Reifying Socio-Technical and Socio-Ecological Perspectives for Systems Changes: From rearranging objects to repacing rhythms*

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Abstract

Purpose: The rise of Socio-Technical Systems (STS) and Socio-Ecological Systems (SES) perspectives originated in the industrialization of the 1950s and 1960s. With ubiquitous computing and globalization compressing time and space, interests in systems thinking by the 2020s have turned towards systems changes. This refocusing on changes has encouraged hypothesizing an alternative world theory of (con)texturalism-dyadicism with a root metaphor of yinyang dancing through [eight] seasons. Through post-colonial sciencing in constructionist philosophizing across Western and Classical Chinese traditions, SES alongside STS are recast as kairotic rhythms casting on and binding off weaves in time.

Approach: This inquiry began with behavioral histories of open-sourcing-while-private-sourcing, in an inductive approach to theory building. Curiosity on the origins of causal texture theory led to plunging into the history of pragmatism, and its associated metaphilosophy. An exploration of processual philosophies revealed a better appreciation through a non-Western approach, via yinyang at the foundation of Classical Chinese Medicine. Developing a (con)textural-dyadic world theory enables conjoining SES and STS as diachronic complements.

Findings: Changes in SES and STS based on Western philosophy presuppose functions and structures as primordial, evoking systems conceptions of rearranging objects. Clarifying root metaphors, changes in SES and STS that foreground processes and behaviors elevate the repacing of rhythms in systems concepts. Systems practice approaches involving action learning can be adapted for the altered foundations.

Originality: In organizational theory, SES and STS have been expressed as different perspectives on systems of interest. Tracing back to metaphilosophy from the 1940s, an alternative branch of pragmatism incorporating yinyang enlarges the scope of systems thinking from its Anglo-American traditions.

Keywords

Socio-Ecological Systems, Socio-Technical Systems, Systems Change, Systems Thinking, [1]

1. Introduction: When systems changes predominate, ↓ (SES function → STS structure), ↑ (SES+STS process → behaviour)

The organizational systems perspectives on Socio-Ecological Systems (SES) and Socio-Technical Systems (STS) are rooted in systems theory based on Western philosophy. After

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WWII, social science in England built on the field theory of Kurt Lewin [1], [2]. Organizational change has been (unfortunately) popularized as transitions between stable states, i.e. unfreeze-move-refreeze [3]. In working through metaphysics, Lewin himself saw challenges in cross-appropriating to psychology from physics as Aristotelian change in form, preferring Galileian change in content: "... in the psychological fields most fundamental to the whole behavior of living things the transition seems inevitable to a Galileian view of dynamics, which does not derive all its vectors from single isolated objects, but from the mutual relations of the factors in the concrete whole situation ..." [4, p. 174]. Dynamics in concrete situations have become a rising interest in systems changes since 2017, from the OECD [5], Stanford Impact Lab [6], UNDP [7] and, Forum for the Future [8]. The emphasis in thinking elevates *changes* as more pressing than *systems* appreciated as static states.

Systems thinking can be characterized with four concepts: (i) *function* is a "contribution of the part to the whole" in non-living systems (referred to as *role*, in living systems), (ii) *structure* is an "arrangement in space"; (ii) *process* is an "arrangement in time"; and (iv) behaviour is a "system change which initiates other events" [9], [10], [11]. Western approaches to systems have generally foregrounded function+structure as primary, with the subsequent consideration of process+behavior.

In a 10-year inquiry started in 2019, Systems Changes Learning [12] reframes systems changes by (i) deprecating the rearranging of objects (function+structure) while (ii) elevating the repacing of rhythms (process+behaviour). The impact on a theory of organizational change is to recast SES alongside STS, with SES as primordial.

A history of SES and STS is reviewed in section 2 below. The research approach trailed over the past decade is outlined in section 3 below. The reifying of philosophy, theory, and practice is described in section 4 below. Implications of the reifications are discussed in section 5 below.

The research not only aims to recap the evolution ofd STS and SES as perspectives, but to recognize an alternative branch of organizational change thought aligned to a post-colonial philosophy of science bridging Western and Classical Chinese roots.

2. Historical Review: Concerns with industrial productivity led to SES and STS perspectives on organization development

In 1947, the Tavistock Institute was incorporated as a charitable organization largely funded by the Rockefeller Foundation, emerging from the social clinic at the Tavistock Clinic where psychoanalysts worked with groups. The founding emphasis was on a Socio-Psychological Systems (SPS) perspective, as society was adjusting to WWII soldiers returning to civilian life. By 1948, with the British economy in serious trouble, the Tavistock Institute received grants for research to improve productivity through better use of human resources. In hindsight, three perspectives developed contemporaneously based on the engagements at hand at the time.: "... the socio-psychological, the socio-technical and the socio-ecological perspectives ... emerged from each other in relation to changes taking place in the wider societal environment. One could not have been forecast from the others. Though interdependent, each has its own focus. Many of the more complex projects require all three perspectives" [13, p. 30]. An interest in contemporary organization development acknowledges SPS, while focusing on SES and STS.

2.1. From the 1950s, STS work reorganizing ← shifting generations of industrial platforms, pacing over years

In 1950, Tavistock postgraduate research fellow Ken Bamforth reported on innovation in work practice and organization at a coal mine in Yorkshire where he previously worked. Eric Trist asked to be introduced to the colliery, with an offer to research the innovation so that it might be replicated to another 20 mines [14, pp. 7–8], [15]. Decades of ongoing development of the STS perspective saw innovation not just in the technology platform, but also with the work organization.

2.1.1. Reduced productivity from a change in technology that reduced work to machine-like tasks was corrected via autonomous workgroups

Short face coal mining cycled work over 24 hours into 3 shifts: (i) cutting the coalface; (ii) filling tubs with coal; and (iii) moving the gate forward. The introduction of the longwall machine altered the sequencing of shifts into (i) cutting, including boring holes, gumming out loose coal, and breaking down the conveyor belt; (ii) ripping, including reassembling the belt and clearing the gates; and (iii) filling, manually throwing shot coal onto the conveyor [15]. The introduction of the longwall machine sometimes resulted in the cutting and ripping shifts passing on bad conditions to the 20 fillers on the third shift. The isolation of the fillers created anxiety and irritation that could lead to neuroses, e.g. work stoppages or leaving the face in rage. In Haighmoor, Trist found that "the men told us that in order to adapt with best advantage to the technical conditions in the new seam, they had evolved a form of work organization based on practices common in unmechanized days when small groups, who took responsibility for the entire cycle, had worked autonomously" [14, p. 8]. These autonomous workgroups (sometimes called self-organizing teams) had interchangeable roles and shifts. The workgroups required minimal supervision, counter to the specification of tasks for human-like interchangeable cogs in a machine.

2.1.2. A broader range of field studies on industrialization → variants on STS approaches

Theorizing STS led to an appreciation of systems relations between function and structure. Fred Emery found that organizations could be adaptive in a wide range of evolving circumstances, by adding redundancy in one of two ways: (i) "By adding redundant parts to the system. Each part is replaceable; as and when one part fails, another takes over"; and (ii) "By adding redundant functions to the parts. At any one time some of the functions of any part will be redundant to the role it is playing at the time; as and when a part fails in the function it is performing, other parts can assume the function; so long as a part retains any of its functional capabilities (i.e., functional relative to system requirements) it is of some value to the system" [16, p. 214]. The arrangement of unit parts in a machine couples function and structure. A human being, however, can serve multiple functions (roles) in an organization. Designs can appreciate the interchangeability of machine parts, while recognizing humans beings can have base competences with individual strengths and deficiencies adapted collectively through teamwork.

Merrelyn Emery has continued this work, describing the relations as Design Principle 1 (DP1), with redundancy of parts "because there are more parts (people) than are required to

perform a task at any one given time", and Design Principle 2 (DP2) with redundancy of functions "because more skills and functions are built into every person than that person can use at any one given point in time " [17, p. 627].

From the 1960s to 1980s, branches of the STS movement spread worldwide. Frans von Eijnhatten intensively describes the application of a Socio-Technical Systems Design (STSD) paradigm as organization theory with democratic values added as a basic philosophy [18, p. 2]. The STSD development trajectories are distinguished: (i) phase 1 (1949-1959+) as the Pioneering Work; (ii) phase 2 (1959-1971+) as Classical STSD; and (iii) phase 3 (after 1971) as Modern STSD. The Modern period is divided into four separate tracks: (i) variant A (from 1971) as Participative Design; (ii) variant B (from 1973) as Integral Organizational Renewal; (iii) variant C (from 1979) as Democratic Dialogue; and (iv) variant D (from 1971) as North American Consultancy [18, p. 18].

The Pioneering period, centered at the Tavistock Institute, saw the Bamforth and Trist research extended to other mines by the National Coal Board. Field experiments observed in the Indian textile industry by A.K Rice in the early 1950s were extended by Eric Miller into the 1960s [19]. The 1950s saw small projects in the London harbour, British retail trade, the Glasgow telephone exchange, automotive manufacturing in Coventry, the Stockholm telephone exchange, a Norwegian clothing factory, a digital instruments manufacturer in California, and a banking debit system in the Hague. The action research approach from the group dynamics research of Kurt Lewin developed into a Tavistock variant where the external parties aimed to minimize intervening in the way jobs were conducted amongst workers hands-on to tasks.

Classical STSD was highlighted by the Norwegian Industrial Democracy Program between 1962 and 1969, initiated by employers, employees, and then the government. Employers in Sweden started their own socio-technical programs in the 1970s, with the most well-known in Kalmar by Volvo.

In the tracks described by von Eijnatten, *Variant A, Participative Design*, developed in Australia after Fred Emery returned in 1969 after 10 years in Europe. Joint optimization of task and organization design was conducted by employees, middle management, and union representatives. Participative Design took a deep slice vertically through the organization, in conceptual and experiential learning workshops. Search Conferences were policy-preparing planning meetings, directed at the joint development of desirable and probable future scenarios.

Variant B, Integral Organizational Renewal, originated in Holland from L. Ulbo de Sitter, with detailed structural principles, and a theory of change by means of worker participation Problems in business functions were solved as improvements (partial changes in structure) and renewal (integral changes in structure). In the 1980s, this variant of STSD connected quality of work life, efficiency and effectiveness, and social binding and cooperation.

Variant C, Democratic Dialogue, went beyond enterprises in Norway and Sweden into large-scale social change processes. From 1982, Norway introduced employer and employee confederations, leading to 200 companies participating in the program. This led to the Norwegian Work Life Centre being founded in Oslo in 1988, running a program to create local networks in both public and private sectors for five years. In 1985 Sweden, the Work Environment Fund founded the "Leadership, Organization and Co-determination (LOM in

Swedish), involving more than 100 institutions in regional networks. These programs centered on a theory of communication, more than a theory of design.

Variant D, North American Consultancy, saw the importation of the Classical STSD from Norway in the 1960s by Louis Davis and Eric Trist. Further development included design principles for knowledge work by William Pasmore and Ronald Purser, and deliberation in white-collar work by Cal Pava. STS ideas became expressed as a team approach, self-directed teams, and empowerment.

In the 1990s, Cal Pava saw STS design of autonomous workgroups as suitable for mechanical technology with programmed tasks in factories, but deficient for nonlinear unprogrammed tasks. These unprogrammed tasks involved diagnosing malfunctions, making decisions, and formulating new strategies. Rather than tracking variances and analyzing roles in linear work, changing work habits encouraged entrepreneurial effort in nonlinear work. With organizational boundaries becoming more fluid, the system of interest changed from a bounded functional operation towards the interfunctional activities coordinated through extended information systems [20].

The entanglements of STS and SES have made separation of the perspectives more challenging. In 1993, Fred Emery wrote: "When many enterprises move to transform their workplaces we start to confront socio-ecological problems that take us beyond STSD" [21, pp. 195–196].

2.1.3. STS variants continue parallel paths into contemporary times

Centered in Australia, OST(E) is the label for Open Systems Theory with the legacy of Fred Emery. As continued by Merrelyn Emery, the approach can be described as STS with SES features incorporated. Active adaptation includes practices in Search Conferences, and in Participative Design Workshops [17]. Other variants have continued to separate the STS perspective from the SES perspective.

Even within STS variances, fine philosophical distinctions reflect divergences. Barton and Selsky describe Russell Ackoff's position as more sympathetic to General Systems Theory, relating "part-to-part within a whole; the whole is emergent and has no identity as a unit(y)". They also describe subtle differences with Eric Trist as a "more institutional approach, identifying specific kinds of meso-level structures (called 'domains,' or social areas of shared interest) that influenced people's behavior in the community" [22, p. 706]. Kira and von Eijnatten aimed to build on STS theory with better foundations for sustainability through a proposed Chaordic Systems Thinking (ChST) [23]. The publishing of the research article led to a refutation by Merrelyn Emery that OST(E) had been misrepresented, and Search Conferences have dealt with social change that includes the natural environment [24]. In response, Kira and von Eijnatten redoubled on their contribution, saying that further perspectives and approaches to work organization sustainability would benefit from research into new conceptual areas [25].

2.2. Evolving from the 1960s, SES changes have included institutional transformations, organizational ecology, and personal computing

In his emeritus days of the late 1970s, Eric Trist continued to look forward. Trist outlined three macrosocial trends, that might be recast with the benefit of 4 decades of hindsight: (i)

institutional transformations, as systems larger than a single organization, potentially crossing corporate initiatives and government programs; (ii) organizational ecology, in platform choices concentrating expert knowledge and financial power, enabling and constraining end users; and (iii) personal computing, with the microprocessor revolution enabling decentralized work, across all industries. These concerns can be framed as more related to SES stemming from projects in the 1960s.

2.2.1. The 1960s surfaced concerns about organizational impacts of changes in public and private institutions as turbulent fields in SES

Concerns of large-scale change problems surfaced in 1960s Tavistock projects in hospitals, prisons, education and political institutions. In two case studies, Emery and Trist described conditions predating the formation of the European Union, where the United Kingdom had been applying for accession into the European Common Market. The proposal failed in 1961 and 1967, finally succeeding in 1969. A Common Agriculture Policy was first introduced between France and Germany in 1962. In the first case study, the food canning industry in the UK was meeting competition with small firms importing fruit and migrating to quick-freezing. In the second case, the National Farmers Union of Great Britain (NFU) headquarters felt out of touch with local branches representing 200,000 farmers in England and Wales. Farmers were feeling competition not only from each other, but from Commonwealth and European producers. Increasingly, large farms were being supplied by giant firms supplying fertilizer, machinery, seeds, etc. [26]

Open systems models of organization not only include theories of internal processes where parts relate to the whole. Open systems are also wholes to be related to their environments. These relations are shown in Figure 1 below.

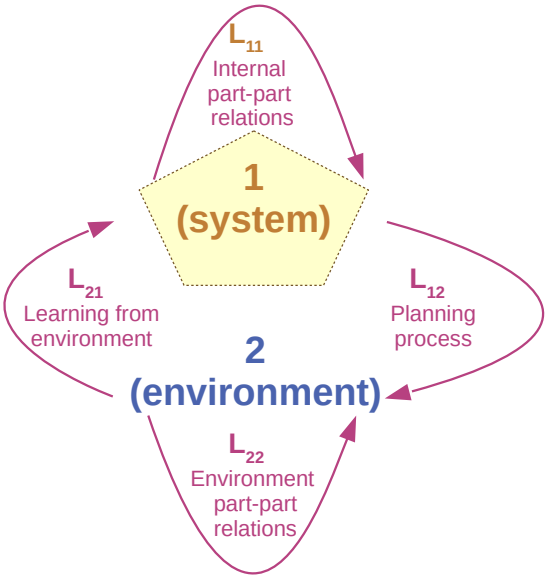

Figure 1: Causal texture as four lawful connections of an organizational system (1) and its environment (2), CC-BY 2024 David Ing

An understanding of organizational behaviour requires some knowledge of four lawful connections: "L_{11} here refers to processes within the organization -- the area of internal interdependencies; L_{12} and L_{21}, to exchanges between the organization and its environment -- the area of transactional interdependencies, from either direction; and L_{22}, to processes through which parts of the environment become related to each other -- i.e. its causal texture the area of interdependencies that belong within the environment itself" [26, p. 22].

These conditions led to isolating four ideal types of causal texture. The first three were familiar. The fourth was new.

The Type 1 causal texture was called a *placid, randomized environment*. It corresponded to the idea of a surface where an organism can find widely scattered heaps of food. The response to move randomly doesn't differentiate between tactics and strategy.

The Type 2 causal texture was called a *placid, clustered environment*. The metaphorical field corresponds to imperfect competition in economics. The clusters of food might motivate an approach, but if competitors are nearby, avoidance is preferred over engagement. Strategy becomes distinct from tactics. An organization can develop distinctive competence.

The Type 3 causal texture was called a *disturbed-reactive environment*. There are several similar organizations at play, e.g. an oligopolistic market in economics. Each competitor not only has to take into account any random encounters, but the information known by one is known by all. Between tactics and strategy, this introduces military operations, choosing actions that will draw off others.

The Type 4 causal texture describes *turbulent fields*. Compared to Type 3 where dynamics arise from interactions of component organizations, the field (e.g. the ground) is in motion. Three trends could contribute to the dynamics: (i) organizational links are so strong that they induce autosynchonic processes, like soldiers marching in step over a bridge; (ii) economic organizations are enmeshed in legislation and public regulation; and (iii) increasing reliance on research and development required to meet competitive challenges presents continuous change gradient. The trends mean a gross increase in the area of relevant uncertainty.

The challenge with dealing with a change in the type of causal texture is the corresponding value change. Establishing new values is a slow social process normally paced generationally, unless conditions of urgency (e.g. war) occur.

2.2.2. The 1970s expanded SES concerns towards organizational ecology and community-based development

Eric Trist became emeritus from the 1969-1978 appointment in the Social Systems Science program at the University of Pennsylvania, the department that had been founded by Russell Ackoff. Between 1978 and 1983, Trist then became a Professor of Organizational Behavior and Social Ecology at York University in Toronto, Canada. "This fifth decade of Trist's academic and professional career has resulted in an amazing wealth of activities: the continuation of his QWL [Quality of Work Life] work throughout the country; his focus on community-based development (to the previous Jamestown, New York, and Craigmillar, Scotland, examples were added Sudbury, Ontario, and Cape Breton, Nova Scotia); new teaching ventures including the re-examination of earlier concepts in 'management in turbulent environments'; the extension of the search-conference idea through its application in Canada and the third world; and the emergence of the action-learning style of action research" [27, p. x].

In this period, the definition of *contextural action research* became more clearly articulated, as in a dissertation by Beth Franklin, as "a praxis-oriented research methodology, distinct from action research (AR), participatory research (PR), participatory action research (PAR), feminist action research (FAR) and other versions of the 'action research' genre. It is its *trans-disciplinary* approach to research practice and the conceptualization of new ideas that characterizes the use of contextural action research in this study. Explicit assumptions are implied by the use of the term *trans-disciplinary*, with regard to the thought, process, and use of theory underlying this study. Contextural action research will be presented as an *enabling methodology* that aims at building capacities from within a context as opposed to reinforcing dependency on external sources of funding and expertise. The values and principles that drive a contextural action research process imply a reframing of established social and political structures of power within society" [28, pp. 3–4]. This published research was a reflective assessment case study of community-based nature tourism in the Windward Islands of the Eastern Caribbean, funded by the Canadian International Development Agency.

The broadened interests for SES were collected into a *festchrift* devoted to the Trist legacy, *Learning Works: Searching for Organizational Futures* [29]. Essays on organizational ecology and the framing of meta-problems included: (i) women, work and family life in Cape Breton, by Linda Mitz; (ii) information technology, by Gareth Morgan; (iii) local economic development on Cape Breton Island, by Peter Homenuck; (iv) international development in sub-Saharan Africa, by Michel Chevalier, Fred Carden and Glen Taylor; (v) Canadian native people, by Mary Bernard; (vi) provincial health planning, by Suzanne F. Jackson; (vii) cooperatives in Japan and Israel, by John G Craig; and (viii) community festivals in France, by Rafael Ramirez.

2.2.3. The 1980s saw SES coordinating across interorganizational networks

An SES perspective reorients viewing each organization as a link in a supply chain, towards an ecology of players interacting in fields. Richard Normann and Rafael Ramirez highlighted multiple cases of organizations as more than value chain links, with a prime mover at the centre of a constellation of services, goods, and design. Cases of value constellations included: (i) IKEA suppliers, logistics, and warehouses, enabling customers to assemble components in their homes; (ii) the Danish Pharmaceutical Association of local pharmacies and subsidiaries interconnecting their services and building relationships with national organizations for the elderly and disabled; and (iii) French water companies working together on research and development of water purification, transport, and waste water treatment [30]. Ramirez described the shift from a conception of an assembly-line industrial value creation that depicts customers as destroying the value created for them, towards value co-production of firms with customers [31].

Extending SES for transorganizational work, Selsky, Ramirez and Baburoglu propose adding to Emery's two STS design principles with a third, called Redundancy of Potentialities. DP3 has three design requirements: (i) the set of actors in a social field are able to constitute and re-define that field, not just function within it; (ii) a wide set of potential inter-organizational connections exist in the field and are imagined by some actors in it; and (ii) at least one value constellation spans across the boundaries of two or more organizations in the field. Then, potentials are options that *might* become available to actors to be exercised; they are not (yet) options that *can* be exercised [32].

For strategic planning under uncertainty, Ramirez and Selsky propose scenario planning as way of dealing with turbulent environments. Causal texture theory suggests three alternative stances for engaging with SES: (i) *stocking up* resources to release or invest in time in order to survive and succeed over a turbulent period; (ii) *relocating* to a region of the field where the turbulence is felt less acutely, and protecting or extending that region; and (ii) *reinventing* collaborative opportunity through enriching partners with knowledge of the unfolding turbulence [33].

2.3. From the 2010s, agile development ⇒ STS change; open innovation ⇒ SES change; service science ⇒ SES+STS change

During the "world is flat" period of Internet revolution and globalization, work practices have outstripped theorizing. The new ways of organizing have implicitly followed the spirit of STS and SES thinking, but are not often recognized for that.

The agile movement was kicked off by the declaration of the Manifesto for Agile Software Development in 2001 [34]. Many practices could be described as STS in use: agile estimating, and working the product backlog can be seen as self-managing within autonomous workgroups; and sprints can be seen as action learning cycles where retrospectives support revisiting prior assumptions. By 2012, methods for enterprise-scale initiatives were formalized as Disciplined Agile Delivery [35]. The challenge for the agile movement has been espousing the label, while operating in reality as "fake agile" or "agile-but".

Open innovation surfaced in 2003 as an emerging approach for research and development [36]. The interorganizational cooperation beyond independent enterprises is a form of SES. Modes of innovation included: (i) funding innovation, via investors and benefactors; (ii) generating innovation, as explorers, merchants, architects, and missionaries; and (iii) commercializing innovation, as marketers or one-stop centers. Organizations work cooperatively in the variety of causal textures.

A science of service systems was proposed in 2007 by Jim Spohrer, Paul Maglio et. al., as the service sector has become the larger part of most industrialized economies [37]. For STS and SES theory developed during the machine age, the concurrent shift of economies from products → services, and material → information [38] warranted a revisiting. "Service systems are value-co-creation configurations of people, technology, value propositions connecting internal and external service systems, and shared information (e.g., language, laws, measures, and methods). [...] Service science combines organization and human understanding with business and technological understanding to categorize and explain the many types of service systems that exist as well as how service systems interact and evolve to co-create value" [39, p. 18].

Acknowledging over 70 years of history of development for STS and SES, we can turn to present-day concerns, while re-examining antecedent foundations.

3. Approach: Inductive case study → theory-building → philosophizing

This progressive study of the SES and STS legacy was motivated by the challenge of understanding the phenomenon of organizations learning the behaviours of open sourcing while private sourcing. Tracing back through the collaboration between Eric Trist and Fred

Emery uncovered the pragmatic metaphilosophy of Stephen C. Pepper. Getting a grip on systems changes, as distinct from mainstream systems thinking based in Western philosophy, has led towards a constructivist post-colonial science where the processualism in ecological anthropology mixes well with the philosophy of science of Classical Chinese Medicine.

3.1. Seven intertwining longitudinal case studies emphasized learning towards fulfilling open innovation

In 2003, the transformation of IBM to Open Innovation was detailed as an exemplar by Henry Chesbrough [36, Ch. 5]. This transformation did not, however, occur overnight. Learning the behaviours of Open Sourcing while Private Sourcing (OswPS) emerged after 2001. "The label of *open sourcing* frames ongoing ways that organizations and individuals conduct themselves with others through continually sharing artifacts and practices of mutual benefit. The label of *private sourcing* frames the contrasting and more traditional ways that business organizations and allied partners develop and keep artifacts and practices to themselves" [40, p. 5]. Learning the behaviours of open sourcing at a scale of a commercial enterprise with 30,000 employees took years. In *Open Innovation Learning*, seven longitudinal case studies in the years between 2001 and 2011 are charted in Figure 2 below.

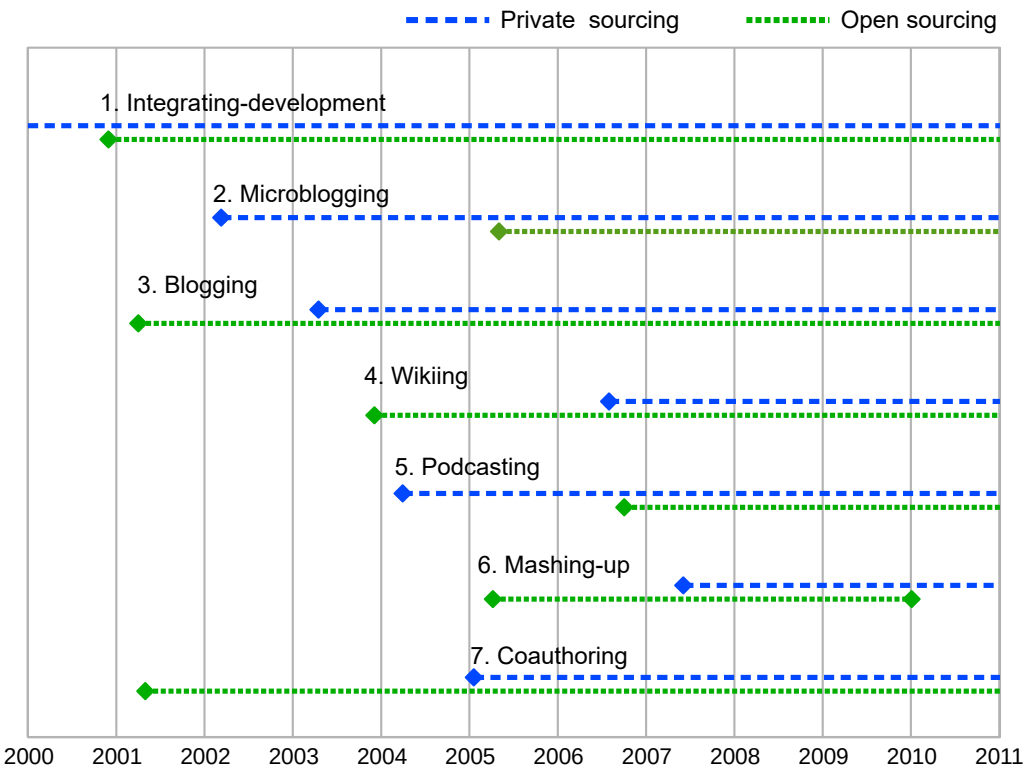

Figure 2: Timelines of 7 case studies of Open Sourcing while Private Sourcing, CC BY-NC-SA 2018 David Ing

Artifacts and practices were reviewed for: (i) integrating-development; (ii) microblogging; (iii) blogging; (iv) wikiing; (v) podcasting;; (vi) mashing-up; and (vii) coauthoring. Some of these initiatives were born and developed internally, and never released externally. Other

initiatives others were developed into offerings that became released to customers as program products.

3.1.1. Theory building was invoked through inductive case studies

The research work on OswPS aimed to build theory based on case studies, as described by Eisenhardt and Graeber [41]. It followed a path of "plunging deeply into the processes themselves to collect fine-grained qualitative data, and attempting to extract theory from the ground up" prescribed by Ann Langley [42, p. 91]. Key considerations included (i) *data*, as process data over a decade, viewed as multilevel; (ii) *analysis*, as sequencing actions, circumstances and outcomes; replicating theoretically; and appreciating contexts changing; (iii) *induction*, as abstracting towards descriptive theory, and generating pattern language; and (iv) *metainquiry*, as interplaying differences and similarities across descriptive theories, to further building normative theory emphasizing innovation learning.

In multiparadigm research, there is a choice of four metatheoretical positions that include (i) *paradigm incommensurability*, where each paradigm is developed and applied separately; (ii) *paradigm integration*, assessing and synthesizing a variety of contributions ignoring differences between competing approaches and underlying assumptions; (iii) *paradigm crossing* in sequential, parallel or bridging approaches; and (iv) *paradigm interplay* that "refers to the simultaneous recognition of both contrasts and connections between paradigms and, thus, to both the differences and similarities between paradigms that are emphasized by the parallel and bridging strategies, respectively" [43, p. 534].

The study to 2017 took an approach of paradigm interplay. Multiparadigm research essentially builds on the sociological paradigms of Burrell & Morgan, with the nature of society framed along two dimensions: subjective ↔ objective, and regulation ↔ radical change [44]. As systems changes became a central research direction, multiparadigm inquiry led to metaphilosophy, as described in section 3.2 below.

3.1.2. Learning longitudinally reorients towards ecological epistemology and processual foundations

Normative theory building, as a conclusion for *Open Innovation Learning*, proposed a paradigm of co-responsive movement in OswPS. This was largely derived from the ecological anthropology of Tim Ingold., maturing over decades with a focus on human correspondence [45]. To reduce confusion with correspondence as letters or messages sent between people, a more verbal form of "co-responding" is preferred. The longer trail of Ingold's view on ecological anthropology involves lines (or threads) and knots [46], [47] and meshwork [48]. These metaphors built on the processual approach first explored as the temporality of the landscape [49].

Ingold extends the ecological psychology of J.J. Gibson [50], [51] and the ecological epistemology of Gregory Bateson [52], [53].

3.1.3. Lines (threads) as wholes alongside wholes time weave into textures

Temporality reframes systems thinking, from an object (substance) perspective of wholes-with-wholes, to a processual texture (or weave) of threads-alongside-threads in time. Time for living systems is appreciated as *kairos* (i.e. felt time), rather than *chronos* (clock time).

Reconnecting texture to "causal texture" from Emery and Trist in 1965 traces back to the 1934 examination of Berkeley pragmatist philosopher Stephen C. Pepper [54] on the purposeful behavior in animals and men by American psychologist E.C. Tolman. The research by Tolman was conducted in 1932 with Hungarian Egon Brunwik during a visit to Vienna. Both researchers became more widely known through a 1935 joint article on organisms and causal texture of the environment [55], and would continue their careers as professors at Berkeley.

The etymology of *texture* as a process of weaving in time comes from an older word use. In this research stream, texture should not be confused with text (as the wording of anything written). Texture derives from the French meaning of *contexture* common in the 17th century, and now rare, according to the Oxford English Dictionary: "The action or process of weaving together or intertwining; the fact of being woven together; the manner in which this is done, texture". The Western presupposition of texture as an object (e.g. a piece of fabric) should be supplanted with texture as a process, as producing in action.

3.2. Appreciating causal texture in SES → metaphilosophizing via pragmatism

In the flow of ideas from the pragmatism of William James through to the systems thinking of Eric Trist and Fred Emery, Stephen C. Pepper is a significant conduit and contributor [56]. In a footnote to "Precedents to Systems Thinking" in the 1969 Penguin paperback, Emery editorialized: "Only pressing problems of space precluded a selection from S. C. Pepper (1950) [sic]. This is of particular importance because the 'root metaphors' he identifies and rigorously defines are all clearly operating in different systems theorists and account for much of the mutual incomprehension that exists among them. 'Contextualism' is the root metaphor which comes closest to our bias in selecting for this volume" [57, p. 15].

3.2.1. A metaphilosophy of metaphysics in the pragmatist tradition led to World Hypotheses

While Pepper never labelled himself as a pragmatist, he was a student of Ralph Barton Perry, the philosophical disciple who consolidated the scattered writings of William James [58]. Metaphysics deals with *world theories*, i.e. ways of explaining the world. In the 1930s and 1940s, the logical positivism from Europe was the leading world theory [59]. American Pragmatism has a tradition of working from common sense, with a sense of skepticism to the classical stances of idealism and realism. Since pragmatism is a theory of knowledge based in doubt, rather than certainty, Pepper approached world theories as *world hypotheses* that could be judged as relatively adequate. As a theoretical contribution to critical systems thinking, Michael C Jackson OBE described the pursuit in "which experiential gestalts have proved useful to humans in finding their way in the world" [60, pp. 7–8].

3.2.2. Root metaphors underpin world theories (framed as hypotheses) in the heritage of American pragmatism

World theories can be placed between the extreme cognitive attitudes of an utter skeptic (i.e. "one who doubts all things") to a dogmatist (i.e. "one whose belief exceeds his cognitive

grounds for belief"). In the moderate middle ground is partial skepticism, that is signified by world hypotheses, for which evidence can provide some certainty.

Six world hypotheses were reviewed, from which two were rejected as inadequate: (i) animism, "for the indeterminateness of its interpretations and lack of precision"; and (ii) mysticism "chiefly for its lack of scope and its lavish use of 'unreality'" [61, pp. 119–120]. This left four world hypotheses judged as relatively adequate, as shown in Table 1 below.

Table 1
Four relatively adequate world hypotheses [CC-BY David Ing]

World Hypothesis	*Dispersive*	*Integrative*
Analytic	**Formism** *Root metaphor*: Similarity, as recurrence or recognizable features	**Mechanism** *Root metaphor:* Machine, where exerting force or energy produces predictable outcomes
Synthetic	**Contextualism** *Root metaphor*: Situation, as a historic event in its living actuality	**Organicism** *Root metaphor*: Constructive development, with orderliness of changes from stage to stage

Pepper named four distinct world hypotheses with unfamiliar names, and coupled them loosely with prior philosophical schools. With each world theory, a root metaphor is induced.

- *Formism* is associated with realism, and the idealism of Plato and Aristotle. Its root metaphor is *similarity*.
- *Mechanism* is associated with *naturalism* or *materialism*, with philosophers such as Rene Descartes, John Locke, and David Hume. Its root metaphor is a *machine*.
- *Contextualism* is associated with pragmatism, and philosophers such as Charles S. Peirce, William James, Henri Bergson, and John Dewey. Its root metaphor is a *situation* (described by Pepper as a historic event, or an act within a setting).
- *Organicism* is associated with absolute idealism, and philosophers such as George F. H. Hegel and Frances H. Bradley. Its root metaphor is *constructive development* (described by Pepper as integration, refinement towards an ideal).

Root metaphor theory builds on maxims, that can be taken as principles or rules on which knowledge is built. Each of the maxims outlined in 1942 is extended with post hoc inferences based on a contemporary appreciation of systems theories.

- *Maxim I*: A world hypothesis is determined by its root metaphor. In application, several systems theories could be based on a shared root metaphor.
- *Maxim II*: Each world hypothesis is autonomous. A systems theory should be independently judged on adequacy by the reliability in its corroboration of evidence within. A systems theory should stands on its on evidence, and not on the shortcomings of an alternative theory.

- *Maxim III*: Eclecticism is confusing. Systems theories are mutually exclusive from each other, based on different root metaphors. Mixing metaphors can introduce conflicting facts, leading to contradiction and a reduction of reliability.
- *Maxim IV:* Concepts which have lost contact with their root metaphors are empty abstractions. A systems theory can grow old, so that associated abstractions get taken for granted. Rejuvenation comes through tracing evidence back to the root metaphor.

In essence, each world hypothesis is itself a system of knowledge, with a root metaphor at its core. Improving the reliability of multiple systems theories without contradiction is practical only if they share the same root metaphor.

Pepper arranges the hypotheses according to two types of treatments that can be depicted as polarities: (i) the theoretical mode of reasoning can be *analytic* or *synthetic*; and (ii) the theoretical mode for organizing evidence can be *dispersive* or *integrative*.

With an *analytic* world theory, *parts in relations* are presumed, and each whole comes inferred, e.g. a world theory is reasoned by taking evidence apart.

With a *synthetic* world theory, *wholes* are presumed, and parts in relations come inferred, e.g. a world theory is reasoned by putting evidence together.

With a *dispersive* world theory, *unpredictability* (non-determinism) is presumed, and determinate order is denied, e.g. a world theory is organized through evidence that comes as scattered (fused through interpretation).

With an *integrative* world theory, *determinate order* is presumed, and unpredictability is denied, e.g. a world theory is organized through evidence that fits properly (casting aside "unreal" facts).

The four world hypotheses are laid out in Table 2 below, to underscore the dimensions.

Table 2
Root metaphors, theories of truth, categories, nature of time [CC-BY David Ing]

World Hypothesis	*Dispersive* *manner for organizing evidence*	*Integrative* *manner for organizing evidence*
Analytic mode of reasoning	**Formism** *Analytic*: parts in relations are presumed; each whole comes inferred; *Dispersive*: unpredictability (non-determinism) is presumed; determinate order is denied.	**Mechanism** *Synthetic*: wholes are presumed; parts in relations come inferred; *Integrative*: determinate order is presumed; unpredictability (non-determinism) is denied.
Synthetic mode of reasoning	**Contextualism** *Synthetic*: wholes are presumed; parts in relations come inferred; *Dispersive*: unpredictability (non-determinism) is presumed; determinate order is denied.	**Organicism** *Synthetic*: wholes are presumed; parts in relations come inferred; *Integrative*: determinate order is presumed; unpredictability (non-determinism) is denied.

Formism is analytic and dispersive. The root metaphor of *similarity* reasons from parts into a whole, while the evidence arrives unpredictably for organizing.

Mechanism is analytic and integrative. The root metaphor of a *machine* reasons from parts into a whole, while evidence arrives in a determinate order.

Contextualism is synthetic and dispersive. The root metaphor of *situation* reasons from the whole into parts, while evidence arrives unpredictably for organizing.

Organicism is synthetic and integrative. The root metaphor of *constructive development* reasons from the whole into parts, while evidence arrives in a determinate order.

Systems thinking recognizes both synthesis and analysis. Working against reductionism, however, authentic systems thinking sequences reasoning through synthesis (i.e. wholes) before reasoning through analysis (i.e. parts) [9, p. 529], [62, pp. 16–17].

In organization theory, the STS perspective relates to organicism [14], [63]. The SES perspective relates to contextualism.

3.2.3. For organizational theories on SES, contextualism via the systems sciences is misunderstood and underappreciated

By the end of the 1980s, the metaphilosophy of World Hypotheses has been mostly forgotten. In 1967, Pepper proposed a fifth World Hypothesis of selectivism, where he himself was unsure if it was adequately distinct from contextualism. In 1972, the publication of *An Introduction to Systems Philosophy* by Ervin Laszlo [64] was reviewed by Pepper as a possible world hypothesis: " To those of us interested in synthetic treatments of philosophical issues, this book comes as a breath of fresh air, like opening a window in a crowded, smoke-filled room" [65, p. 548]. In response to Laszlo making a case for systems philosophy [66], Pepper was "excited over Laszlo's choice of the "systems concept" (including steady-state, invariance, transformation, feedback, etc.) as the paradigm (or, in my term, root metaphor) for a comprehensive world theory", counter to the "overemphasis on analytical philosophy" in the early 1970s [67, p. 151]. Searches for responses from Laszlo have been fruitless, so that invitation does not appear to have a following. Towards a theory of educating, a 1984 thesis by Sheila Webster found selectivism adequate towards providing evidence of educational excellence [68]. Another 1987 thesis by Ronald Hoeflin identified inadequacies in selectivism, and proposed neoselectivism [69].

Merrelyn Emery acknowledges Pepper, while discarding organicism and General Systems Theory: " Organicism is currently manifesting itself as 'whole systems' (context free) and a rash of mystical 'New Age' 'theories'. ... The GST offspring became part of the problem rather than the solution because they are simply variations on the other three world hypotheses while pretending to be different" [17, p. 638]. Emery deprecates World Hypotheses: "While contextualism informed the basic framework of OST(E), directive correlation (Sommerhoff, 1969) brought it to life".

Michael C. Jackson alleges that Merrelyn Emery's perspective on the longer history of Fred Emery's work is off course: "As Fred Emery (1969, p. 15) remarked, all Pepper's 'root metaphors' are in operation in different systems theories and the result is much mutual incomprehension." .... "It was left to Ackoff (see Chapter 15), who had worked closely with Emery and Trist, to make the clean paradigm break that eluded STS" [70, pp. 285–287]. In 2023, Jackson commented on the disagreement: "Sociotechnical thinking went through a brief 'mechanical systems' phase (Trist and Bamforth) before discovering von Bertalanffy and

embracing organicism. It is also true that both Trist and Emery later claimed to have moved beyond organicism and embraced contextualism. My own view is that they did not succeed and that organicism continued to dominate in the L22 work and even in the later socio-ecological work. I recently had an exchange with Merrelyn Emery on this who, of course, says I am wrong and that her and Fred's later work is clearly contextualist" [71], [72].

A deeper reading beyond root metaphors to the dimensions explicated in Table 2 above contributes to the criticism of Jackson to Merrelyn Emery. Appreciating that multiple world hypotheses do exist, much of the effort in contemporary systems thinking has been on moving from *analytic-integrative* mechanicism to *synthetic-integrative* organicism. There is a separate path to the *synthetic-dispersive* contextualism underlying an SES perspective.

3.3. Foregrounding change → constructivist post-colonial sciencing

The ecological anthropology of Tim Ingold provided an entree into processual approaches. Sequencing processes before objects is a challenge within science descended from Descartes and The Enlightenment. The science of Classical Chinese Medicine is inherently processual, leading to exploration of non-Western philosophical foundations. Studies of practices in medicine in Taiwan illuminate how a constructive post-colonial approach to applied science can work.

3.3.1. Living systems as (con)texturalism-dyadicism extends textures in time with yinyang is an alternative world theory (hypothesis)

Broadening ties to the ecological anthropology and systems sciences reviewed above, a World Hypothesis of (con)texturalism-dyadicism is constructed. This extends the contextual-dyadic thinking described by Keekok Lee [73].

In a contextual mode of thinking, "the two values, truth and falsity, have no proper application in the abstract or in a vacuum – they only have application and meaning relative to a particular context. They are context-bound" [73, p. 221]. This is in discord with presuppositions of Western philosophy: "its incompatibility with formal logic, whether as traditional syllogistic logic or as modern propositional logic since the twentieth century, as the latter implies the intelligibility of studying relations between assertions looked at solely through their formal relations as extreme abstractions, with no reference either to content or to context. In contrast, in evaluating an argument, the ancient Chinese were interested not merely in the concept of validity but also in the truth of what was said [73, p. 221].

Dyadic thinking in Classical Chinese philosophy contrasts with dualistic thinking in Western philosophy. Dualistic thinking implies two categories, e.g. mind and body, male and female, human and non-human. Dualism tends towards hierarchical thinking, with one side superior and the other inferior. The higher/superior class denigrates "the other", with reductionist thinking that the inferior member is an appendage of the superior member [73, pp. 221–224].

In contextual-dyadic thinking, the yinyang pairing has a complicated relationship where yin and yang are entwined with each other. "The pairing and the harmonious Whole are empirically based because processes in Nature exhibit them -- day is followed by night, night by day, Winter by Summer, Summer by Winter, heat by cold, cold by heat, life by death,

death by life" [73, p. 222]. The processual nature of yinyang as dyadic is illustrated in Figure 3 below.

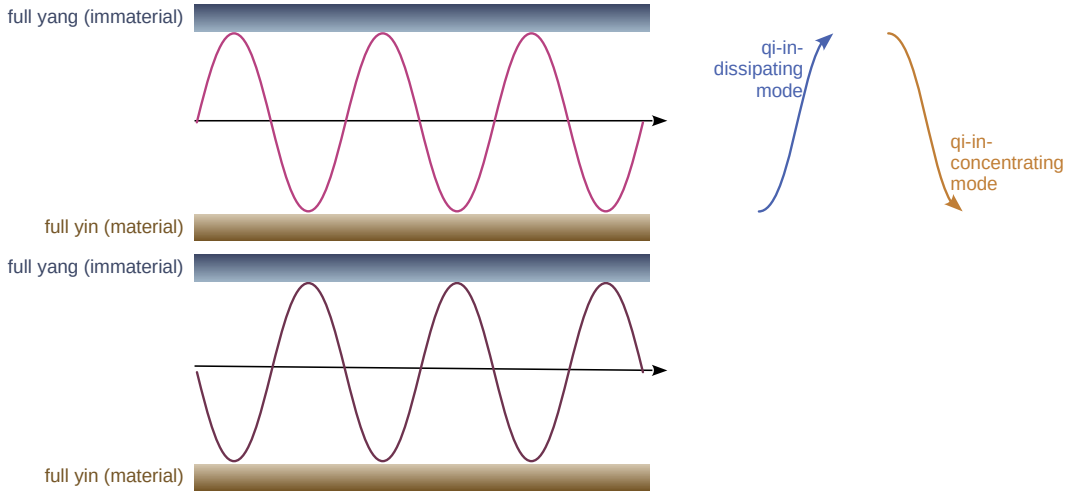

Figure 3: Qi-in-dissipating mode alongside qi-in-concentrating model CC BY-NC-SA 2024 David Ing

In contrast to Western philosophy that places material and immaterial as dualistic, yinyang in Chinese philosophy sees *yin* as material, and *yang* as immaterial. *Qi* is basic ontological category accounting for *wanwu* in life, in a processual view of the dyadic transformations of *yang* (as immaterial) from/to *yin* (as material). In an interpretation from the Zhuangzi: "*Qi* was capable of two modes of existence or being .... These two modes of being may be called: (a) *Qi*-in-concentrating-mode (*qi ju* / 气聚); (b) *Qi*-in-dissipating-mode (*qi san* / 气散). [....] These two modes of being are inter-related, inter-transformable. As already indicated, "inter-transformable" means that *Qi*-in-dissipating mode can become *Qi*-in-concentrating mode, and after a period of time, *Qi*-in-concentrating mode returns as *Qi*-in-dissipating mode, thereby setting up a cycle of sustainable exchange between the two modes [74, pp. 42–43] .

Systems luminary West Churchman, with a direct lineage to the pragmatism of William James, would likely have approved with the exploration of Chinese philosophy in a systems approach. Debora Hammond reported that in conversation, Churchman "often identified the Chinese *I Ching* as the oldest systems approach. As an effort to model dynamic processes of changing relationships between different kinds of elements, the *I Ching* might be seen as a *systemic* approach, in contrast with the more *systematic* approach of rationalist Western thought, rooted in the work of Plato and Aristotle" [75, p. 13].

3.3.2. Post-colonial science in the practice of medicine bridges Western premises with classical Chinese philosophy

Ronnie Littlejohn describes the study of Chinese philosophy from the West has been described as three paradigms: (i) exclusionist, (ii) comparative, and (iii) constructionist [76]. An *exclusionist* paradigm marginalized Chinese philosophy, leading to claims (e.g. in the 18th century by Kant and Hegel) that the Chinese did not actually "do philosophy". A *comparative* paradigm engaged Chinese philosophy as a corrective to Western programs (e.g. in the 20th century, A.C. Graham, David L. Hall and Roger T. Ames), positioning philosophical traditions from different cultures as incommensurable. A *constructionist* philosophy in the 21st century bends language and culture, exploiting and recreating a pluralist view of many texts and traditions. Sciencing and philosophizing on systems thinking in the 21st century can take the constructionist approach [56].

A constructionist approach to post-colonial science, learns from from systems practices of medical practitioners in Taiwan. These physicians consult with patients in a blend of techniques from Classical Chinese Medicine, with procedures and devices common in Western biomedicine. Wei-yuan Lin and John Law found: "correlativity within (at least some) [Classical Chinese Medicine] practices refracts a pattern of practice that *hybridizes without purifying*; gives priority to *situated knowing*; enacts a version of the body that is *non-reductive* even in principle; *weaves patterns* between what Chinese philosophical tradition calls 'the ten thousand things' (*wàn wù,* 萬物); and, finally, adopts a dynamic approach to *propensities* at work in specific situations [77, p. 804]. The description of a visit by a patient with a Chinese Medicine practitioner follows procedures standard to the profession: interviewing on symptoms while taking the pulse with three fingers, and looking under the tongue. Measuring blood pressure with a haemadynamometer and reviewing blood test results come from Western biomedicine. The combined protocols are a "situated reification" of medical practice in hybridity.

3.3.3. Am alternative world theory can be synthetic, and both integrative and dispersive via dyadic yinyang processes

Pepper declared that "each world hypothesis is autonomous", and "eclecticism is confusing" [78, pp. 98–113],. Thus, an STS perspective of organicism with the progressive development should remain distinct from the SES perspective of situation as a historic event. Stepping outside the constraints of Western philosophy, a new world hypothesis of (con)texturalism-dyadicism is offered with the root metaphor of yinyang dancing through [eight] seasons. The dualism of (i) dissipative manner in contextualism and (ii) integrative manner in organicism is dissolved in Table 3 below. (Con)texturalism-dyadicism is a synthetic mode that embraces both the dissipative manner and integrative manner.

Table 3
Contextualism extended and contrasted with (Con)texturalism-dyadicism [CC-BY David Ing]

	Synthetic mode of reasoning	*Synthetic mode of reasoning*	
Dispersive manner for organizing evidence	**Contextualism** *Root metaphor*: Situation, as a historic event in its living actuality *Theory of truth*: Operationalism, via qualitative confirmation of solving a specific problem *Categories* : Strands, texture, quality, novelty *Nature of time*: Qualitative duration, event relative to a specious present	**(Con)texturalism – Dyadicism** *Root metaphor*: *Yinyang* dancing through [eight] seasons, as ((yin qi) ∝ 1/(yang qi)) wayfaring in unfolding wanwu [concentrating ⇌ dissipating] textures *Theory of truth*: Entailment, traceability back through history, with anticipated outcomes indetermined *Categories*: Rhythmic shifts, (con)texture, propensity *Nature of time*: Kairotic, with propitious periods and inopportune periods	*Dispersive + integrative manner for organizing evidence*
Integrative manner for organizing evidence	**Organicism** *Root metaphor*: Constructive development, with orderliness of changes from stage to stage *Theory of truth*: Coherence, where fragments cohere with their nexus, free of contradiction *Categories*: Progression (steps), final outcome (ideal) *Nature of time*: Directional arrow, successive integrations		

A *root metaphor* of yinyang dancing through [eight] seasons expresses the complexity of (con)texturalism-dyadicism.

The dyadicism of "yinyang dancing" is expressed as "((*yin qi*) ∝ 1/(*yang qi*)) wayfaring". The mathematical symbol ∝ is not an alpha, and should be read as "is proportional". *Yin qi* and *yang qi* are inversely proportional, i.e. *yin qi* increases as *yang qi* decreases, and vice versa. Wayfaring sees *yin* and *yang* as *kairotic*, yet not deterministic. A simile for yinyang dancing is a couple engaged in ballroom dancing.

The (con)textualism of "[eight] seasons" is expressed an "unfolding *wanwu* [concentrating ⇌ dissipating] texture. The right-left harpoon arrows (⇌), normally used to denote equilibrium in chemistry, is borrowed for the feature of reversibility of concentrating alongside dissipating. The textures are composed of myriad (countless) temporal strands, and are rhythmically cyclical.

While the seasons of the year are commonly expressed as four (i.e. winter, spring, summer, autumn), the binary dyadic taken to the third power counts to eight seasons. In the *I Ching* (*Yi Jing*), trigrams composed of three *yao* (i.e. broken *yin yao* lines and unbroken *yang yao* lines) result in a permutation of eight. Unfolding, as an adjective, can be defined as disclosing or developing. *Wanwu* is the mutual transformation between qi-in-concentrating mode and qi-in-dissipating mode; materializing and immaterializing; birthing and dying; or originating and decaying. The lining up of natural rhythms in (con)texturalism recognizes irregularities and the specious present in contextualism. The constructive development in dyadicism is orderliness in changes, in the synchrony of successively progressing towards a complete journey.

The *nature of time* in (con)texturalism-dyadicism is kairotic, rather than chronotic, with propitious times and inopportune times. Simply, *kairos* is qualitative duration as felt time; chronos is clock time. More formally, Orlikowski and Yates, say: "Chronos is 'the chronological, serial time of succession, ... time measured by the chronometer not by purpose'. Kairos is the 'the human and living time of intentions and goals ... the time not of measurement but of human activity, of opportunity'" [79, p. 686]. In these world hypotheses, both are eventful moments or durations of time. (Con)texturalism places an event in its specious present of rhythms. Dyadicism sees propitious periods and inopportune periods coming and going in a directional arrow of time, potentially.

The *theory of truth* of (con)texturalism-dyadicism is entailment, a traceability back through history, with anticipated outcomes indetermined. Judith Rosen defines: "'Entails' can be a synonym for 'could lead to'. Entailment and causality are linked concepts, the difference being that causality is 'what does happen' and entailment refers to 'what COULD happen'. Nothing can happen that isn't entailed" [80]. (Con)texturalism allows tracing an outcome back through entailments, without forward-looking causality, e.g. the existence of a child entails parents, but a couple marrying doesn't necessarily cause children. A general systems predisposition appreciates the definition by Ernst Mayr of teleonomy in biology [81] as an alternative to teleology. Dyadicism has a coherence in continuing processual eurhythmia, where living systems are able to overcome temporary periods of incoherence, as arrhythmia.

Categories for (con)texturalism-dyadicism include (i) rhythmic shifts, (ii) (con)texture, and (iii) propensity. (Con)texturalism recasts the temporality of significant events as rhythmic shifts in living systems. Dyadicism weaves pair of strands together into texture; and texture can be interwoven with other textures as contexture to the strands. Propensity, as expressed by François Jullien, is a predisposition related to the arrangement of things, in a non-causal way [82], [83]. (Con)texturalism-dyadicism appreciates propensity when novel circumstances can come together, and progression towards eurhythmia or arrhythmia, rather than idealism.

The SES perspective based on contextualism views wholes living alongside other wholes. The rhythms of strands within the texture may pace slower or faster relative to each other. The sun takes about 365 days for a cycle, the moon takes about 28 days. There are rare occasions when some stars align, or a planetary body goes into an eclipse.

4. Reifying root metaphors: ↓ rearranging objects, ↑ repacing rhythms

Having STS and SES as two perspectives on the world is akin to having cameras to capture still life: looking at one photograph from the inside-out and then a second photograph from outside-in does give a better appreciation of a system than a single perspective. Capturing snapshots in time privileges a photographer the luxury to compose each shot, and release the shutter at an opportune time. If we see the world as yinyang dancing through [eight] seasons, the benefits and challenges of motion pictures come into play. Movies are more than stop-motion photography. The sequential nature of video movies challenges a videographer to take a different frame of mind.

An interest in systems changes reframes the comparative statics in systems thinking into the kairotic fluidity of situations in motion. Rearranging objects is a simile for multiple snapshots as comparative statics in time. Repacing rhythms, in a simile of speeding up or slowing down multiple movies by multiple videographers, is a different frame of mind. These are expressed through reifying foundations in philosophy, theory, and practice.

4.1. Reifying philosophy: ↓ straight-lines + jumps, ↑ rhythms + anticipation

Comparative statics in STS + SES have been implicit in thinking about organizational structuring. Life goes on linearly as chronotic straight lines, punctuated by jumps where roles and positions change. In a game of musical chairs, most of the time is spent sitting in a static place, and acts of asking people to rearrange themselves can be upsetting.

Kairotic fluidity changes the games, where most of the activity is in circling the chairs, with brief periods where players sit down. Players get into a rhythm over movement that becomes as natural as walking, anticipating other players around them so that collisions can be avoided. Watching for rhythmic shifts elevates the attention on processes (as arrangements in time) as a slight deprecation of structures (as arrangements in time). Rhythmic shifts don't happen in a clockwork way, as multiple living systems each experience their own kairos.

4.2. Reifying theory: ↓ reduction down to one, ↑ threads co-responding

The idea of a root cause associated with systems changes is a reduction towards a single explanation, or at least a dominant cause. Aristotle analyzed causes in four ways: (i) material cause, in the composition of the substances or objects of interest; (ii) formal cause, in the rearrangement or reshaping of the thing; (iii) efficient cause, as the agent working on the situation; and (iv) final cause, as the purpose the change. While the conditions for a system might be seen as changing within and without, approaches either as organicist STS or contextualist SES puts one autonomous world hypothesis before the other. An eclectic mix of systems changes in STS and SES together, by Pepper's maxim, is confusing.

Seeing systems changes as threads co-responding doesn't easily reduce to a single explanation. When the lifeline of each being is traced, there are periods when one or more threads come together in a weave, and times when each thread goes its own way. Further, social communications enable threads who are not currently co-responding to hear "news" through intermediaries who are more directly engaged with a situation. Those who are

directly co-responding with each other would have a different impression on circumstances than those who were not directly involved or eyewitness observers.

4.3. Reifying practice: ↓ unfreeze-move-refreeze, ↑ (con)textural dyadic action learning

The conventional way that organizational change programs are conducted typically first analyze the as-is current state, and then prescribe a to-be future state. Cummings, Bridgman and Brown point out that the usual expression of Change as Three Steps -- unfreeze-move-freeze – is improperly attributed to Kurt Lewin [3]. This espoused conventional wisdom has become so dominant that discussing systems changes in a different way almost has a prerequisite step of unlearning that framing.

Action learning derives from action research methods developed by Kurt Lewin in the 1930s experiments in factories and neighbourhoods. Contextual action learning was a refinement by Eric Trist as SES perspectives became a greater concern than STS. (Con)textural dyadic action learning with a root metaphor of yinyang dancing in [eight] seasons alters practice in multiple ways. The dyadic dancing of two partners together means that successfully navigating the field is not the action of one individual pushing the other, but instead mutually cooperating fluidly. The (con)texture of seasons changing means that there will be opportune and inopportune periods for cultivating prosperity, e.g. planting seeds in spring rather than in winter. Learning is not a cognitive absorption of knowledge, but instead an embodiment of an altered predisposition, so that a different behaviour becomes the natural and preferred way.

5. Implications: philosophical, theoretical, practical

Proposing a new world hypothesis can be appreciated as a resequencing of systems thinking. Formism, mechanism, organicism, and contextualism are still appropriate ways of theorizing the way the world works with the richness of root metaphors. Bringing a (con)textural-dyadic world theory to bear on a set of circumstances elevates some features and deprecates others.

5.1. Philosophical implications: ↑ when+where; ↓ what+why

Western philosophy has a long tradition in ontology (i.e. questions of what is), and epistemology (i.e. questions of why, in explaining causality). Moving to a Classical Chinese onto-epistemology puts the contextual circumstances into the foreground. The “it depends” response is not an evasion of a question, but a recognition that situational confluences can be fleeting.

Elevating the questions of when and where opens up thinking about whether action is taken too late or too early. Stories about doing the right thing at the wrong time might can provoke inquiry into situations where doing the wrong thing at the right time led to happy outcomes. The simplicity of a universal truth or the one best way might be reconsidered in a scene of “reading the room” for an appropriate time to express a dissenting opinion or embarking on an non-conventional approach.

(Con)textural-dyadic thinking (i) elevates what+where, and (ii) deprecates what+why.

5.2. Theoretical implications: ↑ kairotic rhythms + dyadic diachrony + situational propensity, ↓ future state ← current state

An ideal-oriented approach starts with analyzing the expected future state, and working backward to the current state to determine the best path to traverse the gap. The path may abstractly be represented as a linear movement, although experience tells us that unanticipated roadblocks may occur and the desired outcome may not unfold. Dwight D. Eisenhower recognized that "plans are worthless, but planning is everything". The abstract destination in the future is a dream, towards which effort is worthwhile, but for which reality will require midcourse corrections.

Kairotic rhythms are anticipatory, with presumed order in the world that unfolds through the of passage time. The best forecast for tomorrow may not be today, but a more complicated confluence of streams that we have experienced, and others for which we have limited or no understanding.

In systems theory, more study is merited to appreciate the distinction between synchronic emergence and diachronic emergence. Emergence sees properties in a whole that are not in the parts. Synchrony is expressed in the coincidence or concurrence of two or more events at a point in time. Diachrony is expressed in the unfolding of an occurrence over time or during a period. The courses of living systems with yinyang as dyadic are not determined. Each thread or strand comes to the current moment with a history, with behaviours situationally revealed in autonomous actions going forward.

The question of whether systems are likely or unlikely to change surfaces their propensities for inaction, reaction, and will. Each system has a nature, for which routine or breakthrough changes may or may not unfold. Propensity is not, however, fixed. Situations can influence action or inaction in direct and indirect ways. Propensity is in the character of a system of interest. External influences may or may not sway that system of interest, depending on circumstances.

(Con)textural-dyadic thinking (i) elevates kairotic rhythms + dyadic diachrony + situational propensity, and (ii) deprecates future state on a course from the current state.

5.3. Practical implications: ↑ doing no harm, ↓ bias for action

Systems changes involve both changes over which human beings have limited influence, and changes where human beings can alter the course of current and future events. Practically, each of us makes judgements about whether an effort will or will not make a difference to the situation. Intervening in systems can have both positive and negative results, depending on who is involved or not involved. Decisions are not without consequences. Much of this rests on our beliefs about nature(s).

Western thinking, since the Enlightenment, has an underlying current of human beings taking command over nature. Machines are an expression of directional control, where mechanical equipment became a substitute for beasts of burden that were unreliable in assisting their masters to reach their goals. As automation has intensified, the artifactual domain created by human beings has made many lives easier, often with hidden or deferred disbenefits that might or might not be repaid. A tendency towards instant gratification feeds a bias for action, in the impatience of bringing on the future, earlier.

With living systems as regenerative, we see physicians and veterinarians (and maybe gardeners) following the Hippocratic oath to do no harm. Illnesses may be treated symptomatically to relieve discomfort, but often the prognosis can be to allow a system the time recover and/or repair itself. Medical interventions are not without risk. These attitudes put nature first, decoupled from human judgements on morality, ethics, and aesthetics. From Classical Chinese philosophy, the *DaoDeJing* (Tao De Ching) is actually two books combined into one: (i) the DaoJing is the way of nature; (ii) the DeJing is the way of human virtue. The two *DaoDeJing* parts have been sequenced in different orders at different times in history.

(Con)textural-dyadic thinking (i) elevates doing no harm, and (ii) deprecates bias for action.

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