MUTUAL CAUSATION BETWEEN BODY AND BRAIN

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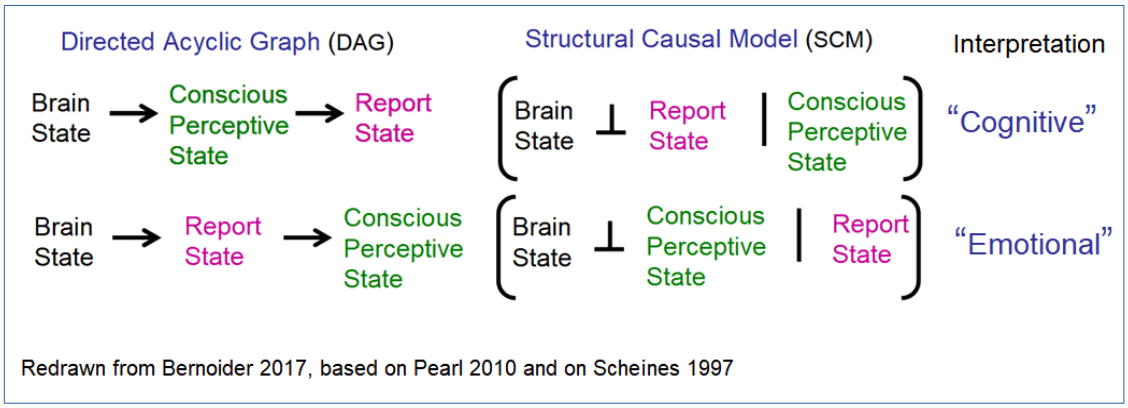
ABSTRACT

Mutual Causation has received relatively little attention since Frankel's[1] analysis demoted it as practical possibility. Indeed its absence is implicit in the increasing application of ***Structural Causal Models*** *to represent causal relations between conscious perceptive states, brain states and report states – as exemplified in the account of* ***Bernroider***[2]. [...]



Here: **(a ⊥ b | c)** means **a** and **b** are *independent conditional* on **c**.

For the "**Emotional**" case: **Brain State** and **Conscious Perceptive State** become **independent conditional** on **Report State** – providing a clean separation between between Brain and Conscious Awareness, provided the individual has the capacity to make report, bodily or through language. This interpretation thus aligns with: (1) Mental processes ***supervening***, rather than intervening, in neuronal physiology (Dewar 1976); (2) consciousness as an evolved ***user illusion*** conditional on an individual's capacity to report their reasoning (Dennett)[3].

Yet does this make sense from a developmental stand-point? Do infants really have zero consciousness until they develop a capacity to report coherently to others, and then themselves? The Table[4] below illustrates how algorithmic substrates may align with infant development.

Evolutionary mechanism	Trial & Error	Natural Selection / genetic replication						Memetic replication, Language, Thinking tools	
Dennett's Creature		**Darwinian**		**Skinnerian**		**Popperian**		**Gregorian**	
Algorithmic substrates		Representational Learning							
				Reinforcement Learning					
						Predictive Coding / Bayesian networks			
								Nested Virtual Machines	
Infant development			CONCEPTION	Reflexive agency	BIRTH	Sensor-motor stage		Preoperational stage	Hands-on-Science
Comprehension	Competence *without* comprehension			Implicit spatio-temporal		Explicit spatial Implicit temporal		Explicit spatio-temporal	Scientific knowledge

The **Predictive Coding** substrate provides automated formation of hypotheses – which, when reported/shared, ask an evidential **grounding**.

If **sentience** precedes full consciousness (e.g. during the developmental **sensor-motor phase**) it could constitute an ontological grounding – by which information may be transformed into knowledge through experiential learning.

If **sentience**-based grounding **causes** information within a **Brain State** to become knowledge while at the same time **reported** knowledge **causes** a **Conscious Perceptive State** there may be a case for considering **Mutual Causation** rather than reducing matters to SCMs derived from DAGs.

There might be a "resonant loop between body states and brain states" as Damasio puts it[5].

1 Lois Frankel, 1986, Mutual causation, simultaneity and event description, *Philosophical Studies: An International Journal for Philosophy in the Analytic Tradition*, vol 49, 3, p.361-372.

2 Gustav Bernroider, 2017, Neural transition dynamics and conscious perceptive states, in *Biophysics of Consciousness: A Foundational Approach* eds. R.R. Poznanski, J.A. Tuszynski and T.E. Feinberg, p.251-277.

3 Daniel C. Dennett, From Bacteria To Bach and Back, Norton, New York NY, 2017. See Chapters. 6 &14

4 Gavin & A Brelstaff, A Touch of Grounding, *Luminous Workshop* page 8--11 - 2019

5 Antonio Damasio, 2010, Self Comes to Mind: Constructing the Conscious Brain, Pantheon New York NY, p.116.