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Evolutionary Stakeholder Discovery: Requisite System Sampling for Co-Creation

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Abstract A significant source of both power and error in social system design is found in the selection of stakeholders for participation in design and planning engagements. When stakeholders are selected to participate in sessions conceived as co-creation practices, where participants are the "designers of the system," then the entire onus of design decisions falls on the selection of participants. Stakeholder selection can be significantly biased by default and unreflective practices common in design engagements. A discovery process of evolutionary stakeholder sampling resolves this concern by adapting multiple dimensions of ontological and social identification, commensurate with the requisite variety in the defined problem or social system of interest to participating stakeholders. This process provides a justified basis for democratic engagement of multiple stakeholders associated with a social system, across a number of inclusive spectra.

Keywords: Requisite variety, Stakeholder discovery, Co-creation, Third-order cybernetics, Sampling

1. Introduction

As increasingly complex domains are addressed in design studies, from healthcare to smart city planning, methodological accounts are published on engagement practices and group interventions for co-creation and design facilitation (Aguirre, Agudelo & Romm, 2017, Donetto, et al., 2015, Jones, 2019). As predicted by Sanders and Stappers (2008) a decade ago, design practices have indeed moved from design for product and service owners to "design with" participants in their own lifeworlds.

However, as the level of complexity moves higher along a notional scale from products to organizations to multiple coordinating organizations, the inclusion of participants and their role in design decision making changes dramatically. The role of a participant in sketching a preferred app interface entails nowhere near the multifactorial complexity or power relations involved in system, policy, or governance decision-making programs. Yet these programs and their workshops are calling on design practitioners for process support, and these engagements are frequently facilitated with similar participatory and generative methods. The stakes are significantly different between user participation and multi-stakeholder consensus on critical issues or wicked problem systems, and the methods for professing to consensus and design decisions differ not only by style but epistemology and disciplinary integration. An underinformed user's contributions to a service prototype would not

have authoritative outcomes. A stakeholder group determining the community's climate adaptation policy ought to require knowledge, personal or professional stake, and the capability to sustain action according to collective decisions.

There may be many systemic design methods considered pragmatically effective in their consultative or engagement settings. Yet in any design process requiring participant decisionmaking, especially with consensus on binding actions, the commitment of the participant to the outcome becomes a critical factor.

Many design scholars have proffered frameworks distinguishing different designing contexts and the skills and mindsets associated with satisfying their felicity conditions. Perhaps the best known is Buchanan's (1991) four orders of design associated with wicked problems in design thinking. Rather than levels associated with problem scale, they are considered four "placements" for design action that can evolve in a design process: symbolic communications, 2) material objects, 3) activities and services, and 4) complex systems and environments. The doctrine of placements regarded the skilled designer as a mediator between these contexts for design. A comprehensive design project might entail production in and across all four placements, such as a multi-branch library system or the multiple functions of a hospital.

The increasing complexity of problem systems engaged by design practice requires a rethinking of the skills and education associated with problems in similar contexts. In Van Patter and Jones (2013) four domains of design were considered to be additive but incommensurable with each other. Skills appropriate to creative production remain necessary, but are completely insufficient to address complex social domains. When multidisciplinary teams Referred to as Design 1.0 – 4.0, the determining factor for each domain was the degree of social (non-design) or ecological complexity entailed in design research and decisionmaking. The first two orders, 1.0 (design as craft) and 2.0 (products and services) are client or brief-driven, typically commercial domains where the parameters for production are well-established or can be set through requirements. Design 3.0 (organizational) and 4.0 (social policy or multi-stakeholder) are both non-parametric design contexts that require methods commensurate with the social complexity (e.g. requisite variety) and ambiguity of outcome. In Design 3.0 and 4.0 we face complexity that does not exist in client projects with a clear user orientation, where appropriate research can settle most design questions. In non-parametric design contexts a practical concern with stakeholder representation arises immediately, with the necessity to represent values and futures across one or many continuing social systems. Unlike product or service design (Design 2.0) we cannot merely sample from a user base to inform design decisions targeting future product releases. A design team may not know the target domain(s) well enough to even identify and represent relevant stakeholders and commensurate methods to facilitate their interaction.

In Design 3.0 and 4.0, the "users" are the system. We treat users as experts in their own experience, not as representatives of a social system of users. We can reliably sample from user populations or market participants, and can identify relevant characteristics of use behaviours to assumed product/service needs. In design research, high deviation from the norm informs design decisions, as

research exploring the extremes of use and application signal the emergence of new options in a product or offering.

But in Design 3.0-4.0 contexts, the signifying tasks manage complex scenarios and decisions for which designers cannot be held to understand as domain participants. The facilitating design activities are much more "abstract" than in product/service design research, and primarily include problem finding and framing, discovering common ground between levels of power and knowledge, and across contexts, constructing credible proposals for action, and facilitating a durable consensus for decisions.

These activities require high-credibility and neutral facilitation of stakeholders, who may be seen as committed expert participants in practices, as genuine "system members." Real stakeholders are not merely representatives of a social system in which they hold titular membership, they are committed co-producers of the social system of concern. In organizational and policy contexts, stakeholders can be seen as political participants in an arena of debate (Renn, 1993). Therefore, one of the most overlooked design choices, stakeholder selection, may be one of the most critical risks and blind spot we face in systemic and policy design.

2. Getting the Whole System in the Room

In the Western knowledge society we have "centred" users and stakeholders as sources of knowledge and veridiction. Human-centring in design is often presented as evidence of ethical practice, or at least, a necessary sensitivity to multivocalism in design process. However, in many if not most design-led participatory workshops, the situated placement of self-selecting participants as representative "voices of the system" can slip into an unreflective (but efficient) process that evades responsibility of future consequences of design decisions. We would not decide a consensus for actual social system participants. Yet how are we disclosing ourselves as lifeworld-sensitive designers, when we decide for a systemic decision, perhaps an even more consequential outcome, of who will be the system participants?

Design problematics in the many domains we now touch involve social complexity and the complex multiplicity of stakeholders. If we recognize stakeholder co-creation as a context for design facilitation for critical decision and planning events (Jones, 2018), we bring forth skills for different roles than product or service designers. As with other design skills, systemic designers are neither authentically domain experts or visionaries in the complex sociotechnical systems we may serve, such as urban planning, healthcare, ecological community design, and advanced technology.

A common phrase among facilitators of large-group interventions is "getting the whole system in the room." Group processes such as Future Search (Weisbord, 1992) have relied on this principle. Such practices (based on the original search conference concept) rely on the assumption that large group workshops increase the points of view and diffuse the power levels among members of a group and raise the likelihood of their learning from each other and making durable decisions together. This practice has been reported as successful within organizations. However, as a social system is expanded to its larger social boundary (as across an industry or community), achieving understanding

and decisions across widely disparate organizations and its stakeholders requires more than just large group workshops and arranging for occasions to meet. We might question the heuristic of the large group intervention, that relies on inclusion of greater numbers of participants rather than targeted compositions of stakeholders and their expected contributions. How could we ever know whether we had acquired the appropriate social variety representative of a given social system, without modelling the system of interest in detail and its interactions? When the very identity of a social system is defined by its members, we would have to involve some quorum of its stakeholders that other members would agree have defined its boundary conditions and inclusions.

Stakeholder selection is itself a wicked problem. As in a wicked problem (Rittel and Webber, 1973) each selection of stakeholder matters, each inclusion of a participant excludes another possible choice. The consequences of participation and non-participation are unknown at the time of selection, but each person's perspective counts and can be seen as a potential representative. Stakeholders as a collective share a context (even if solely due to their invitation to an engagement) and co-create a framing (a reference system) that becomes path-dependent, that cannot be undone. The participant sample defines the problem space. Vision, context and direction setting are extremely sensitive to initial conditions, and – especially when performed well - may create a lock-in effect with confirmation of beliefs among actors that their choices represent desirable preferences for future system participants.

On this logical position we might propose that the selection of stakeholders make more difference to achieving a durable consensus than our choice of design methodology. A carefully-tuned participatory design workshop with attention to co-creation process and designerly practices makes little enduring difference if the participants have no continuing stake in the outcome. When the design team is left to interpret for themselves the meaning of sticky notes pulled off the wall, the workshop has not intervened in the future system.

In systemic design we face a changing problem frame with each selection of participants. We can see shifts between each stage of a progressive design process, sustaining an essentially artificial co-creation engagement. A typical co-creation engagement proceeds from visioning and problem framing, through system intervention or concept formulation, and toward consensus on collective action. All of these activities require stakeholder insight and validation, and much less design guidance and content compared to D2.0 product/service contexts.

A design process becomes irrelevant if stakeholder selection does not represent the variety in the exogenous social system and fails to enrol authentic commitment from selected stakeholders. As design disciplines are predicated on a tradition of creative problem solving, and not social science research, these critical functions are often underdeveloped, especially for workshop-type engagements. When we under-conceptualize the exogenous (external, socially constructed) system we risk failures in outcome, even when co-creation has been deemed highly satisfactory, by failing to select and enrol sufficiently well enough to enable an effective future result in the social system.

2. A Social Science of Cybernetics

Stakeholder selection in systemic design co-creation can be considered an interdisciplinary social science problem, intersecting social science research methodology, sociological analysis of social groups, organizational theory, and action research. In its more rigorous expression, sampling appropriate stakeholders involves non-probability population estimation, and the development of models representing assumptions about the social systems from which inferences about the "whole system" can be justified. The purpose of sampling models or frames in estimating population characteristics becomes critical when policies or decisions are constructed, in design or planning contexts as well as sociopolitical arenas, that affect an entire group's future outcomes. In some respects, every urban planning problem or public policy can be posited as a multi-stakeholder social system. When design teams are given responsibility for convening complex multi-community engagements we require an ethically supportable, transparent process that reveals our criteria, assumptions and system modeling involved in sampling and recruiting.

The method of selecting specific types or even persons meeting necessary criteria to serve as research participants is a well-established method in qualitative research, known as purposive or theoretical sampling. For social systems design, the purposive sample is the most appropriate sampling method. When a group of participants self-selects to participate in an engagement we can determine that some measure of agency bias (personal interest in outcome) could be involved. These implicit biases are difficult to detect, and even harder to balance as their effects are unknown in a session. The so-called random sample of participants, often considered a fair approach in public sector consultations, neglects to identify participants who may be deeply informed and representative of organizations or classes of interest. The purposive sample selects individuals associated with the core purpose of the engagement or study, and is referred to as "theoretical" in that participants match the theoretical issues or constructs of the problem area, which in this case would be a "theory of the system" or a sampling model.2

Evolutionary stakeholder discovery is typically not conducted for well-established groups or defined subsets of organizations, such as a project team, even if users or external stakeholder are involved. This fairly elaborate process is not done for reasons of academic rigor, although increasing rigor without inefficient overhead is usually a desirable practice. Evolutionary stakeholder sampling becomes necessary for ensuring breadth of perspective across the social system and its various constituencies. The process is evolutionary in the sense of the multiple iterations necessary to learn and gain feedback from subsets of the total sample. An evolving process of "discovery" is followed, where the appropriate sample is constructed by evaluating actual stakeholders against models and testing the sampling models against criteria. Such a process protects fairness, neutrality of position, and aims to mitigate power relations within engagements where multiple competing perspectives are expected, and a shared reference outcome, such as a plan or decision, is required.

2.1. Multiple Stakeholder Varieties

Ross Ashby's (1958) principle of requisite variety establishes the primary principle by which stakeholders are selected for a given social system. Ashby also articulated requisite variety with respect to organizations and social systems, as well as the familiar (engineering) control systems with which his theory was applied. With respect to organization, Ashby (1962) revealed the conditions of variety in self-organizing systems, and the consequent uncertainty and conditionality of such systems. Of central concern was the way the "parts" of a dynamic social system change under conditions of the observer's viewpoint. This perspective became known as second order cybernetics (or the cybernetics of cybernetics) by Margaret Mead and von Foerster (2003), a perspective that evolved from the early 1960's and has become a well-established term of art in cybernetics.

The process and purpose of stakeholder *discovery* can also be seen as explicitly cybernetic. Participants are selected for the purposes of the issue of concern. The formulation of stakeholder observations for feedback, feedforward and future control of a social system meets the definition of first-order control. However, since human observers are themselves making observations about systems of concern, this control system of observations serves as a second-order cybernetic system. The *selection* of participating observers charged with formulating observations about their social system's future options adds another layer of control, the management of process and recruiting of relevant participants requires the proposal of a suitable model or conceptual simulation of the process and its outcomes. This executive modeling process becomes a third-order control system. Figure 1 shows a simple representation of these levels of social system observation.

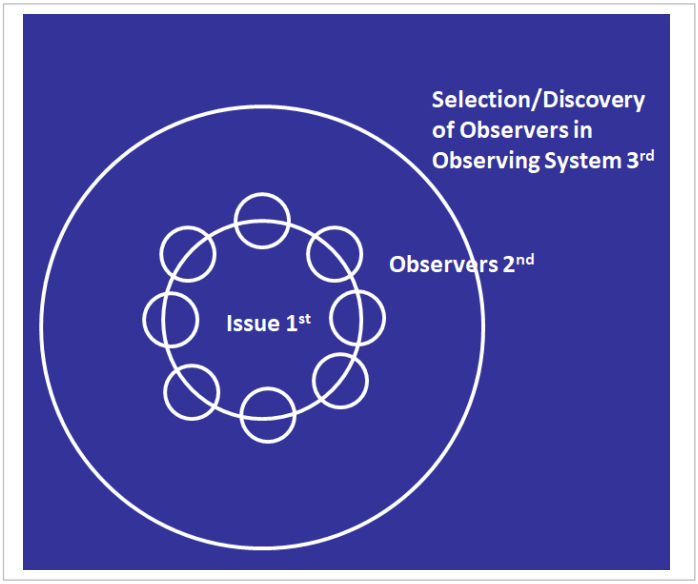

Figure 1. First, Second and Third-Order Observations in a Multi-Stakeholder Design Engagement.

Figure 1 presents a third-order cybernetics frame, an evolution of cybernetic orders developed in the disciplinary discourse for over a decade (c.f. Mancilla, 2011). Here the concept shows the social cybernetics of feedback/feedforward of a 3rd order observing system (e.g., a design team) forming an

observing system of participants (2nd order) who engage directly in the facilitated observations regarding the issue (1st order). The third-order design team, typically the steering committee or core group of an engagement, has responsibility for the identification, selection, and recruiting of stakeholders in the observing system that we refer to as the co-creation engagement.

To summarize, we might describe the multiple configurations of social requisite variety potentially influential in the systemic design stakeholder encounter.

- Multiple perspectives associated with the issue of concern
- Multiple perspectives associated with the Triggering Question (the framing of inquiry as presented to all participants)
- Multiple stakeholders and their organizations holding a commitment to the issue or question (domains in the Arena of debate)
- Multiple stakeholder communities that care about the decision or design outcome
- Variety of sociopolitical diversity criteria to ensure appropriate distribution across age range, career stage or type, gender, ethnicity, geography, and meaningful political spectra.

These varieties are expressed in terms of perspective or representation, which are first described in a sampling model. Criteria from the model are then allocated to stakeholder selection, based on inference and validated by interview or survey questions. Following both research and systems principles, primarily requisite variety, we become ethically obligated to employ a sampling and selection process commensurate with the problem complexity. Social systems are not product marketing, and they require a careful analysis of the entailed social dimensions as a first step. Concurrently the framing of a triggering question shared as critical by the participants must be done and communicated in recruiting. Finally, a complete process requires a dialogic engagement methodology that “absorbs” varieties commensurate to the social complexity of the entire balance of dimensions and their ranges. Preferably such process is sufficiently contained by facilitation to enable dialogue, dissension and agreement to emerge.

3. Evolutionary Sampling for Stakeholder Discovery

The requisite stakeholder variety model for stakeholder discovery was designed to address the necessary variety in high-stakes foresight for long-term R&D strategies and as a reference model for anticipatory policy research. We propose an approach called evolutionary sampling, that iteratively samples stakeholders from across sets of covarying dimensions identified within the social system being designed. This method also effectively enables planners and sponsors to reveal biases and risks and to trade-off potential leaders, dominant voices, and under-represented minority views within the social system of concern.

A pragmatic methodology has been developed with several methods consistently associated with the process. The process of evolutionary sampling refers to the stakeholder reference model developed by a core group to map social system characteristics to possible stakeholder varieties. Several category sets are defined to consider stakeholder influence and power, and to expose risks and blind spots where oversampling subgroups could express systematic biases in an engagement.

3.1. Multi-dimensional sampling by multi-category

An iterative sampling process was developed for Dialogic Design methodology (Christakis & Bausch, 2006) and other foresight practices, where the undersampling of variety leads to insufficient knowledge and gaps within critical areas of social representation. Based on two design action research cases performed with a large US government research lab (Weigand, et al., 2014) and Canadian foresight studies, a sampling reference model was developed that integrates three dimensions ((Fig. 2):

- Ontological commitment, or worldview perspectives, based on Latour's (2013) Modes of Existence ontological typology as a social theory of orthogonal perspectives,
- Foresight trend categories based on STEEP categories (selection of core expertise),
- Social variety (diversity) and demographic characteristics associated with the system.

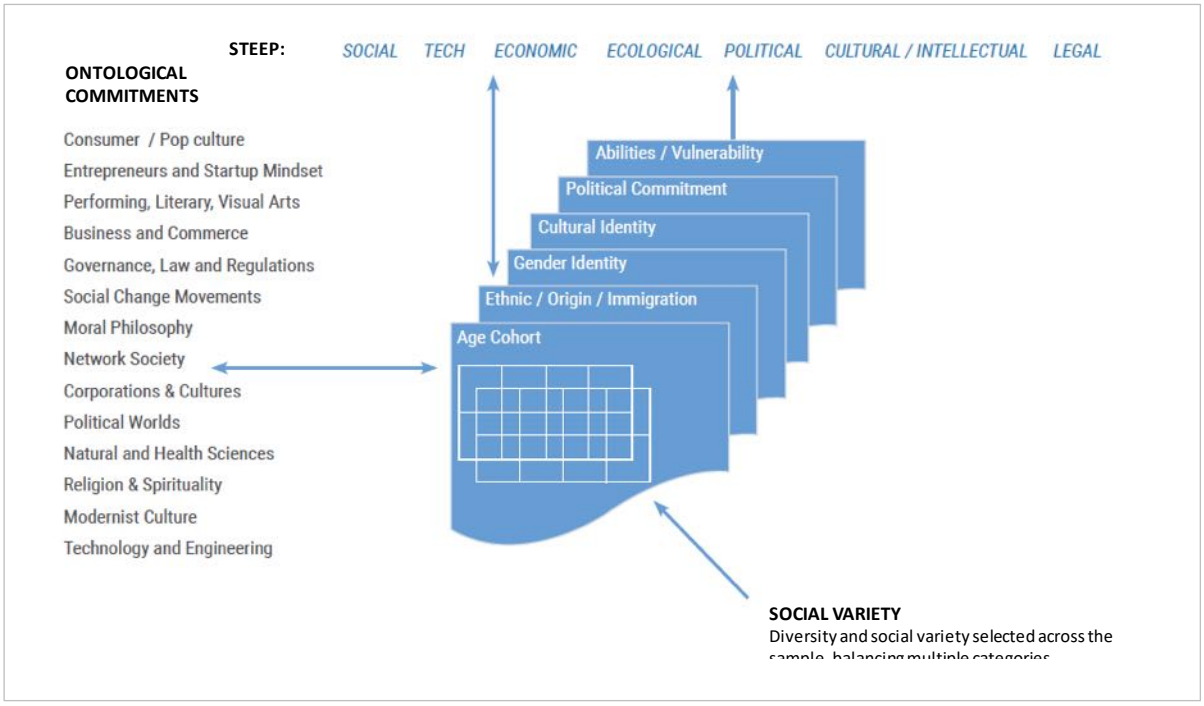

Figure 2. Model Sampling Frame for Evolutionary Stakeholder Discovery.

A model for requisite stakeholder variety enables robust sampling for ontological representation, variety, biases and diversity of knowledge, and exogenous representation of commitment (e.g. *skin in the game*, Taleb & Sandis, 2015). This canonical stakeholder model maps selected domain categories (e.g., STEEP) to worldview ontological domains (Modes), and further diversifies by variety attributes including age, culture, gender, and experience. This mapping identifies significant relationships of knowledge and trends across domains and disciplines. At minimum the stakeholder sampling model provides a checklist that exposes possible risks and blind spots in the available composition of stakeholders or experts. It further provides a schema for identifying values conflicts between

worldviews and other attributes associated with known stakeholder interests (such as strategic preferences that planners wish to include).

The evolutionary sampling process requires several stages of mapping from inquiry to social system. I have described the sampling frame, which is essentially the formation of a framework of dimensions that reflect the exogenous social system of interest. The sampling frame consists of a matrix composed by mapping selected categories from the framework to not only the social system, but a question of interest to participants in that system qualified to act in the future as a result of the engagement or its consensus.

A continuing dialectic is created between the sample and the emerging question that become resolved through the process of recruiting appropriate stakeholders. The dialectic is between the envisioned participants within categories and their match to the question. The process starts with the initial issue framing, the analysis of categories, identifying participants matching those categories, and reframing the question of interest (triggering question) to best fit the emerging interest patterns of the committed participants.

4. Conclusion

The outcomes of any design or strategy engagement can result in conclusive decisions. The interactions of participants are indeterminate, probabilistic and potentially influential of future outcomes. We cannot and do not wish to control or influence the outcomes and decisions of multistakeholder groups. But we cannot know how knowledge and power influences will propagate within a session, especially in high complexity contexts. Since we know that many group process dysfunctions exist, and process facilitation is not a perfect science, it become an ethical imperative to manage the outcome risk for which we have some control. If we can develop better models of the social system of interest in a planning or decision contexts, much of the risk of an unwanted outcome can be mitigated.

The object of evolutionary stakeholder discovery is the best-fit match between participants in a design engagement associated with the requisite variety commensurate with an exogenous social system or crossing of systems. The formation of such a microsystem of macrosystems forms a context for a strong democracy in miniature whereby committed participants, the stakeholders owning the social system design, agree to balance or distribute agency and risk across the system.

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