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INFORMATIONAL SINGULARITY OF SELF-CONSCIOUSNESS

LUCAS JAUED[1*]
[1*]FEDERAL UNIVERSITY OF MINAS GERAIS, EMAIL: lucasjaued@gmail.com

Abstract:
The main objective of this article is to demonstrate that there is a form of self- consciousness where the amount of information generated by (q) (a set of predictions of sensory results, whether interoceptive or exteroceptive, of hypothetical actions) is a direct function of the degree of certainty that the individual attributes to (q). In this context, information is quantified in terms of a direct relationship with the degree of certainty that the individual has in relation to his/her own internal states

INTRODUCTION:

The present conception of consciousness, self-awareness and sense of agency/control is based on the distinction between "self" and "non-self/world", as explored by José Luiz Bermúdez (1998) when characterizing self-awareness at a pre-reflective level.
From this line of research, we propose the Specific Proportionality Principle (SPP), which describes the relationship of dependence between the degree of feeling of control (directly related to the sense of agency) and the level of self-awareness. According to the SPP, the greater the sense of control, the greater the degree of self-awareness associated with this specific form of self-awareness.
Based on this principle, we derive the concept of Informational Singularity of Self- Awareness (ISS), which postulates that, in certain forms of self-awareness, the amount of information generated about the individual himself is directly proportional to the degree of certainty he attributes to his internal states. In other words, the greater the probability of a state or event, the greater the amount of information generated about it.
The next step in this argument is to compare the results obtained with the Free Energy Principle (FEP), which uses the Inverse Relation Principle (IRP) as a central concept. By establishing the ISS, we identify an explanatory limit for the FEP, which attempts to reduce all brain information processing to a single principle.

1. "I" vs. "world" distinction

A central point in the present research is the "I" versus "non-I/world" distinction. This distinction is fundamental in the study of self-awareness (and also consciousness) (ZAHAVI, 2016; MUSHOLT, 2015). The relationships between consciousness, self- awareness, and the "I" vs. "non-I/world" distinction can be approached in various ways. It can be argued, for example, that this distinction constitutes a fundamental element of self-awareness (BERMÚDEZ, 1998, p. 237, p. 272), or that the ability to distinguish oneself from the world is a prerequisite for self-awareness (FRISTON, 2018). Alternatively, one could argue that consciousness itself depends on this distinction (DENNETT, 1991; FLANAGAN, 1992), or that self-consciousness is necessary to distinguish oneself from the world (Bermúdez, 1998, p. 164).
For the purposes of this article, we follow Bermúdez (1998) in adopting the idea that self-consciousness has a fundamental contrastive dimension, where an individual's degree of self-consciousness is a function of the richness of his or her awareness of the external environment. Thus, variation in the perception of the "world" implies a proportional variation in the individual's degree of self-consciousness, since self- consciousness depends on the contrast between the "self" and the "non-self/world".
In Bermúdez's words:
"Registering the distinction between 'self' and 'non-self' is a very primitive form of self-consciousness. This is because self-consciousness has a significant contrastive dimension. A central way of considering a creature's degree of self-awareness is in terms of its ability to distinguish itself from its environment. No creature would be able to distinguish itself from its environment if it did not initially have a minimum degree of self-awareness. But once this minimum degree of self-awareness is established, the richness of self-awareness that accompanies the ability to distinguish the 'self' from the environment is directly proportional to the richness of the awareness of the environment from which the 'self' is being distinguished" (BERMÚDEZ, 1998, p. 164).
We call this idea of self-awareness proportionally dependent on awareness of the environment the Bermudez Principle of Proportionality (BPP).

2. Drawing the Parallel "I" vs. "World" with "What I Do" vs. "What Happens to Me"

Building on the "I" vs. "World" distinction, we draw a parallel with the "what I do" vs. "what happens to me" distinction that comes from the notion of agency. As Richard Taylor (1966, pp. 59–60) notes, this distinction underlies our understanding of the active and the passive, of power and agency on the one hand, and passivity and patience on the other. The sense of self-agency can be defined as the sense of initiating, executing, controlling, correcting, and stopping volitional actions in the world.

Drawing this parallel helps to reveal how the fundamental "I" vs. "not-I/world" distinction manifests itself in the sense of agency. The sense of agency, the notion of "what I do," is ultimately the awareness of "self in action."

3. Establishing the Principle of Proportionality

With the parallel between the distinctions "self" vs. "not-self/world" and "what I do" vs. "what happens to me," we can explore how this latter distinction relates to the degree of self-awareness. Just as the distinction "self" vs. "world" can be used to assess the degree of consciousness of a creature in a contrastive way, the distinction between "what I do" and "what happens to me" serves a similar function.

The richness of the perception of "world" or "not-self" intensifies self-awareness, feeding back into the individual's perception of himself. Bermúdez does not explore this directly, but the intensification of experience at either pole of the duality (world or self) increases the degree of self-awareness.

Based on the established parallel, we suggest that the variation in the sense of control not only increases the contrast between "self" and "non-self/world", but also intensifies the degree of self-awareness of the individual at both poles of the dichotomy. Therefore, self-awareness is a bidirectional function that considers both the "internal awareness" of the "self" and the "external awareness" of the "non-self/world". This revised text can serve as the basis for the article, capturing the main points of the theory and preparing the reader for the deeper exploration of the concepts presented.

4. Informational Singularity of Self-Awareness (ISS)

4.1. Introduction to the Specific Proportionality Principle (SPP) and its Relation to Self-Awareness

According to the Specific Proportionality Principle (SPP), self-awareness varies proportionally to the intensity of the sense of control. In other words, the greater the sense of control, the greater the degree of self-awareness. This increase in self-awareness can be interpreted as an increase in the amount of information that the individual has about himself. Thus, a greater degree of self-awareness implies a greater amount of information about the individual himself.

4.2. Phenomenological and Structural Analysis of the Sense of Control

By analyzing the sense of control, both in its phenomenological and structural dimensions (through the analysis of the mechanisms underlying the sense of agency), we can conclude that the degree of sense of control is related to the probability of success that the individual attributes to himself. In other words, the greater the probability of success, the greater the degree of sense of control.

4.3. Formal Argument for ISS

The argument that relates the SPP to the Informational Singularity of Self- Consciousness (ISS) can be formalized as follows:

Atomic Propositions:

- A = There is an increase in the degree of sense of control.
- B = There is an increase in the degree of self-awareness.
- C = There is an increase in the amount of information about oneself.
- D = There is an increase in the probability of success that the individual attributes to himself.

Argument:

- Premise 1: A → B (SPP: If there is an increase in the degree of feeling of control, there is an increase in the degree of self-awareness).
- Premise 2: B → C (If there is an increase in the degree of self-awareness, there is an increase in the amount of information about oneself).
- Premise 3: D → A (If there is an increase in the probability of success that the individual attributes to himself, there is an increase in the degree of feeling of control).
- Conclusion 4: A → C (Hypothetical Syllogism: Premises 1 and 2; Conslusion: If there is an increase in the feeling of control, there is an increase in the amount of information about oneself).
- Conclusion 5: D → C (Hypothetical Syllogism: Premise 3 and Conclusion 4; Conclusion: If there is an increase in the probability of success that the individual attributes to himself, there is an increase in the amount of information about himself — ISS).

4.4. Counterpoint to the Classical Information Principle (CIP) or Inverse Relation Principle (IRP)

The CIP, also known as the Inverse Relation Principle (IRP), establishes that the amount of information generated by an event is inversely proportional to the probability of the event occurring. This principle, fundamental in several classical theories of information, suggests that less likely events generate more information, as they reduce a greater number of possibilities and uncertainties.

Mathematically, according to Shannon, the amount of information I(e) generated by an event is given by:

$I(e) = -\log_2 p(e)$

where p(e) is the probability of the event.

4.5. The Informational Singularity of Self-Consciousness (ISS) and the Direct Relation Principle (DRP)

ISS proposes that the amount of information generated about the individual increases as the probability of success attributed to him/herself increases. This contradicts the IRP, which suggests that the information generated by an event is directly proportional to the probability of the event. This new principle of quantification of information is called the Direct Relation Principle (DRP).

Mathematically, the DRP can be expressed as: $I(e_i) = -\log_2 (1 - p(e_i))$

or

$I(e_i) = \log_2 (1) / (1 - p(e_i))$

With this formulation, the amount of information associated with the occurrence of an event tends to infinity as the probability of the event approaches 1, and tends to zero as the probability of the event approaches 0.

4.6. Theoretical Implications and Conclusion

ISS suggests an inversion of traditional information principles, proposing that, from the individual's perspective, a high probability of success generates more information about oneself. This establishes a connection between quantitative and qualitative theories of information, considering the meaning that information has for the individual in the first person.

This new perspective is particularly relevant in contexts such as the feeling of agency and control in complex motor tasks, where the increased sense of control is directly related to increased self-awareness and, consequently, to the generation of more information about the individual.

5. Free Energy Principle

The Free Energy Principle (FEP) was first proposed by Karl Friston in 2006 as a comprehensive explanation of the fundamental workings of the brain. A simple way to understand the FEP is to start with universal questions about the existence of living things: What is necessary for life? How do organisms maintain their existence over time? What are the fundamental principles that ensure the continuity of life? What basic characteristics must an organism exhibit to remain alive?

In addition to the assumption that living organisms exist and persist over time, one can answer these questions with the premise that biological agents must actively resist the natural tendency toward disorder. Organisms, living in hostile and unpredictable environments, constantly face the tendency toward disorder described by the second law of thermodynamics, which states that the entropy, or disorder, of a closed system always increases over time. To resist this tendency, organisms must restrict themselves to a limited set of viable states, increasing the probability of finding themselves in these states. This is how organisms locally resist disorder, resisting disintegration, disappearance, and eventually death.

The process by which an organism achieves this effect is characterized by the minimization of free energy, where free energy represents the error in the individual's predictions. Free energy reflects the uncertainty or surprise associated with the inferences that the organism makes about the underlying causes of its sensory states. In other words, free energy is a measure of the uncertainty in the representations generated by the organism's internal model of its environment.

Friston initially proposed the FEP to explain how the sensory cortex infers the causes of its stimuli and the underlying causal regularities. However, the scope of the FEP has expanded over time, becoming a principle used to explain not only perception, but also action, attention, information processing, and ultimately the development and evolution of living organisms. At the heart of this principle is Minimization of Predictive Error (MPE). Friston, in collaboration with other authors, describes in "What might interoceptive inference reveal about consciousness?" that:

"Early theories of predictive processing relied extensively on minimization of prediction error (MPE) to explain phenomena such as visual perception, motor control, agency, or social cognitive metarepresentation. In contrast, the new wave of 'radical predictive processing' embraces the unifying nature of the predictive brain in an attempt to explain how all aspects of information processing and behavior emerge from integrated hierarchical streams of predictions, predictive errors, and their accuracies."

This passage highlights the unifying and reductionist ambition of predictive processing theories, which seek to explain all forms of information processing in the brain from the same principle, including consciousness itself.

5.1. Free Energy Principle (FEP), Consciousness and the Principle of Automatization

The central point of the FEP for our discussion is its use in explaining consciousness and subjective experiences. The FEP synthesizes, under a single principle, all the mechanisms that allow an organism to resist disintegration by reducing surprise and uncertainty. If this is the fundamental principle that an organism must follow in order to remain alive, all its faculties will be oriented towards this goal. Any mechanism that performs an adaptive function must therefore help to reduce uncertainty.

This logic also applies to consciousness. Since free energy measures the lack of synchrony between the organism and its environment, consciousness can be seen as the detection of this uncertainty. Consciousness is therefore the sensation of uncertainty (Solms, 2018). Its fundamental role is to create an alert when the organism begins to deviate from its ideal states. The deterioration of homeostasis or the increase in uncertainty are perceived as negative, while the reduction of uncertainty, which confirms the organism's predictions, is felt as positive.

This perspective reflects the tension between the SPP, the ISS and the FEP. The most intuitive interpretation of SPP and ISS suggests that a sense of agency and control, as well as consciousness, are present in the individual's experience during engaged action. It is believed that during high-level performance, increased accuracy and reduced uncertainty are associated with a greater sense of control and effectiveness. These sensations reflect the individual's attribution of a high probability of success, manifested in the ability to carry out their intentions even in mundane tasks, in which there is a high degree of precision and, correspondingly, low uncertainty. In other words, the greater the precision, the greater the feeling of control and subjective certainty of success.

6. Ambiguity in the Theories of Dreyfus, Friston, Mark Solms and the Predictive Mind Approach

There is ambiguity in the explanations of the sense of agency within the feedback comparator model, which includes both a positive and negative notion of agency. The positive notion occurs when there is compatibility between the predictions of hypothetical actions and the sensory returns, resulting in a sense of agency. The greater the compatibility, the greater

the degree of the sense of agency, if we consider that it can vary in intensity.
On the other hand, there is a negative notion related to the attenuation of self- generated input. The idea is that if there were no mismatch between the predictions and the external environment, there would be no need for consciousness. In a hypothetical scenario where uncertainty is eliminated, consciousness would also disappear.
This ambiguity is similar to that found in Dreyfus' theories of automatization. For Dreyfus, consciousness plays an important role in the learning of motor skills, but as the individual becomes an expert, these skills are automated and consciousness seems to disappear. However, there is still a suggestion that the experience of the expert is somehow "contextualized", characterized by phenomenological elements that indicate a dimension of consciousness and self-referentiality.
Both theories (Dreyfus on the one hand, Friston and Solms on the other) share this oscillation between eliminating and introducing consciousness to explain behavior. In both approaches, consciousness acts as a warning system, reintroduced when there is a deviation from the optimal course or an increase in uncertainty.
This connection suggests that deviation from the optimal course (optimal grip) and uncertainty or free energy are conceptually equivalent. In this perspective, the greater the certainty in predictions, the less the need for consciousness, until, in a state of complete certainty, consciousness could be suppressed completely.

6.1. Conclusion: Limitations and Potentials of Predictive Error Processing (PEM) Theory and Free Energy Principle (FEP)

Predictive Error Processing (PEM) and Theory and Free Energy Principle (FEP) theory offers a robust framework for explaining many aspects of consciousness, self-awareness, and agency/control. However, when attempting to address the transition from the sub-personal, computational level to first-person experience, significant gaps emerge. These gaps are manifested primarily in the inability of FEP to capture the full phenomenology of consciousness, particularly as it relates to the positive dimension of agency and the role of self-awareness.

6.2. Incompleteness of the Free Energy Principle (FEP)

The incompleteness of FEP lies in its fundamental assumption that the amount of information increases proportionally to the improbability of an event, and that consciousness only arises in response to predictive error. This perspective implies that consciousness is merely an alarm mechanism, triggered when there are discrepancies between the generative model and sensory inputs. However, this view neglects crucial aspects of conscious experience that are not directly related to uncertainty or error correction.
For example, self-awareness not only emerges to correct predictive biases, but also plays a role in the construction of a continuous and cohesive identity that goes beyond simply minimizing errors. The sense of self and the perception of control over actions cannot be adequately explained by uncertainty reduction alone. There is an intrinsic dimension to consciousness that involves self-affirmation, meaning-making, and the integration of experiences over time, aspects that are not captured by the traditional FEP approach.

6.3. Argumentative Insufficiency

The argumentative insufficiency of FEP manifests itself in the way it treats consciousness as a mere byproduct of the need to reduce uncertainty. This view is reductionist and fails to capture the complexity of conscious experience, especially when considering the phenomenological perspective. Consciousness is not only a response to external stimuli, but also an entity that processes and generates information about itself in a unique way. In this sense, consciousness is fundamental and irreducible, a characteristic that the FEP, in its current form, fails to fully address.
The standard FEP approach limits the role of consciousness to the function of alertness, failing to recognize that self-awareness and the sense of agency involve autonomous and integrative dimensions that go beyond the simple correction of predictive deviations. The FEP analysis fails to adequately consider the significance that uncertainty reduction has from the perspective of consciousness, neglecting how these phenomena are experienced and represented in first-person experience.

6.4. The Role of the Informational Singularity of Self-Consciousness (ISS)

The introduction of the Informational Singularity of Self-Consciousness (ISS) offers a perspective that can fill some of the gaps left by the FEP. ISS suggests that consciousness has unique ways of processing and creating information about itself, ways that do not depend exclusively on uncertainty or the existence of alternatives. This implies that there are ways of constructing consciousness and the phenomenological dimension that transcend the function of uncertainty reduction.
ISS, by recognizing the sui generis character of the information generated by consciousness, proposes that conscious experience involves a residual autonomy and an intrinsic integrity that cannot be fully explained by the theory of predictive error minimization. Consciousness, from this perspective, is not just an alarm mechanism, but an active system of meaning creation and self-affirmation, playing a fundamental role in the construction of identity and the integration of experiences.

FINAL CONCLUSION

The FEP, in its current form, provides a solid basis for understanding many aspects of consciousness, self-awareness, and agency/control. However, its limitations make evident the need for a more comprehensive approach that also considers the phenomenological dimension of these phenomena. ISS emerges as a theoretical tool that can complement the FEP, offering insights into the intrinsic and irreducible nature of conscious experience.
A proper analysis of the phenomenology of action reveals that consciousness and self-awareness play roles that go beyond the simple reduction of uncertainty. They involve the creation of new meanings and the construction of a cohesive

identity, aspects that are fundamental to human experience and that demand a revision of the way we understand the relationship between consciousness, uncertainty, and agency. Thus, by integrating ISS with the FEP, we can advance the understanding of these complex phenomena, offering a more complete and satisfactory view of the nature of consciousness and self-awareness.

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