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## Transformative Design Frames: A transdisciplinary model to support designing for sustainability transitions

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### 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.

Keywords: framing, design for transition, sustainability transitions, transdisciplinary

## 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.

## **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<sub>2</sub> 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., 2020; 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 1). 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; Robinson et al., 2011). 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 (2020) 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; Sienna 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.

## 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, activist 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 1) and arranged logically (Figure 1). Figure 2 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.

Table 1. Building blocks of a transformative design frame.

<b>Key dimensions</b>	<b>Units of analysis</b>	<b>Examples of frameworks, methods and tools</b>	<b>Component in design frame model</b>
<b>1 Selective Lenses</b>	Geographical, temporal, and sociological scales	Multi-Level Perspective, Domains of Everyday	Macro-meso-micro scales
<b>2 Problem Diagnosis</b>	Core paradoxes, actors, behavioural barriers, socio-technical systemic barriers, problem boundaries, transition “title”	Sustainable Development Goals, Multi-level perspective	Transition case
<b>3 Future Prescription</b>	Visions, transition pathways, scenarios, interim objectives	Vision-led backcasting, X-Curve	Transition strategy
<b>4 Theories of Change</b>	Systemic leverage points, social practices, human behaviour	Theory of leverage points, social practice theory, Behavioural determinants	Systemic lever, Behaviour change
<b>5 Subjective Judgments</b>	Biases, values, perceptions, assumptions	Green Growth vs De-growth, Vision in product design	Worldview

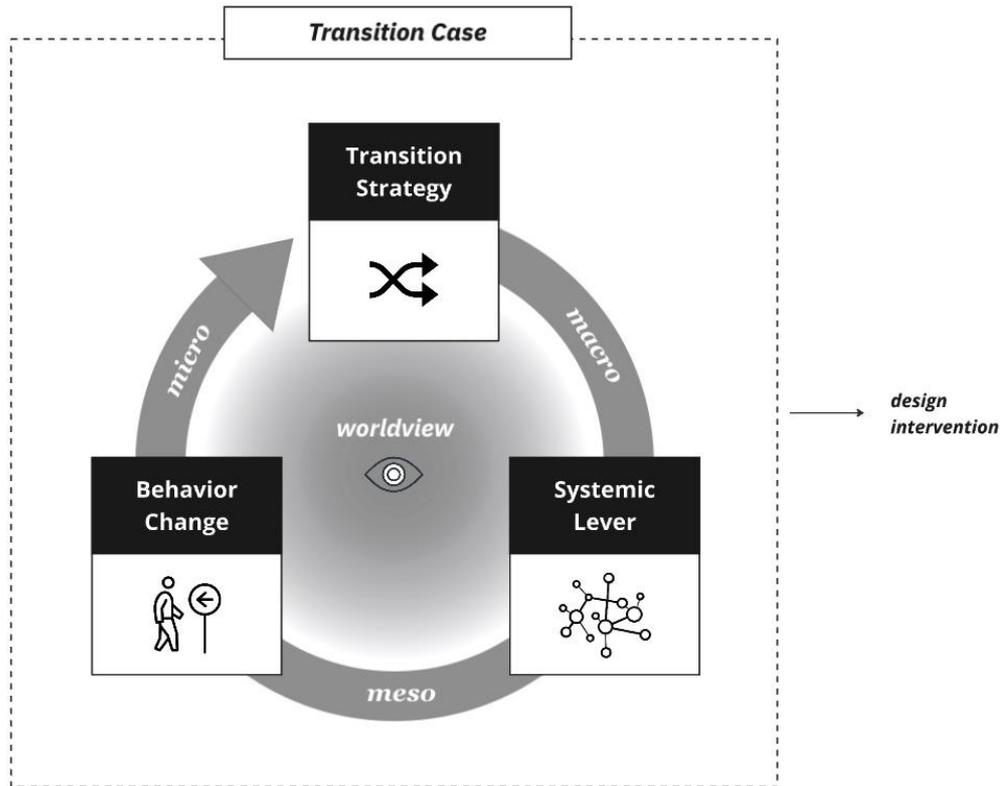


Figure 1. The initial version of the model of a transformative design frame.

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 (Table 2). 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.

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



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

## 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 3).

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 4 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.

*Table 3: The eight themes in the framework analysis.*

<b>Design Frame Model</b>	1. Worldview
	2. Transition Case
	3. Transition Strategy
	4. Systemic Lever
	5. Behaviour Change
<b>Research Questions</b>	6. RQ1: How well does the model correspond with design frames from practitioners?
	7. RQ2a: How does the model support the development of a design rationale?
	8. RQ2b: How does the model support the development of a reframe?"

Table 4: The participating design and innovation agencies of the study.

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

## Research Procedure

The research procedure is depicted in Figure 2. 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 (Appendix A). Each of the three following review sessions had the same agenda, duration, material support, and version of the design frame model (Figure 1). Participants plotted their case and chosen frame on elaborate canvases of the model (Appendices B-D). Thereby, the outputs of each session aligned with the analysis themes.

After the review sessions (Figure 3), 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.

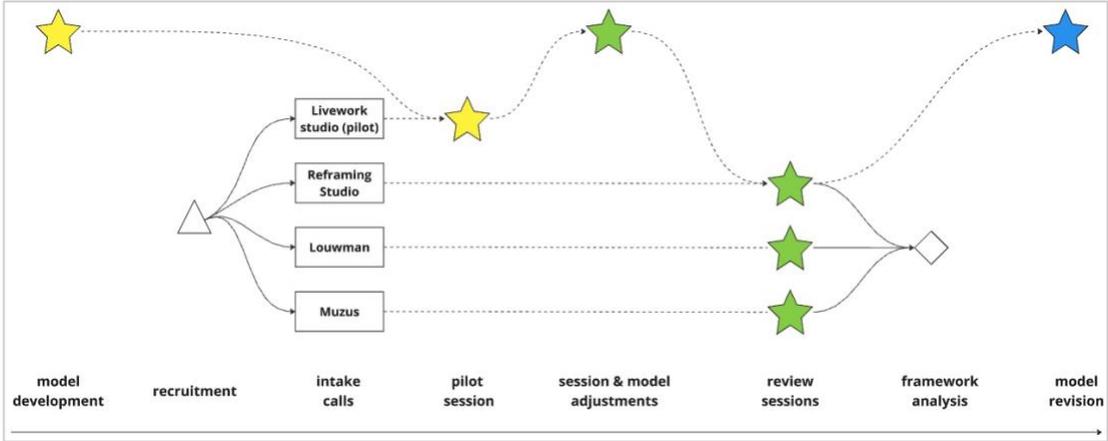


Figure 2. Research procedure.



Figure 3. Pilot review session with Livework Studio.

## 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 4, 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 5. 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.

### 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.

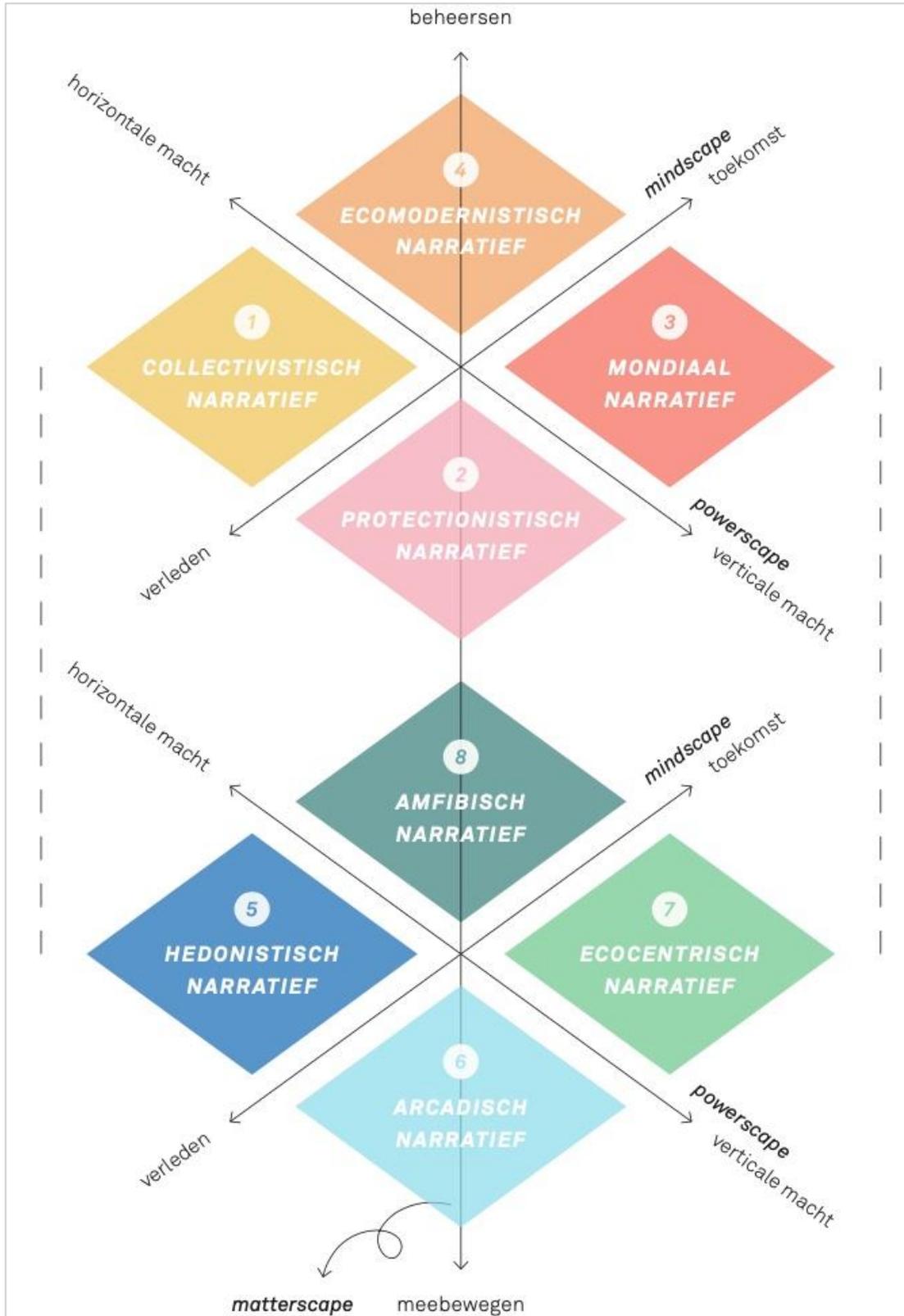


Figure 4: Eight narratives, or frames, developed by Reframing Studio to navigate the Dutch landscape transition.

# amfibisch narratief

Het verhaal van nomadische collectieven die meebewegen met wat de natuur ons voorschrijft. De nadruk in waterveiligheidsbeleid ligt op het leven met het water en verandering. Niet het voorkomen en beheersen, maar het versterken van de veerkracht en samenredzaamheid en het kunnen meebewegen bij veranderende omstandigheden staat centraal.

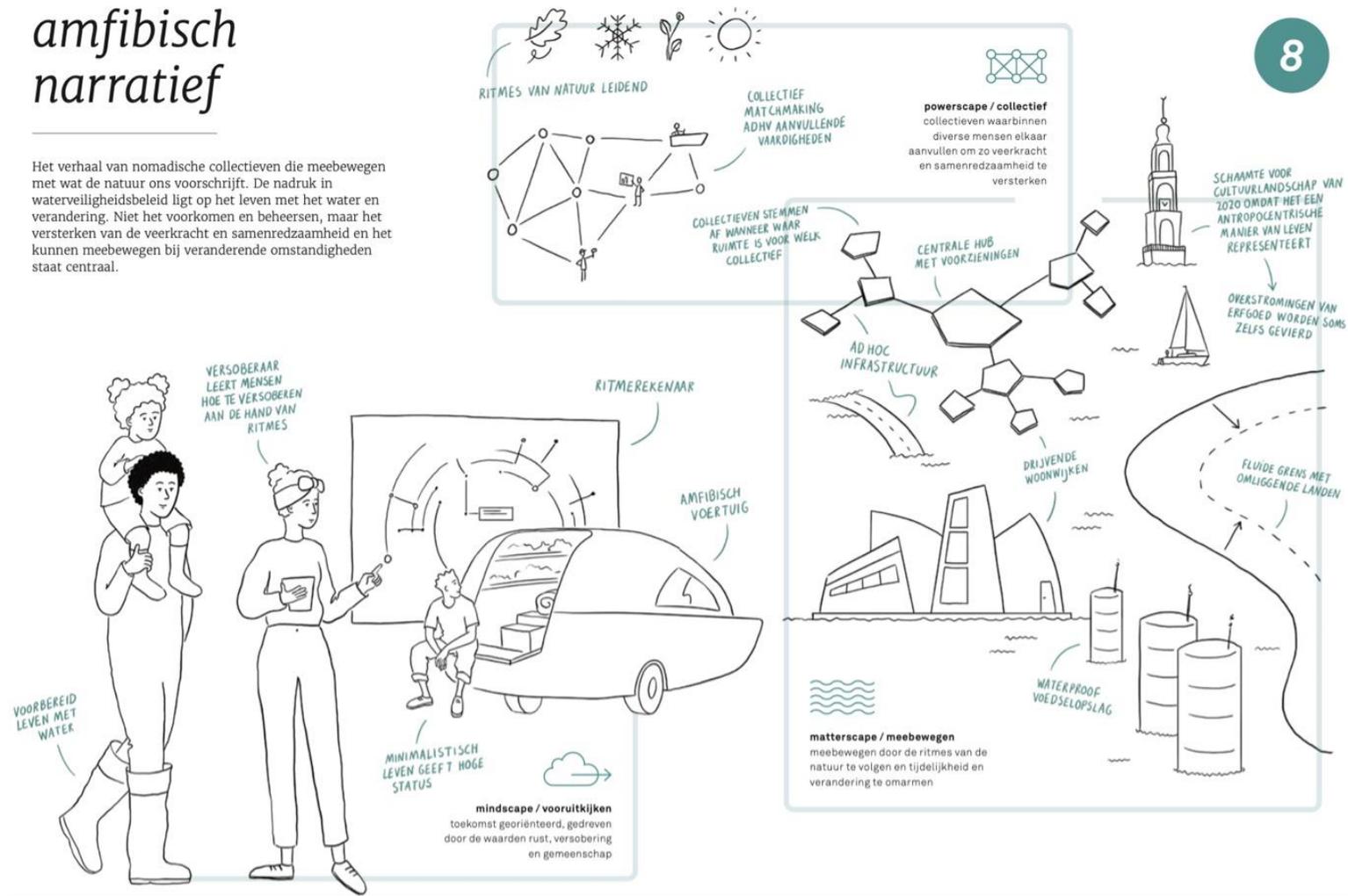


Figure 5. The “Amphibian Narrative” of Reframing Studio was chosen for the review session.



*Figure 6: The Amigo proposition from Louwman.*

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 6). 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.

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 (see Appendix E).

An example of one persona is depicted in Figure 7, 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.

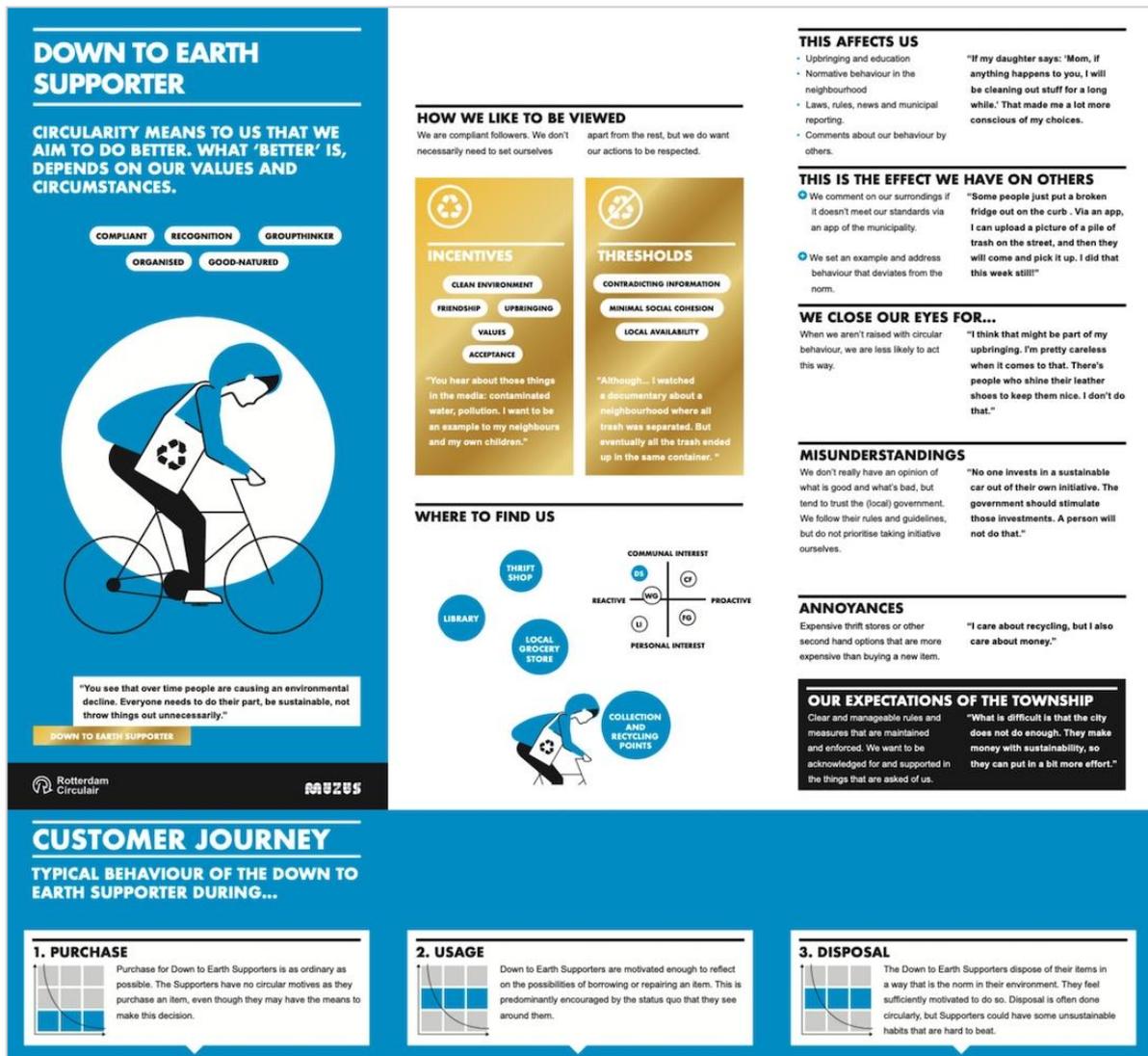


Figure 7. The "Down-to-Earth Supporter" frame from Muzus.

## 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 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 macro-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 under-emphasised. 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.

## 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 8.

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.

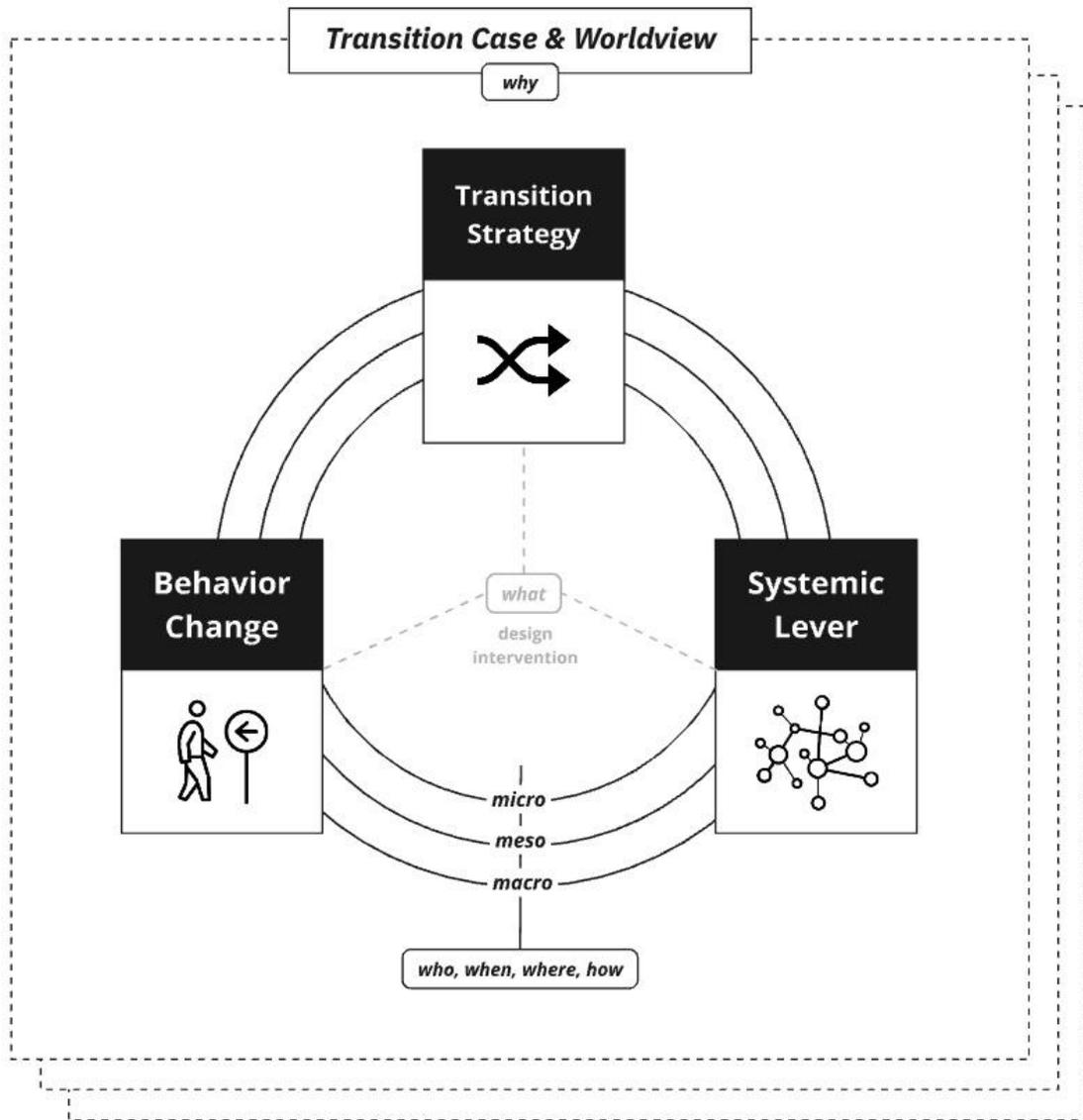


Figure 8: Revised model of a transformative design frame.

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.

## **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.

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