlearning an innovation bias embedded in institutional routines. For a consumer, it can mean recognising that a grandmother's beef stew is not solely an innocent expression of care. In this sense, systemic breakdown entails a plurality of mourning processes, each requiring careful calibration and contextual sensitivity.

Taken together, these early explorations suggest that design for decline may constitute a genuinely transformative - yet deeply challenging – domain of knowledge for societal transitions, including the protein transition.



GENERAL DISCUSSION AND CONCLUSIONS

Chapter 7
General discussion and conclusions

7.1 Revisiting the aim

Above all, this dissertation aimed to have tangible impact in both research and practice, for the 'deanimalisation' of our food system and the embrace of goodbyes in transitions. The mix of methods and outputs – research papers, newspaper articles, podcasts, interviews in trade journals, art pieces, student projects – resulted in a package of theoretical and empirical knowledge. Moreover, the pragmatic approach helped build a strong network of co-researchers and practitioners that continuously shaped new initiatives and research questions, also beyond this dissertation. In this general discussion, we look at the knowledge gained from the chapters and intermezzos combined and reflect on their implications for practice, policy, and education.

For knowledge building, the dual goal for this interdisciplinary research was to identify transformative and novel avenues for the protein transition through reframing, and to explore design for systemic breakdown in transitions. We addressed three overarching research questions (figure 7a):

1. What does a transformative design frame comprise in the context of societal transitions?
2. What are novel and transformative avenues for design to foster the plant-based protein transition?
3. How might design support systemic breakdown in transitions?

Together, these questions targeted interdisciplinary knowledge gaps surrounding (re)framing, the role of consumers in transitions, systemic breakdown, and pluralistic approaches to foster transitions. The three parts of the dissertation each provided substantive answers. In this concluding chapter, we review these answers and link them to implications for research, practice, policymaking and education. We close our discussion with limitations and final recommendations.

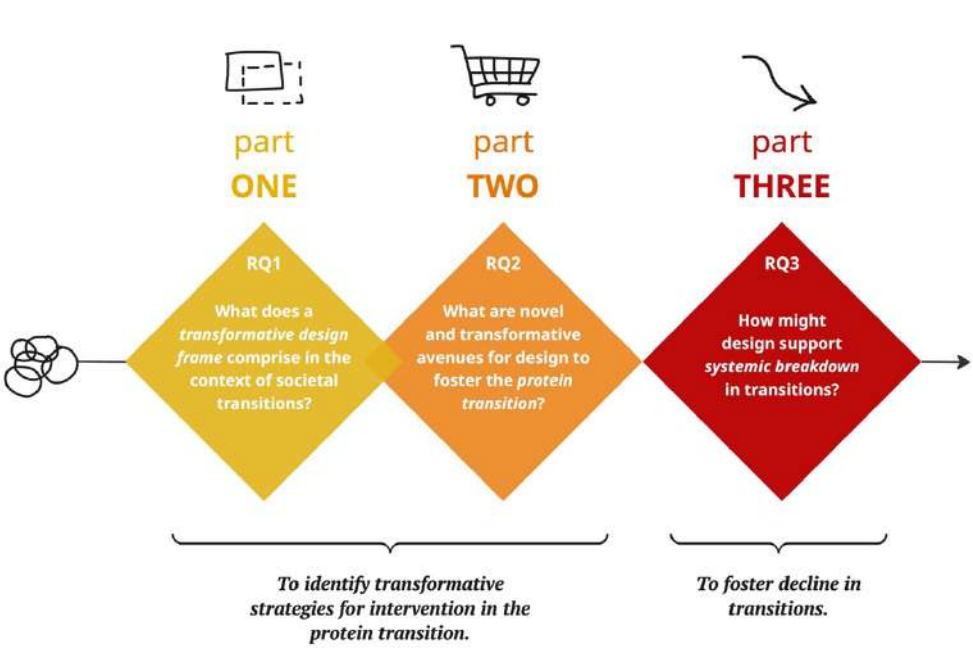


Figure 7a. Three parts of this dissertation, their research questions and objectives. The icons correspond with the four knowledge gap themes they addressed (from left to right: pluralistic approaches in transitions, (re)framing, the role of consumers in transitions, and systemic breakdown).

7.1.1 Pluralistic approaches to foster transitions

Across all three parts, this dissertation illustrates how design offers a pluralistic and actionable approach to foster transitions, which answers to a call in food systems literature (Caniglia et al., 2020) and transition studies (Hölscher et al., 2023; López Reyes et al., 2020; Shove & Walker, 2007; Voß et al., 2009). The model of transformative design frames (Chapter 2) and the Design for Decline research agenda (Chapter 6) both exemplify how design can integrate theory and practice across disciplines to support systemic change. Moreover, this dissertation repeatedly suggested the need for intervention *portfolios*: a plurality of complementary interventions increases their joint transformative potential.

Implications for research • Regarding pluralism, implications for research from this dissertation are twofold. First, as a bridging discipline that generates actionable knowledge for transitions, integrating design can be particularly relevant for empirical transition studies in specific domains, when interventions

are implemented and tested on the ground. Second, for sustainable behavioural research - which often emphasizes individual-level change through singular interventions (e.g. Michie et al., 2011; van Valkengoed et al., 2022) - this dissertation invites a broader and deeper perspective. Echoing recent work in behavioural design literature (Bay Brix Nielsen et al., 2024), as well as in adjacent fields like health psychology. (e.g. Cantera et al., 2015) and implementation science (e.g. Emond et al., 2015), it encourages behavioural researchers to explore portfolios of diverse yet complementary interventions, including those that target social practices (i.e. collective behaviours). Taken together, such systemic-behavioural intervention portfolios are likely more transformative than isolated efforts.

Future research • This dissertation limited its scope to four academic fields: design research, transition studies, sustainable behavioural science, and food systems research. Future transition design research should further explore the integration of additional disciplines, such as political science or death studies (the latter of which offers perspectives on systemic breakdown). Broadening the disciplinary base in this way would not only enrich theoretical understanding but also strengthen the transformative potential of outcomes. A second research opportunity concerns portfolio approaches. While these are well established in fields such as policy studies (particularly on policy mixing, e.g. David, 2017; Kern et al., 2019; Kivimaa & Kern, 2016), design research has generally examined interventions as separate instruments. When multiple interventions are discussed, they are usually treated as loosely connected clusters: sets of experiments or toolkits described in parallel rather than analysed for their interdependencies. Research on design for policy (Bason, 2014; Kimbell & Bailey, 2017) and transition design (Hyysalo et al., 2019; Irwin, 2015) points to combinations of interventions, but rarely conceptualises them as portfolios whose composition, sequencing, and interactions matter. Addressing this gap could strengthen the role of design in transition contexts, where the long-term interplay and adaptability of multiple interventions is critical for transformative outcomes.

7.1.2 Part One: Transformative reframing

The first part of the dissertation theoretically explored what a transformative design frame comprises in societal transitions (Chapter 2). It resulted in a transdisciplinary model that integrated theory from transition studies, design research, and sustainable behavioural science. The model included a transition strategy, systemic levers, behaviour change, and an underlying worldview, spanning societal micro-, meso-, and macro-levels (figure 7b). Four design agencies reviewed the model and confirmed its potential to facilitate more robust design rationales and inspire systematic reframing.

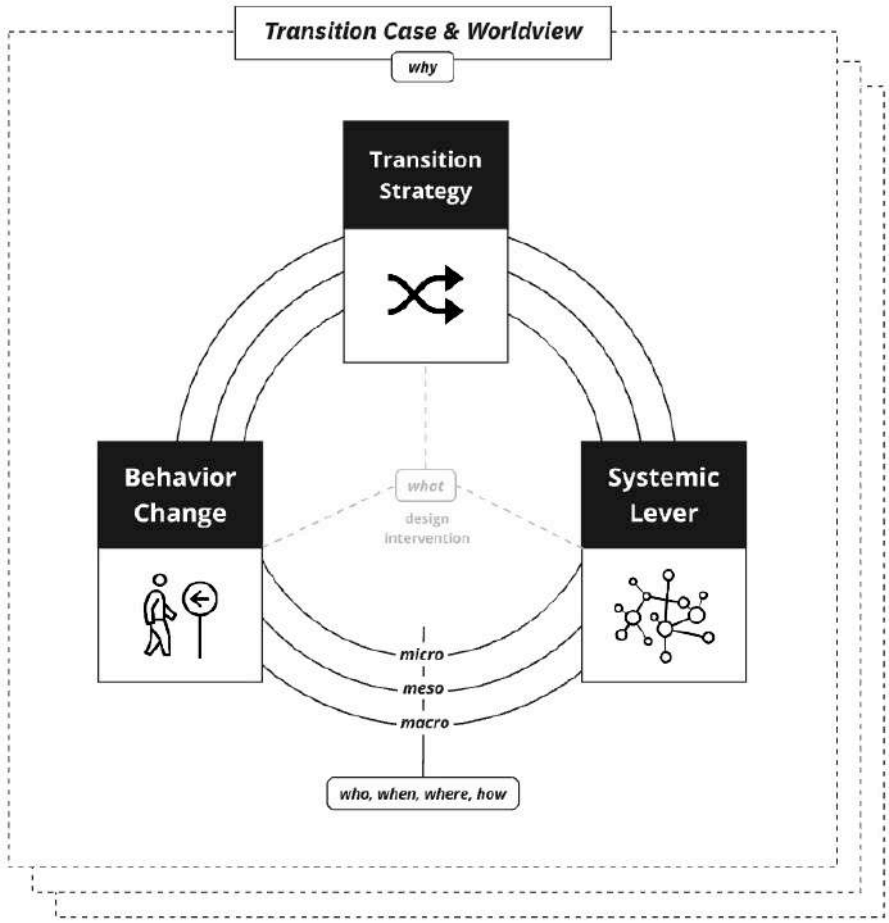


Figure 7b. Model of a transformative design frame, the outcome for our first study (Chapter 2).

While the model's transformative qualities can ultimately only be revealed through application in practice, its theorisation nevertheless guided reasoning and creative explorations throughout the rest of this research. It explicitly informed (re)framing studies in Chapters 3 and 4, structured interviews in Chapter 6, and implicitly shaped Chapter 5 and the Intermezzos. The model served as a constant reminder of the importance of integrating multiple dimensions of systemic change in our reasoning.

Chapters 3 and 4 further illuminated what transformative design frames entail. Chapter 3, drawing on transition theory, suggested that explicitly linking design frames to changing societal ('landscape') structures through narratives increases their transformative potential (Kriechbaum et al., 2023). For example, in the food domain, increased geopolitical unrest and climate crises might pave the way for innovations that boost consumers' resilience, by helping them improvise with available ingredients. Chapter 4 argued that the normative *directionality* of a design frame depends on the envisioned future it aligns with. The expression of a design frame can vary substantially when aligned with an ecomodernist vision than when aligned with a low-tech, regionalist vision. When positioned within the Chapter 2 model, normative orientations fall under the Worldview component, underscoring the importance of normative reflection during reframing.

Implications for research • First, the conceptualisation of a transformative design frame enriches design literature by systematically integrating theoretical concepts from multiple disciplines and further tailoring reframing theory to transition contexts. Second, Chapter 4 suggests that that scenario-based visioning can provide directionality for reframing, illustrating how visioning and pathway development in transitions can reinforce one another. This, in turn, deepens our understanding of how these two practices interrelate in transition design (Irwin, 2015). Third, for transition studies, Chapter 3 demonstrates the value of analysing design frames not only in discourse but also in material interventions, adding methodological depth to framing research.

Future research • In design, future research should further develop and critically assess the theorisation of transformative design frames, with need for empirical studies to evaluate its transformative potential. Similarly, Chapter 4 highlighted the interplay between visioning and reframing, which calls for further examination in real-world transition (design) settings. Studying this interplay explicitly could shed light on how these practices can be aligned most effectively. In addition, Chapter 3 showed how analysing design frames within a domain can

reveal promising pathways for intervention; replicating such analyses in other sectors, like mobility, energy, or fashion, could uncover both established and emerging pathways for systemic change as well.

The insights from Part One provided a foundation for Part Two, which applied the model to the specific case of the Dutch protein transition and examined how transformative reframing can inform design practice in that domain.

7.1.3 Part Two: Reframing for the protein transition

The second part of the dissertation, Chapters 3-5, explored novel and transformative avenues for design to foster the plant-based protein transition. Taken together, Chapters 3 and 4 pointed to six recommended pathways for design and policy to shape the Dutch protein transition (figure 7c).[38] Chapter 3 identified eight 'transition design frames' (i.e pathways for design) currently shaping the Dutch protein transition. It confirmed the dominance of mimicking meat and dairy (the *Tasty Doppelgängers* pathway). Pathways involving regulation and cultural change were recognised as underexplored, while three novel avenues emerged: supporting inclusivity, deliberately reducing animal consumption (i.e. systemic breakdown), and integrating multiple design frames in a single intervention (portfolio).[39]

Chapter 4 expanded this analysis by comparing the eight frames to four scenarios developed in a study by Freedomlab (2024). This revealed the near absence of approaches supporting the reduction of meat and dairy consumption and identified a sixth promising avenue involving *neophobia*: the fear of new or unfamiliar foods.

38 We deliberately use the term 'pathway' to refer to a design frame here, because they have a similar meaning in the context of transitions. These six pathways each involve a unique combination of a theory of change and a (societal-behavioural) outcome – which aligns with our definition of transformative design frames in Chapter 2. Pathway C is slightly different as it proposes the *integration* of other pathways into one portfolio.

39 This pathway can be understood as 'convergent innovation' (Struben et al., 2025). It also aligns with transitions literature on policy mixing (e.g. Kern et al., 2019), which refers to the deliberate combination of multiple policy instruments or approaches to address a complex issue more effectively than any single policy could on its own.

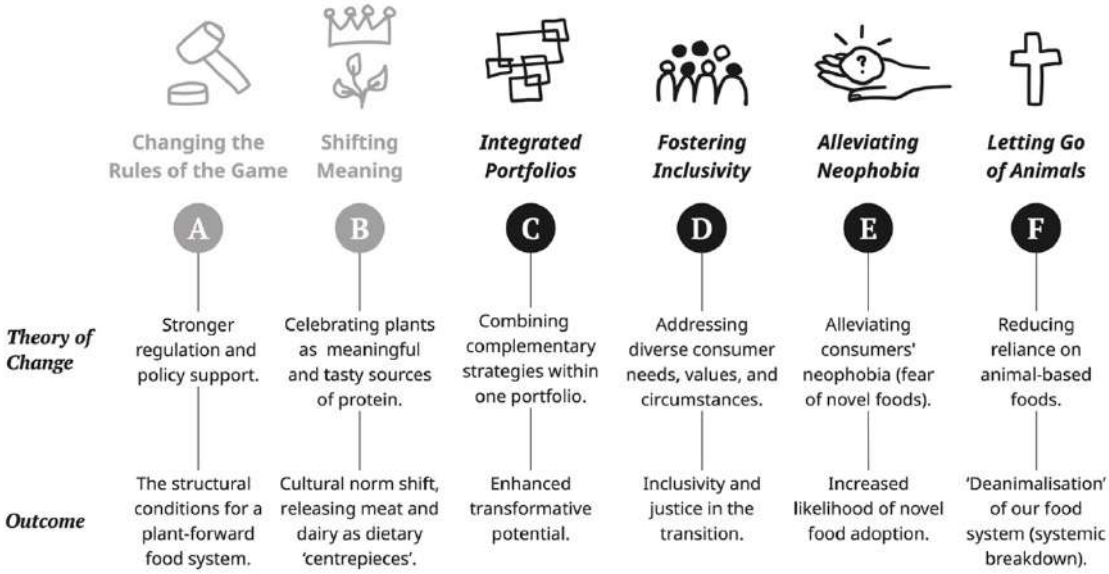


Figure 7c. Six promising pathways for design and policy to foster the Dutch protein transition. Grey icons indicate they are already prevalent in the Dutch protein transition, black indicates underexplored pathways.

Figure 7d visually summarises these six recommended pathways (with icons) alongside the other prevalent pathways in the Netherlands (without icons). The overview reveals their relative (estimated) *transformative* effect on the protein transition and their *novelty* to this transition context in the Netherlands - two qualities explicitly mentioned in the research question of Part Two. Their positioning is informed by theory in Chapters 2-4, combined with an empirical estimation by the primary researcher. Importantly, the visualisation is not conclusive; it is intended to facilitate a reflection on the pathways.

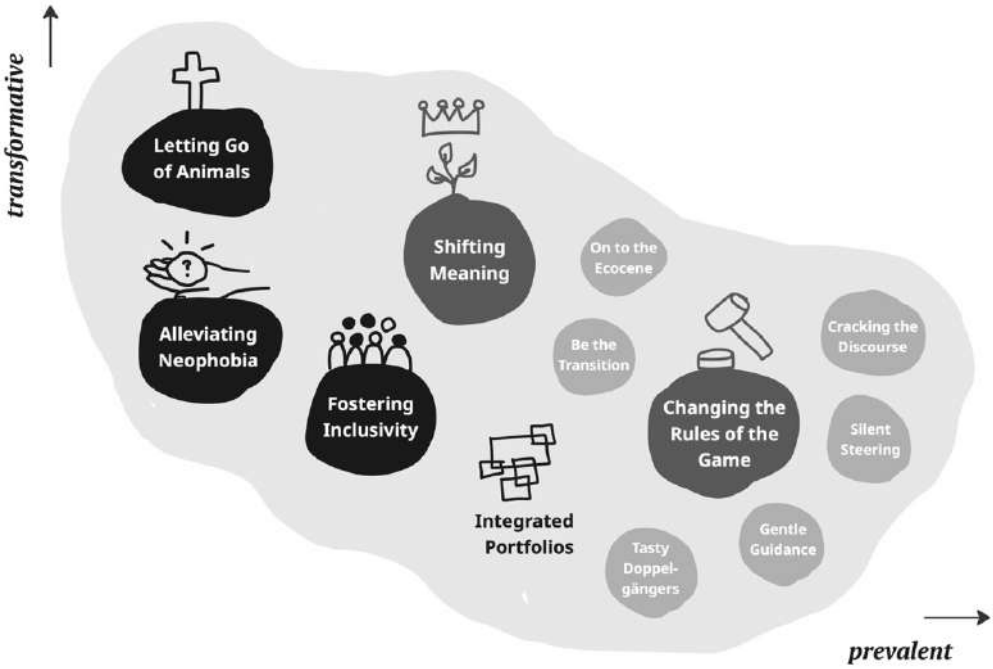


Figure 7d: Pathways for design to foster the Dutch protein transition. The six pathways this dissertation recommends pursuing more are highlighted with icons.

Chapter 2 introduced theories of systems change, emphasising that the most transformative shifts occur at the level of lifestyles (Irwin et al., 2020) and, more profoundly, at the level of mental models (Kania et al., 2018). From this perspective, the *Letting Go of Animals* pathway may be most transformative, as it redefines how animals are perceived in relation to human diets - a point explored further in Part Three. The *Tasty Doppelgängers* pathway, seems less transformative, as discussed in Chapter 3. While this substitution strategy disrupts existing supply chain structures and may increase consumer openness to alternative proteins, it simultaneously reinforces animal-centric norms by imitating meat and dairy, thereby potentially sustaining their cultural status. These analogous products may therefore drive systemic change at a structural level while *reinforcing* animal-based eating practices and cultures (Avelino, 2017). [40] As discussed in Chapter 3, this

40 Notably, many of the other design frames could be applied in a 'reinforcive' way (meaning that they uphold unsustainable/unjust behaviours). For instance, nudging (*Silent Steering*) can be applied to promote cheap meat products during the barbeque season. However, in this dissertation we only explore design frames that may advance the protein transition. The *Tasty Doppelgängers* clearly aim to do so, yet they might (partially) have the opposite effect.

duality illustrates how a single pathway can both enable and constrain transitions - the *Tasty Doppelgängers* seemingly doing both, even at the level of mental models.

Chapter 3 also theoretically discussed the complementarity of different pathways, which Chapter 5 explored empirically by integrating three pathways in one systemic design intervention. While most design frames can be combined into effective portfolios, the *Tasty Doppelgängers* pathway tends to conflict with those aiming at deeper cultural change. For its hindering effect on profound systemic change, much of this dissertation explored how to 'transcend the doppelgänger' through more transformative pathways - a point that also carries practical implications, discussed in sections 7.2 and 7.3.

Implications for research • Part Two has significant research implications across various fields. This dissertation addressed a gap in transition studies by examining consumers as active agents in transitions (Hargreaves et al., 2013; Upham et al., 2025), drawing on design and sustainable behavioural science as consumer-oriented fields. Chapter 5 engaged with consumers directly, while Chapters 3-5 analysed the interventions and choice architecture that influence consumer decision-making within their eating practices. Chapter 4 further linked pathways – each comprising distinct consumer practices - to future scenarios, showing how fostering specific practices can make certain trajectories more likely to unfold. Together, these findings demonstrate that consumers actively shape transitions through their practices, which are themselves influenced by socio-material contexts. For sustainable behavioural science, Chapter 5 also suggests that deliberately integrating multiple frames in choice architecture can be an effective way to shift consumption practices. For food systems research, this dissertation demonstrates that design (with its integrative and generative orientation) and social practice theory (which emphasises how materials, meanings, and competences shape collective behaviours: Shove et al., 2012), may help uncover transformative and actionable strategies to foster plant-based diets. These approaches complement the dominant sociological and consumer behaviour perspectives in the field (for instance, de Bakker & Dagevos, 2012; Pyett et al., 2023).

Future research • For the protein transition, future research could empirically examine how the pathways identified in this dissertation affect different consumer segments with their distinct needs and values (Wang et al., 2021) - an

aspect that this dissertation only explored in the Intermezzos. Studies should also expand beyond consumers to include other system actors, such as farmers and retailers, and examine their roles in shaping the protein transition. Relatedly, research into the interdependencies between actors across the food system is needed (Farla et al., 2012; Wittmayer et al., 2017). Another promising line of inquiry concerns the curation of intervention portfolios: examining which combinations of interventions are most effective across time and space (e.g. different phases of a transition: Rotmans et al., 2001; and varying geographies: Hansen & Coenen, 2015). Finally, Chapter 5 and the Intermezzos explored three novel pathways identified earlier: *Integrated Portfolios*, *Fostering Inclusivity*, and *Letting go of Animals*. Further empirical research on interventions along these pathways is needed to draw more robust conclusions about their transformative potential.

7.1.4 Part Three: Design for systemic breakdown

The final part of this dissertation examined how design can support systemic breakdown in transitions. It responds to a shared gap in both transition studies and design research: the lack of transformative knowledge around design for systemic breakdown. The study presented in Chapter 6 was further motivated by the limited empirical evidence of intentional reductions in animal consumption within the protein transition identified in Chapters 3 and 4.

Chapter 6 therefore advances a proposal for a new area of research and practice, termed Design for Decline. It presents an emerging research agenda that integrates state-of-the-art literature on systemic breakdown from transition studies and design research with empirical insights from 15 experts. The agenda articulates eight knowledge themes around Design for Decline - such as *Conflict in transitions* and *Post-decline futures* (Figure 7e) - which together address both mindset-related and procedural dimensions. These dimensions are crucial for developing an actionable design approach or method (Daalhuizen & Cash, 2021). At the same time, Design for Decline is positioned as a lens within the field of transition design, which can be integrated into established frameworks such as Terry Irwin's Transition Design Framework (2015).

Figure 7e. Eight areas of transformative knowledge around Design for Decline.

Above all, Design for Decline intends to help practitioners *transcend paradigms* - a systemic leverage point with high transformative potential (Meadows, 2009) - and to then guide them through the process of enacting deliberate systemic breakdown in practice.

First explorations of the Design for Decline knowledge themes by practitioners, students, policymakers, and academics suggest strong resonance, although systematic validation did not fit the timeframe of this dissertation. Presentations, workshops, and an art piece sparked deep reflection among audiences, often leading to critical questioning of people's own roles in their organisations and in transitions generally. The concept of 'exnovation' proved particularly evocative.

Implications for research • The implications of Part Three concern the convergence of scarce and fragmented work on the active support of decline across transition studies (Bogner et al., 2024; Köhler et al., 2019) and design research (Coombs et al., 2018; Tonkinwise, 2014). By aligning these strands, Chapter 6 creates a basis for more complementary and transformative engagement with breakdown in both fields. Through the research agenda around Design for Decline, Part Three also lays the groundwork for much-needed empirical research on designing for systemic breakdown in transitions, an area that is only recently starting to be explored (Coops et al., 2024; Noëth et al.,

2023). For sustainable behavioural science, the sixth knowledge theme proposed in Chapter 6 (*Pain and loss in transitions*) suggests that *collective mourning* may constitute a necessary behavioural process in sustainability transitions, building on earlier insights from transitions research (Bogner et al., 2024; Turnheim & Geels, 2012). While sustainability psychology has explored related phenomena - including climate grief, eco-anxiety, and solastalgia[41] (Clayton, 2020; Cunsolo & Ellis, 2018) - the notion of collective mourning as a shared behavioural process that can enable systemic change has received little explicit attention in sustainable behavioural science to date.

Future research • Several areas of knowledge highlighted in Chapter 6 should de deepened. A priority is the exploration of the research questions proposed in the emerging Design for Decline agenda. In addition, existing design approaches - both in transition contexts and beyond - rarely engage explicitly with decline, conflict, loss or pain, revealing opportunities to extend existing methods with tools and interventions that do so intentionally. Such expansion could draw on emerging transition design work - such as *Spaces for Letting Go* (Coops et al., 2024) - as well as insights from other fields, including activism, grief studies, and cultural mourning practices, where processes of confrontation and release are integral to collective transformation. Research and development are also needed for ways to help practitioners shift their mindsets, particularly to overcome an entrenched innovation bias. From a sustainable behavioural perspective, future research could further examine collective mourning as a process in sustainability transitions. Building on climate psychology and transitions literature on decline and exnovation, studies might explore how mourning practices unfold in real-world contexts, and how design can nurture and channel them towards transformative ends. Finally, to complement the initial explorations in Intermezzo III, empirical studies across transition domains are required to validate the transformative potential of the Design for Decline themes identified in Chapter 6.

41 Solastalgia refers to the chronic distress people experience in response to negative environmental change, particularly when it affects a home environment (Clayton, 2020).

7.2 Implications for practice

Characterised by a pragmatist approach, this dissertation has a strong focus on practical relevance. Chapter 2 offers (design) practitioners theoretically robust methodological guidance to design for transitions. The transdisciplinary model of a transformative design frame can directly support the development of a strong design rationale that is considerate of transition and behavioural dynamics, which could help align and mobilise stakeholders. Following the feedback of practitioners in that study, a canvas of the model could be consulted throughout the design process to continuously ensure relevant dimensions of a transition case are not overlooked. Moreover, the model may support transformative reframing, when it is used as an inspirational tool in the creative stages of a design process. Chapter 6 challenges practitioners to transcend their innovation bias and invites them to integrate systemic breakdown into their work by exploring the eight knowledge themes of Design for Decline. Finally, the Intermezzos offer inspirational examples of projects that applied theory from this doctoral research in real-world settings. Together, the outcomes of this dissertation invite practitioners to revisit Herbert Simon's (1996) well-known definition of design as "changing existing situations into preferred ones," and to approach their work with both humility and plural, integrative measures aimed at deep systemic change.

7.3 Implications for policy

Part Two of this dissertation, which focused on ways to advance the protein transition in the Netherlands, holds particular relevance for policymakers. Chapter 3 underscored the need for stronger regulation (the *Changing the Rules of the Game* pathway) to advance the protein transition, implying an explicit call for policymakers to intervene more proactively. Chapters 3-5 combined suggest that the most transformative areas for regulation concern pricing (e.g. fiscal measures in favour of plant-based diets), cultural interventions (e.g. setting plant-forward norms in urban food environments), and systemic breakdown (e.g. restricting the promotion of animal-based foods in public space). These chapters also emphasise the value of portfolio approaches - including policy mixes - that strategically combine multiple interventions to maximise transformative impact.

Implications of Chapter 6 extend beyond practitioners to policymakers, highlighting that the persistent bias towards innovation and growth is equally

entrenched in public institutions. The *Design for Decline* perspective urges policymakers to acknowledge the role of collective letting go in transitions and to institutionalise this insight in policy design and implementation. This is particularly relevant in policy-led phase-out processes. In the protein transition, for instance, recognising the legitimacy of deliberate systemic breakdown could translate into governments explicitly and compassionately offering a plurality of support interventions to dairy farmers as they end practices that have shaped their family identities and livelihoods for generations.

Ultimately, this dissertation calls for policy that governs transitions as living systems - balancing growth with decline and ambition with care - through plural, coordinated measures across domains.

7.4 Implications for education

Design education worldwide is increasingly incorporating themes of systemic design, sustainability, and transition design. The transformative design frame conceptualised in Chapter 2 could enrich such curricula, particularly when reframing is taught as a core design competence. More critically, the Design for Decline agenda outlined in Chapter 6 warrants integration into design education. While design schools have traditionally emphasised creation and innovation, this dissertation provides a timely theoretical foundation for engaging with breakdown processes within design pedagogy. Both the knowledge themes of Design for Decline from Chapter 6 and emerging empirical explorations that foreground design methodologies for systemic breakdown (e.g. Coops et al., 2024; Lockton & Coops, 2025) offer concrete starting points for the development of courses centred on 'designing away'.

For transitions education, such as the MSc in Societal Transitions at Erasmus University Rotterdam, this dissertation underscores the importance of teaching reframing not merely as a strategic or communicative tool, but as a transformative capability to challenge dominant paradigms. Integrating aspects of Design for Decline could also expand the educational repertoire by preparing students to engage with decline, loss, and systemic unlearning.

In sustainable behavioural education, this research could encourage teachers to consider social practices as units of intervention, expanding beyond conventional behavioural tools that target individuals. Additionally, Design for Decline opens

space for integrating collective mourning in curricula as a meaningful and necessary process in sustainability transitions.

Education on food systems and consumer behaviour typically emphasises analytical and behavioural-psychology frameworks, complemented by ethical reflection. It tends to focus on diagnosis and broad, long-term visions. The concrete 'pathways for change' presented in Part Two of this dissertation could add a valuable prescriptive dimension to such curricula, enhancing the practical relevance and applicability of the knowledge students acquire.

Finally, by confronting questions of what should systemically be let go of - and why - the conscious notion of decline could deepen normative and ethical dimensions of education across disciplines.

7.5 Limitations

Given that societal transitions typically unfold over multiple generations, a significant limitation of this dissertation is its relatively short duration of four and a half years. Drawing firm conclusions from our findings would only be possible from a historical vantage point, several decades into the future. For example, the specific role of the *Tasty Doppelgängers* in the Dutch protein transition can only be understood over time. Similarly, the extent to which our conceptualisation of a transformative design frame and the Design for Decline agenda can contribute to transition processes remains uncertain until these ideas have been explored through further research and practice over a longer period. Even then, we may only be able to identify potential correlations between the contributions of this dissertation and broader systemic effects. Establishing a direct causal relationship is unlikely, given the inherently complex and dynamic nature of transitions.

Second, several important dynamics of societal transitions remained underexplored in this dissertation, most notably the role of power and politics and their influence on designing *in* and *for* transitions. While the research engaged with normative orientations, worldviews, and behavioural dynamics, it did not systematically examine how power asymmetries, vested interests, political struggles, or institutional constraints shape which pathways for design become possible, legitimised, or marginalised in practice. This includes, for example, the influence of incumbent actors, regulatory regimes, lobbying, and political ideologies on both the direction and the pace of transitions. Although these

dynamics surfaced implicitly in the empirical explorations - particularly in discussions of resistance, lock-in, and attachment to the status quo in Chapters 3 and 6 - they were not analysed as primary objects of study. A more explicit engagement with political economy, governance studies, or critical policy analysis would be needed to better understand how design interventions interact with power relations and political processes in transitions.

A third limitation involves the generalisability of our findings. Parts One (on reframing) and Three (on systemic breakdown) looked at a variety of transition cases, yet their diversity is still limited due to time and sampling constraints. As such, outcomes of these parts may not apply (entirely) to contexts that were not included. Similarly, Part Two looked at the protein transition in the Netherlands; its relevance for other cultural contexts cannot be assumed without further inquiry.

7.6 Recommendations

This interdisciplinary dissertation has demonstrated the value of *pluralistic approaches* to advance societal transitions, grounded in diverse fields and the strategic use of intervention portfolios. Our primary recommendation is to continue fostering such plurality when addressing today's complex societal challenges. This also means disciplines proactively seek each other's expertise to avoid homogenous 'echo chambers' - a common pitfall across fields.

Secondly, we strongly encourage researchers, policymakers, and practitioners across domains to incorporate *systemic breakdown* into their vocabularies, toolkits, and rationales. This research has shown that build-up and innovation alone represent only part of a change process; equally important is the capacity to navigate decline in transitions.

Finally, this dissertation intentionally opens with a positionality statement. Like any project in academia or practice, it is driven by an underlying agenda. Researchers, policymakers, and practitioners striving for 'better' futures are, in essence, change professionals whose work is inherently *normative*. Yet, in our experience, few explicitly acknowledge the personal and cultural assumptions that inform their decisions. While normativity was not the primary focus of this dissertation, explicitly articulating our normative stance enabled us to position the work more clearly and foster alignment and trust in collaborative partnerships. We therefore advocate for greater transparency around normativity

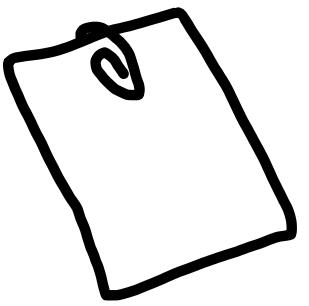
in academia and practice, such as the routine inclusion of positionality statements in research publications and design briefs.

7.7 Conclusions

This dissertation explored how design can contribute to societal transitions through transformative reframing and deliberate systemic breakdown. Integrating insights from transition studies, design research, and sustainable behavioural science, it developed a transdisciplinary model of a transformative design frame and proposed *Design for Decline* as a new area for research and practice. Empirical studies within the Dutch protein transition suggested six promising pathways for design, including novel directions that foster inclusivity and alleviate neophobia.

The research demonstrates that while innovation and build-up are essential in transitions, they must be complemented by the deliberate letting go of practices that are no longer serving society. In doing so, it advances both theoretical and practical understandings of how systemic transformation unfolds. The work also contributes to education, offering frameworks and insights that can enrich curricula in design, transition, behavioural, and food systems studies. Moreover, it calls for normative transparency, urging change professionals to critically examine their own assumptions, positionality, and agency in shaping futures.

Ultimately, this dissertation calls for plural, critical, and reflexive approaches to societal transitions - approaches that make space for both creation and release, and that engage hearts as well as minds. It rests on the belief that such ways of researching and practising can help cultivate more just, resilient, and sustainable forms of coexistence - and on the personal hope that they may bring us closer to the abolition of factory farming.



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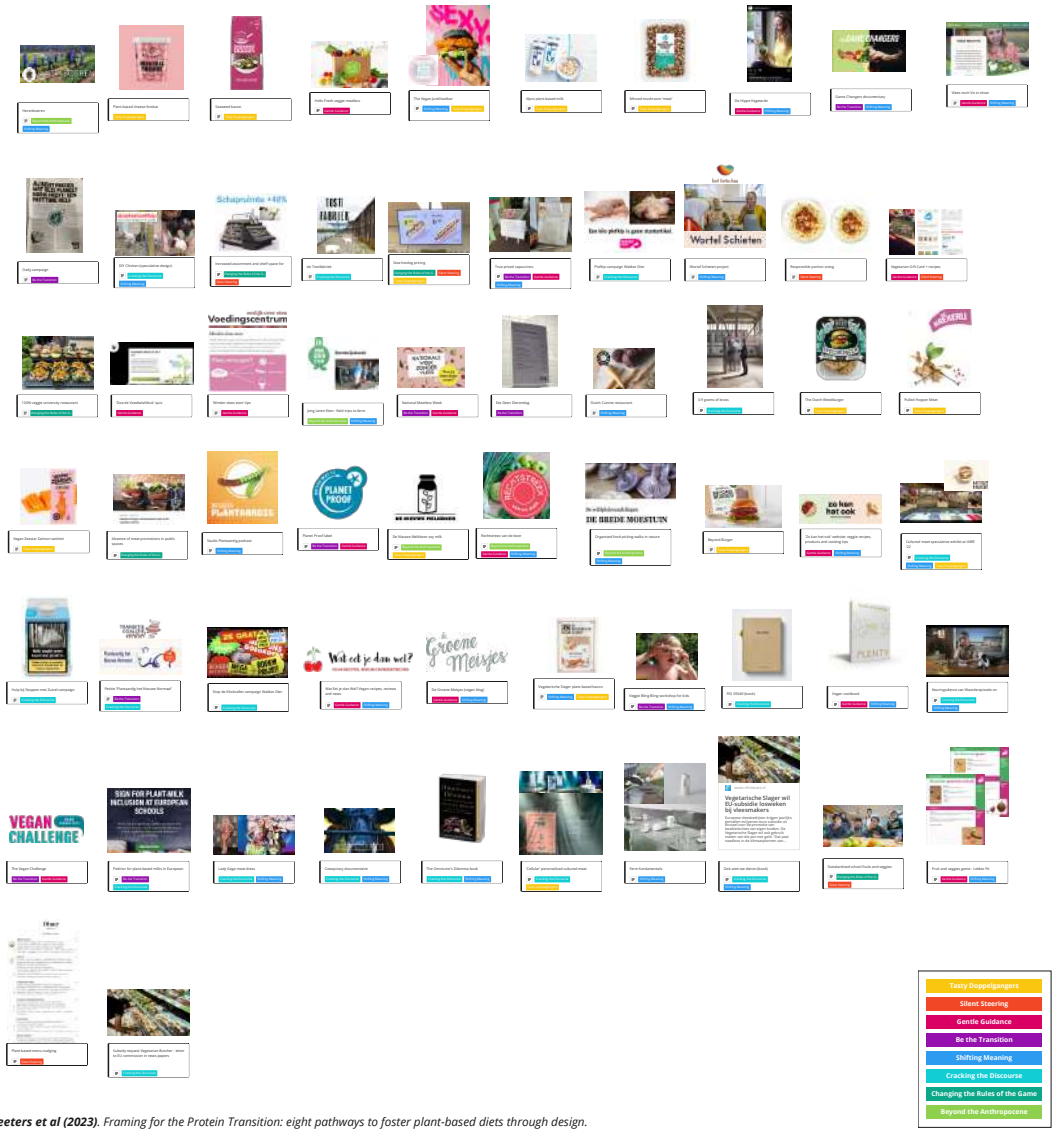
Appendices

Appendix 3A: List of 62 interventions analysed in Chapter 3

High-resolution image can be provided upon request.

		Tasty Doppelgangers	Silent Steering	Gentle Guidance	Be the Transition	Shifting Meaning	Cracking the Discourse	Changing the Rules of the Game	Beyond the Anthropocene	manifestation	creator	source
1	Urban circular farm				x	x			x	product-service system	Herenboeren	https://www.herenboeren.nl/
2	Original Fondue: plant-based cheese fondue	x								food product	Willicroft	https://willicroft.com/original-fondue
3	Seaweed Bacon	x								food product	Seamore	https://www.seamorefood.com/i-sea-bacon/
4	Veggie mealbox			x						product-service system	Hello Fresh	https://www.hellofresh.nl/
5	Vegan fast food restaurant	x				x				restaurant	The Vegan Junkfood Bar	https://www.veganjunkfoodbar.com/
6	Plant-based milk	x								food product	Alpro	https://www.alpro.com/nl/producten/not-mlk/not-mlk/not-mlk-vol/
7	Minced mushrooms	x								food product	Albert Heijn	https://www.ah.nl/producten/product/wi515448/ah-paddenstoelengehakt
8	De Hippe Vegetariër Instagram account			x		x				social media account	De Hippe Vegetariër	https://www.instagram.com/dehippevegetarier/
9	The Game Changers				x	x				documentary	James Cameron	https://gamechangersmovie.com/
10	Vlees noch Vis			x		x				television show	24 Kitchen	https://www.24kitchen.nl/programmas/vlees-noch-vis
11	Part-time hero' campaign				x					campaign	Oatly	https://www.oatly.com/sustainability/empower-a-plant-based-revolution
12	Doe-Het-Zelf Kip (DIY Chicken)					x	x			speculative design	Ultra Ultra	https://www.ultra-ultra.nl/kopie-van-grote-krimp-minimaal
13	Increased space for plant-based products		x					x		retail environment	Dutch retailer	https://nieuws.ah.nl/albert-heijn-zet-standaard-op-plantaardige-voeding/
14	Tosti Fabriek (Grilled Cheese Factory)					x	x			speculative design	Ultra Ultra	https://www.ultra-ultra.nl/kopie-van-dhzkip-minimaal
15	Hot dog pricing	x	x					x		pricing model	IKEA	https://twitter.com/hwremmers/status/1466739204424183812
16	True priced coffees			x	x	x				pricing model	rfood, implemented at Coffee Star, TU De	https://www.facto.nl/21595/cirfood-zet-de-weg-in-naar-zero
17	Plofkip campaign						x			campaign	Wakker Dier	https://www.wakkerdier.nl/campagnes/plofkip/
18	Wortel Schieten					x				social programme	Het Eetschap	https://www.heteetschap.nl/wortelschieten/
19	Responsible portion sizing		x							choice architecture	Green Dish	https://greendish.com/50-gelderse-bedrijven-zetten-zich-in-voor-een-duurzaam-menu/
20	Vegetarian gift card + recipes			x						product-service system	Albert Heijn	https://static.ah.nl/binaries/ah/content/assets/ah-nl/tijdelijk/acties/campagnes/2021/actievoorwaarden-vega-favorieten-2021.pdf
21	100% vegetarian cafeteria					x		x		restaurant	TU Delft faculty of architecture	https://www.tudelft.nl/2021/bk/restaurants-faculteit-bouwkunde-als-eerste-over-op-volledig-vegetarisch-aanbod
22	Doe de voedselafdruk' quiz			x						game	WWF	https://voetafdruktest.wwf.nl/
23	Tips on eating less meat			x						guideline	Het Voedingscentrum	https://www.voedingscentrum.nl/nl/duurzaam-eten/minder-vlees-eten.aspx
24	Field trip to farms for children					x			x	educational programme	Jong Leren Eten	https://www.jonglereneten.nl/boerderijeducatie-0#:~:text=Jong%20Leren%20Eten%20wil%20kinderen,waar%20ons%20voedsel%20vandaan%20komt.
25	National meat & dairy free week			x	x					organized challenge	Week Zonder Vlees	https://www.weekzondervlees.nl/
26	Eat-no-animals day				x					organized challenge	IKEA	https://www.change.inc/agri-food/ikea-restaurants-serveren-volledig-vegetarisch-menu-op-eet-geen-dierendag-32473
27	Dutch cuisine restaurants					x				restaurant	Dutch Cuisine	https://dutch-cuisine.nl/
28	0.9 grams of brass video						x			speculative design	Adelaide Lala Tam	https://adelaidetam.net/09-grams-of-brass
29	the Dutch Weedburger	x								food product	The Dutch Weed	https://dutchweedburger.com/ons-eten/
30	Pulled Hopper Meat	x								food product	De Krekerij	https://krekerij.nl/pulledhoppermeat/
31	Vegan Sashimi	x								food product	Vegan Zeastar	https://www.jumbo.com/producten/vegan-zeastar-zalmon-sashimi-230g-361898PAK
32	Prohibition of meat promotions in public spaces							x		rules / regulation	Municipality of Haarlem	https://nos.nl/artikel/2443046-haarlem-wil-geen-vleesreclames-meer-in-de-openbare-ruimte
33	Podcast on the Protein Shift					x				podcast	Studio Plantaardig	https://www.studioplantaardig.nl/
34	Planet Proof product labeling			x	x					food packaging	On the Way to Planet Proof	https://www.planetproof.eu/en/
35	Local soy milk	x							x	product-service system	De Nieuwe Melkboer	https://nieuwemelkboer.nl/
36	Local fresh produce retailer	x				x			x	product-service system	Rechtstreex	https://www.rechtstreex.nl/
37	Wild mushroom picking walks					x			x	educational programme	De Brede Moestuin	http://www.debredemoestuin.nl/wordperssmaken/basistraining-paddestoelen/
38	Plant based burger	x								food product	Beyond Meat	https://www.beyondmeat.com/nl-NL/products/the-beyond-burger
39	Zo kan het ook': veggie recipes, products and cooking tips			x		x				website	Zo Kan het Ook	https://zokanhetook.nu/
40	Synthetic Cultures - on cultured meat	x				x	x			exhibition	2050+ (exhibited at IABR ' 22)	https://2050.plus/projects/synthetic-cultures/
41	Anti dairy campaign						x			campaign	Animal & Rights Foundation	https://www.dierenrecht.nl/stoppen-met-zuivel
42	Petition plant-based 'the new normal'				x		x			petition	Transitiecoalitie Voedsel	https://transitiecoalitievoedsel.nl/plantaardig-het-nieuwe-normaal/
43	Anti-cheap-meat campaign						x			campaign	Wakker Dier	https://www.wakkerdier.nl/campagnes/kiloknaller/
44	Vegan recipes, reviews and news			x		x				website	Wat Eet Je Dan Wel?	https://wateetjedanwel.nl/
45	Vegan blog			x		x				website	De Groene Meisjes	https://www.degroenemeisjes.nl/
46	Plant-based bacon	x								food product	The Vegetarian Butcher	https://www.devegetarischeslager.nl/producten/retail/vegan/geroockte-speckjes.html
47	Veggie Bling Bling workshop for children				x	x				educational programme	Marije Vogelzang	https://www.marijevogelzang.nl/past-projects/veggie-bling-bling/
48	PIG 05049					x	x			book	Christien Meindertsma	https://christienmeindertsma.com/PIG-05049
49	Plenty - vegan cookbook			x		x				book	Yotam Ottolenghi	https://ottolenghi.co.uk/plenty
50	Het 'dikbilrund'					x	x			documentary	Keuringsdienst van Waarde	https://www.npo3.nl/keuringsdienst-van-waarde/14-01-2021/KN_1724995
51	Vegan challenge			x	x					organized challenge	The Vegan Challenge	https://veganchallenge.nl/
52	Petition for plant-based milks in European schools				x		x			petition	Proveg	https://proveg.com/nl/schoolmilk-petition-ended-2/
53	Meat dress					x	x			(fashion) activism	Lady Gaga	https://www.youtube.com/watch?v=Kk0M54MPEqg
54	Cowspiracy: the Sustainability Secret					x	x			documentary	Kip Andersen	https://www.cowspiracy.com/about
55	The Omnivore's Dilemma					x			x	book	Michael Pollan	https://michaelpollan.com/books/the-omnivores-dilemma/
56	C3llular: design your own cultured meat product	x				x	x			speculative design	a Ceccarelli (exhibited at Dutch Design W	https://ddw.nl/en/programme/7688/embassy-of-food
57	Farm Fundamentals					x				product	Floris Meijer	https://www.studioflorismeijer.nl/farm-fundamentals
58	Ooit aten we dieren					x	x			book	Roanne van Voorst	https://uitgeverijpodium.nl/product/8091/
59	Fruit & veggie maths game			x		x				game	Gezonde Leefstijl op School	https://www.gezondeleefstijlopschool.nl/jong-lekker-fit-activiteiten/
60	Standardised fruits & veggies at schools		x					x		subsidy	Dutch government	https://www.rvo.nl/subsidies-financiering/schoolfruit-en-groenten
61	Plant-based nudging menu		x							communication	Brasserie le Nord	https://lenord.nl/
62	Subsidy request for plant-based meat analogues	x					x			activism	The Vegetarian Butcher	https://www.rtlnieuws.nl/economie/artikel/5046851/vegetarische-slager-subsidie-eu-vlees-promotie-vleesvervangers-timmermans

Appendix 3B: Visual overview of 62 consumer interventions analysed in Chapter 3. High-resolution image can be provided upon request.



***Peeters et al (2023)**. Framing for the Protein Transition: eight pathways to foster plant-based diets through design.*

Appendix 3C: Interview guide from Chapter 3

Setting the stage

- Thanks for participating
- This interview is about framing within the Protein Shift (explain)
- 60 minutes, how tight in time are you? Can we run over?
- Ok with audio/video recording?
- Consent form

Introduction

- What do you do?
- What type of proteins do you eat yourself?

Frames in the Protein Transition

- What role do you consider having in the Protein Shift?
- What are your general thoughts on the Protein Transition?
- What is needed most, to foster this transition?
- What do you consider to be the main (societal) issue that the Protein Transition would solve? Are there multiple issues? *(= value)*
- Which solutions (innovations / interventions / initiatives) do you consider most promising and why? *(= what + mechanism)*
- Which barriers do you see for the transition to take place? (e.g. policies, behaviours, incumbent structures, institutions, norms, paradigms)

Accelerating the Transition

- What do you consider indicators of the transition happening? (e.g. # of people choosing plant-based alternatives, # of vegetarians in NL, # of media outlets on meat consumption, new policies supporting the transition, etc)
- What do you consider indicators of the acceleration of the transition?
- Can you give examples of innovations/initiatives that have accelerated the transition so far? Why do you think they were so effective?
- Do you remember certain pivotal moments in the transition? What were they about?

Framing process

- Where do dominant frames come from? (actors/events)
- Where do you see frames clashing? / Where do you see tension fields (between actors) within the system? What do you believe causes this?

- What do you feel is important in framing for this transition?

Wrap-up

- Summarise
- Discuss next steps (what will be done with data)
- Tips for other interviewees
- Thanks

Appendix 6A: List of interventions fostering systemic breakdown

	Intervention	Description	References	Category
I-1	Regulatory interventions	Government-imposed bans, incentives, standards or moratoria	Heyen et al. (2017); Turnheim & Geels (2012)	Structural
I-2	Market-based interventions	Carbon pricing and subsidy removal	Rosenbloom & Winscheid (2020)	Structural
I-3	Institutional interventions	Stakeholder commissions	Brauer et al (2020)	Structural
I-4	Legal interventions	Phase-out mandates, treaties, litigation and judicial pressure	Trencher et al (2022); Setzer & Hingham (2022)	Structural
I-5	Inhibition, erasure, removal	Limiting access, removing, or preventing future use of technologies or practices	Pierce (2012); Tonkinwise (2014)	Structural
I-6	Disowning	Dematerializing practices through sharing models and servitization to reduce physical ownership.	Tonkinwise (2014); Cheng (2016)	Structural
I-7	Environmental restructuring	Altering physical environments to demote unsustainable behaviour	Tonkinwise (2014)	Structural
I-8	Convergent design	Replacing multiple products with one multi-functional product (e.g. smartphones).	Tonkinwise (2014)	Structural

I-9	Symbolic substitution	Replacing unsustainable practices with symbolic or emotional alternatives.	Pierce (2012); Bogner et al. (2024); Roster (2014)	Cultural
I-10	Restoration	Reviving older, more sustainable alternatives and traditions.	Pierce (2012); van den Elzen et al. (2024)	Cultural
I-11	Downshifting	Reducing work and income to increase time for sustainable living and reduce consumption.	Kennedy et al. (2013)	Cultural
I-12	Vilifying communicatio n	Stigmatizing harmful practices to influence public perception and behaviour.	Tonkinwise (2013); Feola (2019); Peeters et al. (2024)	Cultural
I-13	Compensation	Financial or symbolic compensation to offset perceived losses from transition.	van den Elzen et al. (2024); Nacke et al. (2024)	Emotional / structural
I-14	Practical support	Offering practical guidance and tools to navigate systemic decline and change.	van den Elzen et al. (2024)	Emotional / structural
I-15	Grief or divestment rituals	Cultural or symbolic rituals to support emotional letting go.	Roster (2014); Chamberlin & Callmer (2021)	Emotional / cultural
I-16	Spaces for letting go	Creating supportive spaces for processing emotions in transitions and phase-outs.	Coops et al. (2024); van Mierlo & Beers (2020); van Oers et al. (2023)	Emotional

Appendix 6B: Interview guide for Chapter 6

Welcome

- How are you today?
- Agree to record?
- Background of this project

Introduction

- What do you do? What do you consider as your expertise?
- How do you contribute to system breakdown in your work?
  E.g. analysing / facilitating / experimenting / advocating for / …

Example case of system breakdown (selected before interview)

- What is an exemplary case that you have worked on?
  1+ transitions, depending on the participant. Triggers, scope, etc.
- Which social practices were untenable in this transition?
  Actors involved, materials, meaning, skills
- **Probe 1:** In terms of breakdown / decline, what happened in your case? (x-curve)
  Downward curve + influence of upward curve on breakdown

BREAKDOWN STRATEGY

- Were there different visions on *what* to eliminate?
  What to eliminate; conflicting visions → one 'winner'?
- Were there different ideas about *how* to achieve the elimination? → **theories of change**
  How to achieve the elimination: erasure, inhibition, displacing, restructuring, disowning, vilifying / celebrating, foreclosure → maybe use one as example for next questions?

SYSTEMIC LEVERS: Probe 2

6 conditions of Systems Change, Kania et al (2018)

- Which system structures had to be broken down?
  E.g. rules, policies, resource flows, material stuff.
- What happened to relationships between actors?
  Winners and losers, power dynamics.
- Which deeply held beliefs were threatened?
  Mental models, habits of thought influencing how we think, do and talk.

BEHAVIOUR CHANGE: Probe 3 → also focus on **group level**
COM-B model

- What motivated actors to hold on to their existing practices? And what to let go?
  Specify per actor. Did an attractive alternative play a role (system build-up)
- Which skills or capabilities became obsolete? What needed to be unlearned?
  Specify per actor.
- Which kind of physical & social environment could support actors to let go?
  Opportunties for BC.

FRAME EFFECTIVENESS

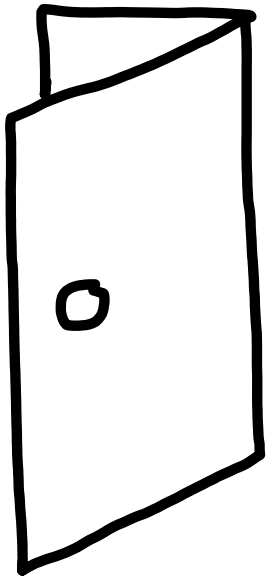
- Which type of strategy was effective in fostering breakdown and why?
  Frame qualities: inspiring, original, robust, thought-provoking
- How did interventions (which you developed) help actors to let go?
  Discuss 1+ example(s)
- What was the outcome of this intervention?
  i.e. frame/intervention's effect

Closing

- *For practitioners*: anything you would have done differently?
- Anything you wish to emphasize?
- Recommendations for participants (especially practitioners)
- Final remarks?

The privilege of a lifetime
is to become who you truly are.

Carl Jung



IN CLOSING

Epilogue

Here we are: four and a half years, my second child Maya, and a dissertation later. When I began this PhD journey, I could not have imagined where it would lead or how it would transform me. I am hopeful that this work has touched some hearts and minds in a meaningful way, perhaps even contributing to the abolition of factory farming. Along the way, this journey has been as much one of inner transformation as of intellectual discovery.

To my surprise, my young children became one of my greatest blessings throughout these years. They were a constant reminder of why this work matters and the reason I kept going - yet, ironically, they also kept me from going too far. To be present for them and to rest sufficiently, I refrained from working late into the night or through weekends. Mothering them offered me the necessary *Ma* - the space in between things - that allowed this PhD to breathe and unfold more thoughtfully. Their presence taught me to pause frequently, step away, and return to the work with fresh eyes.

Because of what I learned through this research, I now see our social practices and daily decisions through a systems lens. I notice the hidden connections between small choices and larger societal patterns - food choices, of course, but also things as ordinary as online shopping or gifting at children's birthday parties. This shift has sparked many deeply meaningful discussions with colleagues, friends, and family, and has quietly changed how we live our everyday lives at home.

This journey has also made me far more societally engaged. Working on questions that touch the world so directly has been deeply fulfilling, and I can no longer imagine doing work that feels detached from societal relevance. Somewhere along the way, I realised that I have arrived on my own path in life, the one I am meant to walk while I am here. Boundaries between my professional and private life have dissolved, in a good way - what I do and who I am have begun to feel like one and the same.

Through this process, I developed a sharper awareness of how research travels - how insights can resonate when disseminated across society. It deepened my appreciation for storytelling and forms of communication that engage diverse audiences. I have learned that I feel most energised in roles that blend direction-setting with building connections: inspiring, linking, and mobilising people across fields and cultures. My international upbringing and design background have also shaped a comfort with inhabiting the space between perspectives, where translation and transformation meet.

Looking ahead, I hope to continue this work as a designer and action-oriented researcher - contributing to the protein transition and to the broader art of fostering systemic breakdown. These two topics, somehow, do not tire me.

And yet, I am glad this particular journey has come to an end. The long hours behind a computer are what I will leave behind most easily. The first thing I will do once I finish writing this dissertation is a cartwheel. That time has finally come. Here we go!

Acknowledgements

This section can only be long. To do this work, I stand on the shoulders of many people I do not even know. I would like to start by thanking all the men and women who have fought for science as an established way of 'understanding' the world, and the emancipation of women in the workforce. Without them, I would not have had this opportunity in the first place. Also, to all the academics and other creatives who published related work before me, thank you for providing the dots that I could connect to one another.

Then a big thank you to **Paul** and **Nynke**, my two initial supervisors who stole me away from design agency Livework in 2021. I am so grateful we always stayed in touch. Thank you for always believing in me, critiquing my ideas with love, and opening doors. I have sincerely missed you since you've left the TU Delft but know you are always one call away.

Jaap and **Jotte**, you stepped in as my new supervisors, a fresh breeze in the middle of my PhD. You have been so inspirational and reliable, I could not have wished for a more solid and supportive team. Thank you for always cheering me on and minding my wellbeing, while keeping me in check when I embarked on yet another 'side project' or conference. You have given me a super safe space to finish this work, which I know is not to be taken for granted.

Despite the solitary project this PhD essentially was, I did it as part of the **Studiolab,** the **Sytemic Design Lab** and the **Food and Eating Design Lab** at our faculty. Thank you to all my colleagues for the sparring, motivation, inspiration and exchange of personal stories. It made it all feel much less lonely. **Hannah**, thank you for riding a very similar wave by my side. It was a blessing having you around as a confidant and now a paranymph, always cheering me on and ready for a chat. Your presence and thoughtfulness have been priceness, and I truly hope our journeys will intertwine again. **Evert**, thank you for our relaxing, honest, and non-judgmental chats. You made me feel at home when I needed it most. **Laura**, thanks for always bringing lightness and realness to the table, you're so good with words I just enjoy hearing you talk. **Thomas**, thank you for your sharp eye, the countless check-ins during the final stretch of my PhD and for being such a reliable partner in our shared communities. **Rick**, thank you for our shared love for food, design and most importantly Maastricht, jeh joah! **Sine**,

thank you for our lovely collaborations and shared motherhood as SDL-ers, I always feel right at home with you. **Mieke**, although you have moved on, you have been so inspirational as a design leader and researcher when you were still around, thank you for being a role model. **Lise**, thank you for our yin-yang collaborations, we were really getting into it as a team. **Timothy** and **Deanne**, thank you for your sincere interest and for letting me pick your beautiful brains during our unplanned chance encounters. You have really helped shape some of my main arguments and activities. **Sophie**, you've been inspirational by being so unapologetically *you*, thank you for your authenticity. **Caiseal**, your sharp reflections and humour make me listen to anything you've got to say. And thank you for fighting for the PhD's wellbeing here at the TU Delft. **Enne**, our chats made the studiolab feel like home for me right until the bitter-sweet end. **Ianus** and **Aadjan**, thank you for offering a stable and warm environment for me to do my research, and for celebrating any milestones along the way. **Haian**, your worldview is fascinating to me and you have been incredibly reliable and inspirational as a sparring partner. I sincerely hope our paths will cross in Shanghai someday.

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I would like to thank the graduation students who had the courage to take on the incredibly complex challenge of designing for transitions: **Maaike**, **Mariska**, **Evelijn**, **Daniek**, **Gijs**, **Ariëla**, **Inés**, and **Mayra**. Especially the last two bit off more than a grad student would usually chew, but you proved us all that it can be done. You have inspired me and shaped this dissertation significantly.

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Without a tribe of friends and family, where would I be. I want to thank my friend of 36 years **Janneke**, who was my rock as a child and continues to be that. **Meret**, **Darinde**, **Frederike**, **Rosèl**, **Siobhan**, **Lisa**, **Julia, Puck** and **Catherine**, thanks for always showing up and accepting me in any state. Thank you to my dear 'hertjes', **Nellie**, **Vla**, **Teus**, **Pip**, **Snor**, **Bel** en **Luis**. You are and always will be my chosen sisters. **Elsien**, **Lonneke**, **Martine**, **Nicky**, **Nicolien**, **Patricia** and **Floor**, the social fit ladies, and **Toscane**, **Simone**, **Jeroen**, **Virpi**, **Bastijn**, **Elsemiek** and **Victor**, my Marmerhof neighbour community, thank you for providing me with a sense of home in Rotterdam.

Moving on to my home, I of course want to thank my family and extended family across the Netherlands, Brazil, and the United States. **Mamãe** en **papa**, you have given me such a solid base, stimulated my creativity, and helped me build bridges in any cultural setting. Nothing ever seemed 'crazy' in your eyes, and I was allowed to follow my enthusiasm wherever it would take me. Thank you for all that. **Isabella**, **Rafaël**, and **René**, my three siblings, thank you for consistently cheering me on and showing genuine interest in my PhD journey. Isabella, you kept surprising me with your curiosity about the process, hungry for all the nitty gritty details – and thank you for setting off the imaginary confetti cannon once I finally hit the milestone of handing in my draft. I felt so seen by you throughout the entire journey.

To all my other relatives, as well as those gained by marriage to Bart: thank you for providing me with such a warm safety net. Especiallt you, **Jan**, **Debby**, **Mieke**, **Paul**, **Ruud**, **Geretta**, **Beatriz** and **Minttu**, and the entire **Meerburg-van Engelen** 'clan.' **Helena**, you are all the way in Rio, but remain close in spirit, I hope to share this with you soon in person. And **Kiki**, no longer physically with

us, I miss you and know you would have been so proud. Your unconditional love until you passed has meant the world to me: *obrigadão*.

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[42] *Ma* (間) is a Japanese concept without a direct equivalent in other languages. It refers to empty space or in-betweenness

About Anna-Louisa

Anna-Louisa Peeters (1988) is a Dutch-Brazilian design researcher. Born and mostly raised in Maastricht, the Netherlands, she has also lived in Rio de Janeiro and San Francisco. After completing both a Bachelor's and Master's degree in Industrial Design Engineering at Delft University of Technology, she worked for several years as an in-house service design consultant at Rabobank. She then joined the international design agency Livework, where she helped public and private organisations around the world strengthen their design capabilities and enhance customer experiences.

In 2021, Anna-Louisa returned to academia to pursue a PhD focused on design for the protein transition - a topic close to her heart. Her doctoral research combines scientific inquiry with practice-based exploration, public engagement, and an integration of the arts.

Anna-Louisa currently resides in Rotterdam, the Netherlands, with her husband, two children, a cat, a praying mantis, and approximately 25 crickets (the mantis' food).

Scientific publications

- Transformative design frames: a transdisciplinary model to support designing for sustainability transitions. **Peeters, A**., Tromp, N., Hekkert, P.P.M. (2025). *Contexts: The Systemic Design Journal. Volume 3*.
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Media appearances

- **Featured**: Design for Decline (and the 'Dismantling' art piece). *Dutch Design Week*. 21 October 2025.
- **Interview**: "Om de eiwittransitie te versnellen, moeten we vleesvervangers overstijgen. Nu blijven we rommelen in de marge". *Food Inspiration trend report*. November 2025.
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Interactive Experiences

- **Workshop**: "Design for Decline in practice." *Climate-action 'Wavemaker' session, hosted by The Good Wave.*
  Brussels (BE), 21 April 2026 (in production).
- **Interactive experience**: "Design for Decline, for a Thriving Planet." *Dutch Design Week: 4TU dialogue session & interactive exhibition.*
  Eindhoven (NL), 21 October 2025.
- **Lecture and interactive panel dicussion**: "Moedig afscheid. Loslaten in de Voedseltransitie." *Springtij Forum.*
  Terschelling (NL), 26 September 2025.
- **Art piece**: "Dismantling." Traveling object to foster dialogue about phase-outs in transitions.
  May 2025 - present.
- **Theatrical keynote**: "Time to Sit in the Dark." *Plant FWD 2025.*
  Amsterdam (NL), 8 April 2025.
- **Interactive presentation**: "Framing: Voor de transitie naar een plantaardige toekomst." *Internationale Architectuurbiënnale Rotterdam (IABR) 2024: Nature of Hope.*
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- **Table conversation host**: "Waar liggen kansen voor reframing in de eiwittransitie?" *Dutch Design Week: Embassy of Food Conference.*
  Eindhoven (NL), 26 October 2023.

BEYOND MEAT AND "MORE!"

As the world faces intertwined social and environmental crises, new ways of thinking and acting are urgently needed. This interdisciplinary dissertation explores how design can foster societal transitions through *reframing*. It develops a theory of transformative reframing and applies it to the protein transition—the shift away from animal-based toward predominantly plant-based diets. Using mixed methods, the dissertation identifies both promising and overlooked pathways for change within the protein transition and beyond. It highlights systemic breakdown as a largely neglected yet critical domain for future design research and practice. The key contributions of this PhD work lie in integrating diverse disciplines and bridging academic inquiry with practice-based exploration, thereby addressing transition challenges in a pluralistic and action-oriented way.

TU Delft