

# Making Predictive Coding More Predictive, More Enactive

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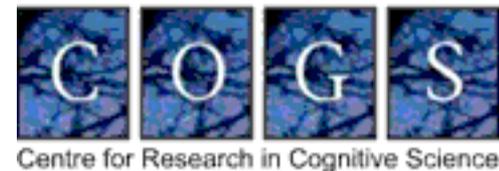
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# Overview

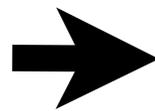
- The appeal of Predictive Coding (PC) models
  - *Thank you, prior speakers*
- Challenges of applying such models to consciousness
- Offer one generalisation of PC models, the Expectational Model (EM), as a way of:
  - a) identifying these challenges
  - b) suggesting some ways to overcome them
  - c) identifying which features of PC models facilitate this and which do not

# From predictive coding models to an expectation-based model

Features **retained**, **transformed**, demoted

## Typical PC model

- Predictive
- Error-minimising
- Inferential (Helmholtz)
- Hierarchical (priors)
- Action-involving
- Probabilistic
- Optimal (Bayesian)
- Subtractive (“suppressive”)



## Expectational Model

- **Predictive**
- **Error-minimising**
- Holistic (Merleau-Ponty)
- Hierarchical (features)
- Enactive
- Probabilistic
- Optimal (Bayesian)
- Subtractive (“suppressive”)

# EM: An expectational model of consciousness

EM has two parts: An expectation-based architecture (EBA), and an expectation-based theory of consciousness

Roughly:

- The *architecture* includes expectations in the form of a forward model: “How will my visual input change if I execute this or that motor command (e.g., eye saccades)?”
- The *theory* posits that the content of visual experience is equal to the content of the expectational state, spatially structured according to the actions ranged over in the forward model

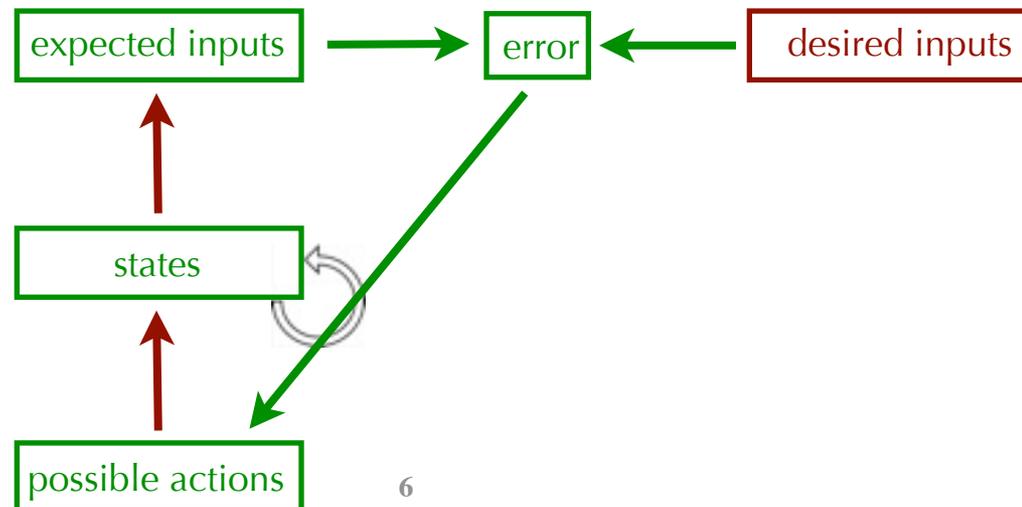
# From PC to EM: Transformed

## ➤ From action-involving to enactive

- What is fundamental is predictions of a particular sort: expectations of how the world will change if I act this way or that.
  - At root, not detached, disembodied abstract causal reasoning
  - Relations between actions actually structure the phenomenal space
- Action is incorporated in a way that supports/explains basic means/end rationality, not undercutting it
  - Friston: As for model selection so also for action selection
  - We do not choose the action that achieves some goal, but rather we perform the action that minimises prediction error
  - Problems:
    - Darkroom (Friston, Thornton and Clark 2012)
    - Radical undermining of what it is to be a cognitive, intentional agent

# From PC to EM: Transformed

- EM *does* find a use for the notion of action-selection that minimises error
- But not, like Friston, with respect to *prediction* error (*actual* world)
- Rather, *expected* error (*desired, non-actual* world)
- Cf third, “planning” deployment of the forward model in EBA:



# From PC to EM: Demoted

- EM is explicated without essential reference to:
  - Expectations as **probabilistic**
  - The settling on one set of expectations as a (Bayesian) **optimal** process
  - The top-down **suppression** of expected components of the input signal
- These features are consistent with EM, and thus could be added if needed
  - E.g., it seems likely that attentional sub-systems would have use for a reduced, error-enhanced signal

# From PC to EM: Demoted

- On the other hand, some of these features of PC models may impede progress on the kind of account of consciousness that EM aims to provide
  - Probabilistic but Optimal:
    - On the one hand, as (Clark 2012) points out, there is a disconnect between the probability and the apparent unity and determinateness of phenomenal experience
    - Of course, some (e.g. Dennett 1991) would reject the determinateness of experience, choosing instead to see it as being relative to how it is probed. But this is not the kind of indeterminateness probabilistic PC models can explain.
    - EM, on the other hand, can handle both: determinateness; or superposition of determinate contents
  - Subtractive
    - Leaving this as an option, rather than a defining feature of the framework, permits accounts of a (less radical) phenomenology in which we *don't* only experience the unexpected

# Further differences between EM and standard PC models

- EM is:
  - Robustly experiential
    - Offers an account of the aspectual shape of experience, not just what the experience is about (unlike, e.g., (Hohwy, Roepstorff & Friston, 2008)?)
  - Counterfactual
    - The content of experience is not given (only) by the prediction of what input *will* be received if the current action is carried out
    - But also in terms of the expectations of what inputs *would be* received if an entire range of non-actual actions were individually carried out

# Further differences between EM and standard PC models

- EM is:
  - Non-monolithic
    - E.g., no insistence on universal application of error suppression
    - But also: no insistence even on universal error-minimisation
      - For example, creative/novelty-seeking forms of cognition might result from an error-minimising predictive model being locked in a spiralling “arms race” with a model that seeks out inputs that exceed (but only just!) the model’s current predictive capabilities (the “subjective edge of chaos”; Chrisley 2008)

# Further differences between EM and standard PC models

- EM is:
  - Embodied
    - E.g., the spatial structure of experience depends on actual spatial structure of actions, not representation of such
    - But also: which actions are to be included in the set of those which determine the experience-generating expectations at any time may depend on whether they would actually provide information about parts of the world from which one is receiving (perhaps impoverished) visual information -- not representation of such
  - This is not to say that no other PC models have these features
    - E.g., (Seth, Critchley and Suzuki 2012) presents an account that is robustly experiential and enactive (and affective)

A dramatic sunset over the ocean. The sun is low on the horizon, partially obscured by dark, heavy clouds. Bright light breaks through the clouds, creating a shimmering path on the water's surface. The sky transitions from a deep blue at the top to a golden yellow near the horizon. In the distance, a pier or breakwater extends into the sea on the right side.

# Thank you.

Comments welcome:  
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