

Beyond the Silo

Adaptive Organisational Boundary Theory: How Complex Systems Evolve Through Specialisation, Governance, and Emergence

By Dr Jason I. Broch

Section One: The Architecture of Persistence

Every enduring system, from a single living cell to a modern nation-state, confronts the same fundamental challenge: **it must continue to exist**.

At first glance, this appears almost trivial. Yet persistence is perhaps the defining characteristic of every complex adaptive system. Systems that fail to maintain themselves disappear. Those that endure have, through biological evolution or institutional design, developed structures capable of preserving coherence while adapting to changing environments.

However, persistence does not necessarily imply success, health, or optimisation. A system may persist because it continually adapts to changing conditions, but it may also persist through defensive mechanisms that protect existing structures while reducing its future capacity to evolve. This distinction is critical for understanding public sector organisations, healthcare delivery networks, and statutory institutions.

Much of contemporary management theory implicitly treats organisations as machines whose structures can be redesigned at will. Departments are merged, reporting lines altered, governance committees created and dissolved, and cultures reshaped in the expectation that organisational behaviour will follow. When these interventions fail to produce lasting integration, explanations typically default to executive leadership, poor communication, or cultural resistance.

Adaptive Organisational Boundary Theory begins from a fundamentally different premise:

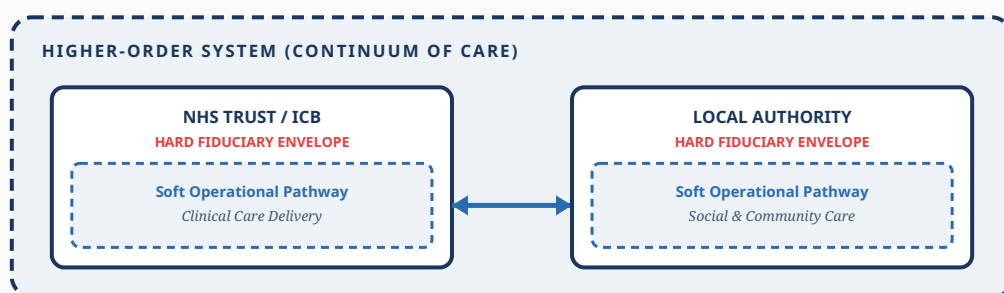


FIGURE 1: MANAGING HARD STATUTORY FIDUCIARY ENVELOPES ALONGSIDE SOFT, PERMEABLE OPERATIONAL INTERFACES

- **Organisations are complex adaptive systems**, not machines.
- Like ecosystems, nervous systems, and economies, organisations comprise many interacting agents, each responding to local information while simultaneously contributing to larger patterns of collective behaviour.

- The organisation itself is not simply the sum of its constituent parts. Rather, it is a dynamic process through which relationships, structures, and behaviours continually reorganise in response to internal and external change.

Understanding organisations in this way shifts the central question. Rather than asking how leaders should remove barriers between departments, we should first ask why boundaries exist at all. The answer lies not in bureaucracy, but in persistence.

Every adaptive system must distinguish itself from its environment sufficiently to maintain coherence while remaining sufficiently open to exchange information, energy, and resources. Complete openness results in dissolution; complete closure results in stagnation. Persistence therefore depends upon the continual regulation of this relationship.

Boundaries are the mechanisms through which this regulation occurs. In biological systems, they appear as cell membranes, immune systems, and neural interfaces. Within societies, they emerge through language, institutions, laws, and social norms. Within organisations, they become strategies, governance arrangements, professional identities, financial controls, and information architectures.

Boundaries should therefore not be understood as barriers. They are adaptive interfaces through which systems regulate interaction with their environment.

This distinction is important because it reframes one of the most persistent misconceptions in organisational theory: **boundaries are not inherently obstacles to integration; they are the precondition for integration.**

Without identifiable subsystems, there can be no higher-order organisation. Cells must first exist before tissues can form. Organs must maintain their identity before organisms can function. Individual organisations must possess coherent capabilities before meaningful partnerships can emerge. Integration is therefore not the elimination of boundaries; it is the evolution of boundaries into new configurations capable of supporting higher-order persistence.

The critical question facing organisations is not whether boundaries exist, but whether those boundaries remain capable of adaptation. A boundary that continues to regulate exchange, preserve capability, and support collective purpose remains adaptive. A boundary that becomes disconnected from the wider system begins to become fixed.

This distinction explains why many organisational transformation efforts fail. Most approaches to integration focus on changing relationships between people while leaving the underlying architecture of boundaries untouched. Collaboration initiatives, communication programmes, and partnership structures are often layered onto systems whose fundamental boundaries continue to generate separation.

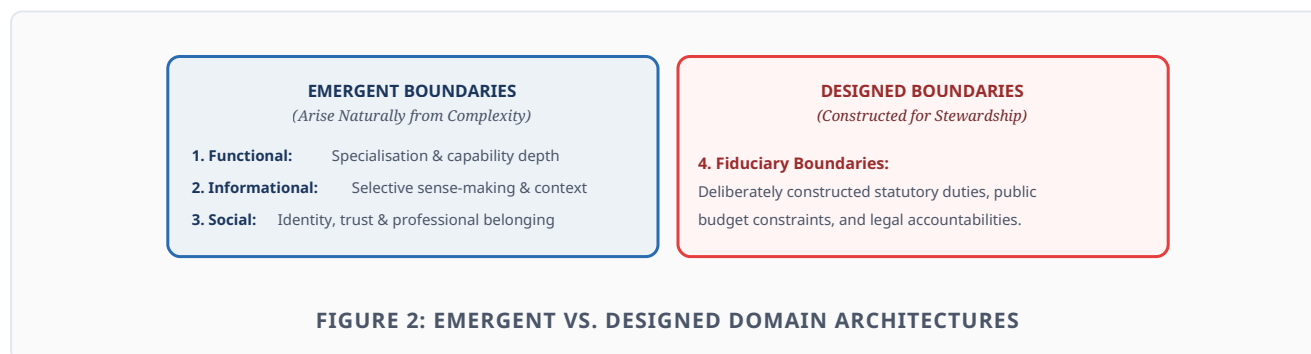
Adaptive Organisational Boundary Theory proposes a different approach: relationships emerge from boundary conditions. Change the architecture of boundaries, and patterns of interaction can change naturally. Leave boundary structures unchanged, and attempts to improve collaboration often become temporary interventions operating against deeper systemic forces.

The task facing organisational leaders is fundamentally architectural rather than behavioural. The task is not simply to encourage people to work together. It is to design systems whose boundaries continuously adapt, allowing persistence at one level to strengthen persistence at the next. The future organisation is therefore not a boundaryless organisation; it is a **boundary-intelligent organisation**—one that understands when boundaries create capability, when they require transformation, and when they have become fixed structures preventing the emergence of something greater.

Section Two: The Four Architectures of Organisational Boundaries

A central mistake in organisational thinking is treating all boundaries as equivalent. A departmental structure, a professional identity, a financial accountability framework, and a data architecture may all appear as barriers between parts of an organisation. However, they exist for fundamentally different reasons, operate through different mechanisms, and respond differently to attempts at integration.

A system cannot evolve effectively unless it understands the nature of the boundaries it is attempting to change. Adaptive Organisational Boundary Theory proposes that organisational boundaries exist across four interacting domains:



The first three are primarily **emergent boundaries**. They arise naturally as complexity increases and systems develop specialised capabilities, shared knowledge, and collective identities:

- **Functional boundaries** emerge because no individual or group can manage the full complexity of a system.
- **Informational boundaries** emerge because adaptive systems must filter vast amounts of information into meaningful representations of reality.
- **Social boundaries** emerge because human systems require trust, belonging, and shared identity to coordinate collective action.

The fourth domain, **fiduciary boundaries**, is fundamentally different. They are **designed boundaries**. They are deliberately constructed through law, governance, regulation, and statutory accountability mechanisms to ensure that resources are stewarded, responsibilities are assigned, and risks are managed.

This distinction is central. Emergent boundaries arise because complexity requires differentiation; designed boundaries arise because society requires responsibility. Both are necessary. Both can become dysfunctional. The challenge is understanding how each evolves.

1. Functional Boundaries: The Evolutionary Advantage of Specialisation

Complexity creates a fundamental information-processing challenge. No individual agent can understand or respond to the entire environment. As systems grow, they develop specialised components capable of focusing on particular tasks, signals, or problems.

This principle is visible throughout biology. The human body does not function because every cell performs every function; it functions because cells specialise. Neurons process information, muscle cells generate movement, liver cells regulate metabolism. Specialisation creates capability.

Organisations follow the same evolutionary logic. Finance teams manage resources, clinical teams develop expertise, digital teams maintain information systems, operational teams coordinate delivery, and legal

teams manage risk. Specialisation is therefore not a flaw in organisational design; it is the mechanism through which complexity becomes manageable.

Functional boundaries allow systems to create depth. They enable expertise, efficiency, and accountability. However, the same mechanisms that improve local capability can reduce awareness of the wider system. A specialist team naturally develops its own language, priorities, metrics, and assumptions. This creates internal coherence and improves local performance.

The problem occurs when a functional boundary becomes mistaken for a complete system boundary. A specialist function may become increasingly effective at answering: *"How do we optimise our part of the system?"* while losing sight of the higher-order question: *"How does our part contribute to the persistence of the whole?"* This is the transition point from specialisation to silo formation.

A silo is therefore not simply a specialised unit. A silo is a specialised unit whose boundary has lost adaptive connection with the wider system.



2. Informational Boundaries: How Systems Sense Reality

Every adaptive system requires a mechanism for deciding what information matters. A biological organism does not process every possible environmental signal; it selectively attends to information relevant to survival. The immune system distinguishes self from non-self; the nervous system filters enormous volumes of sensory input into meaningful patterns.

Organisations operate similarly. They create informational boundaries through professional knowledge, performance indicators, reporting structures, data systems, analytical frameworks, and strategic priorities. These boundaries allow organisations to transform complexity into actionable intelligence. Without informational boundaries, organisations would experience severe information overload.

The challenge is that every informational boundary creates a perspective. Different parts of the same system naturally develop different representations of reality:

- A hospital may understand demand through activity and admission data.
- A community organisation may understand need through lived experience and social context.
- A finance team may understand performance through expenditure and budget variance.
- A population health team may understand the same system through health inequalities, risk stratification, and long-term outcomes.

Each perspective may be valid. The challenge is not deciding which perspective is correct. The challenge is creating a higher-order system capable of integrating multiple perspectives into a shared understanding. This is why data integration alone rarely creates system integration. The challenge is not merely connecting information; it is creating **shared meaning**.

3. Social Boundaries: Identity, Trust, and Belonging

Human systems contain a boundary that biological systems do not possess in the same way: collective identity. People do not simply operate within organisations; they belong to them. Professional groups develop histories, values, language, and shared assumptions. These social boundaries are essential because they create trust, competence, and collective action.

A surgeon, a social worker, a software engineer, and a financial analyst do not become effective because their identities disappear. They become effective because their different identities contribute complementary capabilities. Social boundaries therefore provide continuity and meaning. They allow individuals to understand their role, develop expertise, and coordinate with others who share a common purpose.

However, social boundaries become problematic when identity shifts from contribution to protection. The question changes from: *"What unique contribution do we bring?"* to: *"What must we protect from others?"* At this point, identity becomes a mechanism of separation rather than contribution.

The challenge of integration is therefore not creating a single identity. It is creating a **nested identity**. People must be able to belong simultaneously to their profession, their organisation, and the wider system. A clinician can remain proud of their specialty while identifying with the needs of the whole population. A provider organisation can preserve its expertise while contributing to a wider health system. This is the human equivalent of evolutionary transitions: maintaining local function while enabling higher-order organisation.

4. Fiduciary Boundaries: The Designed Architecture of Accountability

The fourth boundary type is fundamentally different. Unlike functional, informational, and social boundaries, which emerge as complex systems organise themselves, fiduciary boundaries are deliberately created. They represent society's attempt to introduce accountability into complex systems.

A company director has legal responsibilities. A public body has statutory duties. A healthcare organisation has obligations to patients, regulators, and taxpayers. These responsibilities create boundaries around decision-making authority and resource stewardship:

- A board cannot simply dissolve its accountability because collaboration would be easier.
- A finance function cannot release resources without considering sustainability.
- A clinical service cannot redesign care without considering safety and professional obligations.
- A regulator cannot remove requirements solely to accelerate change.

Fiduciary boundaries exist because complex systems require constraint. They protect resources, maintain trust, create responsibility, and prevent collective action problems where many benefit from an activity but no individual organisation is accountable for delivering it.

However, fiduciary boundaries introduce a fundamental paradox. The same mechanisms that create accountability can also inhibit adaptation. A board may rationally protect its organisation's resources while unintentionally limiting a wider system's ability to respond. A provider may defend its budget because it has a legitimate stewardship responsibility. A statutory organisation may optimise against its formal objectives because those are the objectives against which it is judged.

The challenge is not removing fiduciary boundaries. The challenge is ensuring that accountability remains aligned with higher-order system persistence. The mature organisation recognises that accountability exists at multiple levels:

- A hospital must remain financially viable, but the healthcare system must remain effective.

- A department must deliver its objectives, but the organisation must achieve its purpose.
- A local organisation must persist, but the population it serves must also thrive.

Adaptive systems succeed when these levels reinforce rather than compete with each other. Boundaries become dysfunctional not when they exist, but when their purpose becomes disconnected from the persistence of the wider system:

- A functional boundary becomes a silo.
- An informational boundary becomes fragmentation.
- A social boundary becomes tribalism.
- A fiduciary boundary becomes bureaucracy.

The challenge of leadership is therefore not boundary removal; it is **boundary stewardship**. Leaders must understand which boundaries should be protected, which should become more permeable, and which require transformation to enable the emergence of a higher-order system.

Section Three: Boundary Dynamics: From Separation to Emergence

The existence of boundaries does not determine whether a system will fragment or evolve. The critical variable is whether boundaries retain the capacity to adapt.

Complex adaptive systems survive through a continuous tension between differentiation and integration. They separate into specialised components to create capability, but they must also maintain relationships between those components to create collective coherence. This creates a fundamental paradox: **the same boundaries that enable complexity can also prevent further evolution.**

- A system that cannot differentiate becomes incapable of developing specialised capability.
- A system that cannot integrate becomes incapable of collective adaptation.

Evolution therefore depends not on eliminating boundaries, but on continuously transforming them. Adaptive Organisational Boundary Theory proposes that organisational evolution occurs through a repeating cycle:

Differentiation → Stabilisation → Interaction → Recombination → Emergence

However, this pathway is not inevitable. At each stage, boundaries can either remain adaptive or become fixed. The difference between evolution and fragmentation lies in whether boundaries continue to serve the persistence of the wider system.

1. Differentiation: Creating Capability Through Separation

The first stage of complexity development is differentiation. As systems encounter increasing demands, they develop specialised components capable of managing specific challenges. A healthcare system creates specialist services; a business creates functional departments; a scientific field develops disciplines; a technology organisation creates engineering, product, and operational teams.

Differentiation improves performance because it reduces cognitive and operational overload. A specialised component can focus attention, develop expertise, and create solutions that would be impossible within an undifferentiated structure. This is the evolutionary advantage of specialisation.

However, differentiation creates an unavoidable trade-off. The more specialised a component becomes, the narrower its perspective of the wider system may become. Specialisation creates depth, but depth without connection creates fragmentation. A clinical service may optimise clinical excellence while overlooking

population outcomes. A finance function may optimise financial control while overlooking system transformation. A technology team may optimise technical performance while overlooking user experience. None of these perspectives are wrong; they are simply incomplete. Differentiation creates capability, but integration creates coherence.

2. Stabilisation: When Boundaries Create Identity and Order

Following differentiation, systems stabilise. The emerging subsystem develops internal structures that allow it to function reliably. Teams establish shared language, professional norms, operating processes, performance measures, decision-making approaches, and collective identity.

This stabilisation is essential. Without it, specialised components cannot become effective. A newly formed clinical team needs professional standards; a new business function needs processes and accountability; a new partnership requires governance arrangements. Stabilisation represents successful adaptation. The mistake is assuming that stability and adaptability are opposites; healthy systems require both. A stable boundary provides continuity while allowing the system to respond to change. The challenge begins when the mechanisms that create stability become mechanisms of preservation.

3. Interaction: The Need for Adaptive Permeability

For differentiation to contribute to system evolution, boundaries must permit exchange. In adaptive systems, boundaries are not walls; they are membranes. A membrane performs two apparently contradictory functions: maintaining distinction while enabling exchange.

This is true in biology. The cell membrane does not dissolve the distinction between the cell and its environment; it selectively regulates what enters, what leaves, and which signals are recognised. Organisational boundaries operate in the same way. A mature functional team does not need to lose its expertise; it needs mechanisms for knowledge exchange, shared decision-making, reciprocal accountability, aligned incentives, and common purpose.

The relevant question is therefore not: *"How do we break down boundaries?"* The more useful question is: *"What should flow across this boundary, at what rate, and for what purpose?"*

Different boundaries require different forms of permeability:

- A clinical boundary may require shared decision-making.
- An informational boundary may require interoperability.
- A social boundary may require shared identity and trust.
- A fiduciary boundary may require joint accountability arrangements.

Integration is therefore not a universal intervention; it is the intelligent regulation of exchange across boundaries.

4. Boundary Fixation: When Adaptation Becomes Preservation

The transition from healthy differentiation to organisational dysfunction occurs through a process of **boundary fixation**. Boundary fixation occurs when a boundary that originally served adaptation becomes increasingly focused on preserving itself.

The boundary remains visible, the subsystem remains capable, and the people within it remain committed. However, the relationship between the subsystem and the wider system begins to weaken. The question changes. Instead of asking: *"How do we contribute to the persistence of the whole?"* the subsystem increasingly asks: *"How do we protect our position within the system?"*

This transition is often driven by reinforcing feedback loops:

Success → Identity → Protection → Separation → Reduced Shared Understanding → Increased Protection

The result is a self-reinforcing cycle. Boundary fixation is therefore not caused by poor intentions. It emerges because the same mechanisms that create organisational capability can, under different conditions, create organisational rigidity.

5. Recombination: Creating New Organisational Forms

When previously separate components interact effectively, new structures can emerge. This is a defining characteristic of complex systems: the whole becomes capable of behaviours that cannot be explained by the individual components alone.

Individual neurons create networks capable of cognition; individual organisms create ecosystems capable of collective adaptation; individual actors create societies capable of shared institutions. The same principle applies to organisations. A traditional view assumes integration means combining existing structures. Adaptive Organisational Boundary Theory proposes that integration creates the conditions from which new organisational forms emerge. Examples include:

- Multidisciplinary teams emerging across professional boundaries.
- Integrated care systems emerging across organisational boundaries.
- Partnerships emerging across sector boundaries.
- Digital platforms emerging across technological boundaries.

These are not simply collaborations between existing entities; they represent new levels of organisation with new identities, new feedback loops, and new forms of governance. Emergence occurs when boundaries are not removed, but reorganised.

6. The Boundary Paradox and Adaptive Permeability

The evolution of complex systems creates a recurring paradox: **to become more integrated, systems often need more boundaries, not fewer**. At first glance, this appears counterintuitive. If silos are caused by boundaries, surely integration requires removing them?

However, complex systems evolve through nested structures. A human body contains organs, organs contain tissues, and tissues contain cells. Each level has boundaries. The existence of boundaries allows each level to maintain coherence while participating in a larger system. Organisations evolve in the same way. A successful integrated system does not eliminate professional, organisational, or fiduciary identities; it creates a higher-order identity capable of coordinating them.

The central implication is the **Principle of Adaptive Permeability**: healthy systems continuously adjust the permeability of their boundaries according to the complexity and demands of their environment. Too little permeability creates fragmentation; too much permeability creates loss of identity, accountability, and capability. The adaptive zone exists between these extremes.

Section Four: The Missing Boundary: Fiduciary Responsibility in Complex Organisations

Most discussions of organisational boundaries focus on the movement of information, the alignment of culture, or the creation of collaboration. Less attention is given to one of the strongest forces shaping organisational behaviour: **fiduciary responsibility**.

This omission is significant because modern organisations do not operate solely through relationships, knowledge exchange, and shared purpose. They also operate through systems of accountability. Individuals, teams, and institutions are entrusted with responsibilities that extend beyond their immediate interests: financial stewardship, regulatory compliance, professional standards, safety obligations, workforce decisions, legal duties, organisational reputation, and public trust.

These responsibilities create fiduciary boundaries. Unlike functional, informational, and social boundaries, which emerge naturally as complex systems differentiate, fiduciary boundaries are deliberately designed. They are created through governance, legislation, regulation, and formal accountability structures. They represent society's attempt to answer a fundamental question: **Who is responsible when collective action has consequences?**

Fiduciary Boundaries as Designed Constraints

Complex adaptive systems require both freedom and constraint. Too little constraint produces instability; too much constraint produces rigidity. Fiduciary boundaries exist because unrestricted adaptation can create harm:

- A company director cannot simply allocate resources without considering organisational sustainability.
- A public body cannot simply redirect resources without considering fairness and statutory duties.
- A healthcare organisation cannot redesign services without considering patient safety and professional accountability.

These constraints are not failures of integration; they are the conditions that make responsible adaptation possible. In engineering, a structure does not become stronger by removing all constraints. Stability emerges through the interaction between flexibility and limitation. The same principle applies to organisations. Governance provides the structural conditions within which innovation and adaptation can occur safely.

The Fiduciary Paradox and Asymmetry

Fiduciary boundaries create a fundamental paradox: the same mechanisms that protect a system can also prevent its evolution. An organisation may act entirely rationally within its own accountability framework while contributing to dysfunction at a wider system level:

- A board may protect its organisation's financial position because it has a legitimate stewardship responsibility.
- A provider may preserve its resources because it is accountable for maintaining services.
- A statutory organisation may optimise against its formal objectives because those objectives define its success.
- A partnership may struggle to share resources because accountability has not evolved alongside collaboration.

Each action may be defensible, yet collectively, these behaviours can reduce the capacity of the wider system to adapt. This occurs because fiduciary boundaries create **accountability asymmetry**. The organisation making a decision may not be the only part of the system affected by that decision. The benefits of

collaboration may be distributed across the system, while the risks remain concentrated within individual organisations.

This creates a structural tension: the organisation is accountable for protecting its own resources, while the wider system requires resources to move differently. Both perspectives may be legitimate. The challenge is creating governance capable of reconciling them.

From Organisational Accountability to System Accountability

Traditional governance assumes that accountability follows organisational boundaries. A board governs an organisation, a leader manages a department, and a professional group maintains standards within its discipline. This model works well when problems align with organisational structures.

However, many modern challenges do not. Climate change, population health, health inequalities, digital transformation, and complex social needs cross traditional boundaries. The problems increasingly exist at one level of the system while accountability remains located at another.

Adaptive systems require a transition from purely organisational accountability towards **nested accountability**. This does not mean removing responsibility; it means recognising that responsibility exists at multiple levels:

- A hospital must remain financially sustainable, but the healthcare system must remain effective.
- A department must deliver its objectives, but the organisation must achieve its purpose.
- An organisation must persist, but the population it serves must also thrive.

The mature organisation understands that these are not competing responsibilities; they are different expressions of persistence at different system levels. Adaptive fiduciary boundaries preserve accountability while enabling system evolution. They enable shared governance, transparent decision-making, aligned incentives, outcome-based accountability, appropriate delegation of authority, and collective stewardship. Accountabilities must not prevent emergence; they must enable it.

Section Five: Specialisation, Boundary Fixation, and the Birth of Silos

The concept of the organisational silo is one of the most persistent ideas in management thinking. Silos are usually described as problems of separation: departments do not communicate, teams protect information, functions optimise their own priorities, and organisations compete rather than collaborate.

The conventional response is predictable: break down the silos, improve communication, create cross-functional teams, align incentives, and develop a shared culture. These interventions are often valuable, but they address visible symptoms rather than the underlying mechanism.

Adaptive Organisational Boundary Theory proposes a different explanation: silos do not emerge because boundaries **exist; silos emerge when adaptive boundaries become fixed**.

A boundary is an enabling structure when it allows a specialised component to contribute effectively to the wider system. A boundary becomes a silo when it begins to preserve the component at the expense of the system that created it. The silo is therefore not the opposite of specialisation; it is the **evolutionary failure mode of specialisation**.

The Evolutionary Logic of Silo Formation

Specialisation is one of the primary mechanisms through which complex systems develop capability. Differentiation allows components to focus, develop expertise, and respond effectively to specific challenges. A specialist function is therefore not an organisational defect; it is a solution to complexity.

However, every successful adaptation creates a new vulnerability. The more effective a subsystem becomes, the more it develops internal coherence. It creates specialised knowledge, professional language, established processes, performance measures, resource ownership, and collective identity. These characteristics improve local performance, competence, reliability, and confidence.

However, they also strengthen the boundary around the subsystem. The very mechanisms that enable success can gradually reduce permeability. Over time, the subsystem may become less responsive to signals from the wider environment. The boundary begins to shift from being a selective interface to becoming a protective barrier. System optimization shifts from the whole to the subsystem.

The Four Pathways to Boundary Fixation

Because organisations contain different types of boundaries, fixation occurs through four distinct pathways:

Domain Architecture	Adaptive Function	Fixed State (Pathology)
Functional	Expertise and capability depth	Silo: Protection of function over whole-system outcome.
Informational	Selective sense-making	Fragmentation: Confusing local metrics with reality.
Social	Trust and professional identity	Tribalism: Identity used as defensive separation.
Fiduciary	Accountability and stewardship	Bureaucracy: Protecting mechanisms over mission.

1. **Functional Fixation:** Expertise becomes disconnected from system purpose. A clinical specialty focuses exclusively on its service while overlooking population health; a tech team optimises technical performance while losing sight of user outcomes. The question changes from *"How does our expertise contribute to the whole?"* to *"How do we protect our standards and resources?"*
2. **Informational Fixation:** One representation of reality is treated as the whole reality. Activity data is confused with need; financial performance is confused with value; operational measures are confused with outcomes.
3. **Social Fixation:** Identity becomes dysfunctional when belonging requires separation. Professional pride turns into professional protectionism, and group cohesion becomes resistance to external influence.
4. **Fiduciary Fixation:** Governance mechanisms become disconnected from system outcomes. A process designed to protect resources slows necessary adaptation, and financial control prevents investment in long-term prevention. The organisation begins protecting the mechanism rather than achieving the mission.

Restoring Adaptive Boundaries

If silos are understood as fixed boundaries, traditional silo-breaking approaches often fail because removing boundaries destroys capability. Eliminating functional boundaries reduces expertise; removing accountability boundaries creates ambiguity; weakening professional identities reduces trust.

The solution is not boundary destruction, but **boundary transformation**. A fixed boundary becomes adaptive again when the relationship between the subsystem and the wider system is restored:

- **From optimisation to contribution:** How does our success contribute to collective success?
- **From ownership to stewardship:** How do we use our resources to support wider system outcomes?
- **From protection to participation:** How do we maintain our identity while contributing to something larger?
- **From accountability for parts to accountability for outcomes:** How do we remain responsible while sharing responsibility for system performance?

Section Six: Major Evolutionary Transitions and Higher-Order Systems

The evolution of complex systems is not a continuous process of simply becoming larger or more efficient. At certain points, systems undergo fundamental transitions in which previously separate components become organised into a new level of collective existence. These are known as **major evolutionary transitions**.

They represent moments when individual entities that previously operated independently become integrated into a higher-order system with new capabilities, new forms of organisation, and new patterns of behaviour.

The significance of these transitions is that the original components do not disappear; they become embedded within something larger:

- Individual cells did not cease to exist when multicellular organisms evolved.
- Individual organisms did not cease to exist when social systems emerged.
- Individual actors did not cease to exist when institutions and societies developed.

Evolution occurs not through the destruction of lower-level structures, but through their reorganisation into higher-order relationships. This principle provides a powerful insight for understanding organisational change: **the future of organisations is not boundarylessness; it is the emergence of new levels of organisation through the transformation of existing boundaries.**

Emergence: Beyond the Sum of the Parts

In complex systems, emergence occurs when interactions between components create capabilities, behaviours, or properties that cannot be explained by the components alone. The whole develops new characteristics because of the pattern of relationships between its parts. A single neuron does not possess consciousness; a single ant does not create a colony; a single organisation does not create a functioning care ecosystem. The emergent property exists at the level of interaction.

Traditional approaches assume that integration means connecting existing parts more effectively. Adaptive Organisational Boundary Theory proposes something deeper: integration creates the conditions from which a new system may emerge. The objective is the development of a higher-order system capable of behaviours that were previously impossible.

The Evolutionary Pattern of Higher-Order Systems

Major evolutionary transitions generally follow a recognisable pattern:

1. **Independent components develop specialised capability:** Individual units become effective because they develop their own functions, identities, and adaptive responses.

2. **Interaction creates interdependence:** The components begin exchanging resources, information, and signals.
3. **New coordination mechanisms emerge:** The system develops structures that allow collective behaviour.
4. **A new level of organisation forms:** The relationship between components becomes more important than the independence of the components themselves.

This pattern is visible across biology and human institutions. Transformation occurs through layering. A specialist clinical team does not need to disappear for integrated care to emerge; a hospital does not need to lose its identity for population health approaches to develop. Instead, new boundaries form around existing boundaries, creating a nested architecture where a clinician belongs simultaneously to a profession, a specialty, an organisation, a local partnership, and a population health system.

Section Seven: Adaptive Organisational Boundary Theory: A Framework for Organisational Evolution

Adaptive Organisational Boundary Theory proposes that organisational capability emerges from the dynamic relationship between differentiation and integration. The theory synthesises these dynamics into five core principles:

Core Principles of Adaptive Organisational Boundary Theory

- **Principle One: Boundaries Are Necessary Conditions of Complexity.** Complexity requires differentiation. No complex system can function if every component performs the same role. A boundary is not evidence of failure; it is evidence that complexity has increased beyond undifferentiated structures.
- **Principle Two: Boundary Purpose Determines Boundary Value.** A boundary remains valuable when it continues to serve its underlying adaptive purpose (expertise, sense-making, trust, stewardship). Dysfunction occurs when the boundary becomes separated from its purpose.
- **Principle Three: Boundary Permeability Must Be Adaptive.** Systems operate within a zone of productive permeability. Permeability should not be uniform; different boundaries require different forms of exchange (information, resources, decision authority).
- **Principle Four: Boundary Fixation Is the Mechanism of Organisational Pathology.** Fixed boundaries preserve local subsystems at the expense of the whole, giving rise to silos, fragmentation, tribalism, and bureaucracy.
- **Principle Five: Emergence Requires Boundary Transformation.** Complex systems evolve through recombination. Sustainable emergence occurs when boundaries are deliberately transformed to allow new forms of collective intelligence while preserving essential capability.

The Adaptive Organisational Boundary Lifecycle

Organisational boundaries move through a natural five-stage evolutionary lifecycle:

1. **Emergence:** A new boundary forms because complexity creates a need for differentiation.
2. **Consolidation:** The boundary develops stability, creating expertise, identity, and accountability.
3. **Adaptation:** The boundary evolves as the environment changes, maintaining adaptive permeability.
4. **Fixation:** The boundary becomes primarily concerned with protecting its own resources and authority.
5. **Transformation:** The boundary is redesigned to enable a higher-order system, retaining capability while reorganising relationships.

Section Eight: Healthcare as an Example of Organisational Evolution

Healthcare provides one of the clearest examples of the challenge described by Adaptive Organisational Boundary Theory.

Few human systems have achieved such extraordinary capability through specialisation. Modern healthcare has evolved through increasing differentiation: cardiology, oncology, surgery, psychiatry, general practice, and hundreds of specialized disciplines have developed distinct expertise, evidence bases, and professional identities.

This specialisation has saved and improved millions of lives. The success of healthcare is inseparable from its boundaries.

The challenge is not that healthcare has become too specialised. The challenge is that the complexity of modern health challenges has evolved beyond the boundary architecture that originally created its success.

The same structures that enabled excellence in treating acute individual conditions are increasingly challenged by problems that exist at a different level of the system: multimorbidity, health inequalities, mental health, social determinants of health, population ageing, and long-term conditions. These challenges cannot be solved by any single isolated specialist component. They require a higher-order system.

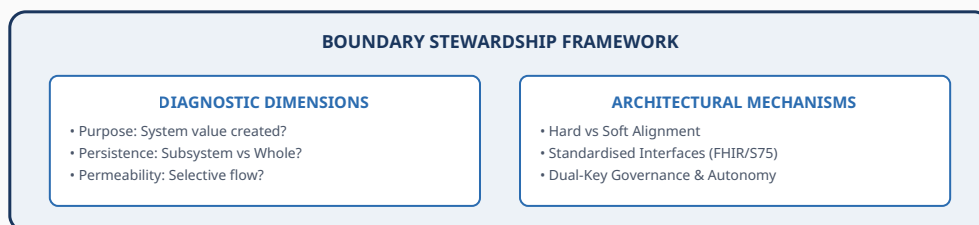


FIGURE 4: THE BOUNDARY STEWARDSHIP FRAMEWORK

Healthcare represents a major evolutionary transition. The question is not how to remove the boundaries that created healthcare capability, but how to transform those boundaries so that they support the next level of system evolution:

- **Functional Boundaries:** A patient with multiple long-term conditions does not experience their needs through departmental boundaries; they experience a single life. Specialists must remain excellent within their domain while participating in a broader adaptive care system.
- **Informational Boundaries:** Hospitals measure activity, primary care measures continuity, public health measures risk, and social care measures daily functioning. True integration requires shared sense-making and a shared model of reality rather than just data pipeline connections.
- **Social Boundaries:** Professional identities create trust and standards. Evolution requires moving from isolated identity to connected, nested identities.
- **Fiduciary Boundaries:** Healthcare organisations operate under strict financial, regulatory, and legal accountabilities. Population health requires mechanisms where organisations remain accountable while sharing responsibility for wider population outcomes.

Integrated care systems and population health models represent the emergence of a higher-order system where hospitals, primary care, local authorities, and community partners retain their identity while becoming part of a coordinated whole.

Section Nine: The Adaptive Organisational Boundary Framework for Leaders

If Adaptive Organisational Boundary Theory is correct, then the role of leadership in complex organisations must change. Traditional approaches position leaders as problem solvers who identify barriers and remove them. The instinctive response to fragmentation is intervention: create a new structure, introduce a new process, mandate collaboration, or realign incentives.

These approaches assume that boundaries are primarily obstacles. Adaptive Organisational Boundary Theory proposes that leaders should act as **stewards of boundary evolution**.

Dimension	Adaptive Leadership Question	Risk When Fixed
Purpose	Why does this boundary exist? What value does it create?	Loss of relevance & bureaucracy
Persistence	Does this boundary strengthen the wider system or only the part?	Subsystem survival at system expense
Permeability	What information, resources, and authority should cross this boundary?	Isolation or chaos
Evolution	What must this boundary become for the next level to emerge?	Organisational stagnation

Designing Conditions for Emergence

Leaders cannot directly force emergence, but they can design the conditions under which emergence becomes possible:

1. **Shared Purpose:** Subsystems must understand the larger system to which they contribute.
2. **Appropriate Autonomy:** Subsystems must retain enough local independence to adapt.
3. **Connected Intelligence:** Information must flow across boundaries to create shared understanding.
4. **Aligned Accountability:** Responsibility must exist at the level where outcomes are created.
5. **Adaptive Governance:** Decision structures must evolve as system demands shift.

Collaboration is not the starting point of organizational transformation; it is the natural consequence of effective boundary design.

Section Ten: Conclusion: Designing for Emergence Rather Than Managing Collaboration

Modern organisations face an enduring paradox: the challenges they confront are increasingly interconnected, yet the structures through which they operate are increasingly specialised. They need expertise, but they need integration; they need autonomy, but they need coordination; they need accountability, but they need collective action; they need stability, but they need adaptation.

This tension is not evidence that organisations are poorly designed; it is evidence that they are complex adaptive systems.

The central crisis of modern organizational design stems from an architectural misunderstanding of these complex systems. The conventional response to fragmentation—attempting to forcefully break down silos and mandate relational collaboration—fails because it ignores the necessity of boundaries for system

integrity and specialized expertise. Without differentiation, there is no depth of capability; without identity, there is no commitment; without accountability, there is no stewardship; and without informational boundaries, there is no capacity for sense-making.

Boundaries are not the enemy of integration; they are the foundation upon which integration becomes possible.

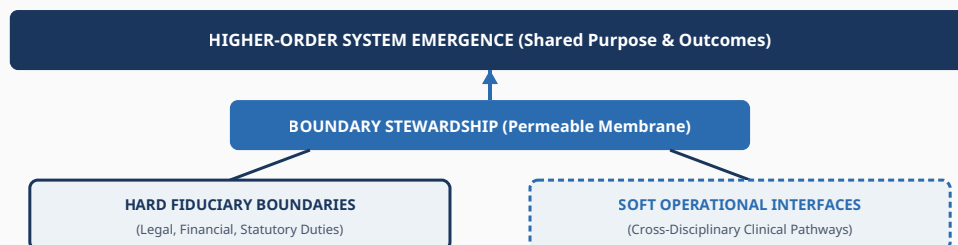


FIGURE 5: THE EMERGENT SYSTEM ARCHITECTURE

Complex systems do not evolve by eliminating boundaries; they evolve by transforming them.

When a boundary loses its adaptive connection to the whole, it degenerates into a silo—a defensive structure focused on local self-preservation rather than system contribution. The solution is not boundary destruction, but the active practice of **boundary stewardship**. Leaders must move away from the exhausting, low-leverage work of trying to manage interpersonal collaboration on top of rigid structures. Instead, they must design the underlying structural conditions: maintaining hard, non-negotiable fiduciary accountabilities where statutory stewardship requires them, while simultaneously engineering soft, permeable operational interfaces through which information, resources, and shared clinical care can fluidly flow.

Integration is ultimately a biological and informational transition. When subsystems are linked through adaptive, permeable boundaries, the whole system undergoes a major evolutionary leap. It becomes capable of sensing reality from multiple perspectives, processing complexity that would overwhelm any single component, and generating collective intelligence.

The organisations of the future will not be boundaryless. They will be **boundary-intelligent**. They will recognize that boundaries exist not to separate us, but to give us the structure required to connect, adapt, and evolve into something greater than the sum of our parts.

ABOUT THE AUTHOR

Dr Jason I Broch is a senior healthcare professional and executive advisor operating at the intersection of integrated care systems, digital health architecture, and complex system transformation. His interest focuses on applying complexity science and biological systems frameworks to redesign frontline healthcare delivery and population health management within a concept of Value-based Health & Care.

To read more of Dr Broch's research, policy essays, and operational blueprints, visit jasonbroch.com

Beyond the Silo: Adaptive Organisational Boundary Theory

Monograph Compendium & Key Theoretical Foundations

INTERESTING REFERENCES

1. Bak, P. (1996). *How Nature Works: The Science of Self-Organised Criticality*. Copernicus / Springer-Verlag.

Synopsis: Introduces self-organised criticality—how complex systems naturally evolve to a critical state where small events can trigger large-scale transformations or re-organisations without external tuning.

Relevance: *Provides the physical and systemic foundation for understanding how organizational boundaries adapt or suddenly reorganise under systemic pressure.*

2. Beer, S. (1985). *Diagnosing the System for Organisations*. John Wiley & Sons.

Synopsis: Outlines the Viable System Model (VSM), a framework describing the structural and informational requirements for any organisation to maintain autonomy and viability within a changing environment.

Relevance: *Informs the concept of boundary intelligence and how subsystems maintain local identity while serving higher-order organisational persistence.*

3. Department of Health and Social Care (2022). *Joining up care for people, places and populations: The government's proposals for health and care integration*. HM Government.

Synopsis: A UK government policy paper detailing proposals to integrate health and social care delivery across Integrated Care Systems (ICSs), local authorities, and primary care networks.

Relevance: *Provides the policy context for real-world integration challenges across statutory health and local government boundaries in England.*

4. Espinosa, A., & Walker, J. (2017). *A Complexity Approach to Sustainability: Theory and Application* (2nd ed.). Imperial College Press.

Synopsis: Applies cybernetics and complexity theory to governance and organisational sustainability, focusing on self-organisation, distributed governance, and ecological persistence.

Relevance: *Illustrates how organisations balance differentiation (local capability) with integration (whole-system coherence).*

5. Healthcare Financial Management Association (HFMA) (2023). *Governance and Accountability in Integrated Care Systems*. HFMA Briefing.

Synopsis: Examines the financial, legal, and statutory accountability frameworks governing NHS bodies and local authorities within integrated systems.

Relevance: *Highlights the practical realities of "fiduciary boundaries"—the hard legal and budget constraints that persist even when clinical care is integrated.*

6. Kauffman, S. A. (1993). *The Origins of Order: Self-Organisation and Selection in Evolution*. Oxford University Press.

Synopsis: Details how self-organisation interacts with natural selection to drive complex biological evolution, emphasising fitness landscapes and modular system structures.

Relevance: *Offers a biological framework for how specialisation and modular boundaries create local depth while enabling system-level evolution.*

7. Maynard Smith, J., & Szathmáry, E. (1995). *The Major Transitions in Evolution*. W. H. Freeman / Spektrum.

Synopsis: Identifies key moments in evolutionary history where independently replicating units combined into higher-order entities (e.g., single cells to multicellular organisms).

Relevance: *Serves as the primary theoretical inspiration for describing integrated care systems as a major evolutionary transition where lower-level units retain capability while embedding within a higher-order whole.*

8. Meadows, D. H. (2008). *Thinking in Systems: A Primer* (D. Wright, Ed.). Chelsea Green Publishing.

Synopsis: A foundational introduction to systems thinking, detailing feedback loops, leverage points, system buffers, and the distinction between subsystem goals and overall system purpose.

Relevance: *Explains the reinforcing feedback loops that lead to boundary fixation and subsystem sub-optimisation (silos).*

9. Santos, F. M., & Eisenhardt, K. M. (2005). *Organisational Boundaries and Theories of Organisation*. *Organization Science*, 16(5), 491–508.

Synopsis: Synthesises four distinct organisational boundary perspectives: efficiency (costs), power (control), competence (resource dependence), and identity.

Relevance: *Groundwork for the monograph's taxonomy of functional, informational, social, and fiduciary domain architectures.*

10. Simon, H. A. (1962). *The Architecture of Complexity*. Proceedings of the American Philosophical Society, 106(6), 467–482.

Synopsis: Argues that complex systems naturally evolve into hierarchical, near-decomposable subsystems, allowing individual components to adapt locally without destabilising the whole structure.

Relevance: *Explains why specialisation and distinct boundaries are essential preconditions for system stability and evolutionary progress.*

11. The King's Fund (2024). *Making Integrated Care Systems Work: Governance, Boundaries, and System Leadership*. The King's Fund Reports.

Synopsis: Analyses operational progress, cultural friction, and governance hurdles across NHS Integrated Care Boards and Place-based Partnerships.

Relevance: *Directly grounds the theoretical framework in contemporary health strategy, NHS policy, and frontline system governance.*

12. Varela, F. J., Maturana, H. R., & Uribe, R. (1974). *Autopoiesis: The Organisation of Living Systems*. BioSystems, 5(4), 187–196.

Synopsis: Defines living systems as autopoietic network processes that generate and maintain their own physical boundaries to persist against environmental decay.

Relevance: *Grounding for defining boundaries as adaptive, self-generating membranes required for survival.*

13. Weick, K. E. (1995). *Sensemaking in Organisations*. SAGE Publications.

Synopsis: Explores how individuals and groups create meaning from environmental cues, establishing shared understandings, identity, and mental models within organisations.

Relevance: *Underpins informational boundaries—explaining why data integration alone does not create system integration without shared sense-making.*