Contexts of Co-creation: Designing with System Stakeholders

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Abstract The concept of co-creation includes a wide range of participatory practices for design and decision making with stakeholders and users. Generally co-creation refers to a style of design or business practice characterized by facilitated participation in orchestrated multi-stakeholder engagements, such as structured workshops and self-organizing modes of engagement. Co-creation envelopes a wide range of skilled social practices that can considerably inform and enhance the effectiveness of organizational development, collaboration, and positive group outcomes. New modes of co-creation have emerged, evolving from legacy forms of engagement such as participatory design and charrettes and newer forms such as collaboratories, generative design, sprints, and labs. Often sessions are structured by methods that recommend common steps or stages, as in design thinking workshops, and some are explicitly undirected and open. While practices abound, we find almost no research theorizing the effectiveness of these models compared to conventional structures of facilitation. As co-creation approaches have become central to systemic design, service design, and participatory design practices, a practice theory from which models might be selected and modified would offer value to practitioners and the literature. The framework that follows was evolved from and assessed by a practice theory of dialogic design. It is intended to guide the development of principles-based guidelines for co-creation practice, which might methodologically bridge the wide epistemological variances that remain unacknowledged in stakeholder co-creation practice.

Introduction

In less than a decade, the promise of participatory design as a sustained practice has diffused into mainstream practice as design co-creation. Co-creation has emerged as a normative mode of participatory engagement for design ideation, creative problem

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P. Jones, K. Kijima (eds.), *Systemic Design*, Translational Systems Sciences 8,
https://doi.org/10.1007/978-4-431-55639-8_1

solving, and decision making. While contemporary practitioners may regard these practices as accepted methods, they have evolved over a 50-year period or more, from earlier forms of co-creation based on social systems and democratic practice theory. In this lengthy integration into common use, the diffusion of co-creation confirms a social form of Buxton's (2008) "long nose" of innovation, whereby new forms of practice incubate for long periods before adoption. Throughout this period, a deep foundation of knowledge and principles has been formulated, contested, and practised based on supporting research from social and systems sciences. However, we can observe that knowledge, methods, and practical applications from the originating systems practices, in particular, have not been translated to modern co-design and workshop methods. The concern for collaborative efficacy addressed here claims that normative design methods have not fully developed and remain at risk of degradation into popularized forms insufficient to the complexity of design problems purportedly addressed by co-creation.

As creative and traditional participatory design methods became popularized across a wide range of contexts, co-creation (or co-design) has emerged as a common reference to participation (Sanders & Stappers, 2008; Robertson & Simonsen, 2012). Systemic design practices have developed co-creation approaches that integrate social systems principles to guide stakeholder design for complex systems. However, emerging design schools such as systemic design, service design, and transition design offer little precedent for research support or universal guidelines for co-creation. Where systems methods cite prior scientific principles to support intervention approaches, design practices often follow "best methods" that are assumed to embody effective principles. Design co-creation methods that fail to account for social systems principles are vulnerable to systematic errors that might result in problematic consequences.

This study addresses the contexts, structures, and processes of design co-creation methods considered essential practices in systemic design. To better bridge theory across design disciplines, we include comparable practices such as design thinking workshops, stakeholder engagements, and participatory and collaborative design methods. The philosophy of co-creation, drawing on participatory design and democratic practices, assumes that stakeholders will achieve satisfactory outcomes if given responsibility for decisions and have equal status in convening roles. However, if we fail to compare these practices with other structures for engagement, we may assume or conclude that successful outcomes are causally determined by certain methods, when many rival hypotheses could explain either beneficial or unsatisfactory outcomes. If we merely valorize the perceived goodwill or social benefits of co-creation, we risk obscuring critique of co-creation methods. Our avoidance of critical discourse inhibits collective scientific learning and, pragmatically, the ability to constructively improve these methods.

Co-creation practices are highly variable in outcome, are contingent on the skills of individual practitioners, and have limitations of which their practitioners are unaware. These are similar concerns expressed in the communities of team consultants, group facilitation practices, and across all types of dialogic practices. As these practice concerns have not been addressed sufficiently in the literature, the problem of *collaborative efficacy* is introduced in this study as a concept of assessment.

What requirements can be identified for effectively adapting co-creation to match the demands of real-world complexity? Our design choices in co-creation practice must have sufficient power to anticipate and effect desired outcomes in target social systems following a design workshop.

Four current questions of co-creation practice are explored and developed:

- How can we improve our ability to understand social system contexts and to select appropriate co-creation methods to the context?
- How can we enhance collaborative efficacy in design co-creation?
- How does system context determine stakeholder representation for complex social systems?
- What systems science models might significantly enhance co-creation practice?

Background and Contexts

The practices assigned to the term co-creation are observed across several domains, and in all cases we find not a coherent methodology but a term of art encompassing many methods. As with other modes of psychosocial understanding (e.g. sensemaking), a framework for practice supported by theory would usefully inform capacities for collaborative efficacy and engagement. A framework enables the transfer of knowledge and training across different domain practices and the development of new skills upon a corpus of accepted knowledge. The intent of the current study is to propose a framework and methods, supported by an established (but relatively unknown) practice theory, to improve the capacity of organizations to advise and enact systemic design workshops with clients, users, and other stakeholders in complex engagement situations.

Both design and systems methods employ participatory stakeholder engagements, whether referred to as inquiries or interventions (in systems modes) or workshops and studios (in design). Group intervention practices based on systems theory include published processes such as Interactive Management (Warfield & Cárdenas, 1994), Appreciative Inquiry (Cooperrider et al., 2008), and Team Syntegrity (Espinosa & Harnden, 2007). Design co-creation practices are not as formally documented or developed. Numerous branded methods have been developed based on structured brainstorming and creative problem solving. Three classes of methods are frequently identified by both design and systems schools: creative problem-solving methods (Osborn, 1963; Nadler, 1981; Basadur et al., 2012), organizational development (Owen, 1987), and group deliberation processes. VanPatter and Pastor (2016) organized 63 process models into six distinct groups, all of which involve co-creation practices:

- Creative problem solving
- Design process models
- Product design
- Service design processes

- Organizational innovation
- Societal innovation

The VanPatter and Pastor report did not perform an evaluation and comparison of method efficacy; rather, they identified (mapped out) internal structures and the applicability of methods to practice contexts. No similar peer-reviewed evaluation has been published to validate the effectiveness of co-creation methods in their appropriate contexts. Many specified methods, even if claimed as scientifically based (e.g. MG Taylor and Basadur Simplexity), are branded or proprietary craft practices and therefore difficult to validate or compare. For these reasons, as well as the difficulty of mastering multiple methods, we find minimal peer critique of methods between practice communities.[1]

Branded co-creation methods are typically supported by core practice communities, trained facilitators that become associated with a single method, even if trained in many through exposure to related practices. Continuing in-cohort practice and invested expertise generally results in a kind of method allegiance, so we might argue that little motivation exists for professionals to objectively assess the effectiveness of a preferred co-creation method. Due to the absence of critical cross-evaluation or peer review of practice methodologies, we might propose that co-creation methods would be enhanced if they were evaluated and improved by assessment according to scientific or reference standard principles.

An unbiased assessment of prevailing methods would present a methodological challenge—what evaluation criteria would be deemed acceptable by the different schools of practice? How could relative levels of expertise be measured? How could the relative effectiveness between methods be presented fairly across practices without the evaluators having significant expertise in the methods themselves?

These questions are raised but not answered. The purpose of this study is to identify methodological and developmental issues shared between all co-creation methods and to recommend a common methodological solution. The assumption is made that systems theory and design methods mutually influence and enable more effective design co-creation and collaboration, and indeed that both are necessary for collaborative efficacy in stakeholder engagement. The knowledge claim is that systems science provides a basis of principles and guidance for assessing and qualifying the effectiveness of all co-creation methods.

Recreating Co-creation

A review of published practices of design co-creation reveals a scattered literature across related disciplines. Forms of structured co-creation, as a stakeholder organizing activity, are noted across disciplinary journals, from collaborative design to

[1] This observation is made based on the author's personal involvement across many group method communities of practice, from the period of research for *Handbook of Team Design* (1998) and continuing into the latest design thinking practice groups, including international online communities and conference-based communities.

design methods to dialogue workshops. The concept of co-creation has evolved independently across several broad disciplines and manifests differently in business, design, or systems fields. There is no apparent canon or core theory of co-creation that the various schools or approaches all recognize. If a widely accepted methodology is to be adopted and propagated across many practices claiming its use, it might make sense for the disciplines that promote co-creation to seek and specify a common referential basis.

Co-creation as Theory of Value

The dual distinction of "co-creation" as a design process and as a business value-finding process requires some clarification from the literature. *Value* co-creation was established as a core theoretical concept in the business literature by Prahalad and Ramaswamy (2004a). Value co-creation was proposed to encompass the shared value constructed between a service provider and consumers in their interaction with the provided service, of value in use, where value is co-created between the provider (and their constellation of resources) and consumers in interaction. In this perspective, value is not "delivered" or exchanged but co-created in active use. Prahalad raised early issues regarding value co-creation through *experience* (Prahalad & Ramaswamy, 2004b) as the basis for value realization. A radical vision for its time, they raised numerous questions only recently studied, for example, with respect to the means by which firms might engage in dialogue with consumers, the emerging governance structures for online firms with massive user bases, and the determination of appropriate management styles and methods for co-creation with customers. Several systematic reviews of value co-creation (Voorberg, Bekkers, & Tummers, 2015; Galvagno & Dalli, 2014; Frow et al., 2015) demonstrate the development of studies with empirical support for value co-creation theory, extensions, and application studies.

Co-creation is also found as a concept of value, rather than an organizing activity, in business innovation contexts. Co-creation represents the realization of value propositions in business contexts and in stakeholder engagement (Frow et al., 2015), and the concept of value co-creation is proposed by service-dominant logic (Vargo, Maglio, & Akaka, 2008). Further, Ind and Coates (2013) have connected the business theory of value co-creation to the co-creation of goods and services in collaboration between consumers and organizations. They extend the context in which co-creation occurs to the meaning-making among participants in a value constellation, including customers, designers, managers, and other stakeholders, equally. Ind and Coates suggest participatory design as a means of co-creation, but recommend no particular methods or practices.

However, many of the theoretical issues raised remain unaddressed, in particular the questions of "how" value co-creation occurs and the observed construction of the experience of value in particular domains. Prahalad's theory has been translated to the practices of design co-creation, where the formulation of new product and

service propositions and artefacts are co-produced to embody the preferences and values of consumers, through key users. This leap, as it were, from theory to method might be considered one of the most influential contributions of value co-creation.

Co-creation as Design Method

In design fields, co-creation is understood as a mindset for creative participatory practice (Sanders & Stappers, 2008), with the adoption of co-creation mindsets following the diffusion of design practices into corporate and public organizations. Yet design co-creation has also been constructed as a process method in action research, as a means of facilitating stakeholder workshops in formal design. If co-creation workshops are to be used in qualitative research, a foundation of canonical work and guidelines might be expected as in any codified disciplinary practice.

The published review of design co-creation process models by VanPatter and Pastor (2016) is one of the few accounts that compare and describe factors across these models. The systems literature does not often refer to the term "co-creation," but reveals a long history of group intervention and problem structuring methods.[2] The systems studies explicate methodologies for group interventions, but do not differentiate collaborative (co-creative) versus expert-led methods. Neither design nor the systems literatures compare relative effectiveness of co-creation methods, again because there are no accepted criteria (across practices) for process or outcome evaluation.

Co-creation methodologies (or methods) are difficult to compare because they are performed in very different practice contexts. Co-creation methodologies can include modes of facilitation (e.g. Art of Hosting), creative organizing (OASIS), generative co-design, and dialogics (Open Space, Appreciative Inquiry). These practices can be rightfully defined as methodologies when structured as frameworks entailing a system of mutually coordinated methods. Yet they are frequently presented as philosophical stances and not formal methods. Even when referenced in social science studies, their phenomena and outcomes are discussed, but not their performance or measures of effectiveness with group behaviour or engagement quality. This study aims to provide a foundation for defining performance criteria and the fit of co-creation methods to appropriate contexts and effective adaptation.

In practice, facilitated or workshop methods are rarely assessed for their fit or weaknesses in a given context. The open literature may be biased by numerous practitioner studies reporting on craft workshop techniques recruited as generative design methods. There are also few scholarly articles that present cases describing applications and outcomes of more than one co-creation method. The quality criteria for this area of design practice is not guaranteed by adherence to standards or

[2] Two widely cited discussions, although not systematic reviews, include Mingers and Rosenhead (2004) and Midgley, Cavana, Brocklesby, Foote, Wood, and Ahuriri-Driscoll (2013).

evidence, or even to process criteria, but to the participants' assessment of workshop outcomes. Evaluating a final result cannot resolve the counterfactual of what a better process might have been.

Co-creation Systems

Systems approaches to co-creation are recognized by their appearance in the systems literature and their specifications of systems science principles underpinning the methods. Systems methods have been developed to support collective planning, social change, and organizational development, all atypical contexts for design practices. Systems methodologies imply their adoption of design as a process, not as a creative discipline but as an approach to synthesis in problem solving and creation of future alternatives, and to "dissolve wicked problems" through system redesign (Pourdehnad, Wilson, & Wexler, 2011). According to Pourdehnad's review, the distinctive difference between design thinking in system and design modes is the different focus of designing activity. Systems co-creation identifies stakeholders as the designers in co-creation and designers as participants invested in their future aims, plans, and outcomes—a central distinction emphasized by Christakis (Christakis & Bausch, 2006).

Systems co-creation methods are developed by formulating models, identifying systemic principles, and evaluating by continual and improving use over numerous cases. Systems methods can account for over 70 years of methodology development, as even basic workshop methods cite Lewin (1951), Mumford's ETHICS, and Trist's Search Conference. Organizational practices for large group intervention and team collaboration developed through guidance from the systems sciences, since the development of the Tavistock Search Conferences by Emery and Trist as early as 1958 (Emery & Purser, 1996), and Jungk's development of the Future Workshop in the early 1970s (Jungk & Müllert, 1987). These methods predated participatory design (i.e. Bjerknes et al. 1987) and anticipated the large group interventions now considered common practice.

Structured systems-inspired methods for collective sensemaking (co-creation) and decision making were developed following the era of normative planning and direct stakeholder engagement, as advocated by Özbekhan (1969) and Jungk in the 1960s. Following Lewin's change methodology and the Tavistock Search Conference model, early organizational change methods were directly based on social systems methodology. During a period when design workshops rarely ventured outside the immediate client context, systems thinkers Warfield and Beer were developing software algorithms to represent group decision making in emerging consensus building methods. The IBIS (Issue-Based Information System) methodology (Kunz & Rittel, 1970) was also developed during this era and adapted for collective issue analysis decades later with the Dialogue Mapping process (Conklin, 2006), an embodiment of IBIS.

The four common systems-oriented co-creation methods include Team Syntegrity (Leonard, 1996), based on Beer's methods; Appreciative Inquiry (Cooperrider & Srivastva, 1987), based on Ackoff's idealization methods; Future Search (Weisbord, 1992), based on the Emery and Trist Search Conference; and Structured Dialogic Design, based on Interactive Management (Warfield & Cárdenas, 1994). All of these share an explicit underlying principle of selection for requisite variety and/or idealization, even though each has uniquely distinct modes and other principles. Systems co-creation methods evolved from the development of scientific theory anticipating collective human behaviour. Well-developed sets of principles and methods of multi-stakeholder participation have been developed within these separate practices by peer review in discourse communities. Little work has been published relating the underlying theories to one another; as with design co-creation, practitioners of one method have not blended or integrated these forms.

Design Co-creation

Design co-creation emphasizes the collaborative, generative creative participation of individuals in design-led workshops and group practices. Sanders and Stappers (2012) describe co-creation as an evolution of participatory design practice that can be conducted by one or more of three modes: mindset, methodology, or tools for engaging users and stakeholders. Design co-creation emerged as a general approach to participatory design resulting from the broader adoption of co-creation as both method and mindset.

Searching for the sources of *design* co-creation reveals a range of commonly adapted practices, from participatory design (Muller, 2003) and IDEO's design thinking methods (Brown & Katz, 2011) to the adoption of the "unconference" derived from Open Space (Owen, 1987) as a co-creation structure.

Design co-creation draws from an ever-expanding range of creative ideational activities employed with appropriate external participants that inform generative ideation, the essential function of co-creation. The context for participation is a key differentiator in design practices. The four design domains in Fig. 1 suggest four populations of participants. Design 2.0 entails product and service design, a context in which product users are situated as the primary participants informing co-creation. Design 3.0 (organizational process) draws on the population of an organization and their knowledge and values from managers, staff, and employees. Design 4.0 draws from across stakeholder populations for social contexts of any scale—community members or citizens, for example, or members of an industry. By definition, the contexts for Design 1.0 are not indicated for co-creation. Design 1.0 involves non-complex design tasks sufficient for a designer or team under direct guidance and not directly informed by stakeholder engagement.

Since roughly 2010, the trend of increasing demand for Design 3.0 (intra-organizational) and 4.0 (social/societal) applications has driven the integration of systems-informed inquiries with design methods. After early attention towards field

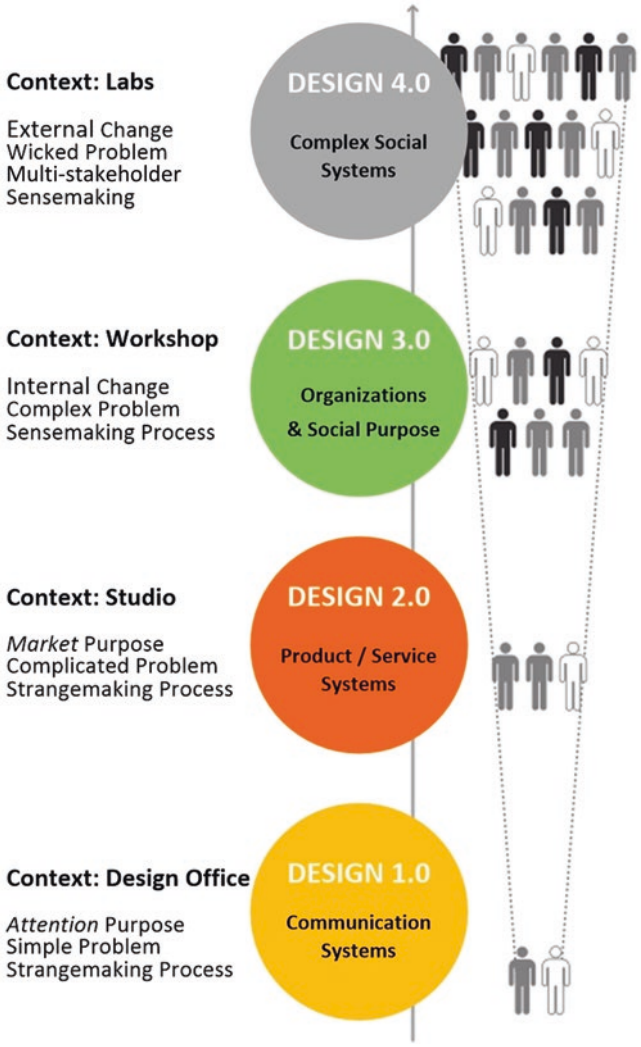

Fig. 1 Design domains and associated contexts

development of theory, methods, and cases, a current focus among scholars (as represented by other articles in this volume) has turned towards developing these contributions to improve performance in their applicable practice areas. Systemic design may be ultimately valued and recognized for field development and methodological contributions to practices and human performance in social systems.

A recent trend in design co-creation is perhaps an antithesis of systemic methodology. The "sprint" (Banfield, Lombardo, & Wax, 2015) is an emerging co-creation workshop approach that has gained use in business and public sector contexts, derived from the agile development processes now accepted and widely used in

corporate practice. As its name suggests, the sprint process favours a rapid action mindset and is an intensive approach to early-stage design production and value proposals. Sprints draw on available organizational participants (Design 2.0 and 3.0) and typically proceed without user research or field studies. Sprints are similar in intent and process to joint application development (Carmel, Whitaker, & George, 1993) and Team Design (Jones, 1998) methodologies, in process and facilitation. These practices all share in common their origination as business-oriented strategies to maximize stakeholder and user responsiveness for often limited periods of team time involvement. The difference with the sprint is its emergence within a significantly different business culture than in the 1990s. JAD and Team Design aspired to become participatory practices, but such approaches remained at cultural variance to North American business organizations. The sprint process has revived the structured facilitation of these methods, with goals of high productivity and return on participation.

Among the notable trade-offs in rapid design co-creation are the lack of time for challenge reframing, the high probability of low stakeholder variety, the groupthink effect facilitated by the consensus drive to immediate accomplishment, and the brittleness of design proposals constructed in a rapid linear process. However, with the emphasis on early-stage design (initial creation) in the sprint or JAD modality, the products of these workshops are never final and are formally assessed, further developed, and evaluated by process teams following the co-creation event.

Co-creation in Design Process

While design co-creation can inform and facilitate nearly any collaboration, it emerges as necessary in complex domains for which a design team would not have knowledge or agency. In earlier work (Jones, 2014), we illustrated four domains that define contexts for design team, participation, and venue for design activities. Figure 1 presents this scaled model differentiating relationships that facilitate the focus of design attention to sensemaking (understanding and articulating stakeholder concerns for design decision), change-making (orienting design decisions towards social or organizational change), or "strangemaking" (articulating design products as distinctive means of shaping attention, as in design of brand identity). The venues—Studio, Workshop, Office, or Lab—reflect four currently practised applications. The framework developed further in the article proposes new distinctions for these venues as contexts aligned to design purposes.

Design 1.0—*Design Office or Studio*. Simple design problems, well defined by briefs. A small design team working within a team context, guided by project sponsors and a design brief.

A "strangemaking" context where the typical object of design is to produce a distinctive, original artefact perceived as unique and high quality.

Design 2.0—*Design Studio*. Complicated but not organizationally complex design problems, resolvable through contemporary methods. A multidisciplinary design team in service to sponsors (product/service owners), typically using an iterative design process in a studio environment.

Balance of sensemaking (e.g. the consensus of understanding developed from user research) and strangemaking (the unique offering and position of product in a market).

Design 3.0—*Design Workshops*, usually at sponsor locations. Complex organizational problems, which may appear complicated until differences in stakeholder positions are recognized. Contexts are not knowable to external design firms, and conventional methods may be inadequate to the complexity of power, history, and routines in an organization. Design team plus multiple expertise disciplines in stakeholder workshops within an organizational setting.

Sensemaking context, with object of design to reach understanding and facilitate decisions for value co-creation for the organization itself, rather than markets. Yet the problem space remains complex and sensitive to the overdetermination of methods.

Design 4.0—*Design "Labs"* hosted by third-party mediators for multi-organizational workshops. Complex problem space that is identified as an external situation of concern to the stakeholders, such as climate change or affordable housing. Sponsors may be a supra-organization, but the multi-stakeholder context may call for offsite or "neutral" locations for workshops.

The object of design may be a strategy, policy agreement, operational concepts, or plans developed by parties in sensemaking context. Methods are entirely oriented towards sensemaking and achieving shared understanding for mutual action.

A default context for formative design co-creation assumes a workshop setting with client and/or user participants joining an extended design team. The physical venue might be a large, supplied conference room or a studio room in the design office.

These venues or settings represent genres or habitual modes of practice developed through accommodation to increasing organizational adoption. As venue and process structures have become less formal through greater adoption of co-creation activities, a wider range of creative and participatory methods have been drawn in to facilitate collaborative ideation and creative visioning and planning. Informal design practices appear to demand less organizational investment. With greater acceptance of informal design-led modes, the demand for more formalized, validated methods has declined, due to the comparative time and costs involved in managing highly structured process. As sponsors have become conversant in the genre of structured collaboration workshops and relax concerns for their productive output, increased demand has emerged for shorter engagements, faster turnaround, and immediate deliverables from co-creation activities. A framework for systemic design co-creation is proposed to enable designers to balance these economic and organizational demands with the necessary activities that guarantee quality outcomes and collaborative efficacy.

Co-creation and Co-design

Design co-creation workshops have experimented with mixes of systems practices and design methods in various ways. A common approach is to develop systems thinking models for understanding contexts and relationships in *existing* problems, and design thinking as methodology to create formative or future possibilities. Typical methods present a system as an existing complex situation that requires inquiry to achieve a common understanding of patterns, behaviours, and places for intervention. Interventions are designed as future options for change in the existing system.

Co-creation approaches, whether as mindset or method, have become adopted as design thinking methodologies across corporate and public sectors (Ind & Coates, 2013). Due as much to their accessibility as effectiveness, design thinking methods have expanded into government and social services and increasingly policy and governance. Fred Collopy argues that, because systems thinking failed to demonstrate wide adoption in management practice, design thinking offers a potentially more productive approach for managers and organizations to engage in complex problems (Collopy, 2009). His argument recognizes the lack of system dynamics reasoning by managers, after more than a decade of training and promotion in business education (Senge, 1990). Collopy proposes that the iterative, product-oriented creative tools of design thinking readily align to the project-oriented work practices of contemporary organizations.[3] While design thinking has now become a broadly adopted approach, its influence in management practice has still not been established, even after a decade of curricular promotion similar in many ways to the systems movement. In co-creation practice, the envisioned integration of thinking methodologies might be developed or fused in the enacted practices of managing projects and multi-stakeholder production.

Co-creation in Social Systems

In the complex, non-parametric (and indefinite outcome) design contexts of Designs 3.0 and 4.0, collaboration among decision makers, experts, and stakeholders becomes a requisite to facilitate agreements and mitigate risks of foresight and execution uncertainty. These contexts for co-creation are complex social systems, involving design and decision processes for large organizations, public sector institutions, industry consortia, healthcare systems, and similar organizations. Complex contexts differ from the problem framing orientation of design, where the shared goal might be to optimize a product or service proposition. Co-creation within

[3] Jones (2009) joined this argument by suggesting that systems thinking was not widely adopted because it failed to address the everyday coping practices of managers, not that it failed as a reasoning mode per se. This proposal suggests a blend of systems thinking with design tools might better resolve complex concerns in innovation contexts.

social systems requires dialogue to elicit, understand, and contrast perspectives and positions, as only dialogue is able to resolve the "variety" in the system context of interest. Both Christakis and Beer argued that forms of dialogue are necessary for channelling and satisfying the requisite variety in a complex social system. Co-creation can be understood as a variety transformer, which accepts the high variety of inputs in a problem system and guides the resolution of positions to a preferred, commonly held reduction of variety into agreements and design decisions.

A substantial body of knowledge on dialogue science exists that might inform co-creation methodology. However, while some models of dialogue are situated in complex organizational settings (e.g. Isaacs, 1993), there is no consensus regarding dialogue methods in design co-creation. It seems likely that systemic design practices could be significantly enhanced by the disciplined exploration of dialogic methods in social systems applications.

A further critical observation is that the micro-practices of dialogue, which require extensive inquiry and sufficient time for listening to all positions, may be at odds with the action-biased approaches of generative design co-creation. From critical observations, it also appears that the time demands for dialogue constrain the practices and therefore choices in design co-creation. An argument can be made that these are false limitations driven more by expediency and the increasing demand for time-efficient practices. The integration of dialogue in design co-creation has not been sufficiently evaluated in real applications to address these superficial assessments.

Framework Development

The effective transfer of learning from a situated methodology to a new domain requires a clear definition of principles and options known in practice and from cases. This study applies the methodology of dialogic design to design co-creation. It follows scientific principles from Warfield's (1986) Domain of Science Model (DoSM) and models extending the DoSM (Christakis & Bausch, 2006; Christakis & Dye, 2008). Warfield promoted the DoSM as a methodology for improving and sustaining a methodological practice, which could include a discipline or design process, following a rigorous process of self-observation, evaluation, and adaptation over the cycles of practice. Without intentional evolution of a methodology, codified processes can drift from the original practice and erode or disappear if not renewed by continuing application and assessment. As Warfield did not publish the DoSM, its working paper became used as a reference model for practitioners, as a kind of practice theory guiding the advancement of systems methods. To our knowledge it has never been applied outside the systems sciences, so the application to design science in the current research represents an "extension.[4]"

[4] The DoSM is *extended* (in the mathematical sense of a logical continuation of a set) to construct a reference model of the performance of collective design practices, commensurate with science and practice.

The DoSM was designed as a practice framework first applied to generic design science (Warfield, 1994), a framework for sociotechnical systems design. Warfield attempted to establish a rigorous basis for describing and intervening in human complexity based on process principles, an approach at odds with the emergence of complexity science at the time. Generic design science is based on structured methods, the formulation of stakeholder observations, and the use of mathematical formalisms to facilitate inter-observer understanding of systemic relations. He formulated two general laws of practice extended to the DoSM:

- Law of limits (all human activities have constraining limitations that must be observed for effective action)
- Law of gradation (conceptual developments, such as in science and design, are structured in stages of progression)

A series of design principles (laws of practice) were drawn from generic design science, which Christakis further developed in the dialogic design science (Christakis & Bausch, 2006; Bausch & Flanagan, 2013). The DoSM requires a corpus of codified knowledge and formal observations to propose extensions to a methodology, constructed from axioms (first principles) as a reference model. This framework was applied to the evolution of Structured Dialogic Design (SDD), the primary practice associated with DoSM. SDD methodology satisfies both laws of practice in the DoSM. SDD is founded on a careful match of methods to human limits, to accommodate the real limitations of cognitive bias, groupthink, and power relations within individual and collective performance. The extension of the staged model promotes continuous enhancement to accommodate changing ecologies of application. Stage gradation enables the transfer of scientific foundations, extending knowledge from dialogic design (a systemic design methodology) to the design practices of co-creation.

Application to Dialogic Design Practice

While the theories of Warfield have been advanced into practice by Christakis, there are core "Warfieldian" theories that might help bridge systems design practice. Systemic design can be conceived as optimizing processes for group design and decision making under conditions of overwhelming conceptual complexity. Based on Warfield's theory of complexity, we address the insufficiency of any individual (or conventional meeting) to resolve relevant knowledge and identify enabling distinctions to make decisions commensurate to the emergent social complexity of a future-situated problem system. Interactive Management was originally designed to enable groups to formulate high-quality conceptualizations of problematics and to achieve durable collective decisions with consensus based on an understanding of systemic relationships.

The process entails high-quality observations from the requisite stakeholders in a system to reach consensus through deep (or sufficient) conceptualization to enable

effective design decisions and change proposals. Such a description of process and outcome was at the heart of the DoSM and the dialogic design processes derived from the model. Warfield and Christakis described the insight within this staged process model as "lessons of the Arena."

While Warfield did not publish a methodology for applying the DoSM, Christakis adopted the framework to inform the evolution of dialogic design science (Christakis & Flangan, 2011). Dialogic design extended the earlier practices of Interactive Management with a systems science foundation to enable its extension by the community of practitioners. This process was initiated by the first compilation of methods and cases (Christakis & Bausch, 2006) and then developed by continuing deliberations, resulting in a series of publications and a revised methodology denoted as Structured Dialogic Design (SDD).

Christakis, collaborating with the practice community, articulated a coherent practice theory and principles that enabled a complete systems thinking process for democratic, collective decision making drawing on the emergent wisdom of participants. Essentially, the original process (based on IM) was rigorously analysed by practitioners for its insufficiencies to democratic theory. Using the DoSM as a guidance, principles (e.g. axioms and laws) were assessed to inform a complete methodology that would serve the applicable practice contexts in the community. We can now make the case that through this self-assessment process, dialogic design functions as a meta-methodology, providing a process framework that can support and validate a wide range of design practices.

A Process for Advancing Science as Reflective Practice

Warfield argued that "higher-quality language" had more impact on science than hypothesis testing, an extraordinary claim and one underdeveloped in science studies. His argument draws on the observation that scientific knowledge advances based on the collective understanding of concepts in a language domain. Higher-quality language enables the effectivity of understanding and the construction of more convincing arguments, allowing scientists (and practitioners) to release strongly held positions that would prevent the adoption of productive principles and methods.

By extension, the same claim can be made for other disciplines, including engineering, design, and certainly social sciences (wherein theoretical positions completely unsupported by hypothesis testing are commonly sustained in the literature). A disciplinary (science or design) language can be clarified through dialogue practices, and very probably similar dialogic practices can facilitate language clarification in any discourse. However, dialogue to produce meaning shared across discourses has become essential for complex systems design, which might involve designers, engineers, scientists, and decision makers. Krippendorf (2000) claims "*languaging matters* enormously."

> Discourses construct vastly different realities into which the ideas of a discourse are inscribed and in turn become available for inquiry and elaboration. … Different discourses not only construct incommensurable realities, their pursuit of different paradigms yields different kinds of knowledge: Experiments are not treatments, and neither are technical inventions (p. 56).

Krippendorff (2000) points out the futility of attempting to harmonize languages between discourses, as this has the effect of reducing the quality or accessibility of meaning to those within the relevant discourse of interest (e.g. design). According to Warfield, the effect of "universal priors" in a discourse based on commonly held knowledge prevents the advancement of high-quality hypotheses (in sciences) and, by extension, design proposals. A new language paradigm would be vastly more productive than sustaining a legacy language that unreflexively held embedded values and positions. However, even as emerging high-quality observations become validated, pre-existing languages and paradigms can persist well beyond their utility in the emerging knowledge base.

Warfield proposed several guidelines that address the research questions of this study, including context of action, stakeholder selection, and validating (selecting) methodology. His guidance included dictums to use design practices to develop a basis for a human science that accounted for whole persons in intentional design and decision activities.

> Conversely, the best way to validate a Science is to manage the language through careful design practices, and to incorporate the Theory of Relations and its isomorphisms as part of the Foundations of the Science. (Warfield, 1986, p. 10)

His recommended process for managing the language of a discipline was a rigorous catalogue of definitions and distinctions for applications. The DoSM proposal was a call for defining the boundaries and *concepts* that constituted a discourse. Warfield believed the means of testing the effectiveness of a design science was to perform its functions in an application with stakeholders (in an *Arena*) and then assess the results in reference to principles established in the theory base (the *Corpus*). He indicated in several papers that a similar methodology for consensus language construction was applicable in organizational (Warfield, 1999) and stakeholder domains (Warfield, 2007). These proposals allow the current study to bridge this model from scientific disciplinary contexts to systemic design practice.

DoSM Model and Design

We also aim to bridge Warfield's DoSM functional model to design methodology. The basic model of the DoSM is shown in Fig. 2, a staged cycle of processes in a series from Foundation to Theory, to Methodology, to Applications, and then to Foundation.

The DoSM represents an idealized process of iterative development of a discourse and practice. The model represents a deliberative process that practice members follow by anticipating the application of methodology to an evolving range of problems. For dialogic design science (and practice), the DoSM has been followed

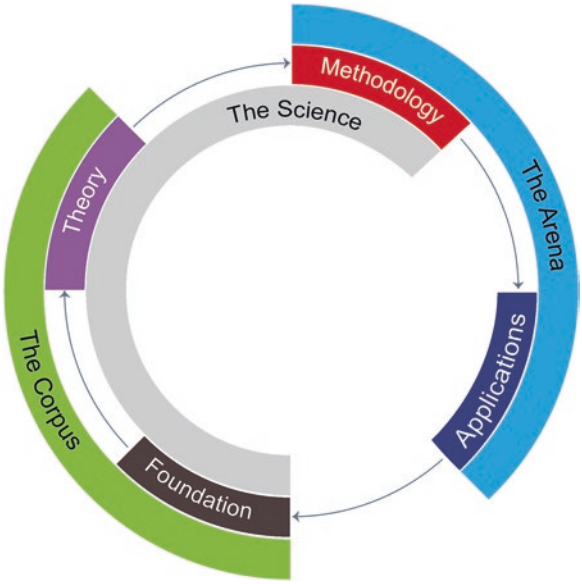

Fig. 2 Domain of Science Model (From Warfield, 1986, image courtesy of Jeff Diedrich)

through (at least partially) four "learning iterations" by the community of practice associated with the research.[5] The staged cycle was envisioned as developmental, wherein learning from research in each stage (*literations*) would yield insights informing the successive stage.

The DoSM entails four stages in two contexts, the Corpus and the Arena, and four linkages of translation between them. The Corpus consists of a Foundation—the prior relevant body of knowledge in a discourse—and Theory. Theory represents the generative extension of the Corpus with descriptive and normative propositions that enable new methods and practices to be developed.

The Arena is the primary context for practice, the application of methodology with stakeholders in a field setting. Methodology refers to the integration of methods in a validated framework, in this case Structured Dialogic Design (SDD). The Application refers to performance of SDD (or theoretically any methodology) in the context of a stakeholder "arena."

This separation of contexts from purposes applies to other practices such as design. As in SDD, it will be unproductive to reinvent every engagement in an Arena; in fact, the impulse to innovate can introduce and transfer risk uncertainties to stakeholders. The DoSM represents a meta-process however, not a theory of change or even of learning from a given engagement. By visiting a stage in reflec-

[5] Institute for 21st Century Agoras, the non-profit organization established to sustain SDD practice and studies with the social purpose of democratic transformation through structured dialogue

tive practice, a learning reflection transfers information and outcomes from that stage to inform the next. These stage transitions can be summarized as follows:

Foundation to Theory This transition translates knowledge in the form of postulates, or axiomatic proposals that inform theory. New references and practice models assessed from applications will be documented as foundations. In the Agoras case, the number of axioms proposed for use in SDD methodology expanded from four to six in the first cycle (2006) and to seven in a second revision of axioms (2009). New laws (principles) were also proposed and evaluated over this DoSM cycle.[6]

Theory to Methodology Selection criteria are translated to methodology, enabling selection of methods in a coherent framework. In practice this includes criteria for proposals or enhancements to a methodology based on theoretical principles. In the Agoras case, criteria for methods were proposed for virtual SDD engagement (2006). Revisions to the theory base and methodology have also been developed in the literature by Agoras members.

Methodology to Application Warfield suggested changes to roles and environment, but revisions to applied practice often emerge from methodological innovation. In several publications and related engagements, Jones (2014, and with Weigand, Flanagan, Dye, & Jones, 2014) demonstrated the application of novel methods for thematic discovery, stakeholder selection, and hybrid design practices.

Application to Foundation The feedback from the field to inform research remains a weak link in most disciplines. Theorizing lessons from practice has been fraught with lack of breadth (across practitioners) and closure (completeness of measures or balance). Warfield only specifies feedback as "strengths and weaknesses," a review point that might start a new cycle.

The current study sought to apply lessons from the DoSM in dialogic design science to applications in systemic design, a practice area that has developed through design education (Jones, 2015) and reflective inquiry (Nelson & Stolterman, 2012). The DoSM can be extended to propose evolution of systemic design, drawing on dialogic design to inform the emerging constellation of systemic design applications. Systemic design applications typically refer to arenas in the Design 4.0 scale such as ecological concerns, urban design, health, and other policy or social systems that require multiple stakeholders.

Translation to Collective Design Contexts

The staged model of the DoSM from dialogic design science is translated as a model of development for co-creation practice in systemic design. The original language of the DoSM is maintained for consistent reference to the mode.

[6] The seven axioms (and laws of dialogue) are significant in themselves as design propositions for dialogic co-creation and are presented in the Framework section.

The basis for the proposed DoSM draws from over a period of 10 years of observation in the arena of primarily public sector projects, as well as analysis of cases from the community of practice. The general process of four stages from Foundation to Theory, Methodology, and Application is retained. The venues of prior (formative) contexts reflect current co-creation practice as evidenced across numerous cases.

Adapting the DoSM to design co-creation required a significant change to the stage contexts. More recent practices and studies have defined the "Arena" as a type of practice setting, a private convening context identified by its stakeholders and their matters of concern. The context of the Agora for stakeholder design was developed by Christakis as a reference to the open public context congruent with the Athenian agora, defined by its accessibility to publics. The Agora discloses a democratic, participatory context articulated by its availability to public stakeholders. Where participants may be invited to an Agora, the context of the Agora represents an accessible venue available to interested members of society. An Agora is defined by the context that the public extends to the venue and its dialogue, rather than by the topic or issues defined by the conveners.

The Arena encloses a selected body of stakeholders representing external potentials for action. There are two types of arenas that occur together in practice. One is the venue of a multi-stakeholder engagement that attempts to formulate a microcosm of the actual social worlds of action in which the stakeholders participate. The other is the sociopolitical idea of arena, defined by Mintzberg (1985) and later Renn (1993) as the organizational context of decision actions by which problems are framed as significant, risks are identified, and resources are allocated. Both of these are implied in the arena of co-creation.

The DoSM for design co-creation is presented as a reference model from the domain of science to anticipate and formulate design functions in four stages. Numerous case studies can be assigned to support and define appropriate practices within each stage. Unlike the DoSM, the contexts do not match each stage precisely, a boundary quandary indicated in Fig. 3. Two contexts (Arena and Agora) are both Applications. Foundation and Theory can be assigned to the Lab. The Studio extends the design of Methodology from the Lab.

Extending the four stages of the DoSM are four contexts of the Lab, Studio, Arena, and Agora. These are observed to match the arrangements of each context for the purposes of co-creation and specific forms of group sensemaking in each stage.

Lab The Lab provides a venue for internal research and deep analysis, theory building, and creating new artefacts to evaluate in a studio setting. The Lab represents the most focused venue and smallest number of organizational participants, and would not typically engage managers and decision makers. Consistent with scientific laboratories, the social and design lab provides the most value as a venue for internal development of systems design proposals, formulation of engagement approaches and methodology, and rigorous evaluation of design options.

In systemic co-creation practices, members can collaborate on creative proposals drawing from the sources in the Foundation. As a task of corpus development, the

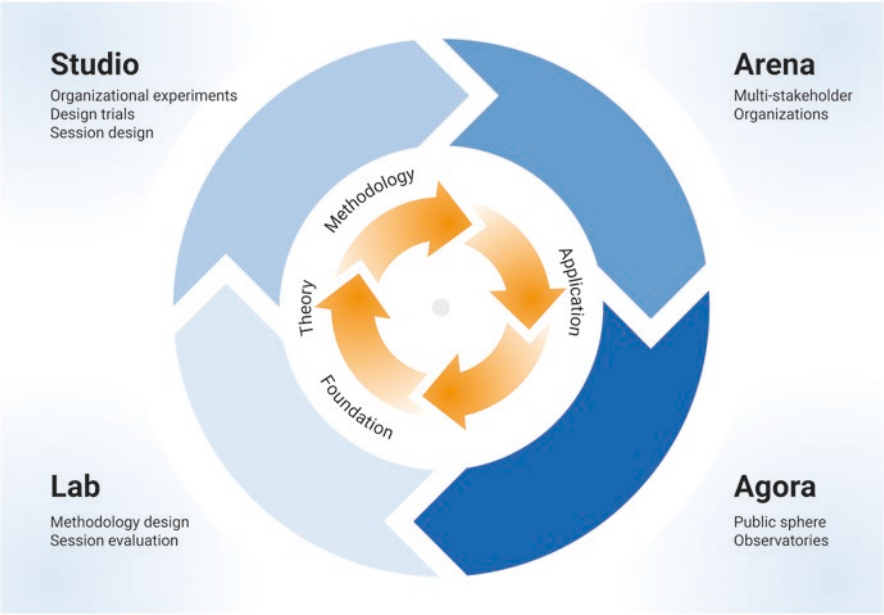

Fig. 3 Stages of DoSM in co-creation contexts

Lab activities draw from across applicable sciences and knowledges (design, systems and cybernetics, philosophy, social sciences, engineering, economics). Sensemaking activities consist largely of problem understanding and framing, including social research, and identifying external references and stakeholders appropriate to defining and advancing methodology.

Studio The Studio represents an internal venue for collaborative design activities conducted to develop concepts, proposals, or prototypes. The Studio is appropriately named based on generations of design education and client work conducted in studio contexts. As the Lab is a strictly "experimental" and developmental context, the Studio provides a place for members to productively collaborate on defined projects in nascent form. The Studio facilitates sociomaterial activities of constructive making. It perhaps is better defined by its composition than its physical environment, as it is one where a core design team invites multidisciplinary collaboration with relevant experts, process advisors, and technical masters.

As suggested by Fig. 3, the Studio (in the context of the DoSM) affords team members the appropriate place to select and develop methodology planned for specific engagements in the Arena. The Studio can be a temporary zone used by team members, client representatives, and invited experts to construct and evaluate plans and engagements. Revisions to methodology, prototype models, and trial sessions can be constructed and evaluated by the team in advance of Arena engagements.

Sensemaking activities in the Studio comprise largely of problem understanding and framing.

Arena Christakis and Warfield defined the Arena as the venue for engaging stakeholders representing the requisite variety of a social system in issues of their direct concern. An "Arena" (Renn, 1993) may be understood as a symbolic location of political action that influences collective decisions. Rather than a specific organizational or policy context, it implies the sociopolitical environment of design process or decision making for outcomes of interest to the selected stakeholders.

Stakeholders are not participants because of their beliefs or even expertise, but based on their capacity to take action and motivate others towards preferred outcomes. The requisite variety of a social system almost guarantees that stakeholder positions, power, and motivations will reveal conflicts or be at odds. The appropriate methodology for negotiating the structural and emergent complexity of the Arena is dialogue—design "qua design" is insufficient to address power variances, and the anticipation of arena constituents requires sufficient methodology and dialogue management capacity.

Unlike the Studio, the Arena context is strictly facilitated; collaboration is structured to prevent inequitable decision or unbalanced coalition formation that might offset perception of the possibility of a consensus outcome across all participants. Arenas are often held in neutral locations with the ability to specify and control the environment. If a large "design studio" environment is used for smaller stakeholder meetings, there may be symbolic meaning to stakeholders.

An Arena differs from the other venues in that only committed stakeholders are invited. A salient process management concern is to facilitate a fair and productive environment with respect to decision power and appropriate stakeholder variety. The Arena constitutes a context for direct application of methodology for the benefit of participants.

Agora The Agora extends the model of design co-creation to democratic contexts, by restoring the committed citizen stakeholder as central to a public. The Agora is not necessarily a venue or place. An Agora shows up when members of a public participate in purposeful dialogue or congregate to co-create and act on a social position. The Agora extends the domain of Applications from Arena to the open public sphere, which becomes enframed for an issue or purpose through disciplined dialogue.

The Agora differs from other stages in the DoSM cycle in that the Arena does not expand or extend to form or inform an Agora. It extends the DoSM however as it establishes a new domain of application praxis informed by prior science and methodology learned in Arenas over time. The Agora holds the potential for significant development of public power and influence, beyond that of the Arena's typical collective problem-solving orientation.

Systemic Design Framework

There are several hundred publications of studies and significant cases demonstrating the effectiveness of SDD and (over 20 years ago) Interactive Management. Most of the methodological development and experimentation remains unpublished, following the tradition in sciences of only reporting peer-reviewed findings and outcomes. The current study builds on the foundation of Flanagan's development with Christakis (Christakis & Flanagan, 2011) and with Bausch (Bausch & Flanagan, 2013) of the major components of a corpus for the SDD methodology. I extend the DoSM to co-creation in systems design practices developed respectfully on the collaborative scholarship of this discourse community.

As in any scientific development, the history of progress is reported through snapshots of research output. The long cycles of developmental work are rarely reported. In the research group associated with the research,[7] the DoSM cycle has been advanced within three cycles of development and up to four partial cycles, since 1997. The major cycles of development are represented by formulation of new Foundation concepts, revisions to Methodology and evaluated trials, and enhancements to practice in the Arena. Observations are presented in summary, incorporating by synthesis the results of research tasks in each cycle.

Process of Model Development

Evaluation and design within the DoSM cycle followed a design-oriented action research process, with a basic series of problem framing, data collection, assessment and analysis, and reflection on findings. Internal sessions as well as full client workshops (applications) were documented and analysed for stakeholder outcomes and methodological effectiveness. Plans, trials, and analyses were also documented throughout the process.

The purpose of the DoSM is to provide guidance for the disciplined cooperative development of a "science" or a body of first principles and methodologies accepted as a working body of knowledge in a practice. The power of a scientific mode of knowledge production, whether for a research discipline or a methodology such as SDD, is that learning and improvements to the practice can be validated and generalized. The "science" at minimum contains the body of knowledge and the rules (methods) for exploiting the knowledge for productive human ends. Without conducting practice research, the innovations developed by practitioners in the Arena can be lost or remain invalidated "personal" styles of facilitation. If we fail to evaluate the effectiveness of new theoretical propositions, the discipline risks slipping into a craft practice. This slippage between a proposed methodology and its performance in the Arena remains a common drift observed in design practice.

[7] Institute for 21st Century Agoras is a non-profit organization established by Alexander Christakis and a core group of senior practitioners and scholars dedicated to the development of democratic practices based on dialogic design science.

The objectives of the 5-year period of practice-based design action research were to identify and respond to salient gaps in the practice, improve and adapt dialogic design methodology to the emerging discipline of systemic design, and thereby redirect the DoSM to a novel design context. The study did not originally envision changes to the modes of co-creation, yet the analysis revealed this opportunity and expressed the following findings, most of which require further research or theorizing.

1. **Adapt Co-creation Methods to Contexts**
   Design co-creation approaches in most design practice are largely based on the Studio model (informal small-group workshops) and one-off large-group Arena workshops. Due to the popular framing of organizational innovation "labs," no distinction is made between activity types suitable for different contexts, as nearly any project context can be represented as a "lab" in current practices. To expand the strategic options available to design practice, consideration ought to be given to the DoSM distinctions that define meaningful contexts for different design activities, participants, and outcomes. Therefore, a definitive lexicon of co-creation frames is proposed.

2. **Design Thinking Co-creation Is Insufficient for Complex Systems**
   Conventional design-led approaches can be shown as insufficient and too short-sighted for the complexity of Design 3.0/4.0 problems. Workshops often rely on popular methods for user understanding such as empathy mapping, idea generation based on small-group brainstorming, and concept formation based on randomized small-group co-construction. These may result in the creative satisfaction of an enjoyable learning experience, but often yield little or no commitment to development or insight into systemic issues in a complex situation. Design thinking's reliance on rapid co-creation methods may offset the effective adoption of structured or staged design methods. Typical design thinking approaches advocate generative creativity to maximize ideational productivity (e.g. "generating more ideas leads to more of better quality"). Continuing reliance on popular modes of design co-creation can erode the potential for structured, rigorous, or systemic approaches that require significantly more investment from participants and sponsors. Design professionals are responsible for enriching the vocabulary and methodological variety available to clients and collaborative projects.

3. **Effective Co-creation Requires Continuity of Consultation**
   Co-creation workshop events require significant support and planning if they are to offer stakeholders more than just facilitated design ideation. Planning and follow-up engagements are often neglected in the design management process, as the skills and objectives for *continuous* episodes of work differ from those in stakeholder *engagement* events. Long-duration, continuous engagements (over a year) require consultation for sponsors and their stakeholders to develop a capacity for effective design and action. The DoSM accommodates an extended cycle by introducing skills and management in the Studio context, in advance of Arena engagements.

4. **Adaptive, Staged Planning for Successful Co-creation**
   For Arena contexts with committed participants, a significant period of inquiry becomes necessary in advance of design co-creation, or the engagement risks an incomplete apprehension of problematics and may suffer from insufficient dialogue towards consensus. Studio workshop practices can be employed to frame focus questions and materials to aid stakeholder understanding in successive Arena engagements.

5. **Stakeholder Accommodation Conflicts Managed by Context**
   Longer-duration consultations may be necessary for long-term productive outcomes, consistent with the time required to enable organizational learning cycles. In many arenas, we can report that stakeholders demand radically shorter time periods per discrete session. An ever-increasing observation among SDD practitioners is that our stakeholders (not necessarily sponsors) are unable to invest 2–3 days duration for mixed-participant co-creation sessions. Workshops of just a single day or less have become more common. We can observe a change in co-creation practices (and method) as design teams continue to accommodate stakeholders by reducing the engagement life cycle to timeframes managed by sponsors. Stakeholders (mixed participants) invited to sponsored co-creation sessions in an Arena often require shorter, focused sessions supportive of their decreasing accessibility. Structured co-creation is required to facilitate sufficiently productive results from these constrained performance timeframes.

6. **Insufficient Stakeholder Discovery Risks Variety Deficit**
   A significant weakness in design co-creation is insufficient attention to stakeholder variety and discovery, by relying on immediate, interested, and available participants without carefully determining requisite sampling variety necessary to fully inform the scope of an inquiry. A critical enhancement to (Arena) practice in this study is a formulation of rigorous stakeholder selection and analysis methods that support requisite variety in stakeholder discovery and associated thematic development of triggering questions.

7. **Methodological Research to Improve Mixed-Presence Co-creation**
   With broad collaborations across geographies and increasing experience with teleconference services, we find an increasing desire for effective mixed-presence co-creation. The employment of mixed-presence modes for SDD and Interpretive Structural Modelling (ISM) in collocated and remote Arena sessions remains underdeveloped and lacks validation in the literature. Significant progress has been made in recent software platforms for creative co-creation. The specialized software systems for SDD (including ISM algorithm development) are now web-hosted and improved.[8] Emerging web-based software platforms and

[8] The primary software systems for SDD include Cogniscope 3 and logosofia. Emerging platforms such as Idea Prism (Future Worlds Centre) are being developed for large-scale remote participation. The Interpretive Structural Modelling algorithm is technically a public domain routine but is developed and maintained within the practice communities that use it regularly, inclusive of the development teams for the SDD software.

videoconferencing have not been validated in methodology (Lab), trials (Studio), nor Arena applications.

These seven observations summarize several fundamental and recurrent problems in co-creation practice. They are not reported in the literature, perhaps due to the inability to openly observe or assess methods in practice research and the relative lack of practice validation studies. Co-creation has been treated as a proprietary craft practice, similar to other design methodologies in wide use (e.g. Open IDEO[9]) that are also unreported in scholarly studies. Design co-creation is not yet treated as a scientific domain that encourages replication and serious external contributions. For co-creation to be determined as "systemic" however, some degree of criteria and tests might be considered that could demonstrate how intended system-level outcomes can be achieved productively. A systemic design methodology ought to also foresee and resolve problematic organizational, social, and psychological constants affecting group sensemaking.

Co-creation System Model

We propose a general model for co-creation practices across contexts, synthesizing from the findings of DoSM research for two practice areas, dialogic design and systemic design. Figure 4 presents the four stages based on the DoSM indicating the customary contexts for co-creation in design practices.

Co-creation in design practice cannot be formalized as a scientific canon; we can instead promote a disciplined attempt to generalize known principles as a model for further development.

While the Corpus/Application model derived for scientific development could be retained, the contexts for design have been represented appropriately to support current practices. As four "venues" these are associated with four domains of design activity in systemic design contexts:

1. **Lab**—*Academic and Experimental*. A Lab context is a private, exploratory venue for core design teams to develop concepts and methods. A Lab provides a safe-to-fail methodological testbed for formulating proposals and conducting individual and small-group design activity. Core design research teams require a dedicated venue, free from sponsor or project involvement, to be a proper "laboratory." With the conflation of the term "labs" now associated with all types of design workshops, the notion of a lab as a private working space for internal teams may be eroding.
2. **Studio**—*Design-Led Exploration*. The Studio environment provides a collaborative setting for all team members to work together on projects in active

[9] Open IDEO (openideo.com) provides resources for design thinking and co-creation in member-led design challenges, most of which are public sector or community value projects, attesting to the "open" reference in the organization.

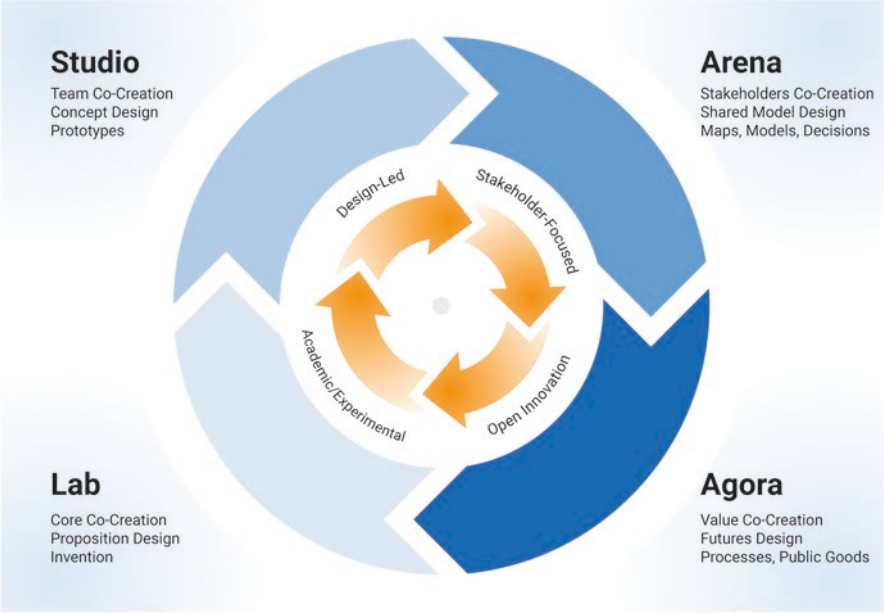

Fig. 4 Adapting the DoSM to co-creation contexts

co-creation and development. In design practice there is a continuous need to convene small groups for concept development, workshop preparation, prototyping, and methodological design. Engaging sponsor team members in studio sessions, design will follow a cycle of workshop encounters and preparation episodes.

3. **Arena**—*Stakeholder-Focused* (private context). The Arena represents the venue for engagement of committed participants in co-creation in dialogue and decision making. The Arena provides the context for applications that co-produce enduring value (beyond the session itself) for both participating stakeholders and those represented by invited members. The Arena is the only context in the cycle where we identify "stakeholders" as participants, as the Agora involves citizens and the Studio engages team members, not stakeholders.
4. **Agora**—*Open Innovation* (public context). The Agora provides an open-ended context for engagement of citizens and publics as participants in co-creation through inquiry and futures creation, according to their own self-determination. Co-creation in the Agora typically engages topical concerns of known public interest, but the level of investment (commitment) to action or design may be inchoate, requiring further staging of engagements to create coalitions for action or dedicated communities of inquiry for an issue.

Three system functions have been identified for each context to define associated practices.

- *Co-creation structure*—The design team and participants in the context (Each context is expansive to potential containing social systems: Core, Team, Stakeholder, Value (public or market).)
- *Design function and process*—The purposeful function of that context and essential process
- *Outcome of design co-creation*—The artefacts or form of design output from the co-creation process

Table 1 presents a function mapping of the design process and products for the four contexts, describing the DoSM diagram in Fig. 1.

The co-creation framework cross-appropriates the DoSM for the purpose of design applications. Its utility is validated and valued through development within a dedicated discourse community, as recommended by Warfield's original (scientific domain) application. Further development through research into systems design co-creation will be necessary to yield a validated set of components to complete a working corpus. Based on the knowledge contributions of dialogic design science and the current research, we can propose a framework of components of principles and methods within the DoSM domains (Table 2).

Table 1 DoSM for co-creation in four contexts

	Lab	Studio	Arena	Agora
Co-creation structure	*Core co-creation*	*Team co-creation*	*Stakeholder co-creation*	*Value co-creation*
	Defining and creating methods, theorizing from arena practice	Process and workshop design, evaluation, method selection and stakeholder discovery	Facilitated events, stakeholder design engagements	Co-facilitated public engagement, focus on shared citizen issues in inquiry
Design function and process	*Proposition design*	*Concept design*	*Shared model design*	*Futures design*
	Proposing theory and method, models for applications, research	Designing session and workshop concepts, testing methods	Stakeholder creation, ownership of actions, decisions	Citizen co-creation of proposals for future policy, programmes, scenarios
Outcome	*Process innovation*	*Methods and prototypes*	*Models, decisions*	*Policies, public goods*
	Theory of use, novel methods, new practices	Studio products used in arena workshops	Stakeholders co-create working models for action and decision making	Citizens develop proposals for change and future public goods

Table 2 Framework of co-creation domain components

1. Foundation domain
Component 1: Axioms (seven dialogic design axioms)
Component 2: Definitions
2. Theory domain
Component 3: Principles
Component 4: Context theory
Component 5: Ontological participation
Component 6: Theory of action intervention
3. Methodology domain
Component 7: Roles and controls
Component 8: Workshop process staging
Component 9: Modes of inquiry
Component 10: Modes of design
Component 11: Modes of anticipation
Component 12: Representation methods
4. Application domain
Component 13: Co-creation workshop: dialogic design co-laboratory (arena)
Component 14: Stakeholder search conference (arena)
Component 15: Civic inquiry (agora)
Component 16: Observatorium (agora)

The co-creation framework proposal originates from the seven axioms instantiated in dialogic design science, which stand as first principles that might apply to all stakeholder co-creation, decision making, and public participation. A total of 16 components are proposed as options to develop as a framework for systemic design co-creation. These extend from the 16 components defined by the Christakis and Flanagan (2011) framework, and an attempt is made to maintain consistency with the original model. However, it may not be necessary to develop all components for a new framework; these are proposals being evaluated in different stages of development.

The proposed domain model serves as a synthesis of the study, incorporates the learning from the prior DoSM cycles performed for dialogic design, and presents a resolution to the drift of practices in design co-creation. These three trajectories of the study—theoretical, methodological, and praxis—might each afford an independent track of continued research and improvements to practice.

Foundation Domain

Foundation: Axioms

The seven definitional axioms[10] represent a foundation for a science of co-creation through collective cognition (dialogue). Axioms precede design principles for the development of engagement practices. The seven are codified as core functions in practices of collective cognition for collaborative action. They were proposed (and articulated by argumentation) as the minimal, meaningful, necessary functions for supporting rigorous dialogue for social systems design. Therefore, they can be expected to be equally meaningful to design co-creation for dialogic design processes. The seven axioms are summarized as follows, in their canonical numeration, agreed titles, brief definition, and the author whose work is attributed to the discrimination of the axiom:

1. *The Complexity Axiom*: Observational variety must be respected when engaging observers/stakeholders in dialogue, while making sure that their cognitive limitations are not violated in our effort to strive for comprehensiveness (John Warfield).
2. *The Engagement Axiom*: Designing complex social systems, such as for healthcare, education, cities, and communities, without the authentic engagement of the stakeholders is unethical and results in inferior plans that are not implementable (Hasan Özbekhan).
3. *The Investment Axiom*: Stakeholders engaged in designing their own social systems must make personal investments of trust, committed faith, or sincere hope, in order to be effective in discovering shared understanding and collaborative solutions (Tom Flanagan).
4. *The Logic Axiom*: Appreciation of distinctions and complementarities among inductive, abductive, deductive, and retroductive logics is essential for collective futures creation. Retroductive logic (referred to in design as backcasting) makes provision for leaps of imagination as part of value- and emotion-laden inquiries by a variety of stakeholders (Norma Romm and Maria Kakoulaki).
5. *The Epistemological Axiom*: A comprehensive human science should inquire about human life in its totality of thinking, wanting, telling, and feeling, as indigenous people and the ancient Athenians were capable of doing. It should not be dominated by the traditional Western epistemology that reduced science to only intellectual dimensions (LaDonna Harris and Reynaldo Trevino).
6. *The Boundary-Spanning Axiom*: A science of dialogue empowers stakeholders to act beyond imposed boundaries in designing social systems that enable people from all walks of life to bond across possible cultural, religious, racialized, and

[10]The seven definitional axioms of dialogic design science had evolved over a decade of practice and reflection and were instantiated as seven axioms in 2012 (with the addition of the final axiom 7). A tradition within the community of practice is to identify the original contributor of the proposal by name, without reference to a specific work but by affirmation.

disciplinary barriers and boundaries, as part of an enrichment of their repertoires for seeing, feeling, and acting (loanna Tsivacou and Norma Romm).

7. *The Reconciliation of Power Axiom*: Social systems design aims to reconcile individual and institutional power relations that are persistent and embedded in every group of stakeholders and their concerns, by honouring requisite variety of distinctions and perspectives as manifested in the Arena (Peter Jones).

Foundation: Definitions

Definitions are proposed as necessary for each stage of development, and for this article proposal, a small set of definitions are provided for the understanding of propositions. Definitions from the dialogic design science canon (where relevant) are selected for the developing framework.

- *Collaborative Foresight*—A model of Structured Dialogic Design oriented towards collaborative futures, where long-term systemic problems are engaged through strategic foresight by engaging multiple stakeholders in collaborative problem identification and strategic resolution.
- *Dialogue*—The engagement of observers/stakeholders in discovering meaning, understanding, wisdom, and actions by means of structured inquiry.
- *Interpretive Structural Modelling*—A matrix algebra method developed by John Warfield, based on the forced juxtaposition of statements to assess systemic relationships in terms of their directional influence. ISM is employed in defining the influence structure (systems of challenges and solutions) represented in an SDD influence map.
- *Leverage*—Solutions that convey a comparatively high degree of influence on other solutions and challenges. In SDD participants assess how collective progress on a deep challenge "leverages" progress on other challenges in a system.
- *Structured Dialogic Design* (SDD)—A registered service mark of the Institute for 21st Century Agoras for the multi-stakeholder dialogue engagement method for collaborative challenge resolution. SDD is an evolution of the practice of Interactive Management developed by John Warfield and Alexander Christakis and is mediated by one of several software systems, including the CogniSystem and logosofia.
- *Triggering Question*—A thoughtfully defined prompt that combines specific boundaries with strategic ambiguity. The focus of inquiry is developed over a period of consultation with sponsor team advisors and the stakeholder candidates for a dialogue. The triggering question evolves as the design team learns about participants' contexts through stakeholder discovery, and is typically presented in early stages to stakeholders, is evaluated through interviews and trials, and is presented as final in an Arena dialogue event. A triggering question frames the strategic intent of SDD and guides the generation of all challenge/solution group work. The common format for a triggering question is a simple question structure, naming the semantic form being elicited (challenge, solution) for a specific boundary in a specific timeframe:

Challenges: "What are the challenges we must face in addressing anticipated climate change impacts by 2025?"
Solutions: "What social and technological options are required to address this system of climate challenges by 2025?"

Theory Domain

Theory: Principles

What set or sets of theory-based design principles ought to be adopted for a systemic framework for social systems design? We can propose two sets of principles, which may be characterized as levels of design.

- Dialogic design science—Seven principles for guiding effective social system co-creation practices (e.g. collaborative efficacy)
- Systemic design—Ten principles for value discovery and systems design from systems and design theory (e.g. design viability)

Dialogic Design Principles

The original seven principles in the DoSM for dialogic design science are based on designing conversations for collective cognition and action based on derivatives of requisite variety. These seven requisites are documented in Christakis and Bausch (2006) and include the following (short labels with reference to author):

1. *Law of Requisite Variety* (Ross Ashby) is a central principle of dialogic design science and the foundation for the derived principles in the theory, based on Ashby's (1958) rule that variety in a system must be controlled or mediated by equal or greater variety in a control system.
2. *Requisite Parsimony* (G.A. Miller, 1956) is based on the limitation of short-term memory, the psychological principle of the attention to 7 +/− 2 chunks of information in a short-term presentation. Warfield proposed that when individuals are in problem-solving situations with other participants, short-term attention becomes limited to 3 +/− 0 units of information.
3. *Requisite Saliency* (Boulding, 1966) states that the relative saliency (distinctiveness) of observations can only be understood through comparisons within an organized set of observations.
4. *Requisite Meaning and Wisdom* states that meaning and wisdom are produced in a dialogue only when observers search for relationships of similarity, priority, and influence within a set of observations. This principle is attributed to C.S. Peirce's abductive logic (Frankfurt, 1958).

5. *Requisite Authenticity and Autonomy* in distinction-making demands that during the dialogue it is necessary to protect the autonomy and authenticity of each observer in drawing distinctions (authorship attributed to Tsivacou, 2005).
6. *Requisite Evolution of Observations* states that learning occurs in a dialogue as the observers search for influence relationships among members of a set of observations (authorship attributed to Kevin Dye, Christakis & Dye, 2008).
7. *Requisite Action* states that action plans to reform complex social systems designed without the authentic and true engagement of those whose futures will be influenced by the change are bound to fail (attributed to Laouris and originally suggested by Özbekhan, 1969).

The dialogic design principles satisfy the theoretical requirements for stakeholder co-creation, for designing and managing collective conversations for understanding complex shared problems and reaching consensus on action. The principles are developed from a pragmatist orientation, consistent with constructivist or critical realist epistemological perspectives. From a constructivist perspective, the principles afford voluntary participants the context for reaching collective awareness and a common mental model (known in SDD as a "consensual linguistic domain"). From a critical realist perspective, the principles enable organizers following these methods to reliably structure and facilitate co-creation workshops with high probabilities for successful outcomes.

Systemic Design Principles

To develop a working theory for systemic design, the author (Jones, 2014) formulated a series of ten principles that demonstrated the correspondence between systems and design theoretical principles for social system and sociotechnical design problems. Systemic design principles enable practitioners to develop systems design proposals and concepts supported by compatible systems science and design concepts. The prospects for value discovery (identifying high-potential situations for shared value in social systems) and design viability (continued value and duration) are amplified, employing the ten principles in design practices. The following brief descriptions describe the principles, which are fully detailed in the reference:

1. *Idealization* is the principle of identifying an ideal state or set of conditions that compels action towards a desirable outcome or signifies the value of a future system or practice.
2. *Appreciating Complexity* acknowledges the dynamic complexity of multi-causal wicked problems and the cognitive factors involved in understanding the relationships that indicate problem complexity.
3. *Purpose Finding* describes that purposes do not exist independently of observation in language, but can be determined by agreement and therefore designed or redesigned.
4. *Boundary Framing* is defined as the principle of determining the most effective fit between a concept and its target environment.

5. *Requisite Variety* in design proposes that, whether in a social system or information system, the functional complexity of a given design must be calibrated to and provide sufficient options for interacting with the known and potential factors of its target environment's complexity.
6. *Feedback Coordination* is a principle describing the function of identifying critical feedback relationships (first-*n* order) in social and technological systems, for coordinating the dynamic fit to environmental and contextual functions.
7. *System Ordering* defines the essential function of design as skilled activity, as all information, assets, organizations, and social systems are ordered in meaningful ways by human custodians. Designers define humanly useful structures that enable visibility and salience within complex situations.
8. *Generative Emergence* is a principle for selecting emergent manifestations for design signification. *Compositional* emergence manifests in design activity as an outcome of *ordering* or the construction of artificial micro-systems for adapting an artefact to environments. *Created* emergence manifests from *organizing* systems, which include physical connections, designed forms, organizing processes, and the synergies that emerge from among these functions.
9. *Continuous Adaptation* is the principle of maintaining a preferred system purpose and objectives (or desiderata) throughout the life cycle of adaptation, conformance to environmental demands, and related system changes.
10. *Self-organizing* in design enables actions that increase awareness, incentives, and social motivations to accelerate organizing behaviours.

Theory: Context Theory

The DoSM model supports the development of theory for interpreting and anticipating the function of principles. Theory articulates propositions (e.g. as a Lab function) that might inform and validate effective practices in the Arena and Agora. Component 4 proposes a theory of context for application of design principles, which in this case is a systems theory of the application of principles in design contexts.

Contexts can be defined in the case of systemic design as the containing boundaries for defined systems of interest. A defined boundary specifies the context for designing functions and artefacts that fit the environment within that boundary. Most systems theories offer a model of nested containing systems that might be adopted as context theories. Methodologically, Bertalanffy's general systems theory, Miller's living systems theory, Jantsch's evolutionary systems model, Luhmann's social systems theory, Bronfenbrenner's bio-socioecological model, and Wilber's integral theory would be viable candidates to adapt as context theories for aligning design aims to actions in an environment.

Two sets of principles apply to two boundary frames, which both operate within different contexts, (a) the context of conversation for collective action and (b) the context for system-level design. Both are theorized as necessary in support of requisite variety of (a) stakeholders to the problem context and (b) design options to the future environment of social/user participation. If we designate a third system

boundary, temporality, we might introduce principles and theory for anticipatory design in future system contexts.

In the current prospectus, we reiterate the design domains (Fig. 1) as the context theory applicable to process, policy, service, and other systems design problems. The four design domains represent four levels of system, distinguished by inherent social complexity necessitated by the domains in which design decisions and transformations are proposed. Technical complexity (theoretically) can be bracketed or isolated by design for interfaces rather than assuming the designer must have technological mastery. The four levels reveal incommensurable complexity, in that complexity within a higher context (e.g. social or organizational) does not correspond to complexity in services or artefacts, and vice versa. If this is the case, expertise and methods from one level may have minimal transfer to the others. While it is possible for a skilled organization to maintain competencies in each domain, this remains atypical and (excepting a small number of major design firms) this attempt can diffuse the position and differentiation of a design practice.

The four domains entail design processes for the following:

- **D1.0**—*Artefacts*: Artefacts are objects and communications designed for bounded purposes or that support a product or service. Complexity is manageable by a small design team. Systemic design principles apply to the containing systems (contexts) for artefacts.
- **D2.0**—*Products and Services*: Context of value co-creation with users (including service design, product innovation, multichannel, and user experience), design as defining and integrating user functions into larger systems and platforms. Complexity as *complicatedness*, manageable by full-service design team with client organization. Systemic design principles apply to designing service systems and interactive interfaces.
- **D3.0**—*Organizational Transformation*: Organizational process change for operationally closed social systems, design of work practices, strategies, and organizational structures. Dynamic complexity requires a specialized design team and full client organization participation. Systemic design and dialogic design principles apply to process design and decision making.
- **D4.0**—*Social Transformation*: Complex, multi-stakeholder, open social systems: design for complex societal situations, social systems, policy making, and community design. Social complexity requires specialized design and system facilitators, with requisite variety of core team for stakeholder participation management. Systemic design and dialogic design principles apply to process design and decision making.

Other publications have discussed the design domains (Jones, 2014) in more detail, and these references will serve as additional information.

Theory: Ontological Variety in Participation

Theoretical support of a domain of design model (DoDM) must account for stakeholder and participant variety in co-creation, including sampling, selection, and anticipated system participation. A general theory of participation across dialogic and systems design would entail ontological variety or a model of committed stakeholders that corresponds to the multiple social systems to which they belong.

A theory of requisite stakeholder variety has been developed for anticipatory studies (Jones, 2017) as a model for participant selection in foresight strategy. In this model, two supporting theories include the cybernetics principles of requisite variety (Ashby, 1958) and second-order control (von Foerster, 2003). These inform a theory of stakeholder discovery that balances selection and variety of disciplines, perspectives, authority, diversity, and stake-ness among participants.

Undersampling stakeholders with investment in the "real" or external system environment leads to insufficient knowledge contribution and commitment to future outcomes. In this approach, multiple worldview perspectives and temporal preference were integrated with a reference stakeholder selection model (the "5 I's" from Christakis & Bausch, 2006).

Latour's (2013) modes of existence worldview typology is further integrated as a social theory of requisite perspectives relevant to complex social concerns, where many legitimate viewpoints and future stakes might be identified in stakeholder sampling. The 15 "modes" represent articulated, orthogonal, yet overlapping positions that define ontological perspectives from recognized institutions in modernist societies, such as law, science, fiction, technology, religion, and so on. These are rendered as institutional beliefs or alliances that would signal and construct a stakeholder's perspective as representative for that institution's commitments and normative relations. Latour's model prescribes a process of "crossings" or value tensions identified in the relations between ontological modes, such as a crossing of reference (scientific worldview) and fiction (essentially, imaginative arts); this might not only entail scientific imaginaries but the adaptation of arts within scientific knowledge translation or the shift in scientific values to include radically subjective meanings. Stakeholders can thusly be identified within modes and crossings that enrich and "requite" the necessary complexity within a problematic system inquiry. The function of crossings between modes is essentially the model used in stakeholder discovery to represent (and to reduce or absorb) variety across dimensions in order to reach a larger proportion of desired stakeholder identifications associated with the problem for which requisite variety is sought.

Requisite stakeholder variety provides a reference model that classifies three modes of stakeholder identification: social diversity, design problem categories, and worldview (ontological preference). At minimum the stakeholder sampling model provides a checklist that exposes possible risks and blind spots in the available composition of stakeholders or experts. The model further provides a schema for identifying value conflicts between worldviews and other attributes associated with known stakeholder interests. The requisite stakeholder variety model for stakeholder discovery was designed to address the necessary variety in systemic design,

particularly for strategic foresight in social transformation projects. It has been further developed in foresight workshops and as a reference model for anticipatory policy research.

We can propose that careful incorporation of the modes of existence to the stakeholder model will make a significant difference in selecting participants with sufficient variety to represent the broadest ranges of design options and commitments to social action. The canonical analysis model for stakeholder variety had previously addressed variety with two axes, of stakeholder "relations to the problem" and "social diversity values" such as education, age, gender, and culture. We add the third dimension of ontological commitment (mode) and allow for crossings of three dimensions to produce a reference for managing high-complexity sampling across perspectives and knowledge domains.

Theory: Theory of Action Intervention

Dialogic design and systemic design entail a wide range of approaches to activating change in social systems. Theories of change are working hypotheses and observations that explain the transition from a current state to a desired outcome for transformative change in organizations or systems. Theories of change are references to models of practice, not predictive theories supported by social science. They have been evolved from a concept within organizational development practices to more well-defined social change methodologies such as developmental evaluation (Patton, 2010) and transition design (Irwin, 2015). While these methodologies can be employed within specific programmes, a general "theory of change" applicable to system change would be misleading. The distinction of "theory" in change refers to the shared mental model of change outcomes expected from actions and choices in a planning context, the "shared idea" among participants about the occurrences leading to change.

Theories of change are necessary tools for action planning for social system change and are meant to be examined and adapted for particular programmes. While the methodologies of Patton, Irwin, and Westley (Westley, Zimmerman & Patton, 2009) provide methods and models, successful case studies, and adaptations, they are not directly appropriated within change projects or action planning.

The Patton and Irwin models correspond to systems methods (with respect to boundary critique, critical system analysis, and social complexity). These are system-level frameworks that developed explicit theories of change and methods for engagement and fieldwork analysis. And as most systems methods, they lack an explicit methodology for stakeholder engagement.

Stakeholder theory appears to be underdeveloped within system change methodology, as there is little development to inform the practices and forms of action expected of stakeholders in change planning. Dialogic design has evolved a practice-based stakeholder methodology from the original theory of Hasan Özbekhan (1969), who had first articulated the ethical necessity of involving "the users" of system change, the stakeholders within the social system. The direct entailment of stake-

holders in social systems design and change through committed action planning was developed in Warfield's Interactive Management methodology.

There are two definitive modes of intervention for action in the frameworks. For Structured Dialogic Design, the engagement method goes far beyond co-creation as participation into the formulation of a consensual linguistic model constructed in dialogue participation. The ISM algorithm is used to structure super-majority votes on relationships of problems and actions to each other, creating a high-consensus influence map. An influence map (in SDD presented as a directed acyclic graph of influences) describes the network of leverage from deeply influential solutions or actions on the outcomes of interest. Similar in respect to outcome mapping, the ISM influence map has a much higher degree of commitment across highly mixed groups of stakeholders with respect to worldviews and power.

Systemic design is inherently situated to design and plan interventions that shift systems and practices to the future outcomes preferred by stakeholders. Therefore, the stakeholder variety theory is essential to any change model adopted in the framework.

Methodology Domain

The Methodology domain of the DoSM model represents a series of practice models developed from reflective analysis of requirements in the Arena. From direct experience with systemic design engagements in practice, the six methodological inquiries offer opportunities for deeper development of evolving methods and to assess their relationship to the theory base.

The following six methodology components are proposals for further practice research within the framework.

Methodology: Roles and Controls

Each stage in the systemic design domain model may require different roles and process controls for managing process, engagements, and design outcomes. Dialogic design identified a Dialogue Management Team consisting of five core team roles. Depending on methodology and the process for control, we propose the following:

- *Lab and Studio*
  - Principal designer
  - System researcher/analyst
  - Design/researcher
- *Arena and Agora*
  - Engagement manager
  - Dialogue facilitator
  - Visual recorder/designer
  - Co-facilitator/coordinator

- *External roles*: Three roles developed in SDD practice might be used in systemic design:
  - Project sponsor—Sponsor organization lead with a commitment to stakeholders and outcomes
  - Organizational broker—Direct project support within the organization to manage the design process, relationships between the design team and organization, and inquiries
  - Logistics coordinator—A coordinator within the organization for process and logistics

Methodology: Workshop Process Staging

The practice models of dialogic design strongly promote the staging of workshop (co-laboratory) engagements in the Arena and Agora. Stages follow an ordering based on the necessity for progressive evolution of learning and design decision making and the process of moving from problematiques to resolutique (solutions) and action. The following stages are typical, though not "canonical" in dialogic design and systemic design:

- *Lab and Studio*
  1. Discovery (theory framing)
  2. Learning
  3. Exploration
  4. Design inquiry
  5. Evaluation
- *Arena*
  1. Discovery (problem framing and stakeholder finding)
  2. Definition (problem structuring)
  3. Design (scenario)
  4. Action planning (strategy making)
- *Agora*
  1. Discovery (problem framing and finding publics)
  2. Problem inquiry
  3. Future co-creation
  4. Movement building

The identification and labelling of design process stages is a process that creates a consensus mental model for constructing the anticipation of engagement activities. Many different lexical labels could refer to essentially the same set of activities, between design process models. The labelled design process stages here signify

both well-established references in the literature (discovery, definition, design) and several novel propositions for the Agora context, to propose a futures-inquiry process for publics, which may have undefined or undeclared agendas.

Methodology: Modes of Inquiry

Churchman's (1971) inquiring systems provide a general basis for the modes of inquiry across all contexts, as follows:

- Inductive
- Hypothetico-deductive
- Dialectic
- Critical, multi-perspectival
- Pragmatic, synthetic, holistic

Methodologically we might clarify and add:

- Peircean, abductive (formal abduction)
- Retroductive[11] (retrospective chaining from future state)
- Normative (value-driven)

Churchman's systems for inquiry remain the foundation model for identifying logical modes for problem investigation. The systems perspective of Churchman's model can be extended with formal abduction and retroduction, and normative evaluation as inquiry.

Methodology: Modes of Design

Systemic design is an integration of design methods with systems theory and approaches (Jones, 2017).

Considering the design domains construct of Design 1.0–4.0, we might explicitly distinguish the relevant modes of design inquiry and processes considered relevant in these domains.

1. Communications design
2. Product and service systems design
3. Organizational and social purpose design
4. Complex social systems design

Of course, it would be possible to introduce a dozen or more emerging and specialized design approaches that are constantly in formation across similar contexts.

[11] Retroductive inquiry has been known for some time as backcasting and has been used recently in social science work in the dialogic design practice, e.g. Romm, N.R. (2013). Revisiting social dominance theory: Invoking a more retroductively-oriented approach to systemic theorizing. *Systemic Practice and Action Research, 26(*2), 111–129.

While other models of design for complex sociotechnical and social systems are proposed in literatures and practice (e.g. translation design, transition design, regenerative design, design futures), these are also types of approaches that fulfil purposes of the four design domains. The four design domains afford a theoretical contribution of isomorphic types with differentiated purposes and objects of design specific to the mode, and with graduated complexity at each level. The emerging purposeful design modes support methodologies that accomplish the aims of (primarily) one of these domains.

Methodology: Modes of Anticipation

Modes of anticipation account for the methods employed in individual and collective reasoning about future change and system evolution, as follows:

- Historical cycles/wave theory
- Normative planning
- Scenario design (narrative patterning)
- Envisioning (group prospection)
- Backcasting (retroduction)
- Influence structuring
- Optionality analysis
- Emerging perspectives

Methodology: Representation Methods

There might conceivably be dozens of representations in systemic design, from formulation of early-stage constructs to visualizing large-scale social systems. Representations are nominal rather than categorical—they cannot be reduced to a baseline set of primitive types, and they can be adapted and combined in unexpected ways. The following list might be considered only a partial inventory of common representations by type employed in systems design studio and arena practices:

- Systems formalisms
- Systems analysis and design methods
- Tables and structured text
- Matrices
- Slope and curve plots
- Statistical summary diagrams
- Rich picture and notional system diagrams
- Concept maps
- System models
- Outcome maps
- Synthesis maps and Gigamaps
- Hierarchies and tree structures

- Process models and flowcharts
- Organizational and stakeholder diagrams
- Network diagrams
- Function hierarchies and decomposition models
- Activity system models
- Cyclic and wave models

Application Domain

The Application components identify four contexts for co-creation in the Arena and Agora. Two Arena contexts (sponsored, stakeholder-driven) include the co-laboratory and strategic dialogue. Two Agora contexts include an open civic inquiry and the (sponsored) observatorium. Note that these application contexts are co-creation practices in systemic design, methodologically informed by dialogic design. They are applications developed in the DoSM (Lab and Studio) for hybrid models of engagement, informed by methodology and practice from SDD engagement.

Application: Co-creation Workshop—Dialogic Design Co-laboratory (Arena)

The foundation model, from which the other workshops are derived, is the dialogic design co-laboratory, based on Structured Dialogic Design (SDD). The canonical method is described in Christakis and Bausch (2006), with the only major changes to the process being the evolution of software for co-lab management and influence structuring (*Cogniscope 3* and *logosofia*).

Application: Co-creation Conference—Strategic Dialogue (Arena)

Strategic dialogue is a general framework for stakeholder decision making in which selected methods from dialogic design are employed, following the principles, to accomplish other strategic goals that might not be enabled with a canonical SDD co-laboratory.

Application: Civic Inquiry (Agora)

The Agora contexts are open public dialogues held as inquiries for critical issues of interest to communities and publics. The “civic inquiry” is an open-ended application that can be adapted to principles and methods of dialogic design to promote co-creation approaches within a dialogue setting.

Application: Observatorium (Agora)

The observatorium, based on Harold Lasswell's social planetarium (Lasswell, 1959), is a means for collective envisioning of alternative future proposals, engaging citizens in rational discourses to arrive at possible scenarios and options. This methodology is being employed in Greece with the Demoscopio programme (Kakoulaki & Christakis, 2018), which involves a series of installations and engagements with towns and their citizens. Toronto's *Design with Dialogue*[12] programme has evolved over this period as a social observatory and open civic engagement process. These two, and other projects like them, provide guidance for organizers of public democratic contexts for civic policy co-creation. In some cases, civic co-creation provides a basis for convening the intellectual capital and early participants for social movements.

Summary

This domain model represents a framework proposal for further application and inquiry. We might expect to evaluate at least a complete cycle of new documented practices across an entire large case to produce a significant research account. To articulate a full framework, we would assess the full set of components across Theory, Methodology, and Applications, their support (or exceptions) for relevant cases, and their rationale for selection. Their development would also require, by necessity of requisite variety, co-creation by practising members of the discourse community.

Discussion and Recommendations

Following a study from practice-based design research, a model and proposal are advanced to resolve well-known concerns in co-creation and social design practices. The primary social purpose of the study is to support a theory of efficacy for multi-stakeholder collaboration for complex design problems, from the early-stage ideation to team and stakeholder decisions and social change outcomes. Building on the reference model of Warfield's Domain of Science Model, a process model for systemic design theory and practice is defined that should produce significant collective stakeholder efficacy within a stage of design or action.

The major practice issue addressed is that of anticipating and advising effective collective decision practices for projects with stakeholders of mixed power and

[12] *Design with Dialogue* is a monthly open dialogue series at OCAD University in Toronto, which holds a continuous learning community for organizational and social transformation through design facilitation of dialogic practices. Hosted as a public agora since 2008, the online site is found at http://designwithdialogue.com.

culture. Our societies continually demonstrate the inability to gain agreement for policy and planning guidance for complex societal problems. The dialogic design practice was developed for dialogic methodologies to enable mixed stakeholders to observe a rigorous design-decision process. *Design* is identified here as an integrated activity of the dialogic process, with the co-design of future options and action scenarios. Systemic design is a *design*-led practice that integrates dialogue in co-creation for sensemaking and decision making, as necessary for understanding system perspectives across stakeholder worldviews, and argue design solutions and propose joint actions. They are highly complementary, with nearly identical values and principles in most cases, but with very different practices, methods, and genres of *design*.

Another major issue addressed by the framework study is its ability to confront the continuing inability in modern society to organize and produce democratic, citizen-informed change in critical complex problems. We live in a time of an oppressive, socialized incapacity of institutional cultures to motivate action beyond extrapolations of false progress. Whether dealing with urbanization, surveillance and security systems, climate and environmental change, corporate economic hegemony, or unresponsive political systems, the embedded bureaucracies of corporate and government power have been sustained by decades of dysfunctional decision practices. Design thinking and conventional genres of design (e.g. communications and service design) have demonstrated no theory of change to democratic power or shared decision making and, in fact, have often been appropriated and directed by the benign fronts of invested power.

Dialogic and systemic design practices are not merely problem-solving processes employed for complex design problems within organizations sharing common purposes. Systemic design is uniquely efficacious in addressing root causes in complex problem systems and in reaching consensus on high-leverage design options and change scenarios. Further beneficial outcomes will result when using the framework as guidance to employ co-creation methods in various contexts with more practitioners.

Co-creation and creative engagement methods have proliferated in recent years, following an increasing demand for design co-creation and co-design in corporate and public sectors. A wide variety of design-trained practitioners (industrial, user experience, strategic, service, and various interdisciplinary designers) and organizations trained in design thinking have socialized creative approaches to group work and problem resolution. However, the major design disciplines have not taken the intellectual lead to study their preferred approaches to co-creation or creative stakeholder engagement—nearly all work found in the grey literature and online shows up as practice methods from design firms or proprietary design firm "methodologies." Many practices employ a false-canonical approach to co-creation, by publishing or prompting bespoke process models or as bodies of local knowledge available to certified practitioners.

Among even advanced practitioners, the prevalent modes of co-creation commonly mix a design thinking methodology with granular creative methods, such as the techniques in IDEO's human-centred design, large group interventions such as

Open Space, and the ubiquitous brainstorming with sticky notes. Research-supported co-creation methods such as Structured Dialogic Design, Team Syntegrity, and Simplexity (Basadur, Basadur, & Licina, 2013) are rigorous, require training to facilitate well, and are (therefore) fairly uncommon in design practice. While certainly not harmful, the creative deployment of such modes of co-creation amounts to craft practice, often wholly dependent on facilitation skill.

A recent development in the systemic design literature is found with the HEC model of design facilitation (Aguirre, Agudelo, & Romm, 2017), developed from observations in the arena of practice. Their methodology proposes a core model for formation of multi-stakeholder design engagements, focusing on facilitation practices and the structuring of co-creation activities. Three process dimensions of co-creation are defined for designing events for participation (genre and method), intention (purpose and outcome design), and function (structures for usability and feasibility across process goals). Three modes of event participation are proposed to calibrate the workshop genre and experience for particular participants: human-centred perspective, experiential, and creative modes. These can be tuned to contribute more or less of each, to customize a type of co-creation event with relatively high, medium, or lower contributions of each mode. This model could also be used to measure differences between other cases for assessment of collaborative efficacy, with relatively more or less creativity, participation, or experience. Facilitation models and genres of co-creation (styles associated with cultural expectations) offer a fruitful area for future development. Such a facilitation methodology might be compatible with the contexts of a co-creation framework, suggesting event-level design facilitation techniques consistent with any engagement adopting principles and methods in the framework.

Evaluating Process Models

There are few standard or well-documented practices supported by research evidence that can validate comparative efficacy among co-creation modalities. In the absence of consensus or standards, we can move ahead with our craft practices shaped by our training and experience with clients, or we can develop guidelines from studying methodology and observing years of successful practices. In this (latter) case, we have further developed sets of principles that other practitioners might employ for their methods and participatory co-creation practices.

If there are no grounds for comparative selection for given types of problems or stakeholders, we cannot determine whether another method would have been superior to a selected method (after having implemented a given practice). We cannot determine in advance the collaborative efficacy of a given method with a particular group of stakeholder participants. We would only have practitioner experience to determine whether the choice of, for example, a structured Team Syntegrity (Leonard, 1996) would produce superior intermediate outcomes and ultimate change compared to the unstructured Open Space (Owen, 1987) for a given context.

In fact, this is also the case with design methodologies (even if not so for research methods, which can be forecasted to have better or worse fit or contribution in types of projects). There is no perfect design process. When we choose a suite of methods and techniques for design process, we employ heuristics from experience, as well as the techniques perfected by the design team and the expectations of a client or sponsor for certain outcomes.

In contexts for co-creation we must address a complex mix of design and method selection factors, based on rationale and conditions that we have only touched upon in this framework study. Even so, the selection of co-creation method often remains entirely a matter decided by sponsors and a design team and their advisors. Typically an expert facilitator on the team will recommend the method for which they are known as expert. We find only a small number of other frameworks or "meta-methodologies" defined for purposes similar to contexts of co-creation. Design toolkits are typically practitioner guidelines, such as the IDEO Design Kit[13], which are methods and consensus practices associated with general design thinking approaches. Among change practices, Liberating Structures[14] is a collection of prior, well-established methods for facilitation purposes loosely organized in a practitioner framework. Practitioner frameworks rarely support the method choices or patterns with research guidance or references. In practice, most practitioners demonstrate clear preferences and strengths in certain methodologies and styles of practice. Experience with methods may be more of a determining factor in their choice than abstract selection rules.

In systems practices we find a tradition of analytical frameworks for integrating and selecting methods for appropriate problem types. In systemic research for social systems, Midgley et al. (2013) proposed a framework for evaluating efficacy of problem structuring methods used in systems studies and outcomes. The framework distinguishes evaluation constructs for context, purpose, methods, and outcomes, which could be a compatible set of evaluative categories for the DoSM. Mingers and Rosenhead (2004) evaluated a wide range of multimethodology studies to propose a framework for selection and integration of multiple problem structuring methods for a context. Midgley et al. (2013) developed an evaluation model compatible with Mingers, with criteria for assessing the contribution of problem structuring methods to complex problem contexts. These are beneficial contributions to methods, evaluation, and theory from classical systems methods, problem structuring studies, soft systems, and operational research. These approaches seem entirely applicable to the Design 3.0 and 4.0 domains as complex multi-stakeholder design contexts. Users of this framework might draw directly on these foundations in the systems disciplines for guidance in multimethodology, problematizing, and selecting and assessing rigorous group methods.

[13] Design Kit from IDEO.org http://www.designkit.org provides a set of handbooks, a website, and resources for learning basic designing practices for human-centred design.

[14] See Liberating Structures: Lipmanowicz, H., & McCandless, K. (2014). *The surprising power of liberating structures: Simple rules to unleash a culture of innovation.* Seattle, WA: Liberating Structures Press.

Conclusion

The chapter presents the findings from an extended period of observations and action research practices that inform a new framework for co-creation practices in systemic design, based on established work in the systems sciences. The framework provides a means of integrating and bridging systems theory-based principles, structured dialogue and group dynamics, and design methodology. This aims to provide a sufficient (requisite) methodology for stakeholder design for social complexity, enabling its users to define interventions and options for social design problem resolution.

The central purpose of the study is to introduce processes known to improve collaborative efficacy for design and decision making in multi-stakeholder co-creation. The framework will fail to accomplish these aims if not adopted in whole or part as a reference model or guideline for design practice. Another aim of the study is to propose and continue the development of a practice theory for systemic design, which might be adopted for convening practices and the management of large systems change programmes involving multiple venues and communities of participants.

Co-creation as a participatory group process has been developed effectively to date as a proprietary and craft practice within communities of practice. When we take this position, supported by the literature and field observations, the evolution of co-creation appears similar to other practice-led design methodologies in wide use, but unreported in scholarly studies. This publication aims to redress that gap in the progression of social science for complex design.

Design studies are not typically investigated as social science research, except for organizational studies of corporate design practices, creative teamwork, and similar boundary practices. However, design co-creation has grown to become a practice norm in many organizational settings and carries embedded values and social interactions that are accepted as productive or effective to design outcomes. We actually know very little about the social effects and influences of design values in co-creation, as researchers have a quite limited ability to instrument and observe changes in social practices resulting from design practice. Co-creation ought to be studied as a sociotechnical intervention, as a social technology with informal and canonical forms, explicit and tacit normative values, and communities of practice. Compared to previous social studies of enabling technologies, such as computer-supported cooperative work (CSCW) and learning (CSCL), we have not assessed the social functions of co-creation as a sociotechnical system of planning, decision making, and design. The current work is a proposal to formulate better models and categories for observation of meaningful operations across the many forms of collaborative design practice.

Finally, the concept of collaborative efficacy in multi-stakeholder participation is a central idea that might be observed and measured through criteria such as those developed in the framework proposition. For co-creation to be determined as "systemic" however, some manner of criteria and evaluations might be considered that could demonstrate how intended system-level outcomes can be achieved produc-

tively. A systemic design methodology ought to also foresee and resolve problematic organizational, social, and psychological constants affecting group sensemaking. Improving collaborative efficacy might serve as a motivating purpose for further social research into the activities and functions of co-creation in organizational and design contexts.

Acknowledgements I am grateful to Alexander Christakis and Thomas Flanagan for their reviews, challenging questions, and commentaries that informed and contributed to this article. As with any project larger than a single paper, the ideas in this study will continue in practice and in future discourse. I also express my appreciation for insights contributed in exchanges with Kevin Dye, Jeff Diedrich, and Kirk Weigand.

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