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The representational structure of noetic feelings

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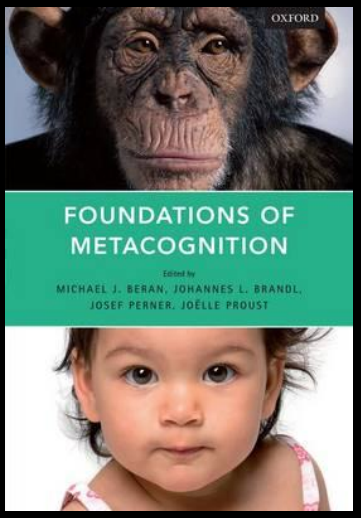
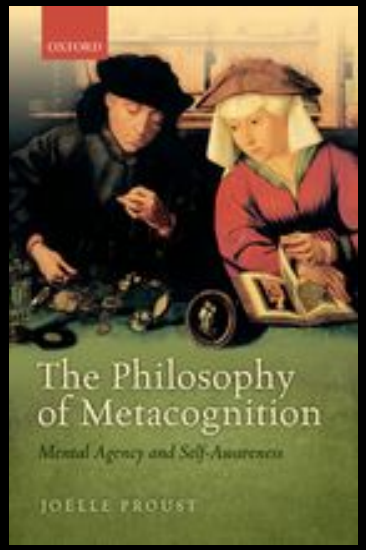




Outline

1. Introduction: why noetic feelings matter
2. Function and action types
3. From function to representational content
4. Feelings, Beliefs and Inferences

Conclusion

1. Introduction
Why noetic feelings matter

Noetic Feelings

Predictive

- cognitive effortfulness
- Familiarity
- knowing
- Tip of the tongue
- Coherence, incoherence

Retrodictive

- Uncertainty about correct performance
- Uncertainty about existing competence
- Feeling of being right

The theoretical importance of noetic feelings

- They have a central role in so-called « experience-based » metacognition, aka procedural metacognition. (Koriat & Levy-Sadot, 1999 , Schwarz & Clore, 2007).
- They involve implicit predictive heuristics
- the relation between feelings and heuristics is described but still unexplained: Koriat (2000) « cross-over principle ».

Arguments in favor of a two-system view of metacognition

- Rhesus monkeys can monitor what they remember or perceive, but have no concepts for their own mental states

- Toddlers can reliably monitor their memory in implicit decisions but fail to report their underlying knowledge states

Dissociation in Children's mc

« Implicit evaluation »

- opting out from a memory task. (Balcomb & Gerken, 2008)
- opting out from a perceptual discrimination task. Bernard et al.(2014, 2015)
- Fixation patterns on a confidence scale for memory (Paulus, Proust & Sodian, 2013).
- Infants ask for help when they don't know Goupil et al. 2016)

« Explicit report » of knowledge

- Smarties task, Gopnik & Astington 1988
- partial perceptual knowledge, Rohwer et al. 2012
- lexical knowledge: Marazita & Merriman, 2004)
- Non-reliable confidence report about correct recall (Paulus, Proust & Sodian, 2013)

Process duality in adult mc

- Adults routinely evaluate their perception and memory on the basis of their noetic feelings (based on fluency).
  - Under cognitive load, Type 1-P is used, even when fluency is not a diagnostic cue for performance success.
  - When the reward is high enough, or when a theory is made available , type 2 deliberative,concept-based, analytic metacognition is used.

Koriat & Levy-Sadot, 1999, Schwarz 2004

Dual-Processing view

Type 1 processing

- short-sighted, automatic, largely non-conscious, fast and unexpensive
- Early-developing
- independent from language
- Inflexible, i.e. encapsulated from the rest of cognition
- Highly contextualized
- Concepts restricted to a specialized domain.

Type 2 processing

- far-sighted, controlled, conscious, slow, expensive
- Later-developping
- dependent on language
- Flexible, unencapsulated
- Decontextualized
- Unrestricted use of concepts

(Evans and Frankish 2009, Kahneman 2003, Smith & DeCoster 2000, Stanovitch, 2004, Thompson et al. 2011)

Speaking of two systems describes rather than dissolves the difficulty

Why are there two systems? How do they work together?

1. Additional executive demands in verbal tasks?
2. Different types of representational processes involved?
3. No radical difference?
    1. System 2 is in fact System 1 ?
    2. System 1 is in fact System 2?

To make progress on this issue

Much more need be said about

- How function constrains representational use
- the Informational processes respectively involved

2 - Function & action types

2 Hypotheses (Proust 2014)

1. No single agentive mechanism **is able to respond simultaneously to**
   - fast-moving objects, to predators, to sudden changes
   - recurrent events
   - long-term uncertain future changes
2. **a principle of economy** drives any action: attain goal at the lower cost possible.

3 action systems are meant to respond to different constraints

- Habitual/routine actions: preference for acting on recurrent environments and cue patterns
- Impulsive or emotional actions: acting on urgent affordances.
- Strategic actions: belief-based plans formed in order to attain more reliably higher/more rewarding/ goals

Cogsci references about our 3 systems

Doll, Simon, Daw, (2012), Lee, Shimojo, O'Doherty (2014), Niv, Joel, Dayan (2006):

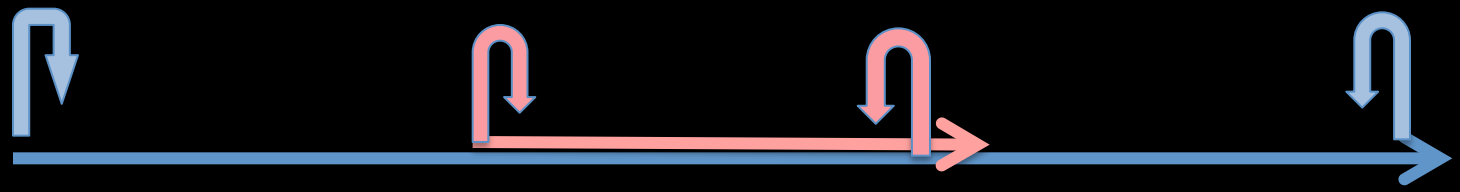
- **Habit ("model free") system is the default way of acting.**
- **Goal directed ("model based") system: puts the break on default system.**
- **Affect-based action system:**
  - Amorapanth, LeDoux, Nader (2000)
  - Borgomaneri et al. (2014)
  - Frijda (1986)

Why relate metacognition to an underlying type of action?

- Metacognition controls and monitors an on-going cognitive action, e.g.: attempting to
  - perceptually discriminate a specific shape, color, etc.
  - retrieve a proper name
  - Learn a material
  - Solve a problem
  - Contribute to a conversation

cognitive action

Epistemic norm(s)



Instrumental action: norm of utility

- Because there are several types of cognitive action,
- There are also several ways of controlling and monitoring them:
  - Experience-based metacognition belongs to **reactive** action monitoring
  - Analytic or concept-based metacognition belongs to **strategic** action monitoring

How the trade-off works

- A reactive mental action is fast and cheap in resources (low cognitive load).
- This evaluation takes control precedence on dispositions to act mentally
  - when time is restricted
  - when risks and benefits are moderate or low.

Impulsive cognitive actions

- An agent intentionally performs her reactive mental action **here and now**, possibly interrupting another ongoing action
- Impulsive and routine mental actions are **"reflex-like" and shortsighted** (no apparent concern for the consequences).
- They react to **some particular features** of a present situation, ignoring others.

Examples of Impulsive cognitive actions

- Feeling that one can't clearly see something and taking a closer look
- Feeling a face familiar and trying to remember who this person is.

ROUTINE cognitive actions: recurrent contexts

- Selecting an action in a tree of alternatives is costly, in terms of mental resources (time, working memory, updated knowledge base)
- Paying attention to the consequences of a given action is costly too, and unnecessary if the context is stable.

Similarity with impulsive actions

- Performance "in the grip of a habit" (vs. "in the grip of an emotion").
- practical reasoning not involved.
  - shortsightedness
  - control precedence (interference with planned action)
- little focal attention, or no conscious awareness (e.g.unconscious driving).

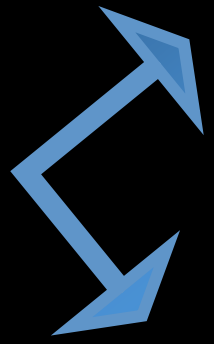
Examples of routine metacognition

- Assessing the validity of an arithmetic operation
- Assessing a claim through an accessibility heuristics

Types of cognitive action-mc cycles

action **metacognition**

Reactive cognitive actions

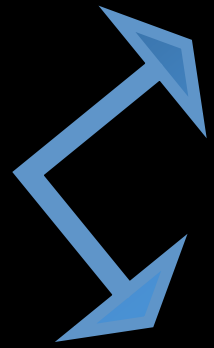


impulsive

routine

:

Strategic cognitive actions



Future-oriented

Reactivity-trained

3 - From cognitive action type to representational use

Hypothesis: Type of information to be used needs to match the constraints applying to cognitive actions

- Reactive (Impulsive and routine) (meta)cognition have an evaluative, feeling-based representational structure.

- Strategic (meta)cognition takes advantage of socially transmitted concepts, such as knowledge, plausibility (and the associated inferences).

(Proust, 2015)

What is an 'experience-based' evaluation?

Several authors (philosophers and psychologists) have independently hypothesized that an

- evaluative
- nonconceptual,
- affect-based mode of representation

is shared by humans and nonhumans.

- **Bermudez’** frames (2009),
- **Cussins**' NASAS, (2012),
- **Dreyfus & Kelly**'s affordance sensings, (2007),
- **Gawronski & Bodenhausen's** associative evaluations (2006),
- **Gendler**'s aliefs, (2008),
- **Griffiths & Scarantino**'s emotional representations (2009),
- **Millikan**’s pushmipullyu representations (1995)
- **Nanay**'s pragmatic representations, (2013).
- **Strawson**’s feature placings (1959)

Evaluations are structured

- They have an associative rather than a propositional structure.
- They detect predictive cues for affordances.
- They include a **felt** valence and intensity
- They are relational and subjective rather than detached and objective.
- Their content includes action guidance

The semantic structure of evaluative attitudes (affordance sensings)

- Affordance$_a$ [Place=here],[Time= Now/soon],
- [Valence$_a$],
- [Intensity$_a$ (on a scale 0 to 1)],
- [motivation to act of degree$_d$ according to action program$_a$].
- All the constituents are associatively related to perceptual cues in the affordance sensing
- a subset may activate the full representation

What noetic feelings represent

- Noetic feelings are evaluative nonconceptual representations
- They react to the presence , in the system, of epistemic affordances
- Epistemic affordances are **subjectively** valenced (pleasant, aversive).
- They predispose to perform a given mental action according to their gradient of valence and intensity

(Proust, 2014, 2015, in press)

Two related new questions

- How do noetic feelings **reliably** track epistemic affordances?

- What is the relation of noetic feelings with conceptual knowledge ?

4 . Feelings, Beliefs and Inferences

How do noetic feelings reliably track epistemic affordances?

- They reliably track affordances when they are based on diagnostic cues, i.e. on cues that were associated with cognitive success in tasks of the same kind.

- Used outside their domain of predictability, cues are the source of evaluative illusions

Vehicle cues are cheaper

- Less costly to extract properties of the vehicle than to substantial epistemic outputs.

- For example, a feeling of knowing depends on the mere quantity of cues being subpersonally accessed when being questioned. (Koriat, 1993).

Single neuron recordings in monkeys and rodents confirm Koriat's claim.

The relevant cues for confidence are provided by the dynamics of information processing by the neural assemblies involved in a given task.

(Fleming, 2014, Kepecs & Mainen, 2012, Kiani & Shadlen, 2009).

Noetic feelings are blind to contents (but not to task)

- **Bayesian Hypothesis:**

The informational input for predictive « noetic affordances » consists in the structural, dynamic properties of the mind-brain being elicited a cognitive action

  - while it is being prepared, (feeling of knowing)
  - While it develops (JOLs, problem solving)
  - or once it has been performed (feeling of being right).

-

- Processing onset latency,
- intensity and increased coherence of cognitive activity over time,
- latency to reach threshold

together predict likely cognitive success in this task.

Question 2

- What is the relation of noetic feelings with beliefs?
- Our Bayesian hypothesis seems to entail that what the subject **believes** about the task and its environment plays no role in how cognitive affordances are sensed.
- The view, however, is merely that feeling-based evaluations bring a **specific** information into play.

Noetic feelings are rarely if ever produced in a conceptual void: chess playing gives rise to feelings.

- The conceptual framing of the context or task precedes affordance sensings.
- The task as framed elicits feelings.
- Once produced, a feeling cannot be swiftly revised.

Alternative view: Two-factor theories of **noetic** feelings

- In our single-factor theory, noetic feelings have an intrinsic intensity and an intrinsic valence.
- Two-factor theories claim rather that:
  - Noetic feelings have an intrinsic arousal level, but their valence and action-guidance potential depends on how the environment and the task are interpreted.

(Kelley and Jacoby, 1998, Schwarz & Clore, 2007, Whittlesea & Williams, 2000).

Two-factor theories of noetic feelings

- Participants have **a primary feeling of fluency**, which they interpret in more specific terms **as a function of their goal and of the context as they consciously represent it to be.**
- For example:
  - As a familiar face,
  - As a true statement,
  - As a reliable memory
  - As a valid discrimination

Two-factor theories of noetic feelings

→ a feeling partly relies on background knowledge, and on a naïve theory concerning the relations between feelings and mental activity.

The naïve theory

- The naïve theory formed by participants goes like this: feelings are about what one is doing, so this feeling must be about this event of trying to perceive, this attempt at retrieving, etc.

Objection 1 to the two-factor account of noetic feelings

A full-blown naïve-theory view is incompatible with monkeys' and young children's epistemic evaluations based on fluency (Beran et al. 2012)

A deflationary interpretation of « interpretation »

- « New information is interpreted in terms of the applicable concept that is most accessible **at the time of encoding** ». (Schwarz 1998)
- The relevant « concept » might work rather as a **predictive/anticipatory cue** within an affordance sensing, rather than a proposition-based interpretation.

→ A « theory of the task » might merely consist in selecting a cognitive action through associative pattern-matching.

Objection 1 to the two-factor account of noetic feelings

Granting the structure of affordance sensings, a context-dependent factor might determine both

- the task to perform
- the reactive noetic feelings elicited by this task,

There is **no posterior interpretation** of a feeling, because the feeling is activity-dependent.

Objection 2 to the two-factor account of noetic feelings

If cognitivism was right, feelings should be modulated by beliefs: when beliefs change, feelings should also change.

In fact:

- subjects can change **their decision** when they learn that a given feeling of fluency is predictively misleading,
- but under time pressure they will act again on their feeling: Cf. Nussinson & Koriat's (2008) anagram experiment.

Objection 2 to the two-factor account of noetic feelings

→ Even when a noetic feeling has been explicitly shown to agents to unduly bias their epistemic assessment, the initial feeling remains unaffected, and is able to promote further epistemic decisions.

Conclusion

Are « noetic feelings » real feelings?

- ✓Are sensing a cognitive affordance,
- ✓Have a positive or negative valence
- ✓Have an intensity on a gradient scale,
- ✓Are embodied in facial gestures
- ✓Include dispositions to specific cognitive actions
- ✓Are about the task presently performed

Are « noetic feelings » real feelings?

Their affective value and intensity depends

on the discrepancy they express between predicted versus observed feedback.

Compare a standard feeling of knowing a proper name with Archimedes' Eureka feeling of exhilaration when discovering a method for determining the volume of an object with an irregular shape.

Can affordance sensings combine?

- Evaluations from many different subsystems are common currency for decision making (Sugrue et al. 2005).

- A major condition for rational decision is that they do! Hence it is difficult to maintain that system 2 control might operate without them.

Thanks for

Your attention !