

A Canonical Representational Process in Brains and Their Extensions in a Pan-Proto-Psychic World

Ron Bar Lev

Introduction

A partial computational principle of "Access-Consciousness" is based on very simple foundation assumptions:

- The role of brains includes the embedding, in-time recognition and enactment of spatiotemporal patterns (information). Processing is constrained by resolution and sensitivity limits

Adding the assumptions that

- Proto-phenomenal manifestation is a low order-of-scale, natural microphysical phenomenon, locally and temporally bounded and brought about by physical interaction
- Natural correlates of consciousness inhere in effectively-continuous processes (in behaviourally relevant orders of scale), as these evolve over the *Now* (transition)

The proposed processing principles support insights regarding the nature of representation, the formation of a physical bearer of a rudimentary experiencing 'I', the natural significance of qualia and the constitution and composition of conscious agents.

Part I: Representation Mediated By Neural-like Computation

Information Embedding And Iconic Pattern Completion

The model postulates that the pattern representation aspect of "Access-Consciousness" function involves in-time universal approximation, by way of pattern completion.

There are distinct advantages to iconic representation:

- It is implementable as a locally self-organizing and error pruning computational scheme (i.e. amenable to distributed processing of distributed information, minimizing the overall communications flux)
- It is generally information conserving, supporting in-system regeneration and re-evaluation

Generative predictive processing theories tend to emphasize the potential for information compression and distribution, which applies also to the proposed model. This particular perspective is motivated by the potential for concurrent, reciprocally superimposed, pattern factorization and regeneration.

A notional sensory perimeter is a useful conceptualization.

An agent that (from within) can project upon it's sensory perimeter patterns to match environmental projections, is in possession of a complete model of the projecting sources.

Stable representations of *that which would project* upon the agent's perimeter, predicting the dynamical trajectory of such projections, implement the complete informational set available to the agent – inclusive of hierarchies of factored causes and their combining relations (e.g. as learned by Bayesian inference. Well known limitations e.g. heuristics to disambiguate and produce 3D world model constructs, can be pragmatically accommodated in the proposed regime).

Accordingly, the learning phase of neural-like (computational) pattern processing may involve the casting of an isomorphic, invertible, embedding transform. Cohesive and contextual spatiotemporal relations may be extracted and embedded in a slowly conducting plastic medium, reduced (by weighted directed interference) to morphing configurations of information depleted, near isotropic, activity.

Information extraction, or "factorization", is likely implemented in a progressively subtractive manner.

An inverse enacting (biasing, filtering) operation would facilitate computational recognition - reconstitution of iconic world model components matching projection patterns upon an agent's sensory perimeter (imagination may be facilitated by tonic afferent sensory noise).

Thus an active representation is a bidirectional process that involves co-sustaining aspects of patterned and isotropic activity.

Representational Smearing

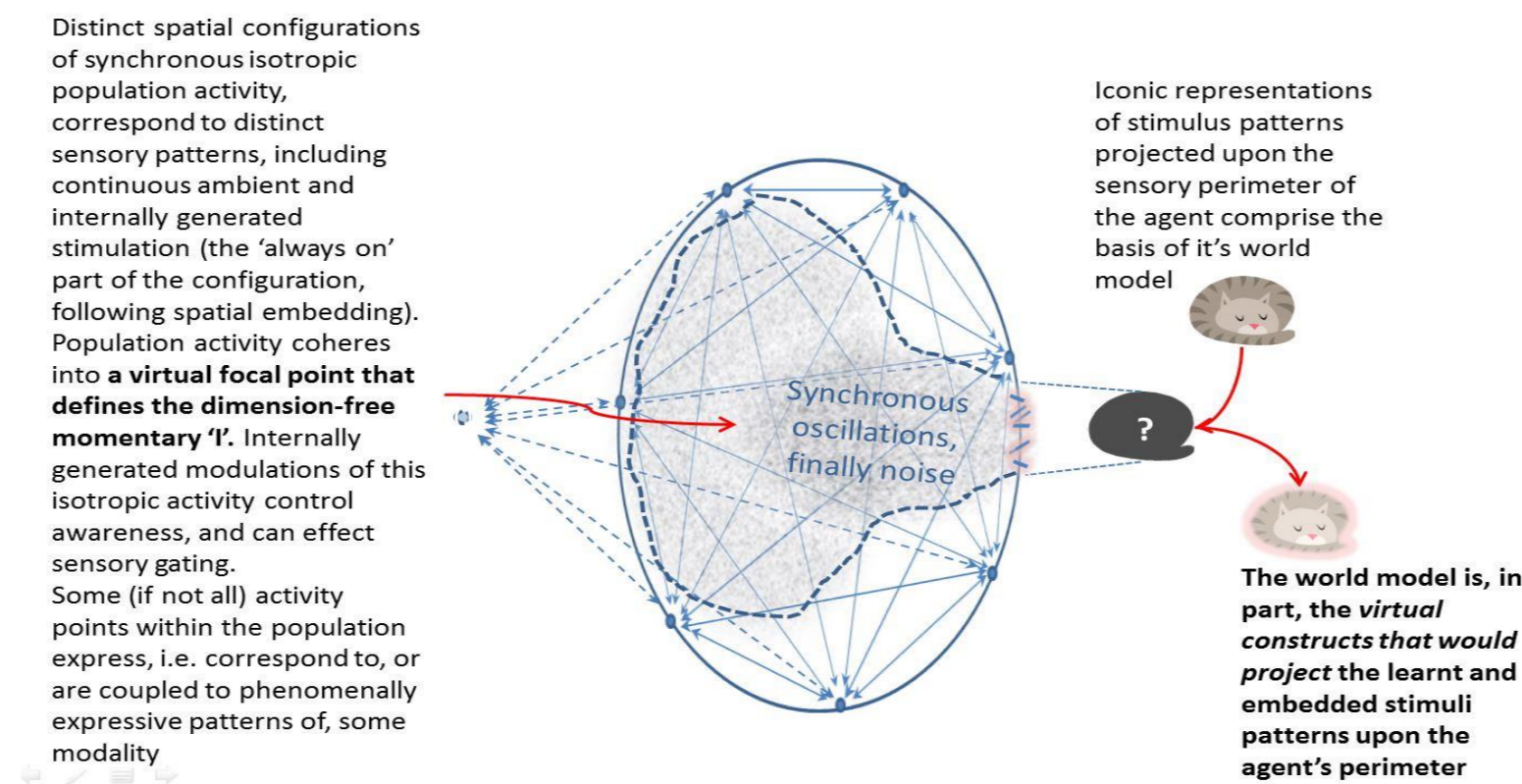
Active pattern representations will have an information-depleted aspect that is *co-active* with an iconic, literal, representation of projections on the sensory perimeter. (The information depleted aspect consists of a compressed point of activity or a population of units exhibiting synchronous oscillations or stochastic tending-to-isotropic activity, over a spatiotemporal configuration).

In "representational space" the two aspects should tie with the same contextual relations.

While pattern phase matching is smeared, the relations supporting pattern composition are conserved (to the degree that they can be predicted). This would be especially apparent with accommodation for representational invariance (e.g. convolutional models).

A Virtual Focal Point Suggestive Of An 'I' Primitive

Assuming phenomenality is (somehow) associated with network activity then by this model the correlates of the basic experience that permeates what we identify as Self (a tonic feeling grounding diachronic unity) could be associated with the hypothesized morphing configurations of near-isotropic activity.



Effective Representational Continuity

The ability to maintain on-going adaptation of internally generated representations to optimally match dynamical patterns of sensory input relies on the accommodation of singularities (and extreme non-linearity) in the continuous universal patterning relational transform (the biological prevalence of opponent center-surround receptive fields conforms with this proposition).

Sensory Resolution Limits Constrain Representational Capacities

Patterns consist of spatiotemporal structure and dynamics. Behaving agents rely on selected sensory causes with behaviorally relevant spatial and temporal pattern resolution (grain) and horizons.

Representational capacity is constrained on both measures: Sensitivity (lower bound of dynamic range, signal to noise ratio) constrains the predictive horizon. Crucially, a modelled sensory projection is cut off from the fine details of it's interacting cause at the sensory interface's resolution limit.

Part II: From the Proto-phenomenal To Phenomenality

Surrogates For Sensory Causes, Proxies For Locally Bounded Information

Encode-able patterns convey band-passed structure and dynamics, discarding fine-grained information. Fortunately, for conscious beings, in light of assumption

- Proto-phenomenal manifestation is a low order-of-scale, natural microphysical phenomenon, locally and temporally bounded ...

fine-grained information that cannot penetrate the sensory perimeter, or that can be represented only in proximity to it - that is "non-relational" by definition - may be made available to the agent by means of surrogates for the various sensory causes:- subjective proxies for the lost information, with distinctive characteristics. By extension any locally bounded information may be similarly shared.

Proto-phenomenal "Micro Contributors" To Experience

A thorough discussion of the notion of proto-psychism is not in scope for this presentation, but an extremely short and informal explanation of the intended meaning of the term, in context, is called for.

The view adopted here considers consciousness to be a composite that comes about through a dynamical spatiotemporal (relational) arrangement of proto-phenomenal "micro-contributors". Each of these contributors provides essential support to the generation of a reflexive expression of some natural mode of interaction over a physical span.

A contributor carries the potential to anchor and essentially take part in a manifestation of (some) subjective experience, when set in a system that provides whatever other complementary elements that may be required to bring about phenomenal manifestation.

In an experiencing system proto-phenomenal "micro-contributors" inseparably support both modal-quality and subjectivity of experience, as sensed over a small physical span.

As surrogates for non-relational content (from a system perspective) proto-phenomenal "micro-contributors" do not intrinsically support any experience of relational configuration. They carry only the potential to effect, when appropriately related, an inscrutable, unitary, opaque experience. Conceivably they may, however, in varying circumstances, partake in a manifestation of distinct phenomenal features, to convey multiple characterizations of sensed environmental conditions.

To clarify:

- No position is implied with regards to the question whether the experiential potential is realized in-and-of-itself by each of these postulated contributors or through complementary dynamical arrangements of the system's constituents
- The notion of a proto-phenomenal micro-contributor is only a useful conceptual abstraction. It should not be seen to carry any implication regarding physical (natural) implementation. The notion can be compatible with diverse ideas regarding the physical substrate giving rise to experiential potential, be these on a sub-microscopic or macro-system scale or involving scale free dynamics.
- The view is neutral with regards to the order of scale of minimal phenomenal manifestation, proposing only that it should be "sub-microscopic"
- The view is neutral on the question of discrete expression ("atomism") vs. a continuum of micro-subjectivity, save for postulating
 - Partially overlapping plurality of expressive sources in the discrete case ("dense activity")
 - A 'grain' of modulation imposed by the computational network (Part I and below)

The view is compatible with a notion of Integrated Information as a fundamental enabler, if not the basis of phenomenality, although the author is inclined to favor a more involved account.

Correlated "Micro Contributors" ; Combination Not A Problem

"Micro-Contributors" know no context nor do they experience (intrinsic) structure.

They do not support an experience of boundaries, and thus can "coalesce" in a "bound" experience.

Relational context is organized by the computational aspect of the system, which traces correlating world lines of proto-phenomenal "micro-contributor" manifestations. The resulting patterns function as iconic filters (or generators).

By this view a patterned set of expressive "micro-contributors", complemented by some operational structure of system, constitutes an "island" of experience. What kind of arrangement would impose a relational constraining structure upon a "soup" of independently manifesting proto-phenomenal sources, to bring out (i.e. isolate) a unified and ordered phenomenal experience?

Following the proposed representation scheme of Part I, an integrated active pattern representation consists of concurrent activity of an information-poor aspect and an iconic construct, both of which could be correlated with manifesting "micro-contributors".

→ The complete phenomenal expression of the represented pattern may synchronously include a vague sense of invariant whole, intertwined with a sense of fully differentiated detail, throughout the duration of activation.

Key here are the notions that

- Experience is effectively temporally contiguous (smearing is required)
- isotropic activity configurations are phenomenally equivalent

Proto-phenomenal "micro-contributors" correlated with the isotropic aspect of composite experience could

- Originate in spontaneous sensory noise
- Originate in sensory responses to generated (tonic or modulated) motor activity
- Be correlated with the diffuse complement of proto-phenomenal expression throughout the agent (originating anywhere in the agent's sensorium)
- Somehow be generated for purpose to manifest experience of the isotropic complement of activity

The bi-faceted nature of experience so composed suggests how islands of experience may combine into a phenomenally rich composite experiencing a diachronically stable sense of 'I'.

Part III: Some Comments And Corollaries

Regarding Synchronicity

As consciousness manifests in *Now*, the implications of binding through synchrony run beyond the conventional notion of promoted meta-stability of neuronal ensemble activity.

- Control of phase coherence ↔ spread could be an NCC operational aspect of greater significance than conventionally appreciated.
- It is tempting to conceive of a dual complementary structure involving activity in a scrambled-phase predictive sub-system and in an aligned-phase actual sub-system reciprocally sustaining each other.
- "Nesting" of oscillatory activity and relative LFP and neural firing phase correlations may be closely related with the sought after NCC.

Regarding Connectivity And The Unity Of Conscious Experience

Connectivity between disparate representations supporting concurrent conscious experiences should traverse through (or approach) the isotropic complement, i.e. a common, shared complement.

Co-occurring conscious contents may be unified without a directed connection between them.

The utility of consciousness, should such utility ever be defined, could extend beyond the provisions of surrogates for fine resolution sensory textures to apply to the generalized assimilation of distributed information.

Regarding Modes Of "Grounding"

Grounding "at the source" by means of interface bounded proxies as "external" referents, may add to the computational capacity for functional grounding. But what advantages are conferred by an ability to model a world segregated by modality and retained associations to "external" referent 'qualities'?

Regarding Proto-Phenomenal Manifestation In Peripheral Sensory Apparatus

The possibility that peripheral sensory apparatus (e.g. retina, olfactory epithelium) manifests proto-phenomenal qualities may have been dismissed prematurely, without due justification.

Evolved to detect a modality – why should it not be involved in the manifestation of modal qualities?

Common objections e.g. temporal delays, phantom limbs, dreaming consciousness', exclusively afferent connectivity, etc. can be countered.

Regarding IIT, Interface Theory, Quantum level phenomena

By this view Integrated Information is also realized differentiated Information, and phenomenality arises through interactions upon constraining boundaries. Phenomenality is that which cannot be communicated as Shannon information. Never the less it may be integration of information (through the transform here proposed) that mediates expression of phenomenality.

Interface theory stresses evolutionary sensory tuning to fitness, which seems to be a common notion, but might be wrong in stressing diversion from a principle of veridity of representation of structural patterns of interface signals.

Quantum level phenomena are most likely to play a functional role in sub-microscopic orders of scale (as with regards to proto-phenomenal expression). Theoretical justification for hypothesizing classical order of scale quantum effects pertaining to full blown consciousness, seems arguable.