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ISOMORPHISM IN GENERAL SYSTEM THEORY: TOWARDS AN ONTOLOGICAL FOUNDATION FOR CRITICAL SYSTEMS INTERVENTION

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Abstract
This paper revisits the role of General System Theory (GST) within Critical Systems Thinking (CST) and Critical Systems Practice (CSP), arguing that GST has been too narrowly interpreted as a functionalist and regulation-oriented approach associated primarily with hard systems thinking. Drawing on Ludwig von Bertalanffy's original concern with isomorphism, the paper proposes an alternative reading in which GST is understood as a general framework for relating structurally comparable models across different domains and paradigms. Inspired by van Fraassen's pragmatic philosophy of science and the use of isomorphism in abstract algebra, the paper argues that isomorphism should be understood primarily as a relation between epistemological models rather than between real-world systems themselves. On this basis, the paper develops Critical Systems Intervention (CSI) as a model-centric approach to multimethodological intervention. CSI maintains coherence across paradigmatic shifts by introducing an explicit intervention ontology in the form of a game model representing the evolving socio-technical situation under study. Different systems methodologies associated with the Burrell–Morgan paradigms are then treated as generating structurally related representations of the same underlying intervention situation. The paper illustrates this argument through a reinterpretation of the Health Information Systems Programme (HISP) and concludes that GST can be repositioned as the broader ontological and epistemological framework within which critical and plural systems interventions become theoretically integrated.

Keywords
General System Theory, Isomorphism, Critical Systems Intervention, Critical Systems Practice, Systems Ontology, Multimethodology, Pragmatism, Burrell–Morgan Paradigms

1 | Introduction

Organisations are often presented as rational systems designed to coordinate activity toward shared goals. In practice, however, many organisational settings are experienced very differently by those who inhabit them. Large-scale reforms, digital transformation initiatives, and new forms of organisational control and coordination have repeatedly been shown to generate asymmetries of power, increased surveillance, and reduced autonomy for particular groups (e.g. Zuboff, 2019; Clegg et al., 2006). Such dynamics are not confined to the private sector or to advanced economies. In the context of global health information infrastructures, for example, research associated with the Health Information Systems Programme (HISP) has documented how efforts to standardise data and improve coordination are shaped by ongoing negotiation between global agendas and local practices, often producing tensions around control, accountability, and the autonomy of local actors (e.g. Sahay et al., 2009; Braa & Sahay, 2012; Walsham, 2001). Such situations are not merely technically complex; they are politically charged and raise questions about how systems interventions can support more equitable and emancipatory outcomes.

Critical Systems Thinking (CST) (Jackson, 1985; Flood & Jackson, 1991b; Flood & Romm, 1996) was developed to address such challenges by integrating systems thinking with critical social theory. It provides the foundation for Critical Systems Practice (CSP), a family of intervention methodologies committed to

critical awareness, emancipation, and methodological pluralism (Flood & Romm, 1996, pp. 11-15). Early formulations, such as Total Systems Intervention (TSI) (Flood & Jackson, 1991a), sought to guide practitioners in selecting and combining systems approaches associated with different sociological paradigms according to the nature of the problem situation. However, TSI was subject to substantial criticism (e.g. Tsoukas, 1993), leading to revised approaches, including the CSP framework developed by Jackson (2000; 2003; 2019; 2024). Despite these developments, concerns remain that the navigation between paradigms is often left to organisational choice, which may limit critical awareness and weaken the potential for emancipatory intervention (Albakri & Wood-Harper, 2025; Øgland & Evans, 2025b).

Critical Systems Intervention (CSI) (Øgland, 2023a; Øgland & Evans, 2025a) has been proposed as a further development of this tradition, seeking to address these limitations by revisiting the theoretical foundations of CST. In particular, CSI draws on a pragmatist, model-centric philosophy of science (van Fraassen, 1980) and incorporates elements of game-theoretic reasoning (Elster, 1982; Frasca, 2001; Øgland, 2009; 2017a; 2023b) to support the construction of systems models that capture strategic interaction in contested situations. In this way, CSI aims to provide a more explicit basis for maintaining critical awareness and supporting emancipatory action across different phases of intervention.

At the same time, placing a model at the centre of intervention raises a further theoretical issue. If multiple systems methodologies are applied within a shared modelling framework, they do not produce independent descriptions of separate realities, but structurally related representations of the same intervention situation. The model therefore functions not merely as an epistemological tool, but as a relatively stable conceptual object through which different theoretical perspectives can be related and compared. In this sense, the model provides a shared ontological reference point for multimethodological intervention. This observation points toward a central but often underemphasised idea in General System Theory (GST): that apparently different forms of description may exhibit structural correspondences, or isomorphisms, across domains and paradigms.

The central research question addressed in this paper is therefore:

- How can General System Theory, understood as a theory of isomorphic representation, provide a unified ontological framework for systems intervention that enables Critical Systems Practice to maintain its emancipatory intent across multiple paradigms?

In addressing this question, CST and CSP are treated broadly as families of approaches to systems intervention. The paper argues that GST should be understood not as a paradigm-specific philosophy associated primarily with hard systems thinking, but as a broader framework for relating different forms of systems representation. From this perspective, isomorphism refers primarily to structural relations between models generated through different theoretical perspectives, rather than to direct equivalence between real-world systems themselves.

The paper develops this argument in four steps. Section 2 re-examines the status of GST within CST/CSP and critically discusses existing interpretations of isomorphism. Section 3 develops an alternative account of GST as a plural, isomorphism-oriented systems framework and shows how it can be integrated with CSI. Section 4 illustrates how this reinterpretation changes the logic of intervention through a case drawn from information systems practice, specifically within the context of the Health Information Systems Programme (HISP) mentioned earlier. Section 5 discusses implications for the relationship between GST, CST, CSP, and CSI. Section 6 concludes.

2 | GST and Its Role in Critical Systems Practice

2.1 | CSP and the Operational Positioning of GST

While Critical Systems Thinking (CST) provides a framework for politically engaged systems interventions, the role of General System Theory (GST) becomes more concretely defined at the level of Critical Systems Practice (CSP). It is within intervention methodologies such as Total Systems Intervention (TSI) and later formulations of CSP that decisions are made about how different systems approaches are to be selected, combined, and applied in practice.

In TSI and subsequent CSP frameworks, systems methodologies are organised with reference to the Burrell–Morgan paradigm scheme (Burrell & Morgan, 1979; Flood, 1990, p. 83; Jackson, 1991, pp. 17-23, 271; Jackson, 2024, pp. 89-90). This provides a structured way of navigating between approaches associated with different assumptions about reality, knowledge, and social change. Within this schema, approaches linked to modelling, control, and design are typically located in the objective–regulation quadrant and treated as appropriate for unitary problem situations. These approaches are often understood as drawing on, or being conceptually grounded in, GST (Jackson, 2000, p. 127).

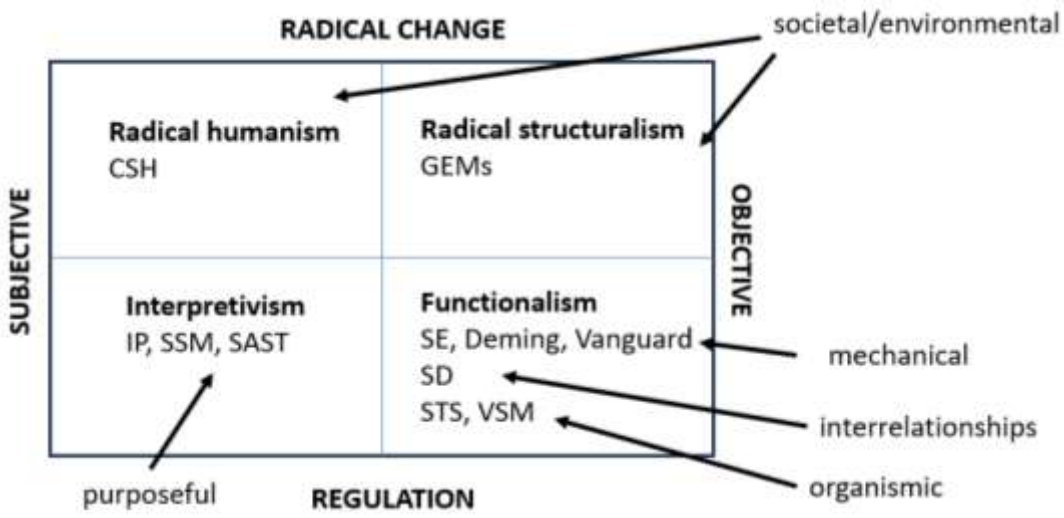
There are clear historical reasons for this association. Many influential applications of GST concepts have emerged in contexts such as operations research, systems engineering, and cybernetics, where systems are treated as objective entities that can be analysed and improved in relation to defined goals. Concepts such as feedback, homeostasis, and adaptation have been central to these developments and have contributed to the success of hard systems approaches. In this respect, the placement of GST within the functionalist paradigm reflects an important strand of its practical use (Burrell & Morgan, 1979, pp. 57-59).

To understand what this positioning of GST means in practice, it is useful to consider the latest methodological version of CSP (Jackson, 2024), which is a cyclic process that consists of four steps named EPIC; *Explore* the problematic situation, *Produce* a systemic intervention strategy, *Intervene* in the problematic situation, and *Check* the results. The diagram in Exhibit 1 shows how the two initial steps are connected by first selecting one or more "systems perspectives" and then choosing a suitable methodology or combination of methodologies.

This way of operationalising methodological pluralism has important advantages. It provides a practical guide for intervention and recognises that different situations require different kinds of analysis. However, despite how it is to be used flexibly to allow for mixing methods, changing methods or running them in parallel rather than sequentially (Jackson, 2024, chapter 7), it still seems unclear how to do this when the four paradigm quadrants in Exhibit 1 differ in epistemology, ontology and political ideology. For instance, the functionalist view is that we develop models and methods for understanding systems in the real world while interpretivists like Checkland (1999, pp. A9-A11) would say that there are no real systems, or he is at least unwilling to use the word *system* for the ontological reality of the issue or real-world problematic situation we are trying to deal with.

In response to earlier concerns about paradigm incommensurability, Jackson (2024, p. 170) now draws on pragmatism as a philosophical basis for CSP. Rather than treating paradigms as competing claims about ontological truth, systems perspectives are understood as alternative but potentially useful ways of engaging with the world, to be evaluated according to their practical consequences. This move seeks to avoid both paradigm incommensurability and relativism. Nevertheless, because the systems methodologies themselves remain grounded in distinct paradigmatic assumptions, it is still unclear how their respective descriptions of a problematic situation are to be related in practice.

Exhibit 1. Visual framework for selecting methodologies in CSP (based on: Jackson, 2024)



Since the purpose of GST was to develop a science of wholeness capable of identifying profound similarities across apparently different systems (Jackson, 2024, pp. 24–27), one might expect GST to provide a basis for relating the different descriptions generated through CSP methodologies. In this context, the search for isomorphism could potentially explain how multiple methodologies applied to the same problematic situation might produce structurally comparable descriptions even when crossing paradigm boundaries. Indeed, Jackson (1991, p. 206) appears to gesture toward such a possibility. However, this becomes difficult to sustain when GST itself is positioned primarily within the functionalist paradigm (Jackson, 2024, pp. 41–42). The result is that the concept of isomorphism remains underdeveloped precisely where it could provide the strongest integrative foundation for multimethodological intervention.

2.2 | Isomorphism and Its Limitation in GST

In his summary of systems thinking, Jackson (2024, p. 25) says that "von Bertalanffy derived insights from his biological work but believed they are relevant across disciplines because they concern the patterns of organisation common to different systems rather than the nature of their material components. There are, he believed, general systems principles that apply to complex systems of all types, whether physical, biological or social."

Simple examples of this can be found in system dynamics textbooks (e.g. Luenberger, 1979), where it is shown how the same set of differential equations can be used for describing dynamics in biology, economics, engineering and so on, so to a certain extent one might say that at least parts of GST have become part of mainstream applied mathematics. When it comes to the search for "general system laws" (Jackson, 2024, p. 27; von Bertalanffy, 1968, chapter 2), one might say that Peter Senge's (1990) system archetypes—such as "limits to growth" and "fixes that fail"—exemplify this in a manner that makes it possible to speak of such laws without explicitly referring to equations that are used for describing the dynamical behaviour of ontologically different systems. According to Rapoport (1986, pp. 26-29), this is exactly what is meant by mathematical isomorphism in the GST literature.

Although it is true that two differential equations with different coefficients represent an isomorphism within the language of abstract algebra, it is a trivial example. Why isomorphisms are important in abstract algebra is because they connect different branches of mathematics, for example showing how *complex numbers* can be represented by *vectors in two-dimensional space* (e.g. Herstein, 1975). This means that two seemingly different mathematical models, one expressed through number theory and another through

linear algebra, can represent the same formal structure despite being articulated through different theoretical languages.

In the language of CST, this way of thinking could mean that a problematic situation seen through the societal/environmental perspective (Jackson, 2024, pp. 99-100) and then modelled through game theory (Elster, 1982; Frasca, 2001; Øgland, 2009) could be understood isomorphically through models expressed through theories associated with the three other paradigms, as addressed by the complete set of system perspectives (Exhibit 1). Furthermore, if the GST literature were to use mathematical isomorphisms in the same way as conventional mathematicians do, and which is also the foundation for structuralist thinking (Piaget, 1970, Chapter 1-2), this might also ease the use of "radical structuralism" or "radical humanism" as a starting point for doing CST interventions that stayed true to the original commitments; social awareness, emancipation and methodological pluralism.

If GST is treated primarily through a functionalist lens, however, the focus shifts toward identifying similarities between objectively existing systems rather than between representations of systems. This makes it difficult to use isomorphism in the stronger epistemological sense, where the emphasis lies on relating different formal descriptions of the same underlying structure. As a consequence, GST loses much of its potential to provide an integrative foundation for multimethodological systems intervention across paradigmatic boundaries.

3 | Reconstruting GST for Use in Critical Systems Interventions

3.1 | GST, Systems Ontology, and Isomorphic Representation

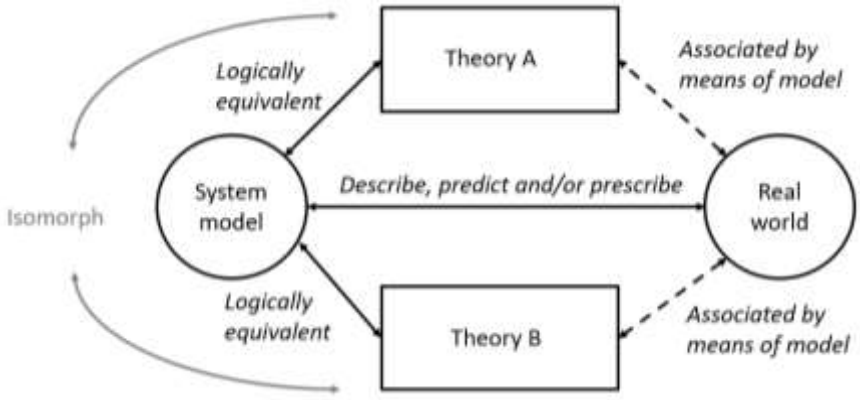
Although GST is commonly associated with functionalist systems thinking, several passages in von Bertalanffy (1968) suggest a broader conception of systems theory. His claim that "a verbal model is better than no model at all" (p. 24) indicates openness toward interpretive forms of modelling, while his discussion of Marxism as a model of historical process (pp. 199–200) suggests at least partial compatibility with critical perspectives.

Nevertheless, recognising plural tendencies within GST is not the same as resolving the ontological and epistemological tensions between systems paradigms. Functionalist approaches typically treat systems as objectively existing entities, whereas soft systems approaches regard "systems" primarily as conceptual devices for inquiry. Critical approaches further complicate the issue by foregrounding ideology and power relations within systems intervention.

For some, Roy Bhaskar's Critical Realism is seen as a useful philosophy of science for uniting the different systems paradigms (e.g. Mingers, 2014), but it remains controversial and has been rejected by others (e.g. Magill, 1994; Jackson, 2009; Øgland, 2017b). By contrast, it has been argued that Bas van Fraassen's (1980) Constructive Empiricism provides a less controversial and more natural foundation for GST (e.g. Øgland, 2016). As a pragmatic philosophy of science, Constructive Empiricism can accommodate multiple paradigmatic perspectives because it treats the aim of science as the production of empirically adequate models rather than truthful claims about unobservable phenomena.

Exhibit 2 presents a way of thinking about isomorphisms in GST when aligning with van Frassen. The circle on the right represents the real-world phenomenon, whose behaviour we can try to understand, predict and/or prescribe by use of the model represented by the circle on the left. Regardless of whether we are engaged in hard, soft, or critical systems thinking, the primary object of theoretical comparison is the model itself. It is through the model that different systems methodologies establish epistemological relations to the real-world phenomenon, making the model the key ontological reference point for multimethodological intervention.

Exhibit 2. Visualisation of GST isomorphisms



In the diagram, theory A and B represent different theories for developing, analysing and using the model. For example, if we think of theory A as Soft Systems Methodology (SSM), then the model is developed for the purpose of discussing the real-world phenomenon for the purpose of understanding and making plans (prescribe). If we think of theory B as System Dynamics (SD), then the purpose is to understand and predict dynamic behaviour. When it says in Exhibit 2 that the theory and model are logically equivalent, this is meant as an informal stating that the theory is true under the interpretation of the model. Although models developed within SSM look different from those used in SD, if they are isomorph with the systems model within the left circle, they are just different perspectives on the same thing.

When using this as a basis for GST, scientific models are neither mirrors of reality nor arbitrary fictions, but pragmatic representations constructed for particular purposes. Different models may therefore coexist without requiring one final description of reality. At the same time, this does not imply that models are merely subjective interpretations. Following Popper's (1978) distinction between physical reality (World 1), subjective understanding (World 2), and shared conceptual knowledge (World 3), intervention models may be understood as relatively stable conceptual objects that support communication, comparison, and cumulative learning across paradigms.

Popper's three worlds illustrate how a scientist (World 2) employs theories and models (World 3) to understand phenomena in physical reality (World 1). The present argument extends this insight by suggesting that GST should be grounded primarily in the ontology of shared conceptual knowledge represented by World 3. From this perspective, isomorphism becomes a relation between conceptual models rather than between real-world systems directly. This aligns GST more closely with the use of isomorphism in abstract algebra and provides a basis for relating systems methodologies across the Burrell–Morgan paradigms.

3.2 | Critical Systems Intervention as Isomorphic Multimethodology

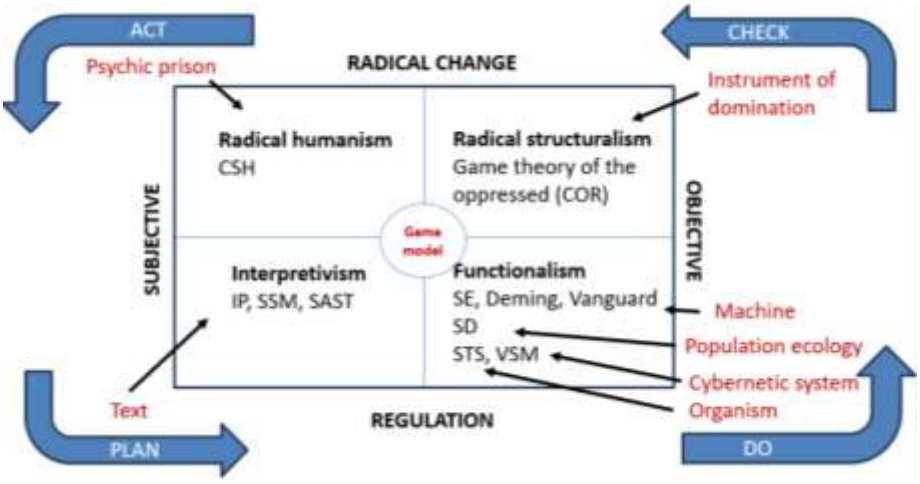
Critical Systems Intervention (CSI) was originally developed as a revision of Total Systems Intervention (TSI) intended to strengthen the emancipatory and critically reflexive dimensions of systems practice (Øgland, 2023a; Øgland & Evans, 2025a). The reinterpretation of GST developed above provides a clearer theoretical foundation for this approach. Whereas CSP primarily treats paradigmatic pluralism as a problem of methodological selection and combination, CSI treats it as a problem of maintaining ontological continuity across multiple forms of analysis and intervention.

The central difference lies in the role assigned to the systems model. In CSP, methodologies associated with different paradigms are selected according to the character of the problem situation. In CSI, by contrast, a shared game model is placed at the centre of the intervention process. This model represents the

evolving problematic situation as a system of actors, constraints, conflicts, and possible transformations. Different methodologies are then used not to construct unrelated systems, but to generate alternative and potentially isomorphic descriptions of the same underlying situation.

The CSI intervention process can be understood as a cyclic movement through the Burrell–Morgan paradigms aligned with an expanded interpretation of the Plan–Do–Check–Act (PDCA) cycle (Exhibit 3). Consistent with the CST commitments, CSI begins from radical structuralism in order to establish an initial understanding of the problematic situation in terms of objective asymmetries of power, strategic constraint, and conflict. This corresponds to the first "Check" phase in what may be described as a CA-PDCA sequence. The problematic situation is represented as a game-like structure in which actors occupy unequal positions and pursue conflicting interests under shared constraints.

Exhibit 3. Cycling the Burrell-Morgan paradigm matrix by use of a PDCA process



At this stage, game models inspired by "games of the oppressed" (Frasca, 2001; Øgland, 2009; 2017a; 2023b) become particularly useful. Such models make it possible to represent organisational and social situations not simply as neutral systems of coordination, but as structured fields of advantage and disadvantage in which some actors possess greater capacity to define goals, shape rules, or control resources than others.

The intervention then moves toward radical humanism through an "Act" phase concerned with critical awareness and emancipatory mobilisation. Here methodologies such as Critical Systems Heuristics (CSH) can be used to challenge existing boundary judgements, reveal ideological assumptions, and assess whether sufficient critical awareness exists among affected actors to support transformative intervention. The concern at this stage is not only whether intervention is technically feasible, but whether participants recognise and contest the conditions shaping the problematic situation.

The subsequent "Plan" phase aligns primarily with interpretivism. Methodologies such as SSM become relevant here because they support processes of dialogue, meaning construction, and negotiated understanding among participants. The purpose is to develop shared interpretations and feasible strategies for intervention while remaining aware that different actors may continue to interpret the same situation differently.

The "Do" phase aligns primarily with functionalism. Once a strategy has been agreed upon, methodologies concerned with coordination, implementation, regulation, and organisational viability become necessary.

Approaches such as the Viable System Model (VSM) are useful at this stage because they focus on communication, control, adaptation, and organisational sustainability.

After implementation, the intervention returns to radical structuralism through a renewed "Check" phase. The purpose is to evaluate whether the intervention has altered the structure of the game itself: whether relations of power, exclusion, dependency, or strategic advantage have changed, and whether actors are still effectively "playing the same game." Finally, a renewed radical humanist "Act" phase considers questions of alienation, legitimacy, participation, and the possibility of further intervention cycles.

The paradigms should not be understood as rigidly separated stages. Each phase foregrounds a particular analytical orientation while remaining open to insights from the others. What holds the intervention together is the shared game model representing the evolving system of interest. This model provides the ontological continuity necessary for relating multiple methodological perspectives through isomorphic analysis.

Seen in this way, CSI transforms the role of GST within systems intervention. GST no longer appears as a functionalist precursor to later developments in systems thinking, but as the broader trans-paradigmatic framework that makes multimethodological intervention intelligible. The concept of isomorphism becomes central because it explains how different paradigmatic methodologies can generate structurally comparable descriptions of the same evolving system while preserving critical and emancipatory intent across intervention cycles.

4 | Illustrative Case: Developing Networks of Action in HISP

4.1 | A CSP Interpretation of the Evolution of HISP

The historical development of the Health Information Systems Programme (HISP) (Braa & Sahay, 2012) was not explicitly guided by Critical Systems Practice (CSP). Nevertheless, the trajectory can plausibly be interpreted through the lens of CSP because it emerged within the Scandinavian tradition of information systems research, which shared many of the same intellectual and political commitments as Critical Systems Thinking (CST). The research was participatory, intervention-oriented, and strongly concerned with empowerment, local autonomy, and organisational learning. It also combined concepts and methods from multiple traditions, including participatory design (PD), system dynamics (SD), complex adaptive systems (CAS), actor-network theory (ANT), and technical systems development.

From a CSP perspective, this multimethodological character appears highly compatible with the logic of methodological pluralism. Different approaches were mobilised at different moments in response to evolving organisational and technical challenges. The development of HISP can therefore be retrospectively narrated as a successful CSP-style intervention process organised around the four phases of Explore, Produce, Intervene, and Check (EPIC), even though the participants themselves did not explicitly use the language of CSP.

Explore: Fragmentation and Conflicting Purposes

HISP emerged during the 1990s in post-apartheid South Africa in the context of efforts to reconstruct fragmented public health administration and reduce historically embedded inequalities in access to healthcare. The health information environment was characterised by institutional fragmentation, weak infrastructure, uneven administrative capacity, and competing reporting requirements imposed by different governmental and donor organisations.

From a CSP perspective, this represented a classic "mess" rather than a clearly bounded technical problem. Different actors defined the situation differently according to their institutional roles and interests: national authorities prioritised standardisation and accountability; local managers coordination and resource

allocation; health workers practical usability; donors measurable outcomes; and technical specialists reliability, scalability, and interoperability.

The challenge was therefore not simply to design a better information system, but to navigate conflicting definitions of relevant success. This plurality of perspectives fits naturally with the exploratory logic of CSP, which treats intervention as beginning from the recognition that complex social situations contain multiple legitimate but competing understandings.

Produce: Methodological Pluralism and Participatory Design

The production phase of HISP relied heavily on participatory experimentation and iterative learning. Rather than assuming that system requirements could be fully specified in advance, developers and users jointly explored local needs, revised reporting categories, adapted workflows, and incrementally modified software functionality. This strongly resembles the interpretive and learning-oriented traditions incorporated into CSP through soft systems thinking.

HISP did not rely on a single methodology. Participatory design informed collaboration with users and local health workers; Actor-Network Theory (ANT) analysed how socio-technical networks were stabilised through negotiation and translation; Complex Adaptive Systems (CAS) informed understanding of distributed innovation and evolving collaboration; while System Dynamics (SD) concepts such as "attractors" helped describe recurring patterns of organisational behaviour and infrastructural growth.

From a CSP perspective, this represents a productive use of multimethodology. Different theories illuminated different aspects of the evolving intervention process, and methodological flexibility allowed the programme to adapt to changing circumstances without becoming locked into a single paradigmatic perspective.

Intervene: Scaling DHIS and Building Infrastructure

As HISP evolved into large-scale implementations of DHIS and later DHIS2 across multiple countries and regions, the character of the intervention changed significantly. Local experimentation and participatory learning remained important, but the growing scale of the infrastructure introduced new requirements related to governance, interoperability, maintenance, training, cyber security, and long-term organisational sustainability.

This transition illustrates how harder systems approaches become increasingly relevant as socio-technical infrastructures mature. Technical architecture, standards management, software engineering, resource coordination, and institutional governance all became necessary components of the intervention process. Distributed innovation networks required stronger coordination mechanisms, and participatory flexibility had to coexist with increasing demands for reliability and standardisation.

CSP explicitly allows for such movement between methodological traditions. The intervention process can therefore be interpreted as a pragmatic transition between paradigms in response to changing systemic conditions. Soft and participatory approaches remained important for local adaptation and stakeholder engagement, while harder systems approaches became increasingly necessary for maintaining viability and scalability across complex infrastructures.

Check: Organisational Learning and Persistent Contradictions

From a CSP perspective, the evolution of HISP can be understood as an extended process of organisational learning shaped by continual reflection on tensions and contradictions within the intervention environment. Rather than solving problems once and for all, the intervention repeatedly navigated competing demands and partially conflicting objectives.

Several tensions remained persistent throughout the development process:

- local flexibility versus national standardisation
- participatory engagement versus managerial control
- innovation versus infrastructural reliability
- professional autonomy versus accountability
- distributed experimentation versus central governance
- donor priorities versus long-term sustainability

CSP interprets such tensions not as failures, but as normal characteristics of plural social systems. Effective intervention therefore depends less on eliminating contradictions than on reflexively balancing them over time.

Viewed retrospectively, the HISP trajectory can be interpreted as a successful example of multimethodological systems intervention in which different approaches contributed useful insights at different stages of infrastructural development. However, while CSP provides a flexible framework for narrating such interventions, it does not provide a unified systems ontology capable of relating these insights through explicit structural correspondence. Approaches such as ANT, PD, SD, and CAS therefore remained largely separate analytical perspectives rather than isomorphic representations of a shared intervention model. From the perspective developed in this paper, the issue is therefore not whether HISP succeeded—which it clearly did—but how its success should be theorised.

4.2 | A CSI/GST Interpretation of the Evolution of HISP

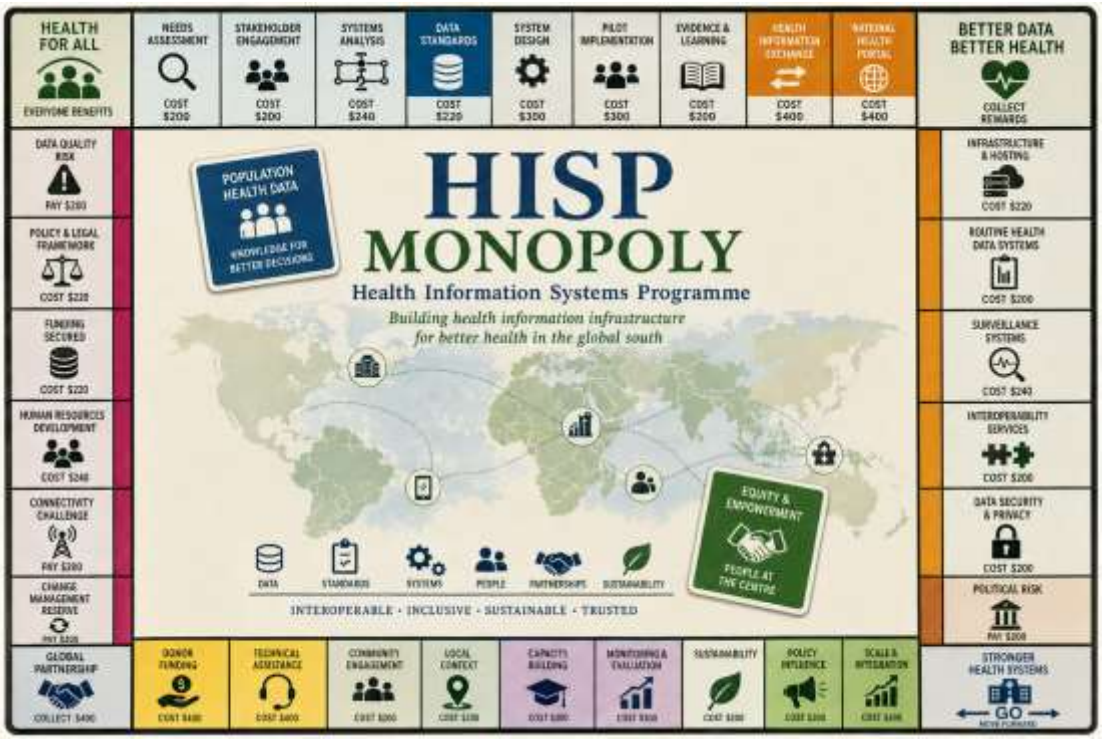
The previous interpretation treated HISP as an evolving multimethodological intervention in which different approaches were selected pragmatically according to changing circumstances. From the perspective of Critical Systems Intervention (CSI), however, the same trajectory can be interpreted differently. Rather than treating methodologies as loosely connected analytical tools, CSI treats them as different isomorphic perspectives on the same evolving system of interest.

Check: Radical Structuralism and Strategic Constraint

CSI begins by analysing the problematic situation from the perspective of radical structuralism. The purpose of the initial “Check” phase is to identify objective asymmetries of power, dependency, and strategic constraint within the socio-technical system.

In order to stabilise this ontological continuity across paradigms, CSI introduces an explicit game model at the centre of the intervention process. In the present case, the development of HISP, DHIS, and DHIS2 can be represented through a Monopoly-like game model (Exhibit 4). This should not be understood as a literal description of the intervention, but as a simplified ontological representation of actors, resources, constraints, strategic positions, and infrastructural expansion.

Exhibit 4. Game model for representing the HISP challenge



Within this representation, countries, regions, institutions, standards, and technological platforms function analogously to properties on a Monopoly board. Building and extending DHIS infrastructures resembles the acquisition and development of interconnected territories within a larger socio-technical landscape. Different actors occupy unequal positions with respect to funding, technical expertise, political authority, and organisational legitimacy. Some actors possess greater capacity to shape rules, define standards, and coordinate infrastructures than others. The game model therefore provides a persistent representation of the intervention situation while remaining open to different forms of theoretical interpretation.

At this stage, approaches such as ANT and political analyses of infrastructure become particularly useful because they reveal how actors attempt to stabilise networks, enrol allies, and shape the rules governing infrastructural development. The purpose is not merely descriptive. Rather, the intervention seeks to identify how the "game" itself is structured and who benefits from its existing configuration.

Act: Radical Humanism and Critical Awareness

The subsequent "Act" phase shifts attention toward critical awareness and emancipatory mobilisation. Once asymmetries of power have been identified, the intervention must assess whether affected actors recognise these conditions and possess sufficient motivation and organisational capacity to challenge them. Methodologies such as Critical Systems Heuristics (CSH) become relevant at this stage.

From the perspective of the Monopoly model, this phase concerns whether marginalised players recognise the rules of the game and are willing to organise collectively in order to change their position within it.

Plan: Interpretivism and Shared Meaning

The "Plan" phase aligns primarily with interpretive systems thinking. Once critical awareness has been established, actors must develop shared understandings concerning feasible strategies for intervention.

Here the same Monopoly model is interpreted differently. Rather than focusing primarily on structural domination, attention shifts toward communication, negotiation, learning, and the practical coordination of collective action. Methodologies associated with SSM and participatory design support the development of locally meaningful interpretations of infrastructural needs and organisational possibilities.

Do: Functionalism and Infrastructural Viability
The "Do" phase foregrounds functionalist concerns related to implementation, coordination, regulation, and organisational viability. At this stage, approaches associated with systems engineering, System Dynamics, Complex Adaptive Systems, and cybernetic management become central.

The scaling of DHIS2 across countries and regions required exactly such capabilities. Technical reliability, interoperability, governance structures, training programmes, resource allocation, and organisational coordination all became necessary for maintaining infrastructural viability. Concepts such as attractors, feedback loops, adaptation, and distributed network growth helped explain how infrastructures expanded and stabilised over time.

Within the Monopoly representation, this phase concerns the practical management and expansion of the game board itself. New territories must be connected, rules coordinated, resources allocated, and infrastructural stability maintained across increasingly complex networks of actors and institutions. As "Jail" is the main attractor when using dynamical systems theory for analysing Monopoly (Luenberger, 1979, pp. 232-234), learning by trial and error played an important role.

Check and Act Again: Recursive Intervention
After implementation, CSI returns to radical structuralist and radical humanist analysis in order to evaluate the consequences of the intervention. The purpose is not only to assess technical success, but to determine whether the structure of the game itself has changed.

Questions emerge such as:

- who gained influence through infrastructural expansion?
- who became increasingly dependent on external platforms or standards?
- were local actors genuinely empowered or merely incorporated into new forms of managerial control?
- did participation reduce alienation or merely legitimise existing structures?

The intervention cycle therefore becomes recursive rather than linear. Different paradigms continue to generate different but potentially isomorphic descriptions of the same evolving system.

From a CSI/GST perspective, the significance of the HISP case lies not merely in successful infrastructure development, but in demonstrating how multimethodological intervention can be integrated through a shared ontology. The Monopoly model functions as a persistent representation of the intervention situation, while different systems methodologies illuminate different structural properties of the same evolving game. GST, understood as a theory of isomorphic representation, therefore provides the ontological and epistemological basis through which paradigmatic pluralism can remain theoretically integrated across successive intervention cycles.

5 | Discussion

5.1 | Why CSI Is Methodologically Stronger than CSP
CSP provides a highly flexible framework for multimethodological intervention by allowing practitioners to combine methodologies associated with different paradigms according to the demands of the situation.

In the HISP case, this makes it relatively straightforward to retrospectively incorporate participatory design, actor-network theory, system dynamics, complex adaptive systems, and technical systems development within a single intervention narrative. However, this flexibility also reveals a methodological weakness. Because CSP primarily treats paradigmatic pluralism as a pragmatic question of methodological selection, it provides limited guidance concerning how different methodologies are theoretically integrated beyond their usefulness within a particular intervention. As a consequence, the original CST commitments to critical awareness, emancipation, and multimethodology increasingly risk being reformulated into a more generalised language of "systemic critique," "systemic pluralism," and "systemic improvement" (Jackson, 2024). While this broader formulation remains compatible with political intervention, it also shifts CSP toward a more generic framework for systemic management and organisational improvement.

CSI represents a development of TSI in the opposite direction. Rather than generalising CST into a broad framework for systemic improvement, CSI seeks to preserve the original emancipatory orientation by maintaining political and structural analysis throughout the intervention process. This is achieved through a shared intervention model that remains stable across paradigmatic transitions. In the HISP case, the Monopoly model functioned as such a model by representing the intervention situation as a structured field of unequal positions, constraints, and strategic possibilities. Different methodologies could then be applied to the same evolving model in order to analyse power relations, support collective learning, negotiate feasible change, and coordinate practical intervention. The methodological advantage of CSI therefore lies not simply in methodological pluralism, but in its capacity to preserve ontological continuity across multiple forms of analysis and action.

The methodological advantage of CSI becomes particularly visible in its capacity to support cumulative learning across interventions. Because CSP does not require a shared intervention model, multimethodological interventions risk remaining retrospective narratives whose success or failure can only be interpreted pragmatically after the fact. CSI, by contrast, employs explicit and revisable intervention models whose usefulness can be evaluated through their capacity to support explanation, prediction, and strategic action. From the perspective of van Frassen's Constructive Empiricism, such models are not intended to provide exhaustive truth claims about reality, but empirically adequate representations capable of guiding intervention and generating further learning. In the HISP case, the Monopoly model should therefore not be understood as a literal description of reality, but as a conceptual framework through which multiple methodologies could be related coherently across paradigms. The value of the model lies precisely in its capacity to preserve ontological continuity while remaining open to revision, reinterpretation, and application in other intervention contexts.

5.2 | Why the Reinterpretation of GST Matters Philosophically

The reinterpretation of GST proposed in this paper matters philosophically because it changes the ontological status of systems theory itself. Rather than treating GST as a search for laws common to objectively existing systems, GST becomes a framework for relating different representations of complex phenomena through isomorphic analysis. The emphasis therefore shifts from systems ontology in the traditional sense toward the ontology of models and conceptual structures.

This shift has important consequences for multimethodological systems intervention. Once isomorphism is understood as a relation between models rather than between real-world systems themselves, paradigmatically different methodologies no longer need to agree on the metaphysical nature of reality in order to contribute to a common intervention process. Hard, soft, and critical systems approaches can instead be understood as generating structurally related representations of the same intervention situation.

Popper's (1978) distinction between World 1, World 2, and World 3 helps clarify this position. Real-world intervention situations continue to exist in World 1, while human interpretation and experience belong to World 2. However, it is within World 3—the domain of shared conceptual knowledge, theories, and

models—that isomorphic integration becomes possible. GST therefore becomes not a theory of identical systems, but a theory of structurally comparable representations.

From this perspective, the philosophical importance of GST lies precisely in its capacity to support ontological continuity across paradigmatically different forms of systems intervention. This makes multimethodological practice theoretically coherent without requiring agreement about ultimate metaphysical truth claims.

6 | Conclusion

This paper has argued that General System Theory (GST) should not be understood primarily as a functionalist approach to objectively existing systems, but as a framework for relating different representations of complex intervention situations through isomorphic analysis. By interpreting isomorphism in a model-theoretic sense inspired by abstract algebra and pragmatic philosophy of science, the paper has proposed a shift from systems ontology toward model ontology as the basis for multimethodological systems intervention.

From this perspective, the challenge of multimethodology is not simply to combine methodologies pragmatically, but to maintain ontological continuity across paradigmatic shifts. Critical Systems Intervention (CSI) was presented as one possible response to this problem by employing shared intervention models capable of supporting structurally related analyses across hard, soft, and critical systems perspectives.

The HISP case illustrated how such models can provide greater theoretical coherence than conventional CSP narratives while also supporting cumulative learning across interventions. GST therefore emerges not as a paradigm-specific form of systems thinking, but as the broader framework that makes coherent multimethodological intervention possible. From this perspective, CST and CSI are best understood not as departures from GST, but as developments within a more philosophically general interpretation of it.

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