HOMEOSTASIS THEORY OF CONSCIOUSNESS

Solving the Hard Problem using physiological correlates of consciousness

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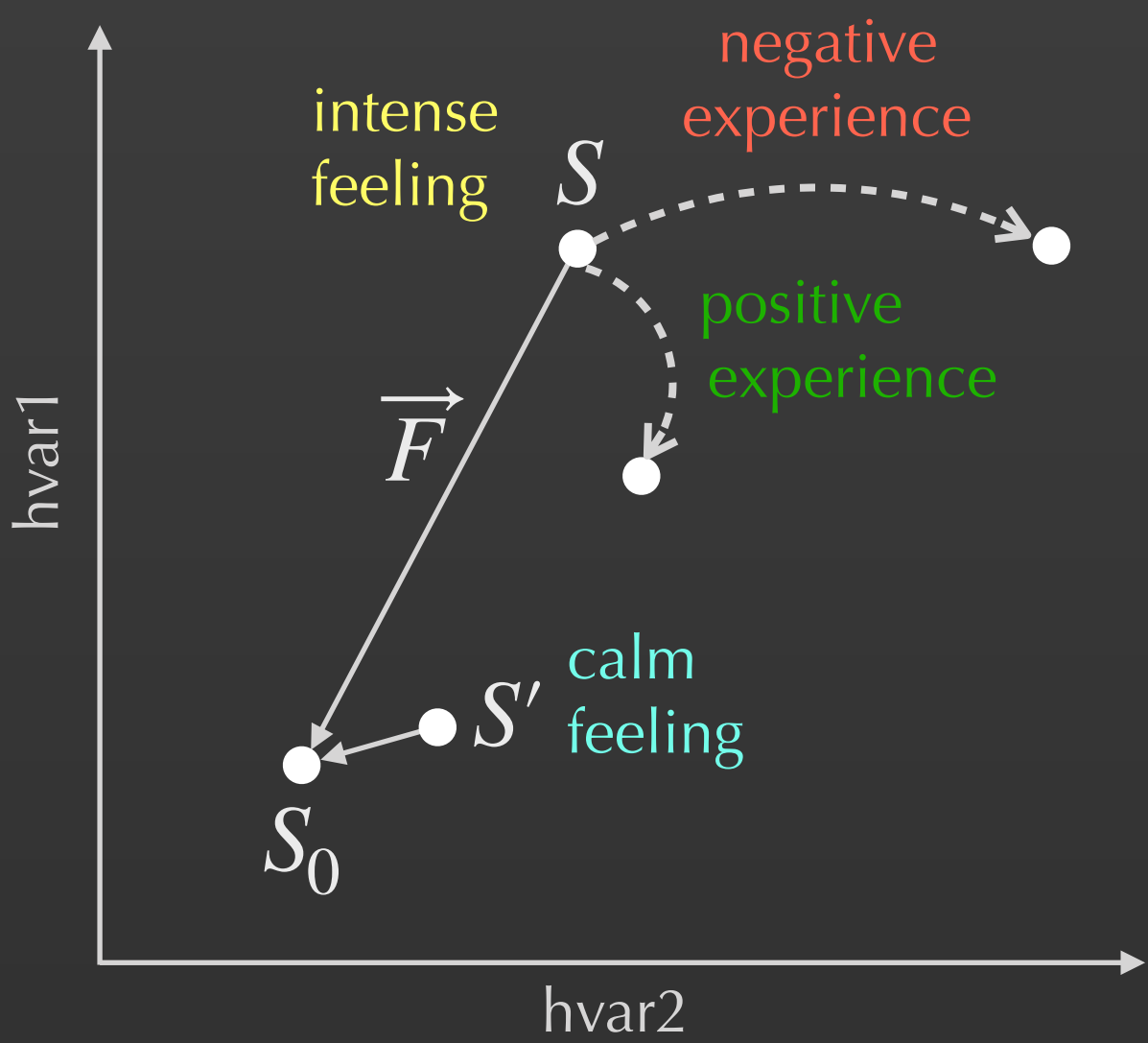
thesis

EMBODIED AGENCY

Homeostatic systems demonstrate an agency that is directed towards homeostasis. This agency is -
- a result of the system's physiology, particularly certain asymmetries and does not need any actor other than the system itself, and
- not under the system's control; a homeostatic system has no choice but to proceed towards homeostasis

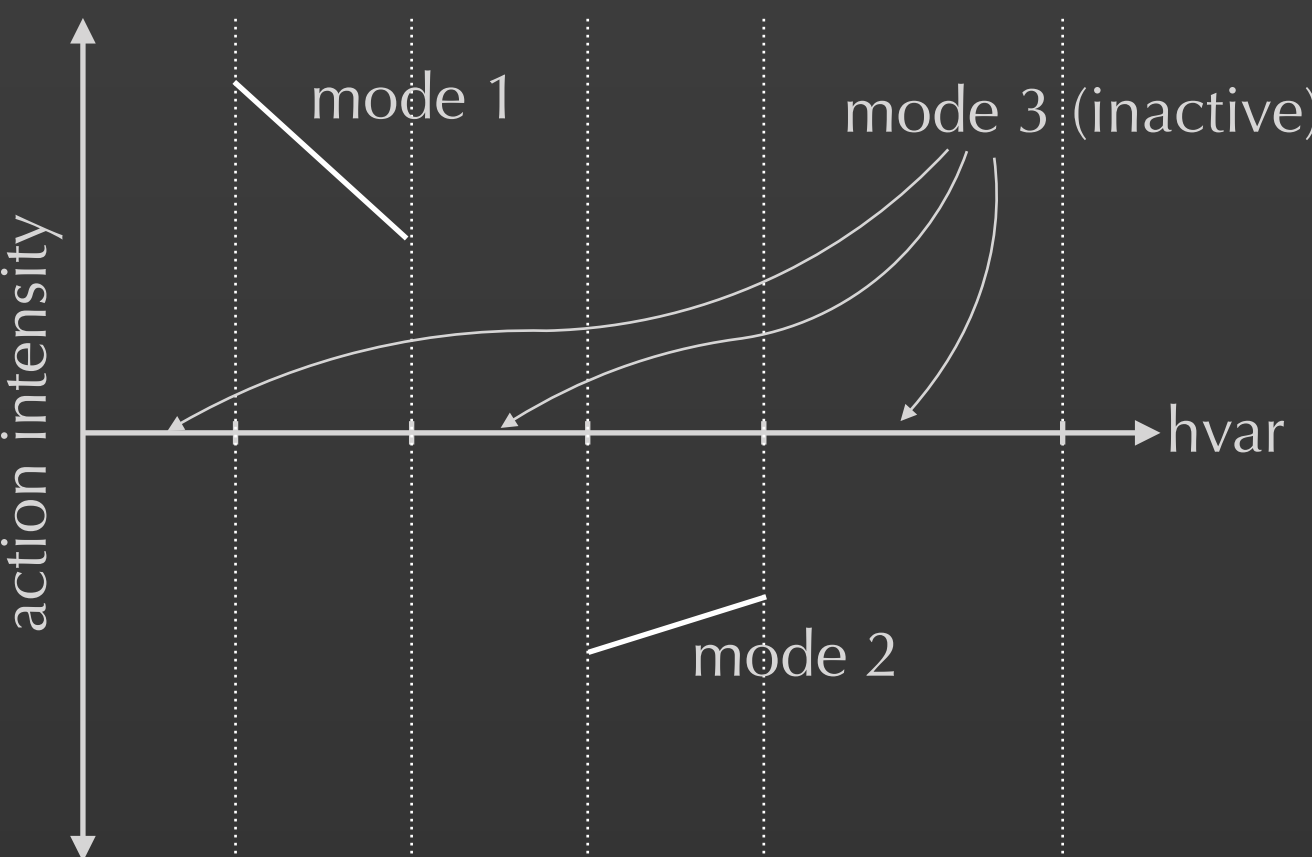Embodied agency can be interpreted as a force (the "Homeostatic Force") that pushes the systems towards homeostasis.

WHAT IS FEELS LIKE

The homeostatic system "viscerally" feels the homeostatic force acting on itself along with the resulting movement of material and energy within it and across its boundaries. This embodied feeling is what it feels like to be that system. This is the basis for phenomenal consciousness.

Intensity of the embodied feeling is proportional to the magnitude of the homeostatic force vector. Specifically, when the system is far away from a steady state, that results in an intense feeling. On the other hand, at or near a steady state, the system feels calm.

EXPERIENCE

Consider an event that moves a system to a new homeostatic state. The homeostatic force vector changes its direction and magnitude in response. An experience is what this transition of homeostatic force vector feels like. An experience feels positive ("good"), negative ("bad") or neutral depending on whether the system moved towards, away from or kept its distance from a steady state.

intuition

Homeostatic force $\vec{F}$ is a vector in the homeostatic state space (where each axis is a homeostatic variable or "hvar"), from current state S to a homeostatic steady state S_0.

A homeostatic system performs certain actions to restore homeostasis. Such actions depend on direct measurement of hvar values or their values inferred from other sensed variables. We can draw a response graph for each hvar-action pair. The above system has 3 distinct modes of operation, and corresponding 3 potential distinct experiences.

core

SIZE / AMOUNT OF CONSCIOUSNESS

The amount of consciousness is quantified as the total number of potential distinct experiences the system may have. We denote this quantity with the symbol ॐ (Om).

$$\text{ॐ} = \prod_{a \in \mathbb{A}} | \uplus_{v \in \mathbb{V}} M_v^a |$$

where,
$\mathbb{A}$ is the set of actions,
$\mathbb{V}$ is the set of hvars,
M_v^a are the modes of operation for hvar v and action a and is denoted by a set of ranges
$\uplus$ gives a set of disjoint subranges from a set of ranges
$|x|$ is the number of unique ranges in a set of ranges

inference

HOMEOSTATIC EFFICIENCY

a relative measure that is inversely proportional to the amount of energy needed to maintain homeostasis against a particular set of homeostatic challenges

HOMEOSTATIC DEFENSE

the set of environmental challenges that a system can maintain homeostasis against

HIERARCHY OF HOMEOSTATIC SYSTEMS

A hierarchically higher level system can be formed from a set of homeostatic subsystems when such arrangement provides better homeostatic defense and/or efficiency compared to any individual subsystems. Such higher level system -

- must be a homeostatic system
- must have own set of hvars and actions
- may be able to control subsystem behavior

EVOLUTION

Homeostatic efficiency and defense are good measures of "fitness" in evolutionary terms. Throughout evolution, life has gained more efficient homeostatic mechanisms with larger defense. These mechanisms, in roughly evolutionary order are 1) Negative feedback, electro-mechano-chemical steady state, 2) Procedural, genetic, 3) Predictive, free energy minimization, 4) Symbolic, software hvars, 5) Self-as-a-symbol, social hvars, and 6) Tools and technology.

implications

FREE WILL

As homeostatic systems, living organisms have no choice but to follow the path towards a steady state. Actions "happen" along the way and the organism has no direct control over them. Organisms guide their own behavior indirectly by erecting "software hvars" such that desired actions are produced as the system proceeds towards homeostasis.

ROLE OF THE BRAIN & NCC

Body, as a homeostatic system, has certain hvars and corresponding phenomenal consciousness. Brain has two main roles - 1) increase the size of consciousness using software hvars, and 2) provide access consciousness apparatus.

NCC could explain access consciousness but not the a subset of phenomenal consciousness.

epilogue

Starting with the axioms of embodied agency and no self-control, a set of deductions causally connect homeostasis with evolution and consciousness. Many questions remain and many experimental and theoretical proofs would be needed to explore the validity of these ideas. HTC challenges many existing theories of consciousness and has the potential for a broad theoretical and practical utility.

ARTIFICIAL CONSCIOUSNESS & AI

Faithful simulation of homeostatic system hierarchy would be conscious within the confines of the simulated environment. It could communicate with outside world if it has access consciousness apparatus.

A new class of algorithms could be designed for robotics and AI. Due to hvar-action interactions, a hierarchy of software hvars can bring together competing interests and decide consensus actions.

IIT AND MORE

- IIT: Non-homeostatic systems with high phi values cannot possess consciousness. The relationship between phi and consciousness should be investigated as a correlation rather than causality.
- Pathology and pharmacology can gain insights from understanding hvars involved, hvar-action profiles and hierarchical control mechanisms
- Psychology can be re-formulated from the ground up as the study of software hvars
- Concepts such as social status and morality could be understood using social hvars

ABOUT THE AUTHOR

Amol Kelkar (kelkar.amol@gmail.com, linkedin.com/in/amol-kelkar) is an independent researcher with experience in computational neurobiology from the University of Texas at Austin. He is an inventor and entrepreneur and has 20+ years of software industry experience, most recently as the CTO for a web technology company.

REFERENCES

Please see the companion manuscript available at homeostasistheory.org