

Is Network Theory Made of DSRP?

A Structural Decomposition of Nodes, Edges, Centrality, Communities, and Network Growth

Derek Cabrera^{a,@}

a: Cabrera Research Lab

@: dac66@cornell.edu

ABSTRACT: Network science is among the most portable representational traditions in modern science, and its primitives are among the fewest. A network is a set of nodes and a set of edges; from that pair the field derives degree, paths, components, clustering, centrality, communities, robustness, and the growth models that generate them. The abstraction descends from a single act performed by Euler in 1735, who solved the Königsberg bridge problem by deleting every measurable property of the city and keeping only which things exist and which are related. DSRP Theory makes a different and more elemental claim: that organization itself can be represented by four recursively entangled Patterns—Distinctions, Systems, Relationships, and Perspectives—composed of eight elemental roles and governed by four structural dynamics. This paper asks whether the constructs of network science introduce any organizational structure not already expressible by DSRP-484. Extending an earlier treatment that decomposed the node and the edge and derived counting heuristics for each Pattern, we execute a pre-registered structural-remainder test against a candidate set of thirty-five constructs drawn exclusively from the field's own vocabulary—Newman's canonical survey, Barabási's textbook, and Euler's founding paper—under the same fixed extraction rule and the same information/organization decision rule applied to system dynamics in the companion run. All thirty-five decompose, with no residual: nodes as Distinctions whose identity is a ledger of what they are and are not; edges as Relationships with action-reaction substructure, themselves reifiable as objects; paths as composed directed Relationships; components as Systems reconstructed from Relationships under a rule-Perspective; centrality as a Perspective on importance; preferential attachment as a reinforcing feedback loop closed through the attaching node's Perspective. The analysis also yields a finding the test was not designed to produce. Six of network science's load-bearing constructs—betweenness centrality, the boundary specification problem, the small-world rewiring effect, the scale-free disproportion, the isolated but contained member, and the hyperedge—work around part-whole and perspectival structure that the formalism's own primitives cannot represent. Every workaround succeeds; none revises the primitives. More broadly, the field's extensions collectively reconstruct the seven elemental roles Euler's traversal abstraction left implicit, often in combination, without introducing an organizational primitive outside DSRP-484. The field's signature findings run on organization its grammar denies. One legitimate network construct requiring a fifth irreducible Pattern, a ninth elemental role, or another irreducible structural dynamic would falsify the claim. None was found. Taken with the system dynamics run, ninety-five constructs across two independent traditions decompose to the same four Patterns—never a fifth, never a different four.

KEYWORDS: DSRP | DSRP-484 | network science | graph theory | structural decomposition | O-Theory | universal ontology | Euler | preferential attachment | formalism bias |

Cite this paper: Cabrera, D. (2026). Is network theory made of DSRP? A structural decomposition of nodes, edges, centrality, communities, and network growth. *Journal of Systems Thinking*, 6(1), 1–33.

<https://doi.org/10.54120/jost.v26i1.dc6ntsd6>

1. The Question Beneath the Graph

Network science begins with an act of subtraction. In 1735 Leonhard Euler was handed a puzzle about seven bridges in Königsberg and answered it by throwing away nearly everything the question contained. He discarded the width of the river, the length of the bridges, the size of the landmasses, the geography of the city — every measurable property — and kept only which pieces of land existed and which were connected to which [1]. What remained was a graph: four nodes, seven edges, and a theorem. The path the citizens sought does not exist, and its non-existence is not a fact about their ingenuity but a property of the structure [2].

That subtraction is the founding move of the field, and it is worth naming precisely what it removed and what it retained. Euler deleted the information and kept the organization. Two and a half centuries later the same abstraction carries the Internet, the cell, the citation graph, and the social world, and the field's canonical survey opens with the same two primitives: "A network is a set of items, which we will call vertices or sometimes nodes, with connections between them, called edges" [3]. Barabási's textbook states it as an inventory: "A network is a catalog of a system's components often called nodes or vertices and the direct interactions between them, called links or edges" [4].

Two primitives, then, and an enormous derived vocabulary: degree, path, geodesic, diameter, component, motif, clique, cycle, tree, clustering, centrality, assortativity, community structure, robustness, percolation, the degree distribution and its power-law form, the small-world effect, growth, preferential attachment, and the models that generate each. The question this paper asks is the one the field's success makes easy to skip: are the node and the edge elemental, or are they themselves organized?

A field can treat a construct as primitive for purposes of modeling without establishing that the construct is organizationally irreducible. Nothing in network science's practice requires the node to be an atom. It requires only that the node be stable enough to compute with — and it is. The question of elementhood is a different question, asked at a different level, and it is the question DSRP-484 puts on the table.

DSRP-484 is specified as four Patterns — Distinction, System, Relationship, and Perspective — containing eight elemental roles: identity/other, part/whole, action/reaction, and point/view. These operate through Equality, Coimplication, Simultaneity, and Enclosure [5–8]. Under Enclosure no Pattern is structurally independent: any instantiated Distinction requires System, Relationship, and Perspective; any System requires Distinction, Relationship, and Perspective; and so on [6]. DSRP-484 is therefore not four descriptive categories but a recursively generative structural calculus, and a calculus of that kind makes a claim that can fail.

A note about the notation used throughout this paper. The name DSRP-484 states the structure: four Patterns, eight elemental roles, four dynamics.

Distinction (D) — identity (D_i) and other (D_o). To draw a thing is to draw what it is not, and the reverse.

System (S) — part (S_p) and whole (S_w). To constitute a whole is to constitute parts, and the reverse.

Relationship (R) — action (R_a) and reaction (R_r). Every relation has two sides, and they need not be symmetric.

Perspective (P) — point (P_p) and view (P_v). Every view is taken from somewhere, and the point determines what the view contains.

Four dynamics govern how the roles behave. *Equality* holds the two roles of a Pattern at equal structural status, neither prior to the other. *Coimplication* holds that neither role can be instantiated without the other. *Simultaneity* holds that they arise together rather than in sequence. *Enclosure* holds that no Pattern is structurally independent: any instantiated Distinction requires System, Relationship, and Perspective; any System requires Distinction, Relationship, and Perspective; and so on for each. This is a summary in plain terms, for a comprehensive treatment of DSRP-484 see [5,6].

An earlier treatment took the first step for network theory, showing that a node is a Distinction whose identity is co-defined by what it is not, that an edge is a Relationship carrying action and reaction, that any edge can be regarded as a node and any node as a part, a whole, a point, or a view — and deriving from those rules counting heuristics for the maximal structure latent in any network of n elements [2]. That chapter established the direction of the decomposition. It did not execute a test. It examined the two primitives rather than the field's vocabulary, it pre-registered nothing, and it kept no residual category in which a failure could be recorded. This paper supplies what was missing.

2. Stand Where Euler Stood

Königsberg in 1735 was a Prussian city built where the Pregel divides. Two banks, an island in the middle, and a further tongue of land where the branches rejoined; seven bridges tying them together. The puzzle the citizens are said to have posed was not a question about networks, because there were no networks. It was a question about a walk: could you cross all seven bridges without crossing any of them twice (Figure 1)?

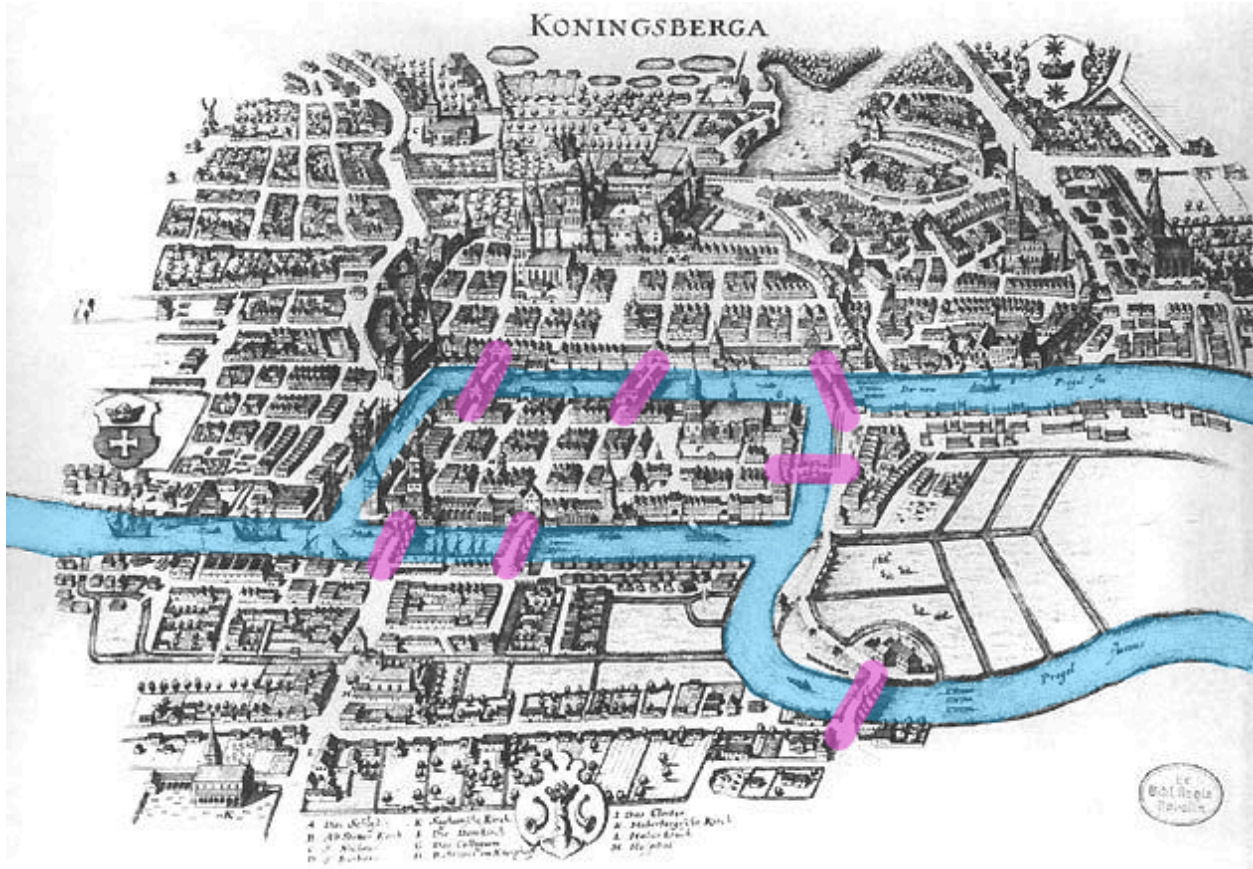


Figure 1. Königsberg, before the subtraction. Matthäus Merian's engraving of the city (c. 1652), with the Pregel tinted and the seven bridges marked. This is what Euler was handed: a river, four land masses, seven bridges, and a yes-or-no question. Everything visible in this image except which land masses exist and which bridges join them was deleted to produce the graph.[9]

To answer it he needed remarkably little. He needed the land masses to be tellable apart — this one, not that one — and he needed to know which bridges ran between which. Nothing else in the engraving bears on the question, and Euler threw all of it away.

The first section explained this as deleting the *information* and keeping the *organization*. That is true, and it is not the whole truth. He also deleted most of the *organization*, and the part he deleted is the part this paper is about.

Consider what the question let him ignore. He did not need a bridge to be a whole made of parts — and a bridge certainly is one, with piers and spans and a deck — because nothing about crossing depends on what a bridge is made of. He did not need to represent how a bridge joins to a land mass; this joint is a real structure, an abutment resting on a bank, and it is irrelevant to a walk. He did not need a land mass to be anything but a point, though each was a district full of streets and houses and people. And he did not need any perspective on the city at all — not the walker's, not the magistrate's, not Prussia's — because the question had already fixed the only perspective in play.

Stated in the notation of the previous section, Euler kept an identity, D_i , and a general relation R_{gen} with none of its own roles inside it. He left out seven: D_o , S_p , S_w , R_a , R_r , P_p , and P_v . One of the eight elemental roles (D_i) survives into the graph, together with a Relationship stripped of its internal structure (R_{gen}). That is the primitive set network science inherited. D_i = node. R_{gen} = edge

Every one of those omissions was earned, and it is worth seeing why, because the reason each was safe in Königsberg is the reason each fails everywhere else.

The other (D_o). Königsberg's land masses are exhaustively enumerated and mutually exclusive. What one is not is fixed completely by the list of the others, so D_o never needs a notation of its own. Take the same chassis to a cell, a citation graph, or a social world and the enumeration is no longer given: which nodes belong in the network becomes a live question with no place in the formalism to answer it. The field discovered this on its own and named it the boundary specification problem [10]. Note, too that the boundary problem is not singular (e.g., the boundary of the system) but fractal (i.e., it applies to every distinction existing in the network).

Part and whole (S_p , S_w). A traversal question does not care what a bridge or a district is made of. The omission of S_p and S_w costs nothing here. Take the same chassis to the brain, the cell, or an organization and nested composition is the entire subject matter — which is why, as later sections show, the field must rebuild the whole from relations as a component, and then keep rebuilding it as motifs, cliques, communities, hierarchies, and multilevel models.

Action and reaction (R_a , R_r). A footbridge is symmetric. You cross it either way, so R_a and R_r genuinely bundle and nothing is lost by leaving them undifferentiated. But take the same chassis to a food web, a citation graph, or a power grid and the asymmetry is the content. The field's repair is the directed edge — which recovers the asymmetry as a label placed on the edge, never as structure inside it. That is also why an edge cannot be an object in this formalism: a Relationship with no roles in it has nothing to reify. The line graph exists to supply what the primitive lacks.

Point and view (P_p , P_v). Perspective was not absent from Königsberg. It was constant. The point was fixed by the question itself — a walker who must cross each bridge exactly once — and the view was the traversal. A constant can be dropped from a notation at no cost whatever. Take the same chassis to systems where the perspective varies, and the constant becomes a variable with nowhere to live: what counts as important, which partition is the right one, who is inside the network, and how the network or its dynamics appear from different reference frames. Each of those, as later sections show, is answered by a Perspective the notation has no slot to declare.

There is one more thing the engraving conceals. Bridges became relations and land masses became identities, but nothing in the world required that assignment. A bridge is a whole made of parts and so is a district; either could have been the node. Network science eventually proved this to itself by inventing the line graph, in which edges become nodes — three centuries later, and as a transformation rather than a recognition. The network chassis presents a choice as though it were a given.

None of this is a criticism of Euler. His abstraction was not incomplete for Königsberg; it was exactly fitted to the problem at hand, and every omission was appropriate for the question he was answering. The difficulty is what happened next. A chassis tuned to a single traversal puzzle was taken up as the general form of relational structure and applied to the internet, the cell, the economy, the brain, and the social world — systems it was never designed for, and in which the omitted roles are precisely what matters. It is not wrong. It is incomplete. And the field has been patching that incompleteness ever since.

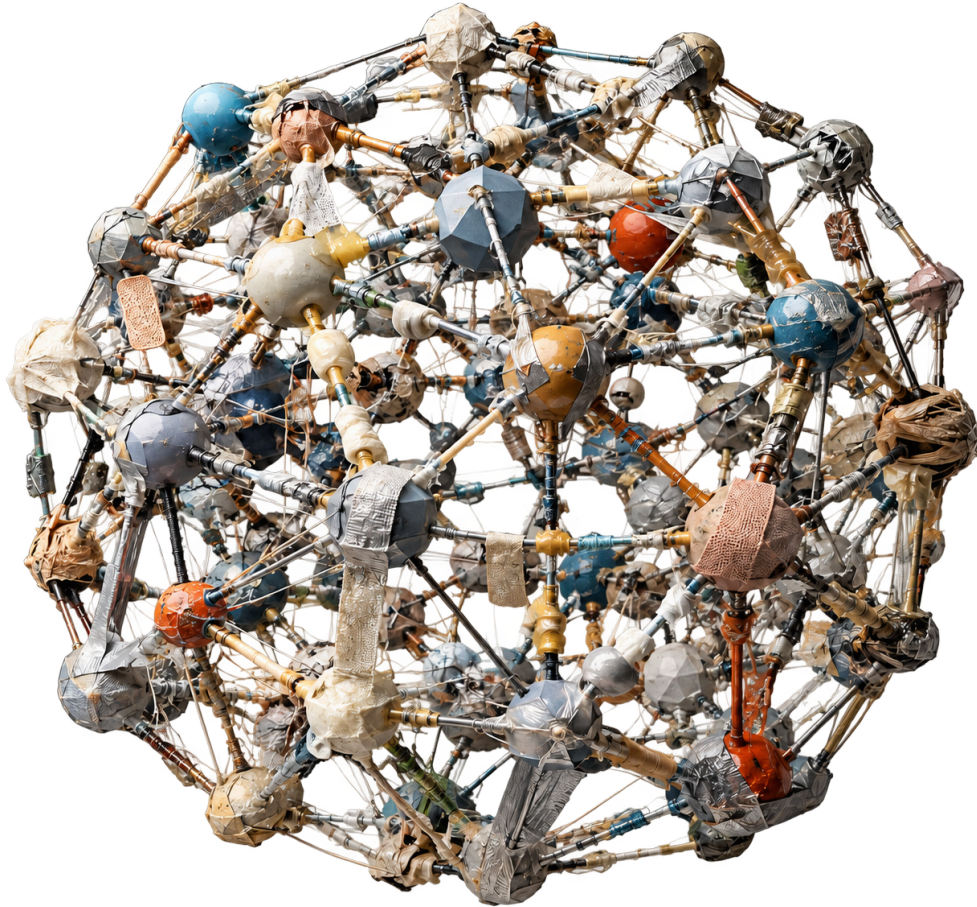


Figure 2. The repetition of patches is the evidence. When the ontology of the target contains structure that a sparse node–edge grammar does not natively represent, that complexity does not disappear; it migrates upward into special constructs, transformations, layers, types, and higher-order models. The evidentiary claim is not that network science has many extensions, but that independently developed extensions repeatedly reconstruct the same omitted organizational structures in different combinations and under different names. This recurring structural signature is the representational debt produced when the ontology of reality outruns the primitive grammar of the model.

That is the claim this paper puts to the test. If it is right, the patches should not look like independent inventions. Directed and weighted edges, hypergraphs, multiplex and typed networks, hierarchical and temporal models, the line graph, community detection, every competing centrality index — each should turn out to reconstruct one or more of the seven missing roles, often in combination, without requiring an additional organizational primitive. The sections that follow decompose the field's own vocabulary, construct by construct, and check.

3. Two Levels That Should Not Be Confused

The argument requires a distinction between information and organization. O-Theory expresses an organized target generally as:

$$X = I \cdot O$$

where (I) denotes informational content and (O) denotes its organization [5,7]. The present claim concerns principally the (O) term.

This matters because not everything in a network model should be expected to be "a DSRP Pattern." Edge weights are information. Degree sequences are information. Probabilities are information. Adjacency matrices are notation. Breadth-first search is an algorithm. Generating functions are mathematics. None needs to be redescribed as a fifth Pattern.

The relevant question is narrower: when those informational values and mathematical operations are organized into a network representation, does that organization require anything outside DSRP-484? For any network construct (c) we write:

$$c = I_c \cdot O_c$$

and test whether:

$$O_c \in \text{Cl}(\text{DSRP-484})$$

A decomposition fails only if some necessary organizational feature of (c) requires a structural primitive (X) such that (X) is not in DSRP-484 and cannot be generated by composition or recursion of D, S, R, and P.

We adopt without modification the decision rule pre-committed in the system dynamics companion run [11]. A feature is organizational if changing it changes what entities or relations exist, or how they are bounded, nested, or ordered. A feature is informational if changing it changes only the values assigned to a structure that remains fixed. The rule does real work in both directions, and network theory supplies clean cases of each. An edge weight is informational: doubling it assigns a different value to a relationship that continues to exist unchanged. Edge direction is organizational: making a symmetric edge directed changes which structure exists, without changing any value. A criterion that could only ever return "information" for inconvenient cases would be no criterion at all; this one can force the discovery of a residual.

Euler's founding act can now be restated in exactly these terms. He set the informational term to zero and kept the organizational term. The field's origin is itself an execution of $X = I \cdot O$, performed in 1735 by someone who had no such notation and needed none.

4. Analytical Method: The Structural Remainder Test

The test is the one specified in the companion run [11], with only the nominating sources changed. Its logic is a structural remainder test: a decomposition succeeds only when nothing organizational remains unexplained, and it is permitted to fail by leaving something over.

The candidate set $C_{networks}$ was fixed before any construct was examined, and it is drawn exclusively from documents the network science field itself authored as statements of its vocabulary or its foundations. Three nominators were pre-registered. First, Newman's "The Structure and Function of Complex Networks" [3] — the field's canonical survey, journal-published, with four hundred and twenty-nine references — supplying every term defined in its terminology box, every property and model its own abstract names as the field's subject matter, and every construct given a section-level definition. Second, Barabási's Network Science [4], the field's standard textbook, supplying terms it defines that Newman does not. Third, Euler's 1741 paper [1], supplying the constructs the field's origin act introduces: the graph abstraction, the node, the edge, degree parity, and traversal.

The authors added nothing to the candidate pool. The earlier DSRP treatment of networks [2] was deliberately excluded as a nominator: the DSRP side of a containment test must not be permitted to choose what the other side is asked to explain. A robustness check on the nominators themselves is available from the field's social-network branch: any construct defined in Wasserman and Faust's standard reference [12] but absent from the nominating sources can be appended to $C_{networks}$ under the same filter and ruled under the same criterion, without disturbing any existing ruling.

An entry enters $C_{networks}$ if it names a construct of network structure, network behavior or statistics, or the modeling relation — what a network model claims about a system. An entry is excluded only if it falls under one of the five pre-declared categories used in the companion run: a numerical or mathematical technique; a research practice or workflow; a representation or notation artifact; a general-language term with no field-specific definition in the nominating sources; or an imported theory from another discipline whose network-specific content is already carried by an included construct. Every exclusion is logged with its category. Nothing is dropped silently.

Synonyms the sources themselves equate — vertex/node/site/actor, edge/link/bond/tie, cumulative advantage/preferential attachment — are merged into one canonical construct with aliases recorded. No construct is split or renamed beyond this.

For every construct three questions are asked: what informational content is specific to it; what organizational structure is necessary for it to exist; and does that organization require a primitive outside DSRP-484? The hypotheses are:

$$H_A : \forall c \in C_{networks}, O_c \in Cl(DSRP-484)$$

versus:

$$H_0 : \exists c \in C_{networks} \text{ such that } O_c \notin Cl(DSRP-484)$$

Each construct is classified as D, S, R, P, a composite of these, purely informational, or X — a residual organizational primitive. The residual category is the point of the exercise. A test that cannot record a failure is not a test, and the decisive result is not a high percentage of matches but the existence or absence of X.

Applying the rule yields thirty-five canonical constructs and ten logged exclusions. Sections 5 through 15 decompose twenty-seven of them; Section 16 completes the remaining eight. The full instrument — rule, candidate set, proposed decompositions, construct-by-construct rulings, verbatim source definitions, and the exclusion log — is available upon request as supplementary material.

5. Nodes Are Distinctions

Network theory defines a node by assigning it a label. Newman's terminology box gives "the fundamental unit of a network, also called a site (physics), a node (computer science), or an actor (sociology)" [3]. The label is an identifier: node A is node A because it has been called A.

The Distinction Rule states that Distinctions are universally structured as co-implying elements: identity (i) and other (o). Applied to a node, this says something the label conceals. The identity of A is not exhausted by the name A. It includes everything A is not — A is not-B, not-C, not-D, not-(BCD) — and those negations are is-statements too [2]. To be a node in a network is to stand in a determinate relation of sameness and difference to every other node in it.

This is not a philosophical embellishment. It is what makes a node's context quantifiable, and it converts an intuition network scientists express informally — that a node is defined by its position — into structure that can be counted. Under the D-Rule, the identity of node A is a ledger of statements, and the ledger spans all four Patterns, not merely Relationships:

A is A. A is not-B, not-C, not-D. A is related to B, C, and D; A is not related to X, Y, Z. A is part of F. A is comprised of parts. A is seen by G. A sees K and G, but not R. And each of these holds according to some perspective, so that A may be related to C according to A and not related to C according to B [2]. We refer below to this full D/S/R/P ledger as A's contextual identity.

Two consequences follow immediately. The first is that a node's context is computable: the ledger is precisely the organization on which A's identity depends, which is what the Context equation $C = O(I|t_0)$ measures [13]. The second is that the ledger is mostly invisible to network theory. Of the statements above, the formalism records the positive relational ones and nothing else. It has no place to put A's non-connections, no place to put A's membership in a whole, and no place at all to put who sees A.

Residual organizational primitive: none identified.

6. Edges Are Relationships — and Relationships Are Objects

An edge is "the line connecting two vertices" [3]. Under the Relationship Rule, an edge is an R, and an R is not a bare line but a structure containing action and reaction. An undirected edge bundles both role assignments; a directed edge assigns them asymmetrically.

That asymmetry is the paper's cleanest organizational case. Newman's terminology box: "An edge is directed if it runs in only one direction (such as a one-way road between two points), and undirected if it runs in both directions" [3]. Changing an edge from undirected to directed changes which structure exists while changing no value whatever — organizational under the rule of Section 3, and the same ruling reached for causal links in the companion run [11]. Edge weight is the mirror image: a number attached to a relationship that persists unchanged when the number changes. Weight is information on organization, the network analog of link polarity.

The same point applies to edge type itself: treating two Relationships as the same kind of edge is a framing decision, not proof that the Relationships are organizationally identical.

Two further edge constructs fall out directly. A self-edge is a Relationship whose two relata are one Distinction — identity relating to itself — which the counting heuristics treat explicitly, and which is why the maximal R-count is $2n^2$ rather than $n(n-1)$ [2]. A multiedge is more than one R between the same pair; which relationships exist is organizational, while how many parallel ones there are is derived information.

The deeper move concerns what an edge is permitted to be. In DSRP any Relationship can be reified: an edge is itself distinguishable, can be decomposed into parts, can stand in relationships to other structures, and can be viewed from a perspective. Any edge can become a node [2]. Network theory does not grant this. In the formalism an edge exists only as the ordered or unordered pair (i, j) ; it has no identity of its own, no internal structure, and no capacity to relate or be related to.

And yet the operation exists. The line graph $L(G)$ — in which the edges of G become the nodes of $L(G)$, adjacent when they share an endpoint — is a standard construction, invented precisely because analysts needed to treat relationships as objects. DSRP predicts that a formalism which forbids R-reification will have to reinvent it as a transformation. It has been reinvented, it is taught, and it is used.

Hyperedges require more structure than the primitive edge can express directly. Newman introduces them in the same discussion that supplies the field's other edge variants: "One can also have hyperedges—edges that join more than two vertices together. Graphs containing such edges are called hypergraphs" [3]. His example is a family: n individuals "connected to each other by virtue of belonging to the same immediate family could be represented by an n -edge joining them" [3].

Read that example against the word chosen to hold it. What is being asserted is that n people belong to one family. No pairwise fact is claimed at all — the family is not a bundle of two-person ties, and decomposing it into ties loses the very thing being said. This is membership in a shared whole: part and whole, asserted directly and without any relation between the parts. It is not a Relationship of any arity.

The formalism, having no primitive for a whole, calls it an edge, because "edge" is the only word its grammar has for more-than-one-thing-together.

The field's own repair confirms the reading. The standard treatment of a hypergraph is to redraw it as a bipartite graph, one class of vertices for the individuals and another for the groups they belong to [3]. That construction performs exactly the move the System Rule requires: it makes the whole into a Distinction, and it makes membership into a Relationship running from each part to it. Network science does recover the System — but only by first converting it into a node, because a node is the only thing the notation can hold.

The hyperedge is therefore the mirror image of the line graph. There, a Relationship needed to become an object, and the formalism supplied a transformation to accomplish it. Here, a whole needs to become an object, and the formalism supplies another. Two workarounds, one cause: a grammar in which only identity and an undifferentiated relation are primitive.

Residual organizational primitive: none identified.

7. Degree Is the Shadow of an Identity Ledger

Degree is "the number of edges connected to a vertex" [3], with in-degree and out-degree distinguished when edges are directed. It is the most-used quantity in the field and the most easily misread.

Degree is a count, and counts are information computed over organization. But Section 5 shows what is being counted. Each edge incident on A is an is-statement constituting A's identity; k is therefore the cardinality of the positive relational slice of the identity ledger. Network theory treats k as external information about a node whose identity was settled by its label; under the D-Rule those same facts are what the node is.

The reading has teeth, because it identifies what k omits. The negative half of the ledger — the $n - 1 - k$ nodes A is not connected to, equally definitional under the D-Rule — is invisible to degree. So are the membership statements and the perspectival statements. Degree is a one-dimensional projection of a four-dimensional ledger, which is exactly why it fails in the cases examined in Sections 11 through 13.

That degree nonetheless carries genuine organizational consequence is established by the field's founding theorem. Euler showed that whether a walk crossing every bridge exactly once can exist is fixed by degree parity: such a path "cannot exist on a graph that has more than two nodes with an odd number of links" [1,4]. A derived informational quantity determines which organizational arrangements are possible. Network theory's first result is already a statement about I/O coupling, and it was proved before either term existed.

Residual organizational primitive: none identified.

8. Paths Are Composed Relationships

"A path is a route that runs along the links of the network. A path's length represents the number of links the path contains" [4]. A path is therefore a composition of Relationships into an ordered chain — the same machinery by which the companion run generates temporal order from directed relationships, and order among the contents of a stock [11]. Order among Rs is organizational; the number of links in the chain is information.

A geodesic is "the shortest path through the network from one vertex to another" [3]. Three things are layered here: the path organization, the comparative information of length, and a criterion of minimality that must be supplied from outside the structure. Which path counts as "the" path between two nodes is what a minimality Perspective picks out; change the cost criterion and a different path is selected while the network stands unchanged. That the field's default criterion — fewest links — is so natural as to be invisible does not make it absent.

A cycle is "a path with the same start and end node" [4]: a chain of relationships composed back onto its origin. Closure is organizational, and it is worth pausing on the fact that this is the identical structural fact that makes a feedback loop a structure in system dynamics [11]. Two fields, two vocabularies, one closure. Neither had to be translated into the other; both decompose to the same composition of directed Rs.

Residual organizational primitive: none identified.

9. Components Are Systems Reconstructed from Relationships

"The component to which a vertex belongs is that set of vertices that can be reached from it by paths running along edges of the graph" [3]. A component looks like a whole that nobody drew: follow the relationships and a bounded set falls out.

The construct is doing two things at once, and both must be said. It is a Perspective whose rule is "related means same whole": under that rule the Relationships generate a System and its boundary Distinction. The boundary is derived from the R-structure rather than imposed by a modeler — the converse of the boundary in system dynamics, which is drawn under a purpose-Perspective [11]. Two routes, one D+S structure, arrived at from opposite directions.

But the rule that makes this work is a special case of System, not the general one. In DSRP, membership is independent of connection. A whole may contain parts x, y, and z that are related to one another and a part p that is related to nothing — contained, but unconnected. Network theory cannot draw that. Under its rule the unrelated member is not a member: it becomes its own component of size one. The formalism has no way to say that something belongs to a system without being wired into it.

The component is thus best described as the field's reconstruction of a missing primitive. Lacking a native System, network theory derives one from Relationships plus a rule-Perspective — and inherits, as the

price, a blind spot precisely where membership and connection come apart. The size of a giant component, "an extensive (i.e., $O(n)$) fraction of all vertices are joined together in a single giant component" [3], is then information about that reconstructed whole.

If the candidate set contains a natural point of attack, it is in components. The component is the only construct whose ruling runs in both directions at once, and the one place where the field's construct genuinely diverges from the general Pattern it reconstructs: the general System permits a member related to nothing, and the component cannot. A reader hunting for a residual should hunt here. What the divergence yields, however, is the reverse of a counterexample. The component is not more than a System; it is less — a System constrained to connectivity — and a restriction of a Pattern is not an addition to one.

Residual organizational primitive: none identified.

10. Motifs, Cliques, and Communities: Part-Whole Structure Bolted On

Once a System has been reconstructed from Relationships, network science needs it repeatedly, and each need produces another construct.

A motif is a recurrent small subgraph — Newman describes the analysis that "picks out recurrent motifs — small subgraphs — from complete networks" [3,14]. Structurally a motif is a sub-System: a network nested inside a network, part-whole recursion applied to organization itself. And it is more specifically a generic structure — the same $S(R)$ pattern re-identified across instantiations, same organization filled with different information — which is the identical construct system dynamics calls a generic or transferable structure [11]. The convergence here is not analogical. It is the same decomposition twice.

A clique is a sub-System of maximal relational density: "In a complete graph each node is connected to every other node... A complete graph is often called a clique" [4]. It is defined purely as a constraint on which relationships exist.

Community structure is the most telling of the three. "A community is a locally dense connected subgraph in a network" [4]; Newman describes "groups of vertices that have a high density of edges within them, with a lower density of edges between groups" [3,15]. Decomposed: the partition into nested sub-Systems is organization; the modularity score is derived information; and which partition counts as best is settled under a Perspective, since a network admits many partitions and the algorithms disagree. Barabási's fundamental hypothesis — "A network's community structure is uniquely encoded in its wiring diagram" [4] — is an explicit wager that the S can be recovered from the R 's alone.

The counting heuristics make the size of the space that wager searches exact. For n root identities the number of possible part-whole groupings is $2^n - 1$ [2]. Community detection is a search through that space under a scoring Perspective, which is why the field has produced so many algorithms and why they disagree: they are different Perspectives on the same possibility space, not competing measurements of one fact.

A formalism with no native part-whole primitive keeps discovering that it needs one, and keeps reconstructing it through derived constructs.

Residual organizational primitive: none identified.

11. Centrality Is a Perspective

Centrality answers the question "which node matters most?" and the field's answer is that it depends what you mean. Degree centrality ranks by connection count. Betweenness centrality — the only index Newman defines formally — is "the number of geodesic paths between other vertices that run through i " [3,16]. Closeness ranks by proximity to everyone; eigenvector centrality and PageRank rank a node by the rank of its neighbors, importance defined recursively.

These are not competing estimates of a single quantity. On a fixed network they disagree, and the disagreement is not resolvable by looking harder at the wiring, because nothing in the wiring says what importance is. Centrality is therefore a Perspective: a point — the chosen meaning of importance — whose view is a ranking of the nodes, filled with derived information. Each index is a distinct sub-Perspective, and each sees its own ordering while ignoring the others. This is structurally the same ruling reached for system order and behavior modes in the companion run [11].

Consider two dense clusters joined by a single node with exactly two edges, one into each cluster. Its degree is near the minimum in the network; its betweenness is near the maximum; delete it and the network falls in half. Degree fails here for a precise reason: the formalism is flat, and it does not recognize that this node is functioning as a Relationship between two Systems. Its importance does not live at the node level at all. It lives one level up, in a part-whole structure the graph does not represent.

Betweenness recovers the right answer by counting paths. But notice what that means: the measure succeeds by counting a consequence of structure the formalism cannot draw. The number of geodesics through a node is the numerical shadow of an S-level Relationship. Network science is measuring organization it has no vocabulary for — and getting it right.

Residual organizational primitive: none identified.

12. Scale-Free Structure: Two Systems That Do Not Officially Exist

"A scale-free network is a network whose degree distribution follows a power law" [4,17]. Newman adds the careful qualification that "it is only their degree distributions that are scale-free" [3]. The degree distribution itself — the fraction p_k of vertices having degree k [3] — is population-level information: structure in, statistics out.

The power-law form is then a signature over that population, and classifying networks by the shape of their distribution is a Perspective on shape, each classification seeing its own form and ignoring others —

the population-level counterpart of the behavior-mode ruling in the companion run, where the same treatment applied to shapes over time [11].

But the construct carries a second content that the distributional reading conceals. What a power law asserts is a disproportion: one set of parts has vastly more effect on the whole than another set of parts. That is a part-whole claim. It says that within the system there are two sub-Systems — informally, the twenty and the eighty — that behave differently and matter differently. Those sub-Systems are operational: they determine robustness, spreading, and search behavior across the entire literature. And they are unrecognized by the formalism, which has no grouping primitive in which to declare them. Hubs, "nodes with an exceptionally large number of links" [4], are the members of one of these unofficial wholes, distinguished by extreme derived information under a threshold nobody in the formalism sets explicitly.

The same disproportion, at the level of cognition rather than networks, is the Cognitive Pareto Bias — confirmed in the frequencies with which the four Patterns appear in published scientific results across thirteen disciplines [18].

Residual organizational primitive: none identified.

13. Small Worlds Work Because Shortcuts Relate Systems

The small-world effect is "the fact that most pairs of vertices in most networks seem to be connected by a short path through the network" [3]; formally, mean distance grows with the logarithm of network size rather than with size itself [4]. Clustering or transitivity is the companion statistic: "if vertex A is connected to vertex B and vertex B to vertex C, then there is a heightened probability that vertex A will also be connected to vertex C. In the language of social networks, the friend of your friend is likely also to be your friend" [3].

Both are derived information over fixed organization — counts of triangles and averages of path lengths. But triadic closure read as a mechanism rather than a statistic is a Perspective claim. The likelihood of seeing your friend is high, so the likelihood of seeing your friend's friend is also high: closure happens where views overlap. The shared node's view brings the two endpoints into each other's view, and the existing two-path raises the probability that a new relationship comes to exist. That is $\Delta I \rightarrow \Delta O$ — information steering which organization comes into being — the same gateway identified for loop dominance in the companion run [11].

The Watts–Strogatz model makes the point structurally. It "interpolates between a regular lattice, which has high clustering but lacks the small-world phenomenon, and a random network, which has low clustering, but displays the small-world property," by rewiring each link with probability p [4,19]; the monograph-length treatment is Watts [20]. Take the canonical ring, with each node connected to its near neighbors, and rewire one edge to connect two nodes on opposite sides. Distances collapse. Why?

Because the new Relationship changes the organization from which higher-order structure can emerge. In a purely abstract ring, "left half" and "right half" are merely possible partitions under a Perspective; they should not be treated as pre-existing Systems simply because an analyst can name them. But in real systems, changed relational organization can generate stable part-whole structure that becomes

behaviorally consequential. A collection of related agents can become a group, organization, town, fungal mat, grove, or other persistent whole whose identity and effects remain even as particular lower-level Relationships change. Under the emergence formulation $E=\Delta O$, changed behavior is downstream of changed organization; under DSRP-484, a persistent emergent whole is itself recursively organized and can be represented as a new Distinction with its own other, parts, Relationships, and framing. [21] The network-theory issue is therefore not that a shortcut mysteriously relates two Systems that were always there. It is that a flat node-edge representation can generate or reveal higher-order organization without natively promoting that new whole into the model's ontology. When the emergent structure becomes real and consequential, the model must reify it through additional machinery. The small-world case is therefore a compact example of ontological updating under model–reality pressure.

Residual organizational primitive: none identified.

14. Growth and Preferential Attachment

"Real networks are the result of a growth process that continuously increases N . In contrast the random network model assumes that the number of nodes, N , is fixed" [4]. Growth is organization changing over time: a sequence of node and edge additions ordered by composed directed Relationships.

The structure is stated exactly by writing the growth rule as a Relationship between the network at one time and the network at the next:

$$S_t \xrightarrow{R_\Delta} S_{t+1}$$

The rule is that Relationship's identity; the delta — which nodes and edges come to exist, which new is-statements enter the ledger of Section 5 — is its content. This is the same schema as the stock's relationship to its own prior state in system dynamics, with one difference: the stock's self-relationship carries a change in information, while the network's carries a change in organization [11].

Preferential attachment specifies the rule. "In real networks new nodes tend to link to the more connected nodes"; the result is that "hubs are the result of a rich-gets-richer phenomenon" [4,17,22]. Decomposed: current degree raises the probability of acquiring new relationships, which raises degree. That is a reinforcing feedback loop. Not analogous to one — identical to one. What system dynamics draws as a positive loop, network science writes as an attachment kernel $\Pi(k)$, and the two notations describe the same organization [11].

The loop closes through a Perspective, but not necessarily a conscious observer. The attachment rule frames candidate nodes in terms of degree: higher-degree nodes are assigned a greater probability of receiving the new edge. In agentic systems that framing may literally be instantiated in what an attaching agent can sense or know; in the abstract Barabási–Albert model it is encoded in the rule itself. The mechanism is degree $\rightarrow$ degree-framed attachment probability $\rightarrow$ attachment $\rightarrow$ higher degree. Preferential attachment is therefore the construct in which all four Patterns appear at once: Distinctions being attached, a System growing, Relationships forming with action and reaction, and a Perspective framing which nodes are preferentially selected.

Residual organizational primitive: none identified.

15. Models Are Claims, Not Structures

Three generative models are named by the field as its own subject matter [3], and all three decompose the same way: as claims about organization rather than instances of it.

"A random network consists of N nodes where each node pair is connected with probability p " [4]; Newman states the recipe as "Take some number n of vertices and connect each pair (or not) with probability p " [3,23]. What the model asserts is a generative rule advanced to explain observed statistics — the network analog of a dynamic hypothesis [11]. The ensemble it defines is a set of possible organizations weighted by information. The Watts–Strogatz model, treated in Section 13, is a second such rule, parameterizing an explicit change of organization by an informational quantity.

Taken alone, p is information: it assigns no edges and fixes no structure, and changing it leaves every possible graph exactly as possible as it was. What p fixes is a distribution over organizations — which graphs are likely, not which graph exists. Yet something genuinely structural does follow from it. Vary p and the organization does not merely become more or less probable; at a critical value it changes in kind, and a giant component appears where before there were only small clusters. That is the $\Delta I \rightarrow \Delta O$ coupling identified for triadic closure in Section 13 and treated as its own construct in Section 16.7, and the random-graph model is where the field first mapped it. A parameter that steers which organization comes into being is not a fifth Pattern. It is the join between the two terms of the decomposition, and the decision rule of Section 3 is what makes that join visible rather than hiding it inside the word "model."

The configuration model makes the information/organization distinction especially clear. It begins, in Newman's words, "Suppose we specify a degree sequence $k_1, k_2, \dots, k_n$ for the vertices of our network" [3], and then randomizes which relationships actually exist subject to that constraint. As the field's standard null model it answers the question: which of these findings follow from the degree sequence alone, and which require more?

Read structurally, the configuration model holds the information fixed and varies the organization. That is the $X = I \cdot O$ split executed as a laboratory operation. Network science does not merely admit the distinction between information and organization — its everyday method of separating real findings from artifacts depends on being able to hold one constant while varying the other. The distinction this paper uses to decompose the field is one the field already uses to police itself, without a name for it.

Residual organizational primitive: none identified.

16. Completing the Decomposition: The Remaining Eight Constructs

Sections 5 through 15 decomposed twenty-seven of the thirty-five constructs extracted under the rule of Section 4. This section completes the test by decomposing the remaining eight. Each entry names the

construct with its merged aliases, quotes the field's own definition, performs the decomposition under the decision rule of Section 3, and closes with the same verdict language used in Table 1.

16.1 Diameter. The diameter is "the length (in number of edges) of the longest geodesic path between any two vertices" [3]. It is a single summary quantity over the whole System: a maximum taken across the set of geodesics, each of which was itself decomposed in Section 8. Changing the diameter is not something one can do directly; it is a readout that changes when the organization changes. Purely informational, and derived. Residual organizational primitive: none identified.

16.2 Tree (forest, acyclic graph). Neither nominator gives a boxed definition; Newman defines the governing contrast, that graphs "can be either cyclic, meaning they contain closed loops of edges, or acyclic meaning they do not" [3], and Barabási uses trees throughout the analysis of random-graph regimes [4]. A tree is therefore an S(R) with closure forbidden. "No cycles" is a rule about which Relationships may exist, which is organizational by the Section 3 rule, and the construct is the structural complement of the closure case in Section 8. Residual organizational primitive: none identified.

16.3 Bipartite (two-mode) network. "A bipartite graph (or bigraph) is a network whose nodes can be divided into two disjoint sets U and V such that each link connects a U-node to a V-node" [4]; Newman describes "graphs that contain vertices of two distinct types, with edges running only between unlike types" [3]. Two decomposable features are present. The typing of nodes is a Distinction drawn on the Ds themselves. The constraint that edges run only across the type boundary is a rule about which Rs may exist between which kinds of parts — a typed-relationship constraint, structurally identical to the rule in system dynamics that an information connector may terminate on auxiliaries and flows but never on stocks [11]. Residual organizational primitive: none identified.

16.4 Degree distribution. "We define p_k to be the fraction of vertices in the network that have degree k. Equivalently, p_k is the probability that a vertex chosen uniformly at random has degree k" [3]. The degree distribution is a population-level frequency profile of a derived quantity — information computed over information computed over organization. Structure goes in and statistics come out; no new organization is introduced. Its functional form is the separate construct treated in Section 12. Residual organizational primitive: none identified.

16.5 Mixing patterns / assortativity. "In social networks this kind of selective linking is called assortative mixing or homophily" [3]. As a statistic, assortativity is a correlation computed across Relationships between attributes of their endpoints: information on fixed organization. As a mechanism, homophily is the $\Delta I \rightarrow \Delta O$ gateway again — attribute values steering which Relationships come to exist — and structurally it is the same move as triadic closure in Section 13, differing only in which informational feature does the steering. Residual organizational primitive: none identified.

16.6 Network resilience / robustness. "The structure of the underlying network plays an essential role in a system's ability to survive random failures or deliberate attacks" [4]. Resilience is the response of derived structure — components, geodesics — to the deletion of Distinctions or Relationships: change of organization by removal. The random-failure case deletes by chance, which is information. The attack case is more interesting: "we first remove the highest degree node, followed by the node with the next highest degree and so on" [4], which is deletion in an order supplied by a centrality ranking — that is, by

a Perspective (Section 11). Organization, information, and perspective appear in a single construct. Residual organizational primitive: none identified.

16.7 Percolation. "If p approaches a critical value p_c , these small clusters grow and coalesce, leading to the emergence of a large cluster at p_c . We call this the percolating cluster"; and inversely, "this fragmentation process is not gradual, but it is characterized by a critical threshold f_c ... Once f exceeds f_c , the giant component vanishes" [4]. Percolation is threshold behavior of component structure as nodes or edges are occupied or removed with probability p . At a critical value of an informational parameter, a qualitatively different organization appears or disappears. This is $\Delta I \rightarrow \Delta O$ at a threshold — the same event system dynamics calls a shift in loop dominance, and the mechanism behind S-shaped growth [11]. That two fields discovered the same coupling in different vocabularies is itself a convergence datum. Residual organizational primitive: none identified.

16.8 Dynamical processes on networks. Newman names "processes taking place on networks" as a principal division of the field's subject matter [3], and Barabási observes that despite their diversity "these spreading processes obey common patterns and can be described using the same network-based theoretical and modeling framework" [4]. Decomposed: state information on the Distinctions, updated along the Relationships by a rule — the network counterpart of simulation, which is a computational operation performed on decomposed structure rather than a new kind of organization [11]. Two features deserve note. Epidemic thresholds tie the process's information dynamics to structural statistics, coupling I and O once more. And navigation with local knowledge — the finding that ordinary people can find short paths they cannot see — is traversal under a limited Perspective, in which the agent's view is its own neighborhood. The compartment models themselves (SIR, SIS) are excluded as imported theory under the rule of Section 4. Residual organizational primitive: none identified.

16.9 Tally. Thirty-five constructs entered the candidate set. Sections 5 through 15 decomposed twenty-seven; this section decomposed eight. Four had been decomposed in the precursor chapter and one partly [2]; two are composites of already-decomposed elements; three are purely informational. Every construct received a ruling. The residual category X contains nothing. Combined with the sixty constructs of the system dynamics run [11], ninety-five constructs across two independent traditions have now been decomposed under a common pre-registered protocol without a residual.

17. The Decomposition in One Table

Table 1. Structural Decomposition of Network Science Constructs Each construct is stated in the field's own terms, decomposed under the rule of Section 3, and assigned a verdict on whether a residual organizational primitive is required.

Network construct	Primary network-science function	DSRP-484 decomposition	Additional organizational primitive required?
Network / graph	Represents a system as relations	System (S) of Distinctions (D) carried by Relationships (R), framed under P	None identified
Node / vertex	Fundamental unit	Distinction (D): identity co-defined by other; ledger across all four Patterns	None identified

Network construct	Primary network-science function	DSRP-484 decomposition	Additional organizational primitive required?
Edge / link	Connects two nodes	Relationship (R) with action-reaction substructure; reifiable as D	None identified
Edge direction	One-way vs two-way	Asymmetric assignment of action and reaction roles	None identified
Edge weight	Strength or capacity	Information (I) attached to an existing R	None identified
Self-edge	Node relating to itself	R whose two relata are one D	None identified
Multiedge	More than one edge on a pair	Which Rs exist is O; how many parallel Rs there are is derived I	None identified
Hyperedge / hypergraph	Edge joining more than two nodes	Membership in a shared whole (Sp, Sw) asserted with no pairwise R; the bipartite redraw makes the whole a D with membership Rs	None identified
Degree	Count of incident edges	Derived I over identity-making O; positive slice of the D-ledger	None identified
Degree distribution	Frequency profile p _k	Population-level I computed over derived I over O	None identified
Path / walk	Route through the network	Composition of Rs into an ordered chain	None identified
Cycle	Path returning to its origin	Composition of directed Rs closed onto its start – the same closure as a feedback loop	None identified
Eulerian path	Traversal using each edge once	Existence of an O-arrangement fixed by derived I (degree parity)	None identified
Geodesic	Shortest path	Path O + comparative I + minimality criterion under P	None identified
Diameter	Longest geodesic	Summary I over the whole S: a maximum across geodesics already decomposed	None identified
Component	Set reachable by paths	S with boundary D derived from R-structure under a rule-P	None identified
Tree / forest	Graph without cycles	S(R) with closure forbidden – a rule on which Rs may exist	None identified
Bipartite / two-mode network	Two node types, edges only across	A D drawn on the Ds, plus a typed-R constraint on which kinds of parts may relate	None identified
Motif / subgraph	Recurrent small structure	Sub-S re-identified across instantiations: same O, different I	None identified
Clique / complete graph	Maximal relational density	Sub-S defined purely as a constraint on which Rs exist	None identified
Community structure	Densely connected groups	Partition into nested sub-Ss (O); modularity (I); best partition under P	None identified
Centrality	Node importance	Perspective: point = meaning of importance, view = ranking filled with derived I	None identified
Scale-free / power law	Degree distribution form	I-signature over the D-population; part-whole disproportion of two sub-Ss	None identified

Network construct	Primary network-science function	DSRP-484 decomposition	Additional organizational primitive required?
Hub	Node with exceptionally many links	Member of an unofficial sub-S, marked by extreme derived I under a threshold nobody sets explicitly	None identified
Clustering / transitivity	Triangle density; closure	Derived I over local O; closure mechanism is $\Delta I \rightarrow \Delta O$ under overlapping views	None identified
Mixing / assortativity	Correlation across endpoint attributes	I on fixed O as a statistic; $\Delta I \rightarrow \Delta O$ as a mechanism	None identified
Small-world effect	Short paths, high clustering	Composite I-signature over fixed O	None identified
Watts–Strogatz model	Interpolates lattice toward random	Claim about possible Os parameterized by an I (rewiring probability)	Model, not new O
Network growth	Structure changing over time	Directed R from the whole-at-t to the whole-at-t+1, carrying ΔO	None identified
Preferential attachment	Rich-get-richer growth	Reinforcing loop of Rs closed through the attaching node's P	None identified
Percolation	Threshold fragmentation	$\Delta I \rightarrow \Delta O$ at a critical value: giant S appears or vanishes	None identified
Network resilience	Response to node or edge removal	ΔO by deletion; the attack case orders removals by a centrality P	None identified
Random graph model	Generative null	Claim about possible Os weighted by I, asserted from a P	Model, not new O
Configuration model	Degree-constrained null	I clamped, O randomized subject to it — the $X=I \cdot O$ split as method	Model, not new O
Dynamical process	Spreading, search, sync	State I on Ds updated along Rs by a rule	Computational procedure, not new O

The result is not that every network construct corresponds one-to-one with one DSRP Pattern. That would be the wrong theory. The result is that the constructs are composites generated through DSRP organization, and that the compositions are the ones the field's own definitions describe.

18. Network Theory Is Not Displaced

Nothing in this analysis says that nodes, edges, components, or preferential attachment stop working. Euler's bridges still admit no traversal. Percolation thresholds still hold. PageRank still ranks. The hundreds of empirical findings the field has produced are untouched by a claim about the level at which their vocabulary is organized.

What the decomposition denies is only the primitiveness of the primitives — a claim network science has rarely made explicitly and does not need. Stocks and flows stood as sound compounds in the companion run, and nodes and edges stand the same way here. They are stable, computable, and enormously productive higher-order constructions whose internal structure can nevertheless be decomposed.

Computational utility and structural fidelity are different questions: a workaround can preserve the former while increasing representational indirection in the latter.

The decomposition also helps explain why the field's results work. Betweenness works because it counts a consequence of an S-level Relationship. Small-world rewiring works because changes in relational organization can generate or reveal higher-order structure. Community detection works because part-whole structure can be recovered from relational organization, and the possibility space it searches has a known size. These are not criticisms. They are accounts of mechanism that the formalism's own vocabulary does not explicitly represent.

The relationship is the one stated for system dynamics: not displacement, but a domain-specific quantitative instantiation of a more elemental organizational calculus.

19. Formalism Bias: The Structures a Flat Grammar Cannot See

Every formalism is itself a Perspective. It over-sees the structures it implements and cannot see the structures it lacks. This is not a defect peculiar to network science; it is what having a grammar costs. But the specific shape of network theory's blindness is now visible from the decomposition, and it is worth stating plainly, because it predicts what the field has had to build. Section 2 named the shape of that blindness in advance: seven of the eight elemental roles were left out of the founding abstraction. What follows is what each omission looks like from inside the field.

First, the other. A node has an identity and no counterpart. The formalism records what a node is connected to and keeps no account of what it is not: there is no negative half of the ledger, and no way to state where the node set ends. D_o is the missing role, and the field met its absence directly enough to give it a name — the boundary specification problem [10]. Sampling frames, snowball designs, and boundary rules are the repairs.

Second, part and whole. Every system is projected onto one level of typeless nodes. Nested composition has no native representation and must be recovered from outside — as the component, as community structure, as hierarchical and multilevel models. S_p and S_w are the missing roles.

Third, action and reaction. This omission shows two faces, and the decomposition is what reveals them as one. Because an edge carries no internal action-reaction structure, it cannot express asymmetry natively; direction has to be attached as a label on the edge rather than found inside it. And because it has no internal structure at all, there is nothing in it to reify: an edge exists only as the pair (i, j) , with no identity of its own, no parts, and no capacity to relate or to be viewed. Typed and multiplex networks repair the first face and the line graph repairs the second, which is why they have been treated as answers to two different limitations. They are one omission. R_a and R_r are the missing roles.

Fourth, point and view. The point-view framing structure never appears natively in the formalism. Every importance measure and every community score brings a Perspective back in as an index or criterion, and

that framing can remain invisible precisely because there is no primitive slot in the notation to declare it. P_p and P_v are the missing roles.

These omissions predict the extensions the field has had to build — hypergraphs, multiplex and typed networks, hierarchical and bipartite structures, temporal networks, and the higher-order and simplicial models now growing quickly around non-pairwise interaction [24]. The extensions do not restore the seven roles one-for-one. Individual constructs often reconstruct combinations of omitted roles, but across the ecology of extensions the full omitted set reappears. Bias, on this reading, is not a complaint about the field. It is a finding of the test: what a formalism cannot represent shows up as structures its practitioners repeatedly rebuild.

The hypergraph is the cleanest case of all, and it was decomposed as a construct in its own right in Section 6. Non-pairwise interaction is among the fastest-growing areas of contemporary network science [24], and what that literature is growing toward is a primitive for the whole. The field has been building the missing role for two decades under a name that describes it as a kind of edge.

The same lens must be turned on system dynamics, and was: that tradition goes looking for feedback loops, stocks, flows, and nonlinearity even where they are absent and where simpler structures would do; it imposes continuous aggregated accumulation on phenomena that are discrete and individuated; and it holds endogeneity as doctrine, defining outside structure away rather than finding it absent [11]. Each bias is a Perspective trained on one structure family whose view fills with its own pattern.

Extensions arise when the inherited grammar is insufficient for a modeling problem. A formalism that lacks a structure but never needs to represent it has no reason to change. Network science has repeatedly had to accommodate wholes, boundaries, asymmetry within Relationships, and framing because those structures matter in the phenomena it models. The pressure comes from the target systems.

The historical record therefore provides a second kind of evidence. The decomposition in this paper is performed by analysts who know DSRP. The extensions were developed independently by network scientists solving field-specific problems. If those independently developed solutions repeatedly reconstruct the same omitted structures, that convergence is evidence that does not depend on the analyst's prior commitment to DSRP.

And the extensions have a shape. As network science moved from Königsberg to the internet, the cell, the brain, citation systems, and the social world, the seven roles Euler's problem allowed the abstraction to leave implicit reappeared in combinations across the field's extensions. On the evidence assembled here, no extension requires an organizational primitive outside D, S, R, and P. That claim is checkable: name an extension whose necessary organization requires something else. The historical trajectory is therefore a retrospective test; Section 20 turns the same logic forward into prospective predictions and falsifiers.

20. Reflexivity and Prediction

The bias argument cuts both ways. DSRP is also a formalism, so the obvious objection is that a DSRP analyst may find D, S, R, and P everywhere simply because those are the structures the formalism is built to see. Thirty-five decompositions out of thirty-five could indicate structural containment. They could also indicate a language flexible enough to redescribe anything after the fact.

DSRP is wildly flexible. That is part of the claim: a small set of structures recursively generates highly adaptive organization in both thought and reality. But flexible is not the same as vague. DSRP-484 and the Unified Calculus specify four Patterns, eight elemental roles, their special Relationships, and four structural dynamics—Equality, Coimplication, Simultaneity, and Enclosure [5–8]. A Distinction is not anything that looks vaguely different; it is identity–other. A System is part–whole. A Relationship contains action–reaction structure. A Perspective is point–view framing. The dynamics then specify what must also exist when any of those structures exists. The theory therefore has very little freedom to redefine its constructs when a difficult case appears.

That specificity matters because description alone would not be enough. If DSRP could only redescribe structures after they were observed, the vacuity objection would be serious. Its stronger claim is predictive. The calculus specifies structures that must exist even when a model does not represent them. An identity predicts an other. A part predicts a whole. A Relationship predicts internal structure and the possibility of becoming an object itself. Any Pattern predicts the others through Enclosure. Those claims can be wrong.

Network science provides an unusually long test of this idea. Euler was not trying to construct a universal grammar of organization. He was solving a specific traversal problem, and for that problem a representation dominated by distinguishable identities and generic Relationships was sufficient. The other seven elemental roles could safely remain implicit. But the graph that solved Königsberg was subsequently carried into domains Euler was not solving: cells, brains, social systems, citation systems, ecosystems, technological systems, populations, and economies. Reality kept presenting organization that the inherited $Di + Rgen$ -heavy grammar could not represent directly.

The field responded by extending the grammar. Not through seven neat one-for-one additions, but through an ecology of extensions that repeatedly reconstruct combinations of the omitted structures: boundary rules, components, communities, hypergraphs, bipartite transformations, directed and typed edges, multiplex and hierarchical networks, line graphs, centrality measures, higher-order models, and others. Across these different inventions, Do , Sp , Sw , Ra , Rr , Pp , Pv return. The important result is not merely that network science accumulated extensions. It is that the extensions repeatedly recover the same structures the original abstraction omitted, and so far they have recovered no organizational primitive outside DSRP-484.

The hypergraph makes the mechanism easy to see. When the phenomenon says that several individuals belong to one family, the organization in reality is part–whole. A node-edge grammar has no native primitive for that statement, so it calls the whole an edge. The standard bipartite transformation then makes the family into another node and represents membership with ordinary edges. The repair works. That is precisely the point. Network science can recover the missing structure, but it must reconstruct it using the grammar it inherited.

The same thing happens elsewhere. A Relationship that needs to become an object is rebuilt through the line graph. Wholes are recovered as components and communities. Relational asymmetry is added to generic edges. Framing returns through centrality criteria, partition criteria, boundary decisions, and other rules that determine what counts for the analysis. These extensions are useful and often mathematically elegant. What matters here is that they keep repeating the same underlying organizational work.

This distinguishes recursion from patch accumulation. DSRP-484 generates complexity by recursively reusing the same elemental grammar. A Relationship can itself become a Distinction, a System, another Relationship, or a Perspective without requiring a new primitive. When an elemental grammar omits those structures, the complexity does not disappear; it moves upward. New constructs recover what the primitives cannot express, and later constructs are built on those earlier encodings. The local repairs can continue to work while the total representational apparatus becomes increasingly indirect. The repetition is the evidence: apparently different higher-order inventions keep solving versions of the same lower-order omissions.

There is an ontological reason to expect this trajectory. The world was organized long before anyone drew a graph of it. Aspen groves, fungal hyphal mats, organisms, cities, markets, and populations are not merely networks because a modeler chooses to draw them that way. They already possess boundaries, composition, differentiated parts, Relationships, constraints, and framing. Those structures can also change and produce new structures. A collection of related people can become a tribe, village, town, or city whose identity and organization persist even as the original people and Relationships change. The emergent whole has become part of reality. If the model is to remain aligned with its target, it eventually has to represent that new organization too.

That is the deeper model–reality claim. If DSRP-484 names real organization rather than a convenient descriptive language, then increasingly faithful models should be pushed toward it. Network science can keep updating its models, but if its primitive grammar remains sparse, each update must be encoded through additional layers. The model can remain useful while accumulating representational debt: patches built on earlier patches, each locally successful, but increasingly distant from a direct representation of the organization that generated the need for the patch in the first place.

This argument does not rest only on the historical record. DSRP-484 makes further predictions that remain exposed to failure. These predictions were not part of the pre-registered thirty-five-construct remainder test; they are deductions of DSRP-484 exposed here for subsequent testing.

20.1 Predictions

1. **Complement prediction.** Every elemental pole predicts its complement. An identity requires an other, a part a whole, an action a reaction, and a point a view. The complement may be implicit or absent from the representation, but it must exist structurally.
2. **Enclosure prediction.** No instantiated D, S, R, or P exists alone. If one Pattern is genuinely present, the organizational conditions supplied by the others should also be recoverable.
3. **Seven-omitted-roles prediction.** A network grammar beginning predominantly with Di + Rgen should repeatedly encounter problems requiring the omitted Do, Sp, Sw, Ra, Rr, Pp, Pv. The history of network science should therefore contain repeated attempts to recover those structures.
4. **Patch-recurrence prediction.** Those recoveries should not occur as seven tidy replacements. Individual extensions should reconstruct combinations of the omitted roles, but across the ecology of extensions the whole omitted set should reappear.
5. **Future-extension prediction.** New network formalisms should continue to recover combinations of those same structures rather than introduce genuinely new organizational primitives. An

apparently new extension may be mathematically novel while remaining organizationally composed of the same DSRP-484 structure.

6. **Relationship-as-object prediction.** Every edge can itself be distinguished and organized. A Relationship should therefore be capable of becoming a node, a System, another Relationship, or a Perspective without changing its ontological status. The line graph is one existing realization of this prediction.
7. **Universal-node prediction.** A sufficiently resolved real node should not remain a featureless Di. Its boundary, composition, Relationships, and framing should become visible as resolution increases.
8. **Contextual-identity prediction.** Building on the identity ledger in Section 5, the identity of a node should be better specified by its full structural profile than by its label or degree alone: what it is and is not, what it contains and belongs to, what it relates and does not relate to, and what it frames or is framed by. Structurally meaningful absences should generate hypotheses about Relationships, memberships, or framings not yet represented.
9. **Distributed-other prediction.** Externality should not exist only at the boundary of the network as a whole. Every distinguished node, Relationship-object, subsystem, community, and other reified structure should have its own corresponding other.
10. **Relationship-heterogeneity prediction.** Apparently homogeneous edges should become increasingly heterogeneous as their organization is resolved. A friendship network can call every edge “friend,” but that equivalence exists under a framing that has decided which relational differences count and which do not. The underlying Relationships should not, in general, prove structurally identical.
11. **Hidden-Perspective prediction.** Whenever a network declares nodes equivalent, edges homogeneous, one partition preferable, one node important, or one boundary correct, some framing structure should be recoverable even when the formalism does not explicitly represent it.
12. **Distributed-Perspective prediction.** In addition to analyst-imposed Perspectives such as centrality and partition criteria, nodes in networks of sensing or acting agents can themselves function as Pp structures on portions of the network. Their local views should collectively affect subsequent network behavior and organization. Perspective should therefore become a property of the network itself, not merely something possessed by an outside analyst. Section 16.8 provides an existing case in local navigation under limited knowledge.
13. **Emergent-organization prediction.** Changes in lower-level organization can produce new behavior and persistent new organization. When an emergent whole becomes real and stable enough to constrain subsequent behavior, it should itself instantiate DSRP structure: identity and other, parts and whole, Relationships, and framing. The emergent whole becomes another organized object in reality rather than remaining merely a statistic over its constituents.
14. **Ontological-update prediction.** As such structures emerge, an adequate network model should eventually have to promote them into its modeled ontology. Network theory can do this, but without a native recursive part-whole grammar it should tend to do so through further node-edge constructions.
15. **Model-reality convergence prediction.** As network models become more structurally faithful to their targets, they should move beyond a flat Di + Rgen representation toward fuller representation of the omitted DSRP structure.

16. **Representational-debt prediction.** When an elemental structure is omitted from a formalism, the missing complexity should migrate upward into special constructs, transformations, layers, types, attributes, exceptions, and auxiliary rules.
17. **Repetition prediction.** A recursively adequate grammar should generate complexity by recombining the same elemental structures. An inadequate primitive grammar should repeatedly reinvent the same missing structures under different higher-order names. Continued repetition is therefore predicted.
18. **Pareto prediction.** Human representations should systematically make some DSRP structures explicit and leave others implicit. In particular, the complementary poles and Perspective should be underexpressed even when their existence is structurally required. The predicted asymmetries have already appeared in large-scale cognitive data [25] and in blind coding of scientific results [18].
19. **Structural-measurement prediction.** Some familiar network statistics should prove to be numerical readouts of richer organization that the graph does not itself explicitly represent. Increasing structural resolution should expose the organization that makes those statistics consequential.

Taken together, these predictions make a directional claim about the future of the field: as network science continues to model richer real-world organization, its representations should become increasingly recursive, heterogeneous, multiscale, object-like, and explicit about boundaries, membership, relational internals, and framing. If DSRP-484 is right, the movement should continue toward the structures the original abstraction omitted.

Those predictions matter only if failure is equally explicit. Section 21 states the falsifiers and reports what the present test returned.

21. What Would Falsify the Claims — and What the Test Returned

The predictions above are useful only if failure is equally explicit.

1. **Master falsifier: a genuinely new organizational primitive.** Find one uncontested organizational structure necessary to network science—or to organized reality more generally—that cannot be represented through any composition or recursion of D, S, R, and P with their eight elemental roles and four dynamics. A fifth Pattern, ninth elemental role, or additional irreducible structural dynamic would falsify the central containment claim. One good case is enough.
2. **Network-trajectory falsifier.** Show that the historical and future extensions of network science do not collectively recover the seven roles omitted by the original Di + Rgen-heavy grammar, or that substantial classes of successful extensions repeatedly require organization outside them.
3. **Prospective-prediction falsifier.** Repeatedly fail the concrete predictions above. A theory that explains the past but consistently misses the structures encountered next loses the strongest answer to the vacuity objection.

4. **Coimplication falsifier.** Find a genuine identity with no possible other, a genuine part with no whole, an action with no reaction, or a point with no view under the formal definitions—not merely a complement omitted from a particular representation.
5. **Enclosure falsifier.** Find a genuine instantiated D, S, R, or P for which one or more of the other Patterns are not merely unobserved but structurally unnecessary.
6. **Relationship-as-object falsifier.** Find a real Relationship that cannot itself be distinguished, decomposed, related, framed, or otherwise treated as an organized object even under increased resolution.
7. **Universal-node falsifier.** Find a sufficiently resolved real node that remains genuinely only Di: no meaningful outside, composition, membership, relational organization, or framing.
8. **Contextual-identity falsifier.** Show across well-defined contexts that the full D/S/R/P profile of a node provides no explanatory or predictive value beyond ordinary node labels, attributes, and local graph statistics, and that structurally salient absences systematically fail to generate useful predictions.
9. **Relationship-heterogeneity falsifier.** After construct validity, context, framing, and unrepresented Relationships are adequately resolved, apparently homogeneous real-world edges remain genuinely homogeneous.
10. **Distributed-Perspective falsifier.** In networks of sensing or acting agents, vary the agents' local point-view structures while holding other relevant organization constant and repeatedly find no effect on behavior, organization, attachment, coordination, traversal, or subsequent network state.
11. **Emergence falsifier.** Repeatedly observe stable new organization that produces changed system behavior without corresponding change in organization, or observe persistent emergent wholes that acquire no distinguishable boundary, composition, Relationships, or framing.
12. **Model-reality trajectory falsifier.** As network models gain empirical fidelity, they systematically become less rather than more complete with respect to Do, Sp, Sw, Ra, Rr, Pp, Pv, while continuing to explain the phenomena those structures are proposed to organize.
13. **Representational-debt falsifier.** Show that a Di + Rgen grammar can represent increasingly rich real organization without accumulating specialized higher-order machinery, transformations, nested workarounds, or redundant constructs.
14. **Repetition falsifier.** Show that the apparent repetition among components, communities, hypergraphs, hierarchical structures, line graphs, centrality frames, and other extensions disappears under rigorous decomposition—that these constructs introduce genuinely unrelated organizational forms rather than recurring combinations of DSRP structures.
15. **Pareto falsifier.** Larger independent corpora repeatedly fail to show the predicted explicit-implicit asymmetries: complement saturation approaches completeness, Perspective is not systematically underexpressed, or the predicted co-occurrence and enclosure effects disappear.

Three failures matter most. First, one genuine organizational primitive outside DSRP-484 would directly falsify the containment claim. Second, if network science's historical and future extensions do not converge on the structures Euler's abstraction omitted, the trajectory argument fails. Third, if DSRP's prospective predictions repeatedly miss what is subsequently found, then its flexibility begins to look like retrospective accommodation rather than theory.

That is the difference between flexibility and vacuity. DSRP-484 can represent an enormous range of organization, but it does not get to change its elemental grammar when the next case arrives. It says what structures should be there, what should be missing from an underspecified model, what kinds of repairs should recur, and what future extensions should continue to look like. Network science has spent nearly three centuries moving from Euler's deliberately sparse abstraction toward richer representations of the organization its expanding subject matter required. DSRP-484 predicts that trajectory should continue. The first genuine structure that requires something else is the result that matters most.

$$\exists c \in C_{networks} : O_c \notin Cl(DSRP-484)$$

The test was executed in full. Thirty-five canonical constructs entered the candidate set under the pre-registered rule of Section 4; ten entries were excluded and logged by category. The exclusions are: graph traversal and search algorithms, generating function methods, mean-field and master-equation approximations, and exponential random graph estimation machinery (numerical or mathematical technique); community-detection algorithms and network sampling procedures (research practice); adjacency matrices and graph layout conventions (representation artifact); "complex system" in its general usage (general term); and epidemiological compartment models as such (imported theory, whose network-specific content is carried by the dynamical-process construct).

Breadth-first search is excluded as a matter of scope, not because procedural order is non-organizational. This paper treats order as organizational — that is how paths were decomposed in Section 8 — but the candidate set concerns the organization a network model attributes to the represented system, not the organization of procedures performed on that representation. Under O-Theory the analyst is an organized target too [3], and an algorithm is organization in the analyst's procedure: its steps are composed directed Relationships, visited-and-unvisited is a Distinction, the search frontier is a System, and the choice of root and traversal rule is a Perspective. Euler's graph asserts nothing about the order in which its nodes are visited; that order belongs to the act performed on the representation, and mind-side organization has its own tests [7,18,25–28]. If breadth-first search were included here, it would produce another DSRP decomposition rather than a residual.

Of the thirty-five constructs, all thirty-five decompose. Four were already decomposed in the precursor chapter and one partly[2]; twenty-five required new decomposition and are given it here and in Section 16; two are composites of already-decomposed elements; three are purely informational. Every construct was ruled by the authors construct by construct, with the ruling, the proposed decomposition, and the verbatim source definition recorded in the supplementary instrument. The residual category X is empty. The candidate set's natural point of attack — the component, whose inability to express membership without connection marks the field's sharpest divergence from the general Pattern (Section 9) — yields a restriction of System, not an addition to it.

The claim therefore stands exposed and unfalsified on this run. It remains exposed: the instrument is available on request, the exclusions are named, and any one of the thirty-five rows may be contested.

22. Convergence

This paper is not a standalone demonstration. It is the second executed run in a series with a common protocol. The first decomposed system dynamics: sixty constructs drawn from the field's official glossary, its published reflections on its own foundations, and its founder's statement of its subject matter — sixty of sixty, no residual [11]. This run decomposes network science: thirty-five of thirty-five, no residual. Ninety-five constructs, two traditions that developed independently for decades, one set of four Patterns.

The convergence is sharper than the totals suggest, because the two vocabularies keep landing on identical structures. A feedback loop and a cycle are the same closure. A generic structure and a motif are the same re-identified pattern. A reinforcing loop and preferential attachment are the same self-amplifying organization. A dominance shift and a percolation threshold are the same event of information crossing a value at which organization changes qualitatively. Neither field borrowed these from the other. They are what two different fields find when they organize the same world.

The unanticipated finding of this run strengthens the case in a different way. In six load-bearing cases isolated by this analysis, network science works around structure its own primitives cannot represent, and in none of them does it revise the primitives. First, betweenness counts the consequence of a Relationship between Systems. Second, the boundary specification problem names the Distinction the formalism lacks. Third, small-world rewiring exploits ring halves that officially do not exist. Fourth, the scale-free disproportion asserts two operational sub-Systems with no notation for either. Fifth, the component construct cannot express membership without connection. Sixth, the hyperedge calls a whole an edge, because edge is the only word the grammar has for more than two things together. The missing patterns are not idle. They are load-bearing, and the field's own results are the evidence. What is worth noticing is not that these are the only repairs in the field, but that all six load-bearing cases isolated here reconstruct organization absent from the primitive grammar. Each one works, and each one leaves the grammar exactly as it was. A formalism can adapt around a missing role indefinitely, because adapting is cheap and revising the primitives is not.

A third pre-registered run has since decomposed UML, where the nominating source is a normative machine-readable metamodel rather than a prose glossary and the candidate set was computed from it directly: a closed set of one hundred forty-two metaclasses, no exclusions to log, and no residual identified [29]. An earlier demonstration outside this protocol reached the same conclusion for object-oriented programming [30]. A further run would test Bayesian graphs. The marginal cost falls with each execution: the rule is fixed, the instrument format exists, and rulings transfer where constructs coincide. The falsifier for the whole program is unchanged and simple: one legitimate organizational structure requiring a fifth Pattern, ninth elemental role, or additional irreducible structural dynamic.

23. Conclusion

Euler began network science by deleting information and keeping organization. The field he founded has spent nearly three centuries computing with what he kept, on the working assumption that its two remaining primitives were as far down as the analysis went.

They are not. A node is a Distinction whose identity is a ledger of what it is and is not, related and unrelated, part and whole, seeing and seen. An edge is a Relationship containing action and reaction, itself reifiable as an object. A path is composed Relationships; a component is a System reconstructed from them under a rule; centrality is a Perspective on importance; a community is part-whole organization recovered from relational density; preferential attachment is a reinforcing loop closed through the attaching node's point of view. Thirty-five constructs, no remainder.

The strongest evidence, though, was not the decomposition. It was the discovery that network science has been measuring the missing structure all along — counting geodesics through a node because that node is a Relationship between two Systems it cannot name, rewiring a ring to connect halves it does not officially have, asking which nodes are in the network because a System coimplies a Distinction whether or not the formalism provides one. The patterns were never absent from the practice. They were absent from the notation.

The claim remains exposed: future network extensions should continue to reconstruct combinations of these same structures; the first legitimate extension that requires something else is the counterexample.

Data availability. The full instrument for this run — the pre-registered extraction rule, the candidate set, the proposed decompositions, the construct-by-construct rulings, the verbatim source definitions, and the exclusion log — is available from the authors upon request.

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