

# The Hierarchical Underpinning Of Conscious Embodiment

Ron Cottam, Willy Ranson, Roger Vounckx

## Abstract

We have earlier presented a biosemiotic view on consciousness derived from system hierarchy. In this paper we address in more detail the nature of the hierarchical underpinning of conscious embodiment, with reference to both classical and quantum physics. The cross-scalar unification of organisms leads to the creation of a *dual* hierarchy, where the first partial-hierarchy is of multiple scaled models of the organism itself, and the second is constituted from the remaining inter-scalar regions of extreme complexity. It is this underpinning duality for consciousness we examine here. The initial partial-hierarchy is expressed in terms of classical physics, and is reductive towards localization. The second, complex-region partial-hierarchy appears to be closely related to quantum physics, and is consequently reductive towards nonlocality. This presents a radically new view of the relationship between classical and quantum physics, indicating not that classical physics is replaced by quantum physics, but that the two make up a complementary duality, integrating their very different properties into a single underpinning for conscious embodiment. Transit between different model-levels of an organism's partial-hierarchical form is constrained by informational differences between the respective models, and it is evident that local changes always (and can only) rely on complete knowledge of the organism's structure. This local-to-and-from-global character is *the* distinguishing property of living systems, and inter-model transit appears to rely on a generic form of quantum error correction. We conclude that consciousness can only be understood from a point of view which accepts the dual-hierarchical underpinning of its embodiment in terms of *both* classical and quantum physics.

**Key Words:** hierarchy, hyperscale, metascale, unification, consciousness.

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## Introduction

We have earlier presented a biosemiotic view on consciousness derived from system hierarchy (Cottam and Ranson, 2013).

In this current paper we address in more detail the nature of the hierarchical underpinning of conscious embodiment, with reference to both classical and quantum physics.

At the outset we should emphasize that not all natural structures and processes are hierarchical in form or dependence, but that there appears to be an overriding tendency towards hierarchy in Nature, even though the scavenging character of evolution often results in non-hierarchical configurations (Gilaie, 2009).

We have described (Cottam and Ranson, 2013) how the cross-scalar unification of organisms leads to the creation of a *dual* hierarchy, where the first partial-hierarchy is of multiple scaled models of the organism itself, and the second is constituted from the remaining

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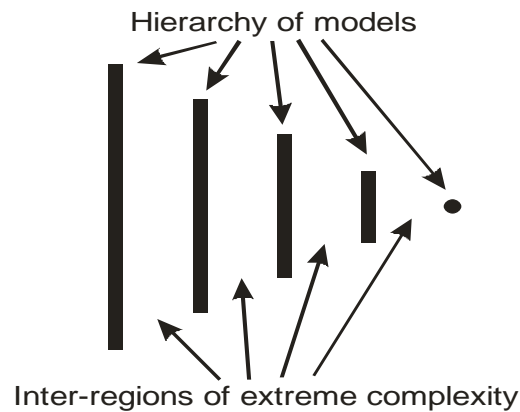
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inter-scalar regions of extreme complexity (Cottam, 2003). It is this underpinning duality for consciousness we will examine in the present work. Our first task is to explain how this structural/process duality

itself comes about: we will follow through a short summary of the derivation we have earlier presented (Cottam and Ranson, 2013).

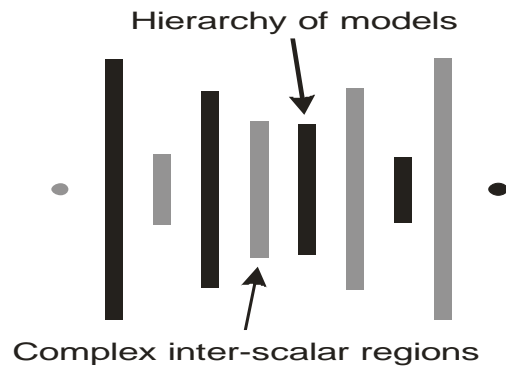


**Figure 1:** The form of a generalized hierarchy of organizational scales in a living system. This is a ‘model’ hierarchy (Cottam *et al.*, 2004), where each scale is a representation of the entire system established at that specific scale: we believe that this style of representation is the most apt to describe living systems. The length of the vertical lines indicates the amount of information required to complete the particular representations. At the left-hand side is the scale associated with the smallest entities (e.g. atoms). Moving towards the right we encounter progressively larger scaled entities (e.g. molecules, cells, organs), finally reaching the extreme right-hand side which is the (smallest) representation of the system, *as itself*.

Differentiated entities display a size-related perceptual relationship to their surroundings. Small entities can most easily relate to similarly-sized entities; similarly for bigger ones. This size-selectivity may be referred to as the *bandwidth* of their feasible interactions. In multiply-scaled living systems the selectivity causes the different organizational scales to be partially isolated, partially in communication, as their individual bandwidths only partially overlap. The result is a hierarchical organizational structure with adjacent scales separated by inter-regions of high complexity, as illustrated in Figure 1.

Note that in the figures of this paper the conventional ‘top’ of a hierarchy is drawn at the right hand side and not the top of the page, to support the notion that there is no single level of organization which is in overall control. The complex inter-regions contain all of the information from lower down in the hierarchy which is *hidden* by the corresponding model.

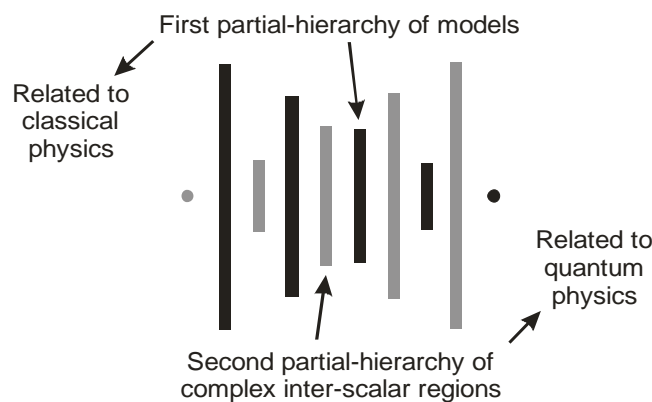
Consequently, if we indicate these regions by vertical bars, similarly to those for the scale models, we arrive at the overall representation of Figure 2.



**Figure 2:** A combined representation of the model-hierarchy and that of the inter-regions. Here again, vertical line-length for the complex inter-regions indicates the amount of *hidden* information at that scale.

Cross-scalar coordination of the model hierarchy, leading to unification, forces the imposition of an order on the inter-scalar regions of hidden information. It is intuitively evident that the complex inter-regions form a second hierarchical structure, in opposition to that of the models, which dissociates from the first hierarchy (Cottam and Ranson, 2013). We now have *two partial-hierarchies* which make up the complete system. The first of these is expressed in terms of classical physics, and is consequently reductive towards localization (at the right-hand side of the figure). The second, complex-region partial-hierarchy appears to be closely related to quantum physics, and is consequently reductive towards nonlocality (at the left-hand side) (Figure 3). Any real organizational scale adopts a position somewhere in between the two

extreme ‘states’ of perfect localization and perfect nonlocality – contrary to the conventional philosophical wisdom of the ‘excluded middle’. *This presents a radically new view of the relationship between classical and quantum physics, indicating not that classical physics is replaced by quantum physics, but that the two make up a complementary duality, integrating their very different properties into a single underpinning for conscious embodiment.* This duality shows up in the neural embodiment, where the ‘classical’ neuron processing of information is complemented by ‘quasi-quantum’ processing in the inter-neuron axonite mesh (Pribram, 2001). The combined nature of living-system hierarchy clearly links into other researchers’ descriptions of the mixed classical and quantum natures of consciousness (Vimal, 2008).



**Figure 3:** The two partial-hierarchies of a natural living-system hierarchical form (for extended information on the dual partial-hierarchies see Cottam and Ranson, 2013).

Transit between different model-scales of a living system's partial-hierarchical form is constrained by informational differences between the respective models, and it is evident that local changes always, and can only, rely on complete knowledge of the organism's structure. This local-to-and-from-global character is the distinguishing property of living systems, and inter-model transit appears to rely on a generic form of quantum error correction (Cottam, 2003).

### 1 - A Philosophical Grounding

Joseph Brenner has published a unified logical system based on a duality of expression, in his book "Logic In Reality" (Brenner, 2008). Historically, this is related to earlier work by Stéphane Lupasco (Brenner, 2010), and similarly to the current authors' position, stated above, it postulates the reality of an *included middle*, rather than the conventional philosophic adoption of the concept of an *excluded middle*.

The fundamental postulate of "Logic in Reality" (LIR), its Principle of Dynamic Opposition, states that:

1) every real complex process is accompanied, logically and functionally, by its opposite or contradiction (Principle of Dynamic Opposition), but only in the sense that when one element is (predominantly) present or actualized, the other is (predominantly) absent or potentialized, alternately and reciprocally, without either ever going to zero; and

2) the emergence of a new entity at a higher level of reality or complexity can take place at the point of equilibrium or maximum interaction between the two.

A necessary concept is the categorial non-separability of, for example, individuality and non-individuality; part and whole; subjectivity and objectivity in relation to the experiment-experimenter pair.

The six axioms of Life in Reality (LIR) are:

LIR1: (Physical) Non-Identity: There is no A at a given time that is identical to A at another time. This formulation is essentially that of Leibniz.

LIR2: Conditional Contradiction: A and non-A both exist at the same time, but only in the sense that when A is primarily actual, non-A is primarily potential, and vice versa, alternately and reciprocally.

LIR3: Included (Emergent) Middle: An included or additional third element or T-state emerges from the point of maximum contradiction at which A and non-A are equally actualized and potentialized, but at a higher level of reality or complexity, at which the contradiction is resolved.

LIR4: Logical Elements: The elements of the logic are all representations of real physical and non-physical entities, processes and systems none of which can be totally identical to another.

LIR5: Functional Association: Every real logical element e – objects, processes, events – always exists in association, structurally and functionally, with its anti-element or contradiction, non-e; in physics terms, they are conjugate variables. This Axiom applies to the classical pairs of dualities, e.g., identity and diversity.

LIR6: Asymptoticity: No process of actualization or potentialization of any element goes to 100% completeness.

These six axioms of LIR form a unified viewpoint which is very close to the proposition we make here. For example, LIR3 and LIR6 correspond to our statement above that quantum logic *complements* post-Newtonian classical logic, identifying all real entities as compromises between the two.

Two differences in approach should be noted, however. Firstly, our representation relates to hierarchical systems consisting of numerous different clearly identifiable scales – this aspect is missing from Brenner's treatment. Secondly, we do not directly specify a functional association of every real logical element with its anti-element or contradiction (c.f. LIR4 above), but a functional association of every entity with its Natural ecosystem. In mono-rational non-hierarchical terms, however, this would reduce to LIR4.

We would prefer to denote Lupasco and Brenner's *included middle* as the *exclusive middle*, to emphasize our proposition's equivalence to the

implications of Brenner’s LIR6. It is then to be expected that the measurement of a particle’s or quantum-wave-packet’s properties with suitable equipment will indicate mixed properties (Mittelstaedt, 1987) and not uniquely particulate or wave characteristics.

It remains to us to clearly define our interpretation of Brenner’s ‘non-A’. A suitable vehicle for this is electrical conduction in a semiconductor, which takes place through the displacement of two different entities, or ‘carriers’: the first is the *electron*, with negative electrical charge; the second is the space left where an electron is absent – referred to as a ‘*hole*’ – with positive charge. Note that Brenner specifies ‘non-A’ and not ‘not-A’, although at first sight the *hole* corresponds to ‘not-A’ and not ‘non-A’. However, the properties of a *hole* are determined by the surrounding context in which it is found – the absence of an electron does not of itself display properties. Consequently, while an *electron* exhibits its own properties in the semiconductor, a *hole* exhibits solely the properties of its environment: the *electron* corresponds to Brenner’s ‘A’ and the *hole* to ‘non-A’.

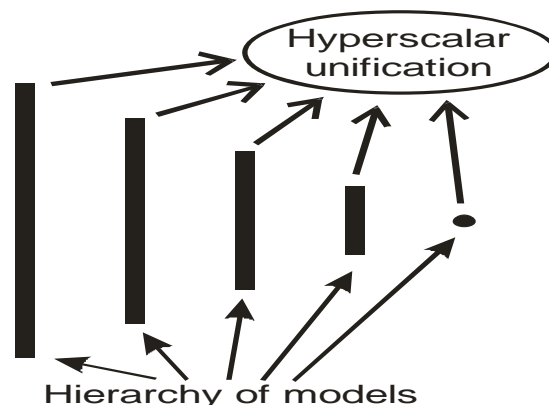
In general, then, our interpretation is that ‘A’ corresponds to an entity or process (Brenner specifies this in terms of processes, not structures), and ‘non-A’ corresponds to that entity or process’s environment. In addition to Havel’s

maintenance that all analysis should take account of scale (Havel, 1995) he has pointed out that *structure* and *event* are only distinguished by differences in timescale. We would add *process* to this.

In our context, *existence* is related to long time scales in comparison to human ones, and *becoming* to short time scales. In a birational framework, ‘existence’ itself ‘becomes’ a derivative of the extremes of localization and nonlocalization! It is notable that these two concepts – *existence* and *becoming* – characterize the differences between classical and quantum physics – yet another coupling of the two conceptual schemes.

## 2 - The Generation of Hyperscale

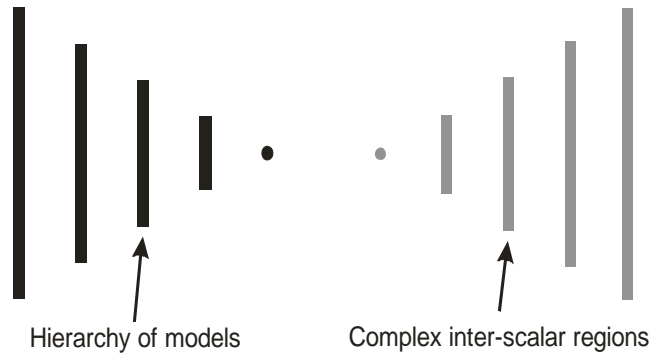
The partial nature of our initial model-hierarchy implies that it is impossible from outside an organizational scale to form an exact image of that scale’s constitution. However, a living system is unified, and this means that all of the individual organizational scales are to some degree correlated. Ultimately, this correlation infers that all of the scales are more or less represented in the reality of the unification itself, albeit in an approximate manner. We refer to this unification as *hyperscale*, and this is the *real* nature of a system when viewed from outside (see Figure 4).



**Figure 4:** The correlation of all the different organizational scales of a system into hyperscalar unification of the hierarchy.

We should remember that this (partial) hierarchy of models is only one component of the complete hierarchy, and that the complex inter-regions form a

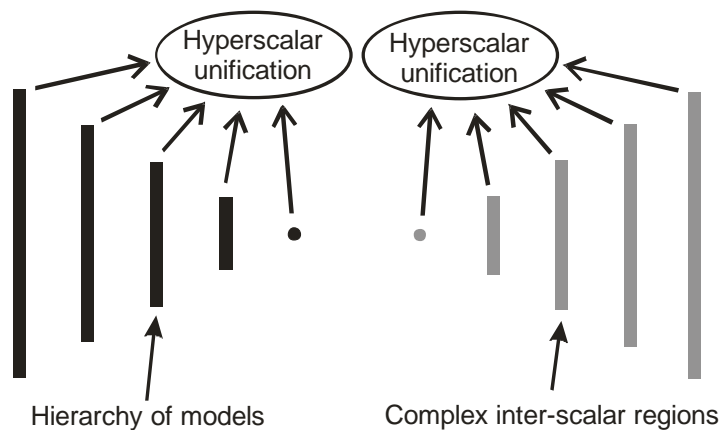
second (partial-)hierarchy. For convenience we will illustrate the two partial hierarchies spatially separated, as in Figure 5.



**Figure 5:** The two partial hierarchies illustrated separately, for descriptive convenience.

In that we have two partial-hierarchies, we will have two unifying

hyperscales. This condition is indicated in Figure 6.

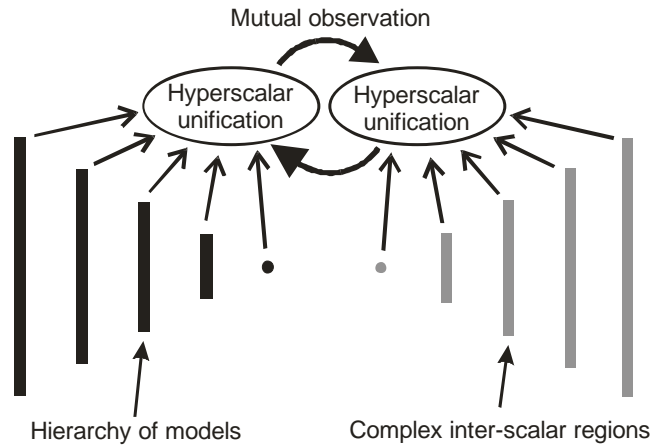


**Figure 6:** Each of the two partial-hierarchies is unified into a hyperscalar representation.

### 3 - The Unification of Hyperscales into Metascale

Brenner's LIR (Brenner, 2008) proposes a very specific form of 'unification', as a way of resolving contradictions between his A and non-A: his LIR3 states that: *an included or*

*additional third element or T-state emerges from the point of maximum contradiction at which A and non-A are equally actualized and potentialized, but at a higher level of reality or complexity, at which the contradiction is resolved.*

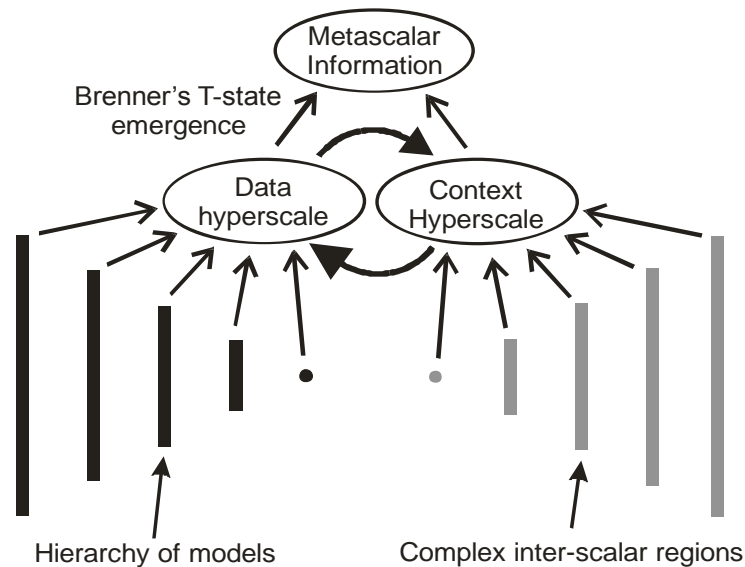


**Figure 7:** Mutual observation between the two hyperscales as the origin of high level consciousness.

We believe that this is what happens to the two hyperscalar representations of a living-system hierarchy. We have proposed earlier (Cottam and Ranson, 2013) that high-level consciousness results from the recursive ‘observation’ of each hyperscale by the other in the manner of Matsuno’s (Matsuno, 2000) ‘mutual measurement’ (see Figure 7), but it appears that the result of hyperscalar reintegration is more complicated than that. In addition to the

mutual observation there is the emergence of a Brenner-related T-state *metascalar* emergence, as indicated in Figure 8, which corresponds to the joining-together of (entity) hyperscalar *data* and its (complex inter-region) hyperscalar *context* to give birth to the concept of *information* (Cottam, 2015).

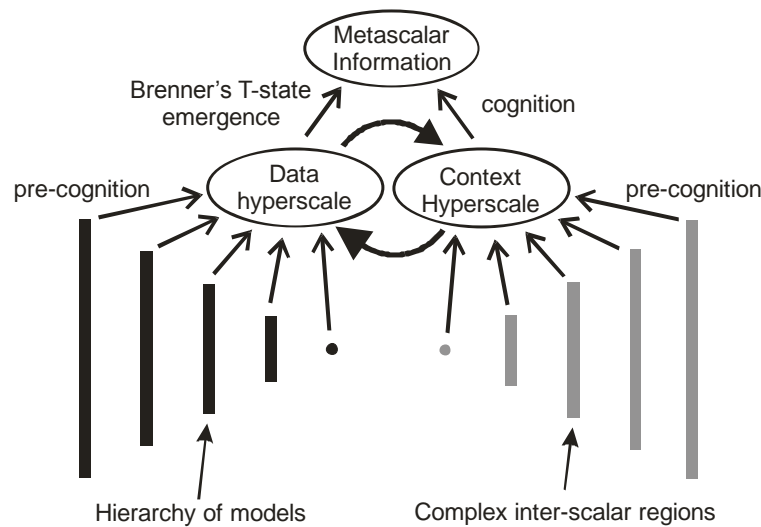
Our final step is to characterize the two kinds of unification process we see in Figure 8.



**Figure 8:** The emergence of singular *metascalar* information from the two hyperscalar representations, in the manner of Brenner’s emergence of a T-state from A and non-A.

To recapitulate, the two partial hierarchies constitute embodiment of the living system, and as Figure 7 indicates, this itself is the grounding for the indirect development of high level consciousness. We have presumed, as in our previous derivation (Cottam and Ranson, 2013) that the elements of embodiment are characterized by an embodied pan-protopsychism which is ultimately amplified to high level consciousness by

the processes we have described here. The integrations leading to the development of the two hyperscales (in Figure 8) is that described by Robert Rosen (1991) in his modeling relation, and consequently these integrations are examples of *pre-cognition*, while the Brenner-like T-state emergence of information is based on cognition, whether conscious or unconscious (or both) (Figure 9).



**Figure 9:** The character of processes involved in the integration of scales to hyperscales, and in the emergence of information as Brenner's T-state.

## Conclusion

We maintain that consciousness is embodied in that it is related to a 'physical' substrate, but submit that, in common with the *unification* of any differentiable entity, this 'physical' substrate is *not* uniquely material. This *reality* of unification bridges the conventionally accepted philosophical gap between material and abstract in a manner which mirrors the *included* (or *exclusive*) *middle* of Lupasco (Brenner, 2010), Brenner (2008) and Cottam *et al.* (2013).

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It is notable that a Natural living-system hierarchy not only embodies aspects of the system itself, but also in the complex inter-regions embodies its 'understanding' of its environment, through lifelong interactions with it (Langloh *et al.*, 1993).

We conclude that consciousness can only be understood from a point of view which accepts the dual-hierarchical underpinning of its embodiment in terms of both classical and quantum physics.

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