Framing for the Protein Transition

Eight pathways to foster plant-based diets through design

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The authors declare no competing interests.

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Abstract

Excessive animal protein consumption 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. The aim of this study was to understand which transition design frames (TD frames) are prevalent in existing consumer interventions that challenge the food regime, to help transcend the dominant substitution pathway. We explore framing through the lens of design, examining man-made interventions in a transition context, to complement the discursive lens that is common in transitions literature. Based on 62 existing consumer interventions and eight expert interviews, we arrived at eight TD frames. We find that market regulation and cultural interventions are strategic avenues to pursue. Reframing opportunities involve inclusivity, system breakdown and integrating multiple frames into single interventions. We observed that a design lens helped elucidate frame types that have not previously been identified in transitions literature.

Keywords: transition design, framing, sustainable behavior, protein transition, plant-based proteins

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 recognize 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., 2023a; 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., 2023a; 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 behavioral 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; Tziva et al., 2022). 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[1]. 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 transition that are typically not brought to light in societal transitions through discourse analysis.

This paper is structured accordingly: in section 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. Section 4 describes the results: eight transition design frames prevalent in the protein transition. In section 5 we reflect upon the implications

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

of the results for further research and practice. Finally, in section 6 we present our conclusions and contributions.

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).

2.1. 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; 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 recognized 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 behavior and can be developed with a particular behavioral influence in mind. The fields of 'Design for Sustainable Behavior' 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, 2002). 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, 2002). 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.

2.2. 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 behaviors 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 favor 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 favoring 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 (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 behavior change at a micro-level can ultimately lead to shifts at the macro level, we have

integrated these intimately connected perspectives into our conceptualization of a 'transition design frame' in section 2.3.

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 behavior 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 hypothesize about potential mechanisms (*the how)* to achieve a desired result (*the outcome)*, which helps conceptualizing the design intervention (*the what*), see figure 1.

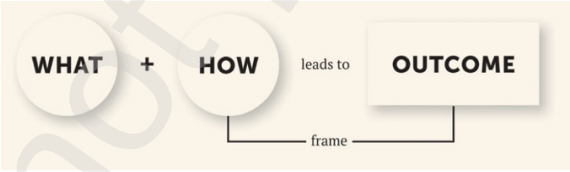

Figure 1: Logical formula describing a frame (from Dorst, 2015)

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 behavioral 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 behavior change strategy. The *outcome* in the formula refers to the actual systemic change resulting from the intervention, i.e. 'transition impact', which connects individual behavior 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-behavioral issue combined with an *artificial* solution direction makes a TD frame.

	Transition Design Frame	
WHAT	**HOW**	**OUTCOME**
design interventions	behavior change mechanism + worldview	(societal-behavioral) transition impact

Table 1: Conceptualization of a Transition Design Frame, the unit of analysis in this study.

3. Material and Methods

With this study we aim to provide a first attempt to analyze 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-behavioral 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.

3.1. Interventions in the Protein Transition

Our primary source of data was a set of 62 consumer interventions. To contextualize 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 programs; 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, 2020). 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-behavioral 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 2. The full list as well as a visual overview of the interventions are included in appendices A 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 2: Three examples of consumer interventions included in this study.

3.2. 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 3. 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 C. 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	Markting manager	Door innovation: meat analogues
7	Food artist	Independent
8	Protein transition ambassador	Network organisation: connecting partners in food system

Table 3: List of experts included in the study.

3.3. 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 analyzed four distinct consumer interventions, which are included in appendix A: 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-behavioral 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 behavioral influence. This meant that if two similar educational programs 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 section 4 (Results).

4. Results

Following the thematic analysis of the consumer interventions and expert interviews, eight TD frames emerged from the data: 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 behavior 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 behavior. As presented in section 2.3 (Transition Design Frame), each TD frame comprises a societal-behavioral 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, behaviors, actions, choices and habits (Silvestri et al., 2020).

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

Table 4: overview of the TD frames and their impact on the protein transition.

4.1. 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 (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 2, 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 2: 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.*

4.2. Silent Steering

The *Silent Steering* TD frame focuses on unconscious behaviors, 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 behaviors (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 3). 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 3: 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.*

4.3. Gentle Guidance

The *Gentle Guidance* TD frame focuses on conscious behavior 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 4). 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 Center for Nutrition to steer consumption patterns.

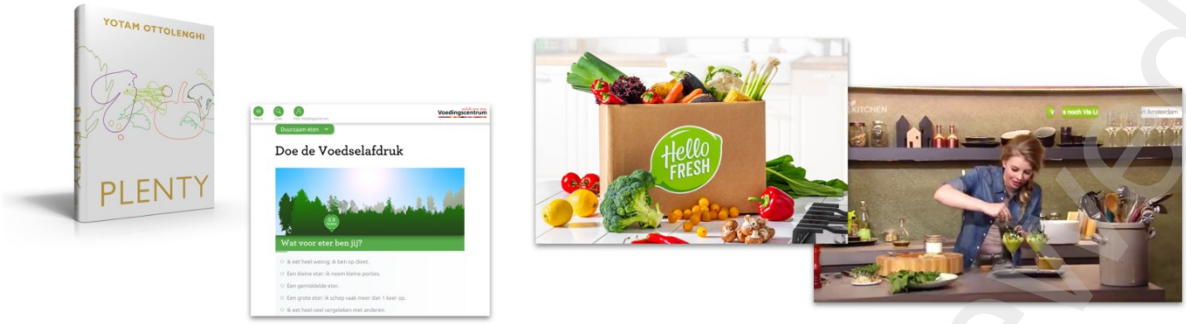

Figure 4: Examples of interventions based on the 'Gentle Guidance' TD frame. From left to right: Vegan cookbook 'Plenty' by Yotam Ottolenghi; ***'Doe de Voedselafdruk'****, a quiz from the Dutch Center for Nutrition for consumers to learn about the environmental impact of their diet; the* ***Hello Fresh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

4.4. 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. Consumers may not always recognize their role in the protein transition (van den Boom et al., 2023). Regarding pro-environmental behavior, 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 behavior (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 5: 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.*

4.5. 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 recognized as a cultural phenomenon with social and spiritual meaning (Anderson, 2005). The role of 'meat as a centerpiece' 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 6) 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 6: 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.*

4.6. 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 behavior, 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 speciesm (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 7). 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 7: 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).*

4.7. 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 8: 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; **subsidized fruit at primary schools, subsidized** by the Dutch government.*

4.8. 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. *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 behaviors (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 9: 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.*

5. Discussion

5.1. 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

behavioral 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.

5.2. 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 behavior. 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 behavioral change mechanisms, the chances of consumers purchasing a veggie dog are increased. We hypothesize 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, 2004; 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.

5.3. 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; Bulah et al.,

2023b). 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 (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' behavior 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.

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-behavioral issues surrounding the adoption of plant-based diets, connecting micro-level behaviors 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 behavior. 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.

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