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Systemic design agendas in education and design research

A report and reflections on the RSD5 Symposium workshop

Abstract

Since 2014, an international collaborative of design leaders has been exploring ways in which methods can be augmented, transitioning from the heritage legacy focus on products and services towards a broad range of complex sociotechnical systems and contemporary societal problem issues. At the Fourth Relating Systems Thinking and Design (RSD4) symposium in 2015, DesignX co-founder Don Norman presented a keynote talk on the frontiers of design practice and the necessity for advanced design education for highly complex sociotechnical problems. He identified the qualities of these systems as relevant to DesignX problems, and called for systemics, transdisciplinarity and the need for high-quality observations (or evidence) in these design problems. Initial directions found were proposed in the first DesignX workshop in October 2015 and published in the design journal Shè Jì. In October 2016, another DesignX workshop was held at Tongji University in Shanghai, overlapping with the timing of the RSD5 Symposium where this workshop was convened. The timing of these events presented an opportunity to explore the design education and the research concepts, ideas and directions of thought that emerged from the multiple discussions and reflections in this experimental workshop. The aim of this paper is to report on the workshop as a continuing project in the DesignX discourse and to share reflections and recommendations from this working group.

***Keywords*:** Systemic design, DesignX, Design education, Design methods.

Introduction

The Fifth Relating Systems Thinking and Design (RSD5) symposium that convened in Toronto in October 2016, provided an opportunity to gather intelligence from a wide range of design practitioners with perspectives on design research and associated educational programmes and to make progress in developing a community on systemic design. To achieve this, the DesignX workshop drew from a large network of diverse participants, many of whom would not have been sufficiently engaged or invited to attend a dedicated DesignX symposium. The purpose of the workshop was to build relationships between RSD and DesignX and to explore the relationships between systemic design, existing educational programmes and the DesignX agenda. We report on three stages in the workshop's learning process: (a) setting context; (b) issues developed from group discussions; and (c) post-workshop questions and further reflections for additional complementary research. This last stage poses questions for future exploration.

Conducted in the same week as the *Emerging Practices Design Research and Education Conference* in Shanghai, RSD5 participants in Toronto were invited to contribute towards 'sketching some future paths for design professionals'. The intention was to be mindful of some of the ideas occurring between the Shanghai and Toronto workshops, using this DesignX themed workshop. As one of 14 pre-symposium workshops offered to 300 attendees, 26 participants were attracted to attend the half-day 'Future Paths for Design Professionals' workshop, which focused on ties to the previous DesignX themes. The symposium theme of

'Systemic Design for Social Complexity' invited participants to bring their stories, cases, methods, hopes and trial-and-error experiences for mutual learning and shared insight.

The workshop briefed engaged 26 participants on the discourse to date on the DesignX research and design education agenda. The workshop self-organized into five groups for thematic discussions after which group representatives presented sketches tracing the discussion and giving brief verbal recaps of key points. Subsequent reflections by the workshop facilitators raised three questions about: (a) echoes of the Design Methods movement; (b) changes in social and technological contexts in the 21st century; and (c) contemporaneous advances in complementary action agendas. These are critical topics currently under discussion in the design research community at large and the systemic design symposia conducted over the past five years.

Figure 1. Participants in the Future Paths for Design Professionals workshop.

The workshop opened with a high-level review of relevant journal articles, a discussion of the historical development of design education and an overview of recent connections between DesignX and the systemic design community. A suggested frame was presented to prompt groups to explore and record issues in breakout sessions. Following small group workshopping, summaries were presented from each table in a common plenary.

Workshop context and process

Susu Nousala facilitated an orientation with an introduction giving key excerpts from *Shè Jì* tracking the development of DesignX. As one of the authors invited to comment on the DesignX issue of *Shè Jì*, Peter Jones then reflected on the leading ideas, contexts, drivers, similarities and differences between the DesignX and RSD movements. David Ing introduced an alternative model for workshop theme framing, moving from the traditional format of a 'solution to a problem in context' pattern to a service-systems approach.

Participants then organized themselves into interest groups for the productive collaborative work of the event. Time was given for open discussion based on shared interests at each table. Outcomes of the discussions were sketched on poster-sized paper to track the course of conversations. These drawings and words served as cues for group reflection and to record and report shared and divergent interests. The facilitators monitored progress and encouraged each group to cover at least three rounds of issues in the time allotted.

Groups debriefed the other participants on the highlights of their conversations, and following the workshop, posters were displayed on the conference room walls to encourage review and response. The participants were further invited to engage in continued reflection and discussion through asynchronous email discussions.

Prior development of DesignX

Prior DesignX meetings in Shanghai involved position papers and discussion amongst top experts in the field. For this workshop in Toronto, practitioners who were unfamiliar with the renewed interest in design research were provided with a light briefing on recent progress in the discourse community. The primary agenda for the workshop was, however, to gather the views of those in everyday design practice about research and education that might respond in the long-term to the challenges faced by today's complex projects. This participation was intended to broaden the perspectives on design research with additional voices and to validate and/or add to concerns that had previously surfaced. The outcomes of this workshop might be further developed by academics and practitioners working together to bridge concerns and explore potential futures.

The 2014 DesignX collaborative initiative and manifesto involved educators from five universities and raised the need for a more comprehensive, evidence-based approach to design in complex systems and societal problems. It raised the question 'how design can address the complex sociotechnological systems that characterize our world' (Norman, 2014). Discussions leading up to DesignX explored the emerging role of design practices in developing extremely complex sociotechnical domains and the appropriate education and contributions for these activities. Some of the central questions at the time were 'Do our educational methods, especially the emphasis upon craft, prepare designers for this? What can design add?'

By 2015, the new international design journal *Shè Jì* had published a series of articles documenting the progress and state of discourses in DesignX. These articles were useful, as they documented the chronology of the discussion points to date. This made it possible to create a literature review based on the *Shè Jì* articles.

Workshop Briefing

Susu Nousala led the first part of the workshop, providing quotations sourced from *Shè Jì* to familiarise workshop participants with current concepts. These excerpts were shared with the participants by readings, discussion and reviewing ideas or issues and by printing them in large font and posting them on a wall to form a 'shrub' consisting of 'branches' of key concepts. The excerpts provided a springboard from which participants could develop key points that emerged from sharing the readings and discussion. Participants could also review the excerpts and/or full hardcopy journal issues provided by workshop facilitators.

The workshop 'shrub' image of *Shè Jì* text excerpts remained on the wall throughout the session so participants could consult its reference points during the discussion period. These points were not novel or futuristic but were pragmatic and intended to summarise the flow of ideas over several years in the prior development of DesignX. Whilst there were many points that participants could consider, the selections listed below particularly resonated as key points for participants, subsequently sparking group conversations that would then produce discussion and reflections.

An interdisciplinary gap

The journal *Shè Jì* and the DesignX symposium address an interdisciplinary gap perceived as having persisted in the design disciplines since the 1970's (K. Friedman, Lou, & Ma, 2015, p. 1). While the journal's title 'shè jì' means to 'establish a strategy', its subtitle, 'The Journal of

Design, Economics, and Innovation', is more explicit. According its founders, the journal's intent is to 'reinvigorate the concept of *Shè Jì* at the level of science and technology, and at systemic and strategic levels' (K. Friedman et al., 2015, p. 3). While the 'economics' of *Shè Jì* is still building its literature, the design context seems largely oriented toward business, social policy and other evidence-based sectors. The editorial intent of the journal meets DesignX in addressing the interdisciplinary gap in design research addressing complex systems.

Interest from the management and organisation communities has led to a deepening of design thinking and a revisiting of creative inquiry and the quality of experience (Buchanan, 2015). The development of design research can be integrated within the design curriculum through cross-disciplinary teams working in communities of practice (Poggenpohl, 2015).

Complex sociotechnical systems

The DesignX position paper in 2014 led to a series of developments that included formal articles in the inaugural issue of *Shè Jì* centred on design for complex sociotechnical systems and reporting of the 2015 DesignX workshop in Shanghai (Norman & Stappers, 2015a). DesignX recognises that the need to address systemic approaches to design problems and appropriate education is not new. It has been developing for at least 45 years, since Nigel Cross's declaration of design methods for complex problems (Cross, 1972).

The first DesignX workshop deliberately sought adjacent disciplines relevant to sociotechnical systems, including Flach's (2015) commentary from cognitive psychology and cognitive engineering. Flach makes a point about the need for engagement and learning in STS, especially reconsidering the level of commitment necessary in designing for complex systems, as designers ought not to expect to 'sit outside the sociotechnical system and throw solutions over the fence' (Flach, 2015).

Human-centric

In another commentary, this time from a human-centred design perspective, the modest ambition of small modular steps was seen as counter to design's tradition of bold thinking associated with giant creative leaps (Myerson, 2015). In response to these two commentaries (plus a third by Jones, outlined below), the authors of the original article argued that DesignX is not limited solely to one person, one phase or one solution. A creative collaboration between actors and stakeholders would include development and preparation through design education (Norman & Stappers, 2015b). The shift with DesignX could be seen as placing less emphasis on the 'making' and more on defining that which is to be made and its content (K. Friedman, 2015).

Reporting on the Shanghai DesignX workshop

Peter Jones shared a brief summary of his experience with the DesignX movement. Dr Jones was a participant in the October 2015 DesignX workshop in Shanghai, where he was invited to present one of the core case studies for discussion. Following the workshop, he provided a commentary (Jones, 2015) in *Shè Jì* that emphasised the influence of social complexity in all sociotechnical design contexts.

Norman's nine system factors (Norman and Stappers, 2015a) were presented as a backdrop to understanding the types of systems and conditions of interest in DesignX. These factors were proposed as the core characteristics of sociotechnical problems, here simplified as: (a) social and psychological factors of system participants and designers; (b) political and economic frameworks of complex systems; and (c) technical and systemic factors within STS problems.

Given that the workshop's intent was to orient participants to practice problems requiring an approach to social system change, a DesignX Theory of Change was discussed.

This approach involves recognition of: (a) sensitivity to initial conditions in an organisational context; (b) knowledge of social systems by internal and external stakeholders; and (c) recognition of the time required for change to become institutionalised.

Amongst the workshop groups, the team that focused on design education grappled with the issues of educational responsibility, defining the locus of change, and next-generation modes and disciplines. This coincided with developing views on solidarity between designers and other disciplines in dealing with complex systems and the call to address the complexity of innovation policy for shared societal contexts such as climate change, new economic systems and international affairs. Dr Jones also touched on the intent of the workshop to act as a bridge between DesignX and the Systemic Design communities towards continuing future discussion.

Generative Pattern Language Format

David Ing introduced a template for each group to frame their ideas and discussions based on early research on a pattern language for service systems (Ing, 2016). As an alternative to the traditional pattern format as a 'solution to a problem in context,' a service systems thinking approach advocates:

- who and what (voices on issues),
- how and why (affording values), and
- where and when (spatio-temporal frames).

Given the workshop's open discussion period of less than two hours, convergence on only a subset of the issues relevant to the first item (the 'who and what') was expected, and this would represent good progress.

Addressing perspectival variety

Participants' group presentations developed around five areas of focus, each of which entailed different interests and perspectives. Participants were asked to move around the other tables to share their focus and conversation and hear other perspectives and to self-organise according to common interests.

DesignX problem areas

Each of the five groups oriented towards a different DesignX problem area relevant to design practice, methods or education. Groups were invited to select representatives to review the sketches on their flip charts and relate highlights of the conversations.

- Design educators: For a design educator, what specialised expertise requires preparatory knowledge and practices to enable participants (citizens) to engage and lead transformations extended from the lab and studio to the arena and agora?
- Social designers: For a design professional in social innovation contexts, what can a community of practice do to develop our roles as social leaders on multidisciplinary teams for change?
- Designers working in policy: For policy designers, what can and should they do that others cannot to contribute to policy practices?
- Stakeholder design practices: For designers engaged with stakeholders (customers to planet), what are the values associated with the products and services co-created in the bigger system?
- Design learners: For design learners, what is the best way to continue ongoing learning in real life that includes learning by failing?

Preliminary common themes

Given that the workshop was a half-day session, the possibility of bringing together the same or similar groups at a later date was discussed with a view to extending discussion of the topics with exploratory reflection after the workshop/conference had closed. This approach was not actively pursued, although it was considered a useful suggestion.

At a pre-conference workshop, a wide range of nearly 30 design practitioners sought the opportunity to discuss generally the development of methodological techniques and approaches for working in a collective manner. This group work also allowed consideration of the rapid and ever-changing dynamics of the topics chosen and experienced by each group.

One emergent theme was support for designers in communities of practice and attractor contexts, raising questions about the elements necessary for the effective communication, dissemination and germination of ideas. This echoed changes that should be observed in design practice today, as published in the first issue of *Shè Jì*:

> Based on observed changes in design focus largely due to the widespread availability of technology, design research and its role in education and practice need to be newly situated. [....] Communities form around ideas, key people, institutions, programmes, books and journals. They provide the context and glue from which we can build without having to begin from scratch (Poggenpohl, 2015, p. 44, 56).

The context and focal points are clearly very important. A common point of reference or 'foothold' is often difficult to grasp. We find ourselves continuing to explore questions such as where and how practitioners position themselves and the problems within a larger sphere. In a systemic approach, design thinking is expected to give attention to the focal and domain levels simultaneously. The appropriate focus on skills required to comprehend dynamic contexts for design continues as a challenge to practitioners, students and trainers (Nousala, 2009).

Design education raised several themes, from new pedagogy and curriculum design to the experiential learning of designers in systemic design training. For design educators, specialised expertise requires significant preparatory knowledge and a formidable working practice of transdisciplinary study and design research. They require or must cultivate a deep understanding of the realities of social systems, institutions and work domains to direct educational attention to productive and meaningful systems contexts. New collaborative design and decision practices are necessary in pedagogy, not just technical systems design, as designers will serve as skilled facilitators for social participants (citizens) to engage and lead transformations extending from the studio to the practice arena and civic *agoras*.

Themes from the technological landscape of Big Data and the Internet of Things seem to be a significant factor for the shift in design education. This impact is influencing how design educators prepare individuals, including participants in design domain development. M.P. Ranjan was cited in the challenge between a designed object at hand and the context in which it is designed and used.

> I think we need to redefine what we are doing and think that design is not about making the object, but rather about defining what one shall make and in what context. The word 'context' for me is very important, and when we talk about context, we think about the globe, about climate change, and ecology, and so on. All these things emerge from that one square foot of land on which you are standing. Can you do something with that one square foot of land?
>
> (K. Friedman, 2015, pp. 81–82).

Both Ranjan and Poggenpohl were speaking about context as a systemic concept. In both authors we find a concern for social scale and human focus of action. From this viewpoint, we can locate both systemic and design thinking in a common context from which to work.

Future systemic and design thinking will also need to consider translations of increasingly dynamic and complex landscapes. We might better need to understand the skill sets we are educating to engage design within systemic, social contexts and those of non-human complex adaptive systems. Future methodologies may emerge as combinations of 'pathfinders' from across multiple domains that have already become intertwined in interdisciplinary programmes. As presented in the workshop, many educators are discovering ways to navigate this interdisciplinary terrain effectively, but only a handful of design curricula address systemic design in advanced degrees.

Reflections

Post-workshop reflections have been developed and questions formulated for subsequent continuing inquiry. By reviewing materials and recorded discussions from multiple sources, posters, sketches, and recordings, we have identified several key questions to guide continued deliberation of DesignX.

Where Are We Heading?

To what extent is DesignX retrieving, echoing, or perpetuating unresolved issues from the Design Methods movement? The influential Design Methods movement, started by J.C. Jones and others in a 1962 conference, was 'the result of post war optimism and a belief that making design more scientific would help to produce a better world' (Langrish, 2016, p. 1). The movement splintered in the 1970s when its primary direction was challenged by movements from both systems thinking and design.

If we count four generations of design methods (Jones, 2014), we might recognise the current movement of generative and co-design methods, even if it is not codified by the styles of scientific discourse as in prior movements. Table 1 shows a history of design methods and the approaches, or more precisely, authors, that distinguish the relationships between systemics and design in each.

Table 1. Four generations of design methods (Jones, 2014).

Generation	First	Second	Third	Fourth
Orientation	Rational 1960's	Pragmatic 1970's	Phenomenological 1980's	Generative 2000's
Methods	Movement from artistic craft to standardised methods	Instrumentality, methods defined & customised to context	Design research and stakeholder methods, design cognition	Generative, empathic & transdisciplinary methods
Influences & Outcomes	Simon, Fuller; Design science	Popper, Rittel, Jones; Wicked problems	Varela, Cross, Norman; User-centred design, participatory Design	Dubberly, Sanders; Generative design service design
Systems influence	Sciences and systems engineering	Natural systems and hard systems	System dynamics, social systems	Complexity

The first generation was characterised by a rationalist approach to developing methods for industrial design to meet the challenges of scale and corporate growth. The second generation recognised the necessity for adaptation and complexity, exemplified by Horst Rittel's systems-planning methods to address larger scale, so-called wicked problems. The third generation recognised the variety of human experience and the insufficiency of problem-solving and

rationalist methods. In design thinking, Don Norman and Richard Buchanan addressed design's reorientation towards experience and principles. In systemics, Flores and Ackoff exemplified the extension of design to complex stakeholder contexts. The rise of participatory design led to the current era, which we might consider in the wide acceptance of generative and co-creative methods across many scales and contexts. If we consider the modes of learning and education over four generations, the current era remains lacking in definitive, accepted methodologies. The current landscape seems quite consistent with the stakeholder-led empowerment inherent in the ideas of leading authors Sanders and Stappers (2012) and Lucy Kimbell (2012). In an era characterised by complexity, we might acknowledge there are many practitioners and practices, but few canons.

Directions of Design Research

We expect major criticisms of the relevance of design research during academic conferences; however, given the systemic mandate, how does design studies and research respond to the new century's social and technological changes?

Design studies suffers from being caught between ancient debates (e.g. the role of systems thinking) and current arguments (e.g. transition, decolonisation). The interest in a design research agenda by academics, practitioners and institutions worldwide is leading the current generation to revisit questions explored by leading authors who are now retired and/or no longer active in discussions. As often occurs when advancing interdisciplinary scholarship, newcomers mine the more accessible, appropriable concepts implicit in the structure of ideas and may find studies range-bound within a corpus. The typical developmental errors of citing recent sources and reading from design or single-disciplinary sources can shunt the direction of research towards well-worn pathways that are well-known in different literatures. Guiding design research through these pathways requires a breadth of vision encompassing different disciplinary discourses, multiple areas of depth and precedential knowledge.

Interdisciplinary design research recognises how ideas and practices become shared and developed through a discourse community. As Poggenpohl reminds us: 'communities form around ideas, key people, institutions, programmes, books and journals. They provide the context and glue from which we can build without having to begin from scratch' (2015, p. 56). This workshop was designed to sustain the systemic design community of research discourse by connecting DesignX to the RSD Symposium, reaching a much wider audience than invitational workshops.

We must also acknowledge that the career progression of design professionals encourages working well beyond the frame of academic or discourse-directed design research. The professional field of 'design' is 'full of fundamental contradictions and deep inner tensions that continuously feed discussion in the field' (Dorst, 2015, p. 30). An expanded range of that field spans: (a) commercial success versus public good; (b) creation versus problem solving; (c) idealism versus pragmatics; (e) outcome materiality versus immateriality, and (f) art school versus an academic degree. The distance between these ranges exposes many tensions.

Ph.D. programmes in design differ from 'doctorates in established fields and disciplines in that there is no set of intellectual norms against which to measure the value of a new degree, nor is there a community of scholars who can pass judgment on its merits' (Margolin, 2016, p. 5). If there was a distinction between advanced degrees in producing design and design studies, multiple legitimate standards might be established in peer reviews for journals, and pedagogical programmes contingent on the types of projects or interventions undertaken. In an interdisciplinary design programme such as systemic design, this tension of norm legitimation can become even more pronounced if there is insufficient capacity of senior programme advisors.

The design research agenda now enjoys an enlarged set of contexts in which to perform, as compared to the Design Methods movement. In the first generation of design methods, designers focused primarily on material products and focused on physicality and the associated phenomenology of human experience. With the third generation, in the 1980s, personal computing led to human-computer interaction, resulting in user-centred design and then interaction design practices. With the ubiquity of the internet and globalisation by the turn of the century, the fourth generation of generative design emerged with increased connectivity. Now the third decade of the internet is grappling with the Internet-of-Things (including Industrial-Internet-of-Things, IIoT), cognitive computing, and social breakdowns from hyper-connectivity and the inherent contradictions of globalisation.

Thus, the DesignX position paper asked whether education emphasising traditional crafts in design is preparing 'designers for work in and with complex sociotechnical systems' such as healthcare, transportation, government policy and environmental protection (Norman & Stappers, 2015a, p. 84). The suggested way forward for designers was proposed as 'muddling through, or 'to avoid trying to construct or redesign a large, complex system in one step', and instead, reaching the solution 'through modularity, and the introduction of numerous small, incremental steps' (Norman & Stappers, 2015a, p. 93).

A variety of responses ensued from the manifesto. John Flach emphasised that 'the design process never ends'. Educators are encouraged to recognise that rapid change and future uncertainties drive a pedagogy of continuous learning and adaptation, leading to designers who can participate with organisations that are 'self-organising, continuously redesigning themselves' (Flach, 2015, p. 98). Jeremy Myerson said that the sensible approach of taking small, modular steps 'goes against the grain of more than 50 years of project-based design education in which designers have been taught to think big and bold outside the constraints of any system, and to learn through trying, making, and failing' (Myerson, 2015, p. 101). Jones noted that any theory of systems change challenges designers to live with the consequences of their proposals. Any sociotechnical systems design ethically requires us to identify and discover deep users and stakeholders as participants to be engaged over much longer timeframes than we typically allow (Jones, 2015).

Jones (2014) further proposed a range of design domains required for the new territory of design: Design 1.0 or skilled craft design; Design 2.0, for product/service design in consumer markets and two non-parametric design domains; Design 3.0, for practices in organisational transformation, and Design 4.0 for social transformation. These positions are not placements in the (Buchanan) sense of multiple locations for integrated design thinking. D1.0–4.0 are conceived as having substantially different skill sets and design epistemologies. According to van Patter and Jones (2013), four domains range across stakeholders: (few ↔ many). processes (partial, downstream ↔ complete. upstream), challenge scale (compact ↔ expansive), complexity (simple ↔ multiple site complexity), fuzziness of challenges (defined ↔ undefined), and proportion of sensemaking to strangemaking (differentiating).

Progressing from Design 1.0 to Design 4.0 geographies increasingly gathers technical engineering and social sciences into larger creative systemic challenges. Educators in engineering, management and design all face the issue of crossing the borders of different disciplines. For designers to actively lead in multi-disciplinary endeavours, they have to assume both the privileges and burdens of translators and integrators across knowledge domains. A Design 4.0 geography of social transformation design calls for solidifying a poly-disciplinary network of researchers and academic institutions (Nousala et., al. 2012; Garduno et., al. 2015), drawing professionals from private and public sectors into a community of interest that becomes a community of practice (Garduño Garcia, Nousala, & Fuad-Luke, 2015, pp. 367–368).

Co-evolution of Systemic Design(X)

Are DesignX and systemic design developing in parallel or coevolving? If they are coevolving can we identify complementary programmes or research agendas for current and future studies? How do they align with other design advances? We conclude the workshop review with an overview of design research frames relevant to a DesignX research agenda.

A communicative research agenda develops and studies system-design languages for design and social change programmes. Design languages are techniques in which: (a) meaning is co-constructed into objects and processes, making meanings visible for people; (b) people learn to understand and use maps, models and knowledge representations for their practices; and (c) representations and objects become assimilated into people's experiences and activities. Several programmes associated with RSD have developed practices for their own cultural settings, including Oslo School of Architecture and Design, OCAD University, and India's National Institute of Design. The well-known practice of Gigamapping engages systemic problems with designerly modes of visualisation and future-creation, not to 'tame wicked problems' but in an attempt to grasp, embrace and mirror the complexity and wickedness of real life design situations (Sevaldson, 2011). Synthesis maps have developed to incorporate modelling from systems theory for complex social design problems, with each map project creating a systemic visual language resulting from the collaborations of a multidisciplinary team's study to translate knowledge and design proposals for wicked problems (Jones & Bowes, 2017). The research agenda does not aim to produce better mapping practices per se but the effects of employing integrated systems methods in complex sociotechnical design problems. Developing a repertoire and theory of practice for visual synthesis is a beneficial outcome of the research agenda, but the purpose of the design research remains that of effective process and system design.

A dialogic agenda in systemic design has developed over years of converging methods and schools of practice, primarily from systems practices, for design for democratic policy and collective social action. Dubberly and Pangaro (2015) proposed an agenda drawn from Glanville and Pask implicating an orientation to conversation as a cybernetic foundation for design. Where dialogue differs from communication design language is the necessity for second-order reflection, a process enmeshed in politics (according to Rittel), for agentive interaction to accomplish design intents. Jones (2014) recognised and developed four design trajectories associated with dialogic research intents.

1. Understanding: design as social science, relevant to understanding social practices, and for social designing for uncertain futures;
2. Anticipation: an agenda for designing cybernetic and multi-modal reasoning enabling anticipation for preferred futures,
3. Transformation: an emancipatory and evaluative agenda for defining critical proposals for social system and organisational change, and
4. Social Design: a social and participatory mode for design action research for organisational development and co-creative social design.

'In systemic design, any or all four research intents may emerge in a relevant research application. In some cases at least one of each intent for the different stages in research may be appropriate' (Jones, 2014, pp. 3–5).

The social innovation design agenda has developed over more than a decade, largely following 'research through design' practices and design modes of action research. Early movements in the social design agenda were established by DESIS (Manzini, 2010) and developed through design action in community practices (Manzini & Coad, 2015). The design activism movement has developed along somewhat parallel lines, 'opening design to continuously act on social problems, which involves stakeholders in collaborative ways to

generalise the problem-solving outcomes and knowledge' (Song & Lou, 2016, p. 286). Design research for social innovation has become a designerly mode of action research that refines ideation and exploration phases may become better established.

Design research agendas in health promotion and design for health contexts have rapidly grown, following a long incubation in healthcare-relevant research. The RSD symposia have given a platform to interdisciplinary health design studies, supporting work that does not yet fit or follow other discourse communities. The recent collection in Design for Health (Tsekleves & Cooper, 2017) featured studies developed to promote emerging agendas in public health, acute, chronic, and health policy. OCAD University's new Design for Health graduate programme has framed curricula and research with a broad health context, integrating public health and healthcare across the systems of policy, services and design for patient and community needs. Recently Fischer (2018) articulated a research agenda for future health through design for quality of life as a purpose-driven framework for transforming economies, lifestyle habits and social practices.

A broad sustainability design agenda has evolved from continuing programmes in environmental and socioecological design, with primary concern for sustainable product design and reconciling human habitation with sustaining ecosystems and bioregions. Ecodesign and Design for Sustainability (DfS) agendas have been characterised by four levels of design innovation: (a) product innovation, including green design and ecodesign, emotionally durable design, the nature-inspired design of cradle-to-cradle and biomimicry, and design for the base of the pyramid, (b) product-service system innovation, including value propositions satisfying function delivery rather than products and shifting from ownership to access and sharing, (c) spatio-social innovation, including design for social innovation, the natural-inspired design of systemic production of material and energy flowing from outputs of one process into the inputs of others, and (d) sociotechnical complexity, involving sustainability science, future studies, theories of transition, and cities as complex adaptive systems (Ceschin & Gaziulusoy, 2016). Some design approaches lean more towards an environmental dimension ranging from insular to systemic; others lean more towards a socio-ethical dimension ranging from technology to people, and design for system innovations and societal transition is among the most ambitious.

Evolving from some of the early sustainability agendas are more radical design-led directions consistent with systemic design themes. The transition design programme (Irwin, 2015) has evolved internationally as a philosophical redirection and design movement in response to ecological and economic overshoot. The 'design for flourishing' movement has developed as a socioecological design programme for business and government actors, with a critical argument against 'sustainable development' in favour of whole-system flourishing models. Human flourishing proposals have been developed as design principles drawn from reflexive modernism and strong sustainability, questioning the concept of the business firm and its normative measures of success. Design research agendas for flourishing business models (Upward & Jones, 2016) redefine the business-model canvas, business cases for startups and the business logic of competitive advantage. New directions in cultural sustainability (Skjerven & Reitan, 2017, Jones, 2017) redirect social and governance policies toward sustaining social, heritage, and historical cultural contexts. Relevant to the agenda for social flourishing, an emancipatory agenda for 'design for good', 'grounded on a clear ethical justification', challenges the presumption that economic growth is ultimately necessary (Garduño Garcia, 2017, p. 21; Garduno et., al. 2015)).

An architectural agenda with 'the user as inhabitant of a system' expresses the 'social and political human truths of the design process' (Steenson, 2016, pp. 1–5). Popularised by Christopher Alexander and adopted by the software development community, 'the language of patterns is a format that organises the parts, wholes and relationships in a design problem'. Created and interactive things in the world are mediated by design languages that 'play an

important role in the expression of the unfolding of meaning of objects' (Rheinfrank & Evenson, 1996, pp. 65–69).

The above catalogue of agendas for systemic design research is not meant to be exhaustive or exclusive, but instead to draw attention to the variety of forces at play in horizontal knowledge development and transfer between individuals and groups. Further, the emergence, evolution and sustaining of knowledge on design research occurs on many scales and across project teams, educational institutions and laboratories, small businesses, larger organisations, industry forums, industry clusters, urban districts and nation states (Nousala & Hall, 2008). Dynamic learning approaches for longitudinal development of robust groups or communities (e.g. action based learning, action research, living labs) include experiential learning cycles for independent, self-determining and self-governing innovation (Song, Nousala, & Aibéo, 2015).

Conclusion

The RSD5 DesignX workshop provided for continuity and discourse building between members of various design programmes, practices and allegiances. It was a not intended as a venue for specifically articulating and defining the design research agendas linking DesignX with systemic design studies or with these agendas. Further development of these enquiries through other workshops and discourses will extend the continuity of the discussion and evolve something of a common language, if not a corpus, to better fulfil the potential of design research agendas in systemic design.

The RSD5 workshop held in Toronto October 2016 resulted in a rich body of conversations amongst participants that is only partially reflected in this summary. It is hoped that the opportunity for subsequent sessions with differing members of the discipline (such as the contemporaneous doctoral workshop at the Tongji University College of Design and Innovation) will deepen the enquiry into the purposes and meaning for design research. Engaging practicing designers on issues with current and prospective work reveals blind spots to which educational programmes should respond. The questions raised in the post-workshop reflections could be expanded, exploring additional perspectives that have not as yet been recognised or appreciated.

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