SOCIAL SUSTAINABILITY
A DESIGN RESEARCH APPROACH TO SUSTAINABLE DEVELOPMENT

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ABSTRACT

While issues such as clean production and energy efficiency are still central in sustainable development discourse, attention is increasingly on patterns of consumption at multiple levels in society. This opens new opportunities and responsibilities for design research, as we shift from a focus on product lifecycles to people's lifestyles. It also requires further understanding the 'social sustainability' aspects of the environment and development, including the complexity of problematics characterized by uncertainties, contradictions and controversies. In response, we propose a programmatic approach, in which a tentative assemblage of theoretical and experimental strategies frame a common ground for a collaborative and practice-led inquiry. We present a design research program based on two propositions: socio-cultural practices are the basic unit for design, and; transitions, and transition management, are the basic points of design intervention. Rather than affirming the status quo or the prevailing discourse, we argue for design research as a 'critical practice', in which cultural diversity, non-humans and multiple futures are considered.

Keywords: social sustainability, design theory, sustainable development

INTRODUCTION

Beneath the broad umbrella of 'sustainable design', there is an ever-expanding range of approaches. Aligned with the 'clean production' paradigm dominating the sustainable development discourse until recently, much focus has been on the use of innocuous, recyclable, biodegradable and renewable resources, efficient and optimized mechanics that consume fewer resources and produce fewer offsets, waste and pollution treatment, etc. Such approaches have been integrated at a variety of levels, from the integration of lifecycle assessment (LCA) into marketing, engineering and design practices (f.ex. Tukker and Tischner, 2006), to government and corporate policies (f.ex. 'polluter pays' principle and corporate social responsibility) and third-party certification standards (f.ex. LEED, Green Seal, Bra Miljöval, etc.). Such approaches have placed emphasis (and responsibility) on producers and production-side techniques. For example, LCA has focused on material sources, distribution systems and 'end-of-pipe' remedies (offsets, waste and recycling) – mitigation of environmental factors that are in the purview of the producer (Hertwich, 2006).

However, assessments show that production-side measures, including supply-chain issues in agriculture and manufacture, will not be sufficient to mitigate environmental damage (f.ex. Keyfitz, 1998). Increased efficiency of production and products has been countered by increased consumption, and technological improvements are offset by volume effects resulting from behavioral, social and demographic factors (Stø et al., 2006). Consequently, while the phrase 'sustainable consumption' was not much used until the Brundtland report (1987), it has since become a keystone in declarations and implementations (f.ex. the 2005 Oslo Declaration, Agenda 21, the Marrakech Process, and the UNEP's Sustainable Consumption unit). The sustainable development discourse has expanded to include (or, as Stø et al., 2006, argue, a transfer of responsibility onto) consumption and consumers. Given that consumption is an area in which design is present, powerful and persuasive in a variety of ways (c.f. Forty, 1986; Buchanan, 1989; Redström, 2006b; Mazé, 2007), this shift in focus also

opens new opportunities and responsibilities for design research.

This shift in focus to consumption expands how we must relate to sustainability in design. Certainly, lifecycle(s) thinking attends to consumption, which is included as a phase in LCA assessment. However, focus still tends to be on the aspects of product lifecycle(s) that are within the producer's purview and control (Lorek, 2008; Avila et al., 2010), with consumption easily reduced to and measured as point-of-purchase, perpetuating the macro-economic bias of traditional consumer studies that has tended to 'black box' consumption (c.f. Stø et al., 2006; Dobers and Strannegård, 2005). Approaches explicitly taking on sustainable consumption are proliferating in design, however, including information or advertising campaigns promoting change in general attitudes or behaviors, computer-based eco-visualizations of personal or household consumption patterns, product designs that encourage alternative consumption practices, or vehicle or product displays of real-time feedback on minute actions (some examples in Verbeek and Slob, 2006; Sylwan and Stål, 2008; Keyson and Jin, 2009; DiSalvo et al., 2010; Fry, 2009). In these, the shift in focus from sustainable production to sustainable consumption is paralleled with an expansion of design focus beyond lifecycles to life*styles*, or ways of living.

Approaches to sustainable consumption, however, including those in design and design research, are still limited. For one thing, consumption is typically framed as a set of decisions made in a narrowly defined period in space and time. For example, a range of sustainability and design factors may be in focus at point-of-purchase, but the act and context of purchase does not account for the longer and larger factors relevant to the sustainability, such as other practices that take place before, alongside and after purchasing an item. Many approaches are based on traditional marketing and economics, premised on rational models of decision-making that assume that more information and/or incentives leads to the 'right' choices, but sociological studies demonstrate that not only does it not necessarily lead to changes in attitudes but, even when it does, the change in attitude does not always translate into behavior change (Power and Mont, 2010). Such approaches are often characterized by limited change, 'rebound' effects, or reversal of change, and failure of change to spill-over into wider attitudes and behaviors outside (Crompton, 2008; Verbeek and Slob, 2006). Further, approaches premised on primary-market purchase do not account for secondary- and tertiary markets and other forms of value and exchange that are of particular interest from a sustainability point of view (f.ex. Margolin, 1995; Bell, 2003). Most approaches tend to privilege mitigation of an existing practice that is narrowly defined, rather than imagining and operating outside of existing production-consumption paradigms.

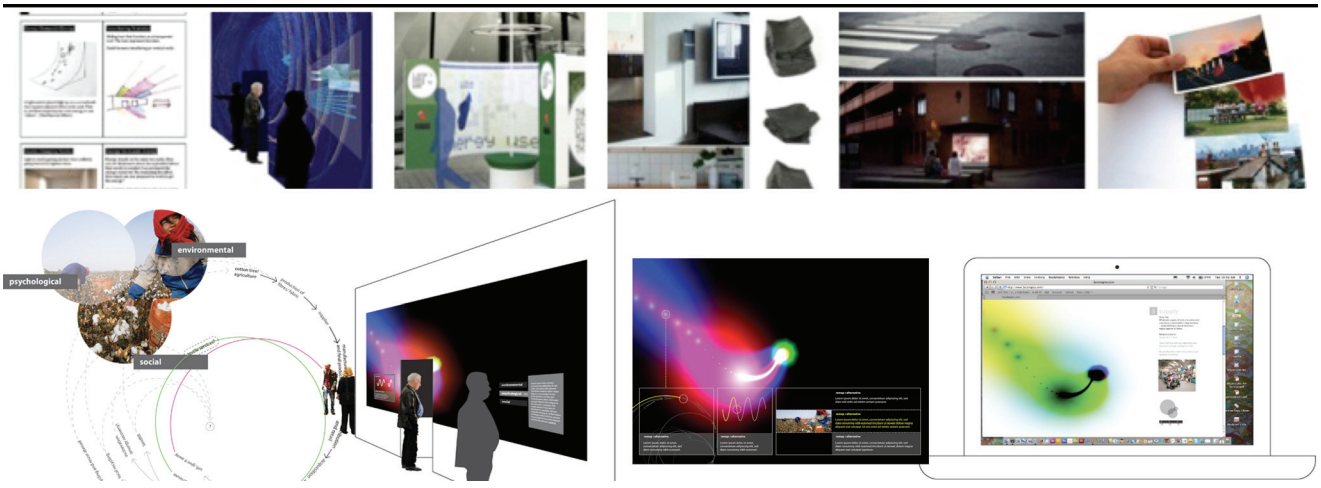
This suggests a need for further ways of understanding and designing in relation to consumption. A significant implication of the move from sustainable production to sustainable consumption is a shift in emphasis on technologies and techniques on the production side to the *socio*-technical (Geels, 2002; Shove, 2003). This opens up the macro-economic 'black box' of consumption, which counts 'green consumption' only at point of purchase and too easily subjects 'captive consumers' to 'demand-side management' policies (Stø et al., 2008; Vliet, 2006). Ordinary practices of consumption come into focus, including the micro-social aspects of consumer-citizens as knowledgeable and capable actors (Spaargaren et al., 2006). Reclaiming and engaging with consumption in contemporary sustainable development requires new approaches, and new disciplinary orientations, to better understand 'the social' with respect to ways of (sustainable) living.

SOCIAL SUSTAINABILITY

Unlike problems in specialized scientific fields, which may have definite conditions, design addresses the fundamental indeterminacy inherent in all but the most trivial of social problems. 'Wicked' problems, as characterized by Rittel and colleagues, are a "class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing" (Rittel and Webber, 1973; Margolin, 1996). Rather than

objectively given, there is no authoritative set of rules, criteria, or methods, nor any ultimate test of validity for problems and solutions within fields such as design, planning, policy and management. This characterizes the problematics of sustainable development, which are set within a pluricentric society wherein resources and agency are distributed across many actors and at many levels, and the capacity of governments to act has decreased and become more complex. This is exacerbated by the increasing unsustainability of contemporary society, in which economic, political, ecological and socio-cultural interests are often in competition at a time of rapid globalization, conflicts over diminishing resources, and rising risk factors (c.f. Loorbach, 2002; Cuczella, 2010).

Approaches that merely reproduce existing production-consumption paradigms may not adequately come to terms with the increasing and social complexity of sustainable development. While ecosophies such as Guattari's 'three ecologies' (1989) fundamentally reframe societal-environmental relations, the prevailing 'triple bottom line' merely elaborates an existing economic paradigm and social condition (Avila et al., 2010) (see EXAMPLE: Switch! 3Ecologies). A common perception in the sustainable consumption paradigm, though rarely explicit, is that sustainable lifestyles will converge upon a middle-class standard, which developing countries will rise to and developed countries will retain. Keyfitz (1998) characterizes this as the 'middle class package', which includes home appliances, ICT and cars, the environmental effects of which are merely optimized and mitigated by conventional policy and technology approaches. Studies of 'the social', however, reveals many and increasing variations and, consequently, implications for sustainable development. This is also evident in the diverse forms of design for sustainability – bottom-up collaboration in Italy, national strategic control systems in China, solidarity economy in Brazil and beneficent sufficiency in Thailand, for example (c.f. Ceschin et al., 2010). The ways in which problems and ideals in sustainable development are framed (by policy-makers and designers) embody specific power, class, cultural, global and gender dimensions, a particularly social complexity that is not addressed in prevailing 'managerialist' and 'technocratic' approaches (Bradley, 2009).



EXAMPLE: Switch! 3Ecologies

'Switch! Energy Ecologies in Everyday Life' was a design research program (2008-2009) (Mazé and Redström, 2008) inquiring into energy issues in terms of critical practice and everyday ecologies. Through design interventions that disrupt existing - and introduce new - values within particular situations, the aim was to influence the perception of energy within a given ecology. This practice-led research produced a series of design examples, including prototypes, conceptual design proposals and use scenarios (first row of images, above).

One of the design examples was 3Ecologies (Avila et al., 2010) (second row of images, above). Challenging and extending conventional 'triple bottom line' and 'lifecycle assessment' models, we adopted Guattari's framework to "to be able to apprehend the world through the interchangeable lenses or points of view of the three ecologies" (1998: 28). Within engineering and economics, there are a variety of models for analyzing the environmental factors such as energy, emissions and waste involved during production, consumption and disposal. Our expanded model emphasizes human impact and choices, socio-political and equity issues, potential consequences and futures. Psychological, sociological and environmental factors are mapped over time - throughout the extended lifecycle(s) of products. Case studies of familiar products are developed to demonstrate the conceptual model, and three applications are proposed to reach designers, consumers and the general public. 3Ecologies is an interactive visualization of the sustainability of consumer products - an alternative view upon the 'life' of things ordinarily taken for granted.

Taking on the problematics of sustainable development requires critical approaches to understanding and directing change within the social realm. Because sustainable development is intrinsically normative (ie., that there is a desirable or preferred direction of change), a critical perspective needs to incorporate questions about how problems and ideals are constructed and by whom (including questions of legitimacy and authority), how to change and change by whom (including questions of environmental justice), who is represented and who benefits (including the politics of representation of non-humans and future generations) (Gidley et al., 2009; Inayatullah, 1990; see also Wangel, 2011). In relation to the particular complexity of 'wicked problems', we may look to related fields to expand how we understand 'the social', learning from the ways that cultural, geographic and anthropological perspectives are incorporated in, for example, political ecology, critical realism and resilience studies (see Mazé and Redström, 2008). These suggest a more critical and political relation to 'our common future' presumed in the Brundtland report (1987, c.f. Stengers, 2005; Fry, 2009) and to the kinds of 'radical change' advocated within current sustainability discourse (Andersen and Tukker, 2006).

Design, as particularly capable of addressing such problematics, can also be understood as a 'critical practice', necessarily querying preceding or prevailing approaches (Mazé, 2007; Mazé and Redström, 2009). This requires expanding and further elaborating on the theories, methods and ethics that are needed as a basis for design research in the area of *social* sustainability. As we rethink production-consumption paradigms, for example, taking on 'the social' opens for a wider variety of actors and forms of agency in social change processes. In addition to better understanding existing consumption practices, the socio-cultural diversity and the kinds of radical departures from the status quo suggested by sustainable development require both critical and futures-oriented perspectives. In designing for social (and not only technical) change, we must also anticipate and experiment with innovations that are disruptive and catalytic, which may affect the distribution of power and resources or the basic beliefs that define systems and regimes (Westley and Antadze, 2009). Not only expanding but deepening sustainable design from a basis in 'the social' requires design research to further develop ways of thinking and acting, imagining and intervening, in social change processes.

In this paper, we discuss issues for design research operating in the area of social sustainability. We do this through the lens of our own practice-led design research, which is conducted within the research program 'Designing for Social Sustainability', an international, interdisciplinary and cross-institutional program in its first phase. We lay out two axioms, which guide our discussion in this paper of relevant theories and methods for our approach to 'social sustainability' that will be the basis for case studies and a pilot project to be conducted in the program. This research is based on extensive previous research experiences in related areas, which we point to here as examples of concepts and terms introduced.

A DESIGN RESEARCH PROGRAM

The range of issues and stakeholders in a social approach to sustainable development are vast, a complexity riddled with uncertainties, contradictions and controversies impossible to definitively overview. To initiate and conduct research in this area, we therefore propose a programmatic approach, which acts as a 'provisional knowledge regime' (Redström, 2006a). In interdisciplinary research, any one discipline, in itself, cannot provide consistency or coherence, raising the question of how this complex research area can become operational for design practice and, in our practice-led design research, for framing critical, constructive and collaborative work conducted through case studies and practical experiments. A program specifies a tentative assemblage of theoretical and experimental strategies and relations between, which functions to frame a common ground, a worldview prototyped in the form of the program. This is not to say that the particular worldview prototyped is the only or the 'right' one, but one of necessarily multiple articulations of what such an assemblage could be like as we try to shift design towards social sustainability.

Here we outline a design research program based on two propositions (or, more accurately, axioms):

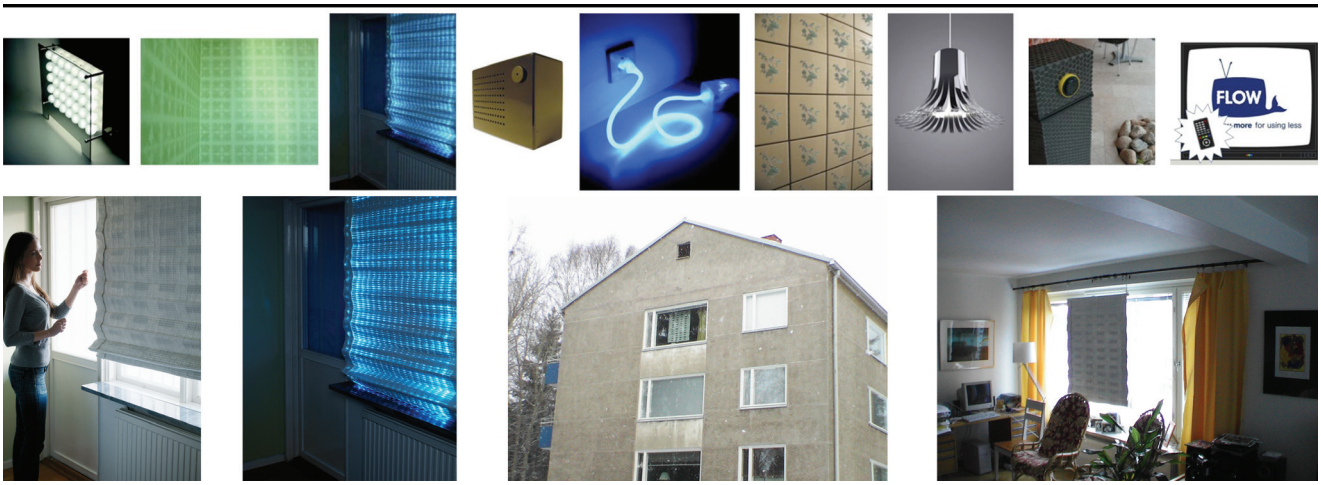
- Socio-cultural practices are the basic unit (for design)
- Transitions are the site of (design) intervention

Obviously, these two propositions do not hold true for all design – but it is not design as it is now that we aim to explore. Rather, these propositions outline the basis for a different kind of design practice, one that we will try to prototype and evaluate.

Socio-cultural practices are the basic unit (for design). We reconsider the 'unit of analysis' typically in focus in human-centered and sustainable design, beyond individual people or discrete products, services and systems. Socio-cultural practice theories are central to our research approach, and we develop design as a practice-centered activity, including practices that may not be counted only in terms of primary-market consumption.

Transitions are the site of (design) intervention. We consider design in its capacity to change courses of thought, action, interactions and behavior. In this, design can be understood as a kind of transition management, visualizing and materializing possible alternatives and futures, enabling a critical examination and constructive experiences of socio-cultural practices and policies.

In the following sections, we will elaborate on 'socio-cultural practices' and 'transition management', drawing on theories from the social sciences, innovation studies, policy and management. We interpret these in terms of dimensions that have specific relevance to (sustainable) design research, and reflect upon these towards our future work in the 'Designing for Social Sustainability' research program. Throughout the paper, we raise issues relevant to design as a 'critical practice', in which we argue for the role of design research in investigating what might be, rather than affirming what is or prescribing what ought to be. Dealing with practices and transitions within socially sustainable development, design involves problematics that



EXAMPLE: Static!

'Static! Designing for energy awareness' was a design research program (2004-2005) (Mazé, 2010). The research program built on two main axioms: that designers can work with energy not only from a technical but also from an aesthetic point of view, thereby integrating the often separate areas of design and engineering, and; that use artifacts need not only be about utility and ease-of-use but also about critical reflection on energy through the objects at hand. This practice-led research produced a series of design examples, including prototypes, conceptual design proposals, and use scenarios (first row of images, above).

Two prototypes were deployed in a long-term study in different households with different types of families, over extended periods of time, and across seasons (Routarinne and Redström, 2007; Routarinne, 2010). Study methods inspired by social science theories attended not only to immediate verbal and physical reactions to the artifacts but to extended and emerging practices. In one home, for example, introduction of the Energy Curtain (second row of images, above) prompted rearrangement of other furnishings and lighting sources and became subject to home experiments. The artifacts changed hands and power relations, were repurposed and even 'cheated'. While traditional usability methods might have focused attention on the intelligibility of design or accuracy of use, typically with a 'unit of analysis' delimited by a particular moment in space and time, we learned about how artifacts prompt wider and longer processes of negotiation and appropriation within family life, the material culture of the home, and socio-cultural practices.

include issues of diversity and controversy. Towards this end, we discuss the role of design research as (re)framing microcosms for critically rethinking sustainable design/development and for intervening in social change processes.

SOCIO-CULTURAL PRACTICES AS THE BASIC UNIT (FOR DESIGN)

An emerging and growing approach to treating 'the social' is 'social practice theory', which we develop more specifically in terms of socio-cultural practices (de Jong and Mazé, 2010). While many and previous theories of consumption focus on more macro-level issues, such as the reproduction of norms and values within cultural groups in society, as well as the aesthetic, symbolic and experiential dimensions of consumer culture, contemporary theories of social practice examine these within situations of everyday, ordinary consumption. In such theories, consumption is understood in terms of dynamic relations among conventions that people relate to (for example, 'comfort', 'cleanliness' and 'convenience', Shove, 2003), the knowledge and skills of individuals and social groups, and the artifacts (material and natural resources) that are intertwined in the achievement of particular everyday practices. A socio-cultural account examines the intersubjective basis of practices, including a history of changes and differences across history, cultures and diverse 'communities of practice' (Wenger, 1998). This approach can be an alternative, or complement, to the cognitive and rationalistic bias prevalent in behaviorist accounts (Power and Mont, 2010; Jackson, 2009).

The 'unit of analysis' for examining relations between 'the social' and sustainability may vary widely between, for example, psychology, sociology, economics and anthropology. Spaargaren et al. (2006) positions social practices between socio-psychological perspectives (typically focused on the motives, values and beliefs of individuals) and technological-system perspectives (focused on large-scale regulations and resources). Between these 'macro' and 'micro' levels, social practices may be understood at a range of scales, including households and other social groups such as co-located or translocal communities, (eco)systems and organizations, etc. At different scales, practices such as cooking and bathing (f.ex. de Jong and Mazé, 2010; Kuijer and de Jong, 2009) travelling and gardening (f.ex. Spaargaren et al., 2006), can be studied in terms of how they are constituted and how they change. Socio-cultural practices might be understood as building-blocks, or a set of socio-culturally situated processes in everyday life, that constitute lifestyles.

DESIGN RESEARCH DIMENSIONS

Socio-cultural practice theory specifically addresses certain of our theoretical and methodological concerns in design research for social sustainability. First, it explicitly treats the materiality of consumption practices. Noting the Latourian critique of the 'missing masses' in much technology and consumption studies, Shove (et al. 2007; 2003) discusses how artifacts carry meanings, agency and resources for the construction of individual and collective identities. Beyond the study of individual things as carriers of semiotic meaning, relations within and among 'complexes of stuff' are in focus. In contrast to approaches that treat the meaning of artifacts as fixed by design or passively accepted by users, material cultures and social practices are understood to co-evolve. Attending to the relations evolving within such complexes, design research into socio-cultural practices is irreducible to a product-, user- or eco-centric logic. Even if this expands the conceptual frame typically applied to study design (Ingram et al., 2007), we argue that the 'unit of analysis' can still be placed within the actions and contexts of 'things in use' (de Jong and Mazé, 2010; EXAMPLE: Static! Energy Curtain), in which meanings are materialized.

In addition to expanding the socio-material unit of analysis, this trajectory of thinking also expands the temporal frame. Attention is on how relations among artifacts, people and resources interplay within larger and longer meaning-making processes. Further, the historicity of practices is studied, which allows for the study of change in practices over time and for imagining alternatives in the future. Practices such as cooking might seem perhaps too 'close to home', a merely commonplace and mundane practice many of us do everyday. However,

it is far from mere routine (see, for example, elaborations on women's know-how and 'ordinary intelligence' by Giard in de Certeau et al., 1998). Studying such practices reveals how they are intertwined with bodily experience, childhood memories and cultural histories, which entails differences and changes in practice that are resonant with poetic and political meaning (see EXAMPLE: 'Ways of Doing' Cooking). This approach attends to the effort and agency within practices, which is always oriented toward the future, with potentials for reflexivity about and change in relation to those future images.

TRANSITIONS AS THE SITE OF (DESIGN) INTERVENTION

A socio-cultural practices approach to design research is aligned in several significant ways with certain systems and change management approaches to sustainable development. Specifically, the 'transition management' approach has evolved models of technical innovation to address the socio-technical. Developed in a setting in which technology and policy towards, for example, housing, landfills, mobility and land-use were contested within a plural society (Loorbach and Rotmans, 2008), transition management represents a kind of third way after the environmental failings of post-war 'big government' and 'big business' in the 1980s-90s. An emerging and multi-disciplinary field spanning policy, management and innovation studies, it utilizes bottom-up and radical innovations, along with incremental optimizations, by strategically coordinating different levels of governance and scales of organization. Goals are chosen (often implicitly through debates and opinions) by society, policies are not set in stone but are constantly assessed and periodically adjusted (Kemp et al., 2006). The model proposes forms of governance and social theory (management principles), based on a philosophy of steering direction and pace.

As a departure from 'command and control' approaches to technology and policy development, this approach studies and directs change processes at multiple levels and multiple phases (Geels, 2002; Loorbach, 2002). While the macro-level is characterized by slow changes in society, such as economic systems, demography, worldviews and geopolitical realities, niches at the micro-level are a source of more radical changes and innovations

EXAMPLE: 'Ways of doing' cooking

'"Ways of doing" cooking' (de Jong and Mazé, 2010) was a 'quick and dirty' study carried with students out over 10 weeks. There were six participating households, including families or singles of different ages from Iran, Vietnam, Morocco, Suriname and two from The Netherlands. While originating from different countries, they were resident in Delft, in comparable types of Dutch housing.

Through studying and reflecting on the different 'ways of doing' cooking (collage of images, above, from observational studies and interviews), we gained insights into how cooking and a range of associated practices and artifacts are deeply embedded in traditions, meanings and aspirations. This was based on some surprising findings - for example, the Surinamese home had multiple freezers in the living room for storage, which seemed to them a very different way of arranging appliances, organizing space and practicing 'doings' relevant to cooking. Diverse ways of cooking proved to constitute and overlap (spatially and temporally) with a preparing and storing ingredients, preparing and cooking dishes, preparing and storing food that was left over or planned excess, secondary consumption of left-/planned-overs. Issues of environmental consumption, such as water, energy and waste, are at stake in such design research but, as we argue, so is attention and sensitivity to how these are interwoven in meaningful socio-cultural practices. As expressed in our collaborative analysis session, it is not simply that "a kitchen is a kitchen".

arising from individuals, practices, technologies and localites. At the meso-level, transition management is implemented through markets (for example, price mechanisms and choice-editing), planning (innovation support and policy strategies) and institutions (transition arenas and alignment of actors) (as adopted across five ministries in The Netherlands since 2001). At this level, social norms and consumer practices, organizations and infrastructures, institutions and regulations, may be reformed or created in light of normative objectives. Like socio-cultural practices, the 'unit of analysis' is between the macro and micro, in which transition management develops strategies for studying and directing pathways for phased change across levels.

DESIGN RESEARCH DIMENSIONS

A transition management approach has some things in common with the Scandinavian tradition of participatory design and technology development. Transition management engages alignment and change processes through recursive, 'higher-order' learning. While the worldviews, values and interests of actors may not coincide, formulation of differences within social learning processes has been successful in altering assumptions, norms and interpretive frames (Brown and Vergragt, 2008) as well as negotiating common problem definitions and approaches (Quist, 2007; Vergragt, 2010). Similarly, in participatory design, stakeholders with diverse forms of skill, knowledge and power are involved in co-learning and –designing processes(f.ex. Bjerknes et al., 1987). Such approaches deal with complexity and uncertainty by incorporating difference and dissent while facilitating deep learning and broadening understanding, enrolling actors and steering a common process. Like transition management, participatory action research approaches in design operate through intervention – 'learning-by-doing' with propositions, probes and experiments (f.ex. Argyris and Schön, 1989).

A futures-orientation in transition management and participatory design complements the temporal basis established in socio-cultural practices approaches. An understanding of the historicity of socio-cultural practices is necessarily a study of transitions and breaks, just as the situation within socially- and culturally-situated 'communities of practice' is about recognizing differences and potentials for (radical) change. The futures perspective is explicit and instrumentalized in transition management, as methods such as backcasting, interactive scenario planning and transition pathways, which can (or should, Quist and Vergragt, 2006) be developed through the participation people in the community, publics in multiple locales, civil society as well as governments, businesses and transnational institutional actors as well as the representation of non-human actors (natural, environmental, built and technological artifacts) and future stakeholders. In participatory design, 'trying out' alternatives and futures are made interactive and accessible through mock-ups, games and role-play, which are infrastructures for active participation in learning, negotiation and development processes (f.ex. Muller et al., 1993; Ehn, 2008) (see EXAMPLE: Switch! Energy Futures). In participatory and futures-oriented policy and design, the aim is not to control the future, but to address uncertainty and risk through interactions that build common ground, anticipatory consciousness and social resilience through iterative cycles of learning within experimental settings (Gidley, 2009; Glenn and Gordon, 2003).

FUTURE RESEARCH WORK

In the design research program 'Designing for Social Sustainability', these theories and dimensions are being further developed. We consider these as relevant for studying and creating 'microcosms for social change', in which we investigate how incremental change through design intervention into small groups may generate dynamics fueling larger-scale and longer-term transformations within individuals, groups or societies. Our conceptual and practical work in this area will take the form of analysis of existing related work, or case studies, and of a new pilot project, in which concepts and methods from the case studies will be central to a collaborative practice-led research experiment.

The case studies of related projects examine the activity, materiality and the effects of design intervention into socio-cultural practices. 'Practices' are selected from areas including resource

consumption (water, energy, etc.), green space and habitats, waste and resource management. The role of design materials ('things in use', such as visual, material and built artifacts) will be examined in such practices, as well as design research methods of intervention (staging participation in analysis and design/policy development). In addition to the research approaches demonstrated in our previous work, we are investigating ways to more explicitly include futures perspectives through, for example, agent-based modeling and simulation as well as backcasting and visioning futures.

AXIOMATIC REFLECTIONS

The axioms that act to frame the research program imply a certain position, or worldview, that also has implications and poses questions for design research. First, as we propose *socio-cultural practices as the basic unit for design*, one implication is that design research cannot merely be a matter of examining problems in the world as it is now and then designing a (technical) solution to shift the current into a more desirable state. This is not (just) to say that we will not design solutions to problems, but that such solutions might not be there for us to design at this point. There is no single preferred version of such a future state and, because sustainable development is intrinsically a normative (non-neutral and subjective) notion, research and change processes have to incorporate the diversity and potential conflicts among the values, interests, and goals of a multitude of stakeholders. In order to treat the problematics of social sustainability in their complexity, we start with existing socio-cultural practices and their ongoing transformation as a basis – which leads us to the second axiom.

Besides better understanding the 'here and now' of socio-cultural practices, we work with *transitions as the site of design intervention*, towards particular (normative, ie., sustainable) futures. This implies an even larger spectrum of stakeholders, particular within a participatory approach in which are included not only those already bound into the production-consumption discourse but also those who are not represented (and the potential inclusion of the interests of non-humans and future generations). Combined with the perspective of socio-cultural practices, this implies working not only with what is said and thought, but also physically with what is

EXAMPLE: Switch! Energy Futures

'Switch! Energy Ecologies in Everyday Life' was a design research program (2008-2009) (Mazé and Redström, 2008) (See EXAMPLE: Switch! 3Ecologies on previous page) This practice-led research produced a series of design examples (first row of images, above).

One of the design examples, 'Energy Futures' (second row of images, above) (Mazé and Önal, 2010), speculates on socio-cultural practices of energy consumption. Applying methods from futures studies, Energy Futures takes root in current behavioral trends and forecasts of energy futures. As tracked by social scientists, tipping points in energy cost trigger radical behavioral and cultural effects. Extending these into design, the project revisits familiar urban and domestic artifacts, which are reinterpreted as designs for transitions from one status quo *of electricity consumption to others in a possible future. Countering both the incremental reforms of user-centered design and the utopias of visionary design, Energy Futures operates between the familiar now and extreme future, intervening strangely familiar objects that exist somewhere in between. The project takes the form of fictional scenarios in which the (re)designed artifacts are intervened into a participatory workshop/exhibition. Within this 'staging', designers, architects and other stakeholders must collaborate to make sense of these Energy Futures. Emerging along the way was a variety of intimate stories and personal opinions, as well as political issues and professional points of view. Through the intervention of a (super)fictive narrative and props, the project operated as platform for hosting a debate about probable and preferred futures of electricity consumption.*

actually done. Ways of living, or doing, are considered within an expanded unit of analysis that is embedded in histories and communities of practice, which may be a resource for the kind of 'radical innovation' arising from niches within transition management theory. In this, design research and intervention may inquire more deeply into the fabric of the everyday than traditional instruments of social science or policy-making.

DISCUSSION

Social sustainability, as we interpret and work with the concept in our research, requires addressing the 'wicked' problematics bound up in the social construction and negotiation of environmental sustainability and sustainable development. Sustainability cannot be about an identifiable end state, nor can it start with a fixed idea – it is an essentially contested concept, involving dissent on goals, means, the nature of the problem and preferred futures (Guy and Farmer, 2001; Bradley, 2006). Problematics are themselves characterized by indeterminacy and uncertainty, which we see even as a small scale in rebound and spill-over effects, and other shortcomings of the 'small steps' approaches in sustainable design. As design incorporates theories and methods from relevant fields, we argue for and extent the particular capacity of design to address such problematics, to address 'the social' beyond the 'select' social or even the 'existing' social that are typically in focus in sustainable production/consumption approaches.

In this, critical and participatory dimensions of design research are necessary, which has also been emphasized as policy seeks to take normative change within society (Nye and Hargreaves, 2010). Design and design research do not only look to fit macro/meso-level policies and decisions onto the micro-level of consumption (a top-down approach), but, from a purview within micro- and socio-cultural practices, we actively examine and (re)frame problematics of sustainable production and consumption. Diversity and complexity is engaged through alternatives and futures querying the socio-political dimensions of gender, class, culture, etc. Unlike much traditional design, our approach is not to prescribe what ought to be but to critically examine and explore what can be. This requires design to shift from an affirmative discipline in service of power and beyond sustainable design as an instrument of informing and implementing policy and business decisions. In the tradition of participatory design and critical futures, our design research takes on a role of framing 'microcosms' in which societal and future problematics may be made present, visible and tangible, as a basis for critical thinking, social learning and constructive action.

Social sustainability, in our practice-led research, includes not only ways of studying socio-cultural practices and transitions, but also constructing and staging interventions. In this, it is fundamentally future-oriented, requiring the development of further methods and ethics (Mazé, 2007). The transformation of socio-technical systems requires transitional processes of co-evolution and co-production among a variety of stakeholders, in which design may play a role in the emerging policy space of formulating differences, aligning visions and testing alternatives. Sustainable design plays an important role in changing current design ideals, requirements and products – but there is a further role to play in querying and (re)framing how design may operate in societal/environmental futures that may look very different from the present. If one way to approach such futures is through socio-technical experiments and participatory processes, design may be implicated in both niche introductions and radical innovations, as well as larger/longer transition pathways and change processes. Design and design research have a critical role to play, drawing on disciplinary expertise in visualizing and materializing alternatives and futures, an artifactual basis for interventions introduced into 'microcosms' as bounded experiments, or beta-tests, that can be a basis for investigating change processes in socio-cultural practices.

In addition to design materials, design and research methods have a role to play as policy and governance increasingly operate towards 'higher-order' learning. Participatory design, action research and design anthropology are a basis for 'infrastructuring' and 'staging' both the artifactual setting for social research studies as well as the social aspects of

preparing, performing and facilitating participatory or co-learning processes (see also Mazé and Redström, 2008; Clarke, 2007). Operating in relation to complexity does not necessarily take complex forms. Learning from participatory design, political ecology, and critical futures, conversations, images and stories are powerful forms for identity formulation, co-learning and community-building. Verbal, visual and tangible modalities can be particularly effective for more inclusive approaches, in which diverse 'ways of knowing' should and must be incorporated (Mazé and Önal, 2010). We take an approach based on the concept of 'design for negotiation of logics', in which such materials and methods can infrastructure the conceptual spaces for social sharing and change processes and the common grounds necessary for cross-disciplinary research and design in this area (see Gregory, 2009).

Change is only possible if alternatives are possible to imagine, value and choose, and if there is back-up, opportunities and commitment not only at the micro- but meso-level to sustain and grow social change processes. In this, an emerging role for design research (academic and research institutions as well as Living Labs) is structuring and staging the experimentation and learning processes among diverse stakeholders, silo-ed disciplines and public/private sector actors (Vezzoli et al., 2008). This points to a key problem in doing design research in this area: on one hand, it needs to bridge across and connect diverse and sometimes opposing interests yet, on the other, maintain some kind of specificity so as not to become everything and nothing. This is where a programmatic approach can be useful. Rather than bringing multiple perspectives together by synthesizing one, generalized view, it takes a more specific selection of theories, methods and axioms to be able investigate the consequences. To use the silo metaphor again: it is not a shift from a vertical orientation to a horizontal one, but a kind of transverse or diagonal. This is particularly relevant in the context of social sustainability, in which simplistic dichotomies between top-down and bottom-up are not sufficient. Sustainability cannot be dealt with on a strictly disciplinary (vertical) basis but a horizontal one becomes so broad so as to be impossible to operationalize. While a diagonal through this complex assemblage only will present a limited view, making multiple cuts over time can help us to form an intellectual basis for the conceptual spaces we need to expand and ground design research for social sustainability.

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