Systems Thinking for Bottom-Up Social Innovation: An Examination of Social Practices

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ABSTRACT

The principles of sustainability and social design have been widely adopted to develop new models of community practice, engagement and innovation. Considering the growing interest of social practices and sustainable models, systems thinking provides an opportunity to further frame and organise various design activities to develop a deeper understanding of the spaces of impact through social innovation. Cybernetics, as a way of looking at and engaging with systems, is discussed to position the role of the designer. Using mapping as a visualisation tool and conversational activity, case-studies are evaluated to provide a broad framework of bottom-up systems thinking through participatory methods to enhance social and cultural values. This paper examines the practices of existing social enterprises to identify best practices, develop replicable models and processes, and inform future social design contexts.

Keywords: systems thinking, sustainable design, social innovation, participatory design

INTRODUCTION

Design has broadened and expanded its research perspectives to involve environmental, technological, political, social and cultural systems (Norman and Stappers, 2015). This shift has produced a new focus towards social design that considers the impact, scale and sustainability of design activities and practices. The growing interest in the complexities and interdependence of design systems has posed a new concern for understanding and measuring the effectiveness of individual activities against broader systems of change. This calls for new ways to define and categorise systems to develop common goals, generate linkages and identify potential gaps in practice.

Design involves the social process of creating through the development of contexts and systems within communities of practice. This paper presents a discussion of systems thinking to support how the visualisation tool of mapping can be used to clarify models and frameworks of practice through bottom-up scaling and thinking. Through an analysis of existing sustainable practices, this paper examines the role of mapping to identify emergent themes and overlapping areas of interest by (1) introducing systems thinking as a design

approach, (2) mapping existing social enterprises, sustainable design practices and participatory design communities, and (3) presenting a framework for bottom-up social innovation.

1. CYBERNETICS AND THE DESIGNING OF SYSTEMS

Cybernetics is a way of thinking that involves the role of observers, and their subsequent experiences, to emphasise the interaction between observing and the observed (Glanville, 2007). The observer enters a process of circularity to form a model of communication that serves as a circular system relying on exchange and feedback. While Glanville argues that cybernetics in design can be defined as the study of circular systems and their consequences, these conversational activities require contexts of use to further define the boundaries of control.

Buchanan's (2001) Four Orders of Design introduced new definitions for categorising and positioning the various outputs of design from symbols and things to actions and thoughts. One key reason for needing such definitions is rooted in the question of what constitutes a system and how systems are understood. As humans engage with and within systems, reiterating the circularity posed by cybernetics, there is value in understanding the impact of human involvement and the experiences afforded through systems. Buchanan (2001) emphasises the fourth order as a future focus for design:

> By definition, a system is the totality of all that is contained, has been contained, and may yet be contained within it. We can never see or experience this totality. We can only experience our personal pathway through a system. And in our effort to navigate the systems and environments that affect our lives, we create symbols or representations that attempt to express the idea or thought that is the organizing principle. (p. 12).

Systems, according to Buchanan, are necessary to frame all human activities and are navigated through varying degrees of human interaction and experience. This redefines human-centered design not as interactions between human and machine, namely computer interfaces, but all interactions between humans and artefacts (Krippendorff, 2007). Human-centered design, thereby, constitutes the forming of systems through processes of realising affordances for participants with the anticipation of continued reconstruction by involved stakeholders. Krippendorff supports the argument that design is cybernetic, within its circularity, as the designing of affordances enables further observations of practices of living. A designer produces a design to be interpreted and made meaningful to users, which serves as a representation of cultural and social practice. In this manner, design produces affordances that influence larger systems of interaction and use.

The design problems of today are challenged by increasing complexity due to difficulties in defining situations and contexts. Design in the 20th Century shifted from modes of making to manufacturing, naturally evolving into a focus on systems and systems of systems. The current state of design complexity requires designers to understand the interrelatedness of system-to-system relations in order to produce effective designs. Dubberly and Pangaro (2015) emphasise the cybernetic viewpoint of design, as conversation, to address complexities through subjective framing for the identification of common goals. This requires the 21st Century designer to be open to collaboration and conversation in order to discover new goals, opportunities and co-construct arguments.

It can be presumed that all design activities are cybernetic, in that designers engage with systems to effect change while simultaneously existing within the systems as members of society. The implications of second-order cybernetics, positioning designers as active participants of systems under continual modifications, democratise design as all systems require participatory and social activities through circular processes (Glanville, 2007; Krippendorff, 2007). This produces new discourses of design, building narratives of how one action is understood and perceived in relation to another, motivating broader levels of participation.

Table 1. Design and Systems

Author	Perspective	Definitions of System
Buchanan (2001)	4 Orders of Design	Systems involve layers of interactions, activities, stakeholders and users
Glanville (2007)	Second-Order Cybernetics	Systems are circular and involve an observer, the observed and all interactions within
Krippendorff (2007)	Human-Centered Design	Systems are defined by interfaces involving human interactions to observe practices of living
Dubberly & Pangaro (2015)	Design Systems	Systems are complex and require collaboration through conversation

Four perspectives of cybernetics and systems design are presented in Table 1. Buchanan (2001) identified the fourth order of design as systems containing all levels of interaction. While Glanville (2007) explores systems through second-order cybernetics, Krippendorff (2007) focuses on the interfaces afforded by design that enable second-order participation (designer-to-design and design-to-user interface). Dubberly and Pangaro (2015) define systems as requiring increased collaboration, through cybernetic circularity in conversation, to achieve common goals and understandings. The cybernetic implications of design, as

conversation, will be expanded upon to map how systems thinking can define, clarify and frame the systemic challenges of social design.

Social design has become a recent focus for many designers, businesses and communities to sustain cultures and societies. As citizens become more invested in social issues and needs, new innovations are necessary to provide solutions to improve capabilities and relationships within social systems (Simon and Davies, 2013). According to Manzini (2013), social innovation initiatives will become increasingly more relevant as contemporary societies shift towards sustainability. This transition will require new ways of understanding the systems of social design to map new possibilities and future directions. One way to ensure that designers can meet the challenges of sustainability is to reinvestigate the relationship between design and systems thinking (Sevaldson, 2017).

Designers are positioned to think about the future and contribute solutions through understanding how design might impact the existing problems faced today (Margolin, 2015). Margolin defines the role of the "citizen designer" within the following system of actions:

1. **Micro-Level (individual action)** - the production and proposition of tangible and intangible outcomes
2. **Meso-Level (group action)** - the development of discourses to communicate design practice and research through collaboration
3. **Macro-Level (organisational action)** - participation in broader social processes to develop new policies for action

This section has examined the theoretical context of this research, beginning with a review of cybernetics as governing all design activities by defining the role of the designer as both observer and participant to effect and affect systemic change. The conversational activity of design is explored as a precondition to understanding systems, further amplifying the need to define the convergent spaces of social practices. Cybernetics is broadly discussed as producing circular systems of thinking, allowing citizens to contribute through developing discourses and sustainable activities. Margolin's (2015) three levels of action provide a scale and measure of how design can facilitate and support meaningful contributions through individual, group and organisational levels of interaction.

2. MAPPING AS A SYSTEMS THINKING METHODOLOGY

This research began with the premise of understanding bottom-up social innovation processes that allow social actors to become co-producers and co-designers of intended

social interventions (Morelli, 2007). The three levels of action (Margolin, 2015) provide the boundaries within which social design practices can be further evaluated. This research reviewed a total of 22 social enterprises and sustainable business models that were established in Singapore within the past 10 years. Of the 22 case-studies, 9 were selected to further analyse based on their common goals of community building, knowledge sharing and cultural sustainability.

The challenge of this research was to connect the 9 social design models and forge systemic relationships to propose a more impactful sustainable movement within the region. Taking from the previous section's argument that all design exists within systems and all systems are cybernetically understood, mapping was used as a tool to define the three levels of action and engage with the existing systems. The methodology involved a threefold process:

1. In-depth case-study analyses
2. Mapping of keywords and drawing relationships
3. Identifying thematic parallels

2.1.Case-Study Analysis

The 9 business models included in this study were selected based on an active engagement of sustainable initiatives involving either social or environmental issues within the creative industries. They have been organised in Table 2.

Table 2. Case-Studies of 9 Social Enterprises

Organisation	Sustainability Agenda	Operational Model
Art for Good	Social Issues	Built on the principle of "doing good through art" to build communities for vulnerable children with special needs, living in poverty or suffering from mental health issues.
Baliza Shop	Social Issues	Partners with a vocational center in India to provide transferable skills through textile design. Traditional crafts are sustained and preserved through education, profits are used to support communities of women and children living in poverty.
Covenant Jewellery	Social issues	Employs young jewellers and silversmiths in Cambodia to preserve traditional crafts and culture, creating employment opportunities.
Eden+Ellie	Social Issues	Provides work opportunities for communities in need through social integration and training of skills.
Ma Te Sai	Social Issues	Works with artisans from disadvantaged communities in Laos to gain access to consumer markets, preserving cultural traditions.
Matter Prints	Environmental Issues	Educates consumers on the concept of slow living, translating narratives and heritage through print design.
Terra by Qlothe	Environmental Issues	Uses sustainably sourced materials.
Timbre Group	Social Issues	Employs ex-convicts and at-risk youths through music mentorship.
Unpackt	Environmental Issues	Zero-waste bulk store that promotes waste minimisation.

The selected cases are representative of existing activities that increase the social value and quality of a revised, inclusive market (Morelli, 2007). It can be seen from the table that the immediate concerns of the 9 case-studies involve community building and participation through fashion and textile design, handicrafts, art therapy, music education and sustainable consumption. The cases were analysed and further classified by sustainability agenda, focusing on environmental or social issues, and operational models. These social enterprises serve as catalysts to position art and design as a means to connect and engage with communities, promote inclusivity, empower through knowledge and skills, preserve traditional crafts and culture, and adopt ecologically mindful solutions. The 9 case-studies represent a sampling of social enterprises emphasising the importance of collaborative and participatory methods in creative practice.

2.2. Mapping

Form-giving, as an aesthetic and synthetic activity, is necessary to explicate design processes and designerly thinking (Sevaldson, 2017). The visual thinking process of mapping provides participants with rich insights and knowledge by moving across divergent and convergent dimensions of thinking. This produces a generative process of creating structures through interpretations and sense-making, to be further shared and communicated.

Mapping was found to be a necessary tool for this study, to visualise the relationships between the 9 case-studies and identify any overlapping themes or key areas of interest. According to Bowes and Jones (2016), "humans have been obsessed with systematically collecting and reorganising what in effect already exist". Mapping becomes a design tool to produce representations of complex systems to better understand problems through visual analysis. Glanville (2007) uses the analogy of drawing to illustrate the conversational experience of design, where the central act in designing becomes a cybernetic conversation with oneself. This same analogy can be applied to the activity of mapping, whereby a designer or researcher constructs meanings that can later be reinterpreted when viewing and observing the visualisation of information. The designer, as an observer, is outside of the system when placing pen to paper but becomes part of the system when interpreting and making sense of its implications. This allows a process of divergent-convergent thinking through the criticality of producing keywords and linkages.

The researcher applied the analysis of the case-studies (inferred from Table 2) into a process of unfiltered mapping to draw out keywords, actions, descriptions, boundaries, sub-themes and themes. As outlined in Table 3, three levels of mapping were implemented and

information was reorganised, restructured and layered to develop a bottom-up mapping of the 9 case-studies. Although sustainability was an overarching theme, the mapping process revealed that it was not a key objective or underlying motivation shared by all cases.

Table 3. Mapping as a Systems Thinking Methodology

Level	Intention	Process
1) Linkages	Divergent Thinking	List all related keywords and metaphors to define the core terminology
2) Concepts	Descriptive Analysis	Draw linkages and provide detailed descriptions to formulate concepts
3) Themes	Emergent Boundaries	Identify broader themes to organise all keywords, descriptions and linkages

Using Margolin's (2015) system of actions as a framework, a list of keywords was organised and mapped according to the commonalities found in individual practice and categorised as activities centered around communities, inclusivity and narratives. The keywords were further expanded with descriptions and reorganised by common linkages to identify the core themes of sustainability, skills and social change. These three thematic boundaries were scaled up to define the broader organisational implications for cultural, circular and design economies.

2.3. Levels of Action

The mapping process produced shared themes and identified broad areas for future action, producing the classification of individual, group and organisational activities. Mapping has revealed the macro, meso and micro-levels framing the 9 case-studies, suggesting a need to build a classification of sustainable practices in the arts.

Table 4. Analysis of Mapping

MACRO-LEVEL	
Focus	**Description**
Circular Economy	minimise waste, recycle, upcycle, refurbish, reuse, etc, into a closed-loop system
Cultural Economy	preserve, conserve, sustain, communicate, redefine, redesign into a collective identity
Design Economy	transfer, share, train, educate, etc. in the creation of value for society
MESO-LEVEL	
Focus	**Description**
Sustainability	need to preserve and conserve for future generations
Skills	ability to transfer knowledge and reinvent ways of making, doing, communicating
Social Change	allowing participants to engage in future-oriented actions and plans

MICRO-LEVEL	
Focus	**Description**
Community	defining the role of communities and the extent of involvement (Baliza, Covenant, Unpackt)
Inclusivity	opening the space of participation to all interested parties (Art for Good, Eden+Ellie, Timbre)
Narratives	focusing on individual stories and traditions (Matter Prints, Ma Te Sai, Terra by Qlothe)

Systems thinking can be used as an approach to analyse and understand existing situations at the micro-level, where impact is defined by the activities of existing social practices. Actions at this level produce and propose alternative solutions by introducing community activities, products and services to communicate individual narratives, and create spaces for inclusivity and community-building. The micro-level presents current and ongoing activities as the premise for proposing bottom-up social innovation and change.

The meso-level, which begins to link and connect the existing practices, comprises the key areas for collaboration beyond individual or organisational engagement. This space involves group action through the development of discourses to align shared principles and produce potential spaces for collaboration. *Sustainability* has become a key focus for individuals, businesses and governments, making it imperative that designers consider the implications and adopt its principles throughout processes of doing, making and communicating. *Skills* are not only necessary to transition societies from one way of living to another but transfer intangible knowledge through traditions and craft, producing communities of practice. *Social change* occurs through the active involvement of individuals, communities and organisations to create new movements of thinking and living.

The macro-level indicates opportunities for design to address future contexts of social innovation and sustainable practice. A discussion of a *circular economy* is inevitable when considering sustainability as a paradigm for creative practice, as all citizens contribute to the adverse outcomes of human action. The *cultural economy* is relevant to the understanding of how culture is transferred, preserved, reproduced, communicated and redefined against micro-meso-macro-level changes. Within the scope of this study, the *design economy* is defined as containing all working relationships and knowledge pertaining to the transfer of skills to form communities of practice.

Designers are collaborators in developing methods for dealing with complex systems and applying human-centered perspectives through design implementation (Norman and Stappers, 2015). Defining three levels of action provides a framework for understanding the

current landscape of social innovation practices. Actions at the *micro-level* are easily influenced and concern individual practices and ground-level interventions. The *macro-level* is defined by the overarching principles framing all activities through economies informing circular models, cultural preservation, and design practices. However, it is at the *meso-level* that design may be of most influence as this level involves interactions within social networks and institutional frameworks (Margolin, 2015). It is proposed that strategies at the meso-level demand a participatory approach, through co-design, for stakeholders to take ownership of solutions and increase the willingness towards multiple compromises (Norman & Stappers, 2015).

3. BOTTOM-UP SOCIAL INNOVATION THROUGH SYSTEMS THINKING

This paper proposes that cybernetics, as a conversational process, is deeply embedded within all design activities. Designers observe systems to induce change, producing holistic overviews across sociocultural contexts. This was explored through the conversational tool of bottom-up mapping to position existing social practices and mark the boundaries of systems and sub-systems. The visualisation process provided insights to further understand the deeper levels of existing social enterprises, identifying gaps in how the three levels of action form a system of change. One key factor in systemic change is the role of collaboration, which has become an important focus of design in recent years.

3.1. Participatory Approach to Social Design

Sanders and Stappers (2008) address the ambiguity of participatory methods by defining the terminology associated with collaborative work. Participatory thinking and collective creativity allow multiple stakeholders to develop peripheral awareness of neighbouring domains of practice and realise shared objectives and goals. The differences between the roles of co-creation, co-design and facilitation are distinguished by how the designer or domain expert is positioned within the collaborative working group. According to Sanders and Stappers (2008), co-creation involves any form of collective creativity between experts and non-experts. Co-design is defined by any form of co-creation, between designers and non-designers, following a design process. Designers, researchers and experts can also assume the position of facilitators, leading and guiding participants through creative processes. This produces a hierarchy of collaboration, where participants may enter a participatory working group as a co-creator and eventually engage in the process of co-design. Furthermore, the role of facilitator is increasingly important to develop and foster future collaborative teams to create more impact for sustainable systems.

Social innovation requires the alignment of activities, processes and policies across micro-meso-macro-levels. Figure 1 illustrates the hierarchy of collaboration, positioning the modes of participation to the three levels of action.
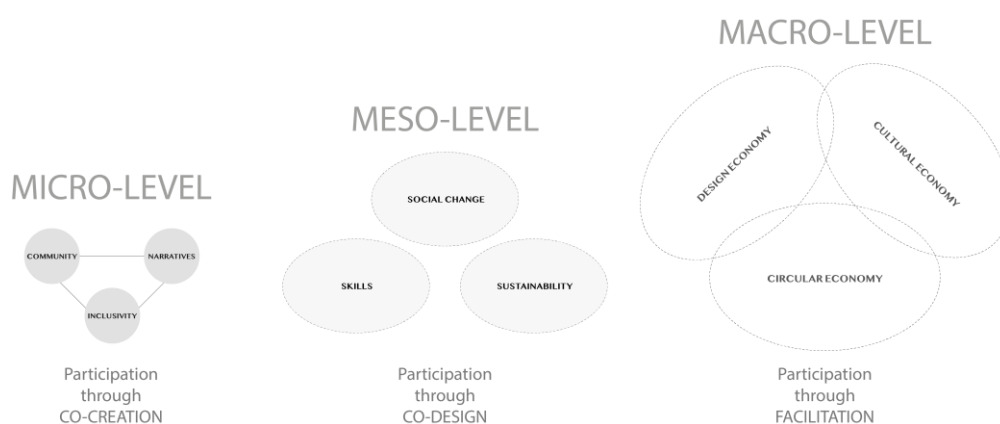
Figure 1. Levels of Social Design

The *micro-level*, concerning the practices of community, inclusivity and narratives, engages participants through the model of co-creation. Participants are involved in collective creativity, but the methods and processes may not necessarily follow those arising from the discipline of design. It is proposed that the *meso-level*, containing the sub-themes of skills, sustainability and social change, require design expertise to realise relevant and meaningful outcomes. This demands collaboration through co-design, as all involved stakeholders would need to partake in design development processes to inform and enrich a more dynamic space of participation. The *macro-level* focuses on the broader systems of the design, circular and cultural economies. It is at this level that the role of the facilitator would be most appropriate to foster the strengths and critical approaches of all stakeholders, through activities of co-creation and co-design.

3.2. Model for Social Innovation

Situating current practices allows for the representation of collective issues and concerns to be identified for future solutions to emerge. Systems thinking provides an alternative form of knowing and doing, where external relationships and complexities can be organised through modular sub-systems. Through a bottom-up approach to design, the implications for future action are supported and evidenced by these situated practices. The views, experiences and objectives of individual organisations serve as indicators of shifting trends and spaces for future modifications.

Problem identification in design utilises a systemic approach to draw the context of the issue and demarcate the boundaries for spaces of inquiry. This requires clear objectives for determining how systems can be defined:

1. Systems can be conceptual – *formulated to better understand the context of study;*
2. Systems can be cultural – *influencing ways of thinking, acting and behaving;*
3. Systems can be operational and directional – *defined by goals and objectives;*
4. Systems can be relational – *where each action influences future actions;*
5. Systems can be speculative – *proposing future problems against artificial constructs.*

Systems serve as explanations for complexities and a successful systems design is able to be decomposed, simplified, or approximated by linearisation (Norman and Stappers, 2015). Understanding the abstraction of problems through a system is a necessary precondition to developing frameworks, models and processes for future actions. As systems provide an understanding of ways of life, by containing all existing things and relationships, it conceptualises and articulates the problems spaces for future design enhancements. The discussion of the case-study has presented a systems thinking methodology within the scope of social design.

Figure 2. Systems Thinking for Social Innovation

This research presents an approach to systems thinking for social innovation that relies on (1) a clear understanding of systems as a means to frame and contextualise communities of practice, (2) the use of visual methods and tools to draw linkages and identify emerging themes, (3) the evaluation and classification of complexity through micro, meso and macro levels, and (4) developing a strategy for intervention. This framework provides a new perspective of design's role in defining sustainable futures through the application of systems thinking in social innovation and design.

4. CONCLUSION

Design has produced a world in which designers are presented with opportunities to alter, augment, intervene, and change existing conditions by imagining future possibilities. Many of the challenges facing the world today extend into a range of complex, societal issues resulting in a call towards sustainability. This has shifted the role of design from using systematic methods to produce artefacts and information towards a focus on interactions and citizenry. Design now requires new ways of thinking and doing through modifications, iterations and reflections to establish more robust models to evolve as a discipline for positive, social change.

The current movements of sustainability have developed participatory methods and community groups, informing discourses on various issues affecting complex systems. Cybernetics was introduced as a way of thinking and viewing systems through the three levels of action - micro, meso and macro. This paper collected, organised and evaluated the emergence of socially and environmentally positioned creative practices through a method of visualisation. Case-studies were analysed and categorised according to scale, scope, and impact to inform future contexts of collaboration through the modes of co-creation, co-design and facilitation. This bottom-up approach to systems thinking has produced a classification for the case-studies and future models of sustainability and social innovation. The implications of this paper suggest that systems thinking can be utilised to analyse, examine and contextualise existing creative practices, mapping the spaces of interaction to build a framework of understanding.

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