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Epistemic feelings, task indexing and thought
awareness

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- What are the informational processes that underly thought awareness?
- **Method:** use jointly
 - phenomenological observations
 - Experimental evidence and theorizing from behavioral and neuroscientific studies
 - Philosophical theorizing about evaluative attitudes.

Defining thought awareness

Thought awareness = Df the conscious experience that is **specifically** elicited when agents are "thinking", i.e. when they are engaged in first-order cognitive activities such as reasoning, discriminating or interpreting.

Thought awareness comes in two varieties

- 'Hearing one's own thought in internal speech', having visual imagery (thereby accessing what one thinks about'),
- Seeming to understand a sentence
- Finding a distinction clear/obscure
- Finding a proposal coherent/incoherent, relevant/irrelevant
- Finding a cognitive task demanding/easy
- Having the impression of having sufficiently studied a given item.
- Having a name on the tip of one's tongue.

Noetic
feelings

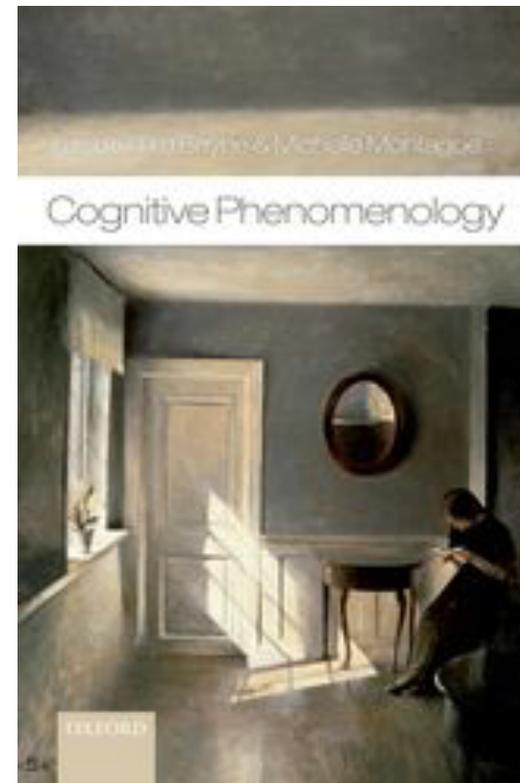
Internal speech/imagery and noetic feelings are recognized parts of cognitive phenomenology

Ray Jackendoff (1987)



Internal speech/imagery and noetic feelings are recognized parts of cognitive phenomenology

- Ray Jackendoff (1987)
- Jessie Prinz (2011) in Bayne & Montague, ch. 8



What is lacking at present is an *encompassing naturalistic theory* explaining

- *the possible functions* of each type of cognitive phenomenology
- why they are best served by making information *consciously available*.
- *Why it is that cognitive phenomenology is presentified in terms of thought contents*
- **We will start addressing these questions through Asher Koriat's discussion at ASSC 1**

Outline

1. Asher Koriat's "cross-over principle"
2. Incompatible new evidence invites revision
3. Noetic feelings are **structured evaluative attitudes**
4. Internal speech has an **indexing** function
5. Why are task indexings and noetic feelings experienced as about the task.
6. Conclusion: the function of thought awareness

1 – Asher Koriat's "cross-over principle"

Asher Koriat
ASSC I, Claremont University (1996)

"The study of metacognition can shed light on some fundamental issues about consciousness and its role in behavior, (..) in particular, **the genesis of subjective experience, the function of self-reflective consciousness, and the cause-and-effect relation between subjective experience and behavior.**



- Koriat, A. (2000). The feeling of knowing: Some metatheoretical implications for consciousness and control. *Consciousness and Cognition*, 9, 149-171.

Two kinds of metacognition



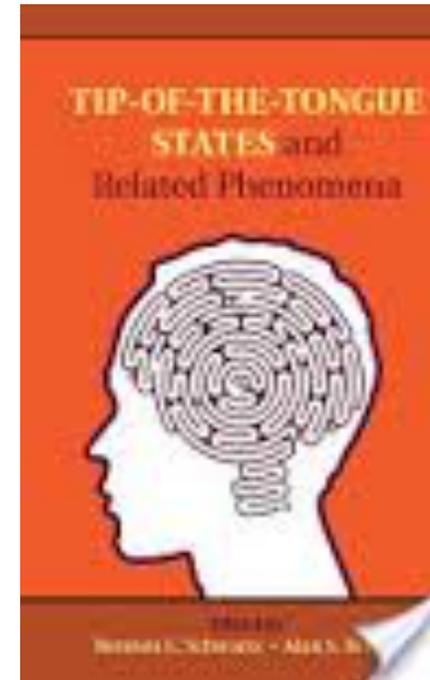
- Metacognitive judgments: based on one's beliefs and theories ("I'm good in maths")
- Experience-based assessments: "entail a qualitatively different process. Consider, for example, a TOT experience. The strong conviction that one knows the elusive target is based on a sheer subjective feeling."
- The TOT "involves the application of **nonanalytic [i.e.: nonconceptual] heuristics** that operate below full consciousness and give rise to a sheer subjective experience." (Koriat, 2007, p. 297)

TOT : Schwartz 2014

More intense PREDICT → higher resolution rate
→ Higher recognition rate
→ FOK

More emotional PREDICT → better recognition,
→ not better resolution
(retrieval blocking)

With feeling of Imminence PREDICT → better resolution
→ better recognition.



Noetic feelings have either a predictive or a retrospective evaluation function

- Finding a perceptual or memory task demanding/easy.
- Having a feeling of familiarity
- Having a word on the tip of the tongue
- Feeling of knowing the answer to a question
- Seeming to understand a sentence
- Finding a proposal coherent/incoherent, relevant/irrelevant etc.
- Having the impression of having sufficiently studied a given item.

Prediction of epistemic success (effort & persistence regulation)

Retrospective evaluation of epistemic value, based on the specific normative goal of the cognitive action.

Among the unconscious heuristics

- **Cue familiarity:** elicited by the terms of the question (Reder, 1987)
- **Overall accessibility** of pertinent information regarding the target: elicited by the activity triggered by the question (Koriat, 1993)
- **Fluency heuristic:** responses that come to mind quickly are deemed correct. (see priming experiments as a source of confidence enhancement: Kelley & Lindsay, 1993)

Other activity-dependent heuristics have been proposed

- Predictive neural dynamics: Kepecs & Mainen (2012).
- Predictive interoceptive cues from the respiratory, circulatory, digestive, and perhaps endocrine systems: Barrett & Symons (2015), Park & Tallon-Baudry (2014).
- Proprioceptive (postural, facial) cue-based heuristics: possible interpretation from Stepper & Strack (1993)

Cross-over model: a summary (Koriat, 2000)



Metacognitive experiences are

- implicit in their antecedents (unconscious processing)
- (once formed): explicit in their consequences (controlled decision-making)

Cross-over model: a summary (Koriat, 2000)



- Note that: **NOETIC FEELINGS ARE NOT BASED ON** conscious or unconscious access to content of thought (metacognitive experiences are not "metarepresentations" of first order contents!)
- "**IMPLICIT ANTECEDENTS**" refer to unconscious that extract **activity-dependent information**, i.e., **information about the vehicle** that processes the first-order task

"EXPLICIT CONSEQUENCES"

- Predictive noetic feelings reliably assess likely success in current cognitive task (and motivate a conscious, reportable, rational decision)
- Retrospective noetic feelings reliably assess likely correction of task outcome (and motivate a conscious, reportable, rational decision)
- Noetic feelings are sometimes illusory, but
 - When warned about a potential source of illusion, participants can adjust their decision accordingly.



Interpretation by Koriat (2000)

" The subjective monitoring of knowledge, **that is, knowing about knowing**, appears to constitute one of the **defining** properties of consciousness, because consciousness would seem to imply not only that I know something, **but also that I know that I know it**. Thus, consciousness can be said to bind together knowledge and metaknowledge."

→ CONSCIOUS NOETIC FEELINGS (AFTER THE CROSS-OVER)
ARE THERE TO GENERATE A HIGHER-ORDER
REPRESENTATION OF KNOWING THAT ONE KNOWS.

2- Evidence of non-human metacognition

New evidence, however, leads to revise the relation between

- **conscious awareness** and
- **knowing that one knows** (an inference between an experience and a judgment that by having an experience of knowing, one comes to know **that one knows**)

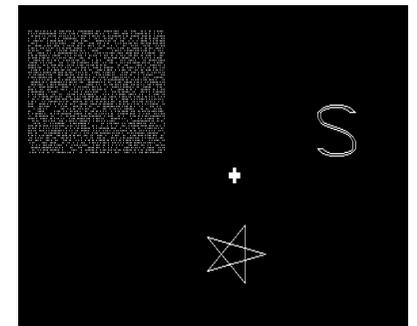
Experimental evidence for **non-human** metacognition

3 main experimental paradigms (behavior/neural evidence)

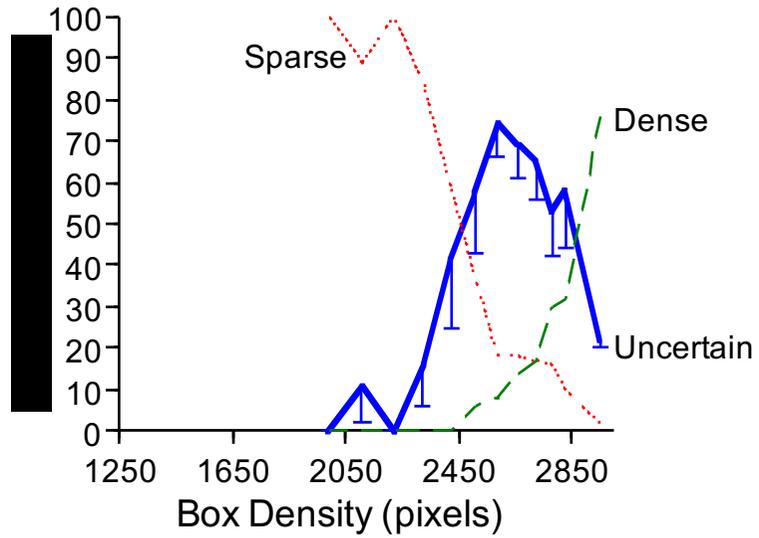
- 1. Seek information before acting**
- 2. Choose/decline to perform a task of various difficulty**
- 3. Wager on previous cognitive decision**

Smith & coll. on metacognition in monkeys

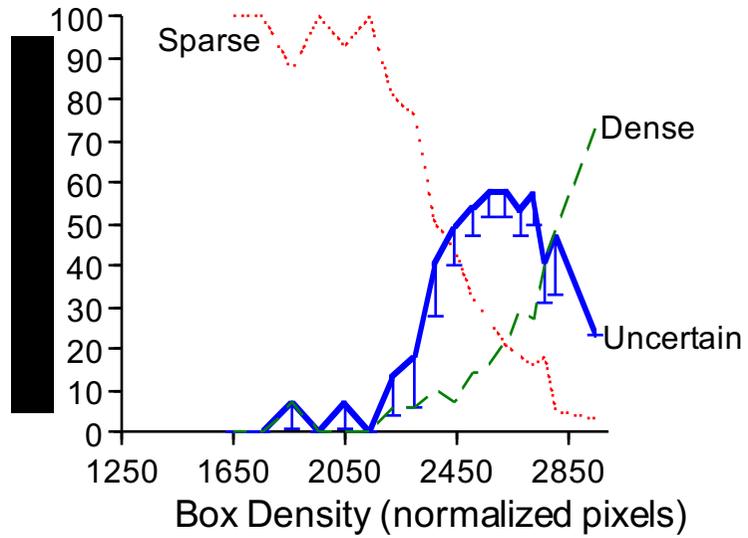
- Rhesus monkeys decline most the most difficult trials in **visual discrimination tasks** (Shield, Smith & Washburn, 1997) and in **memory tasks** (Hampton, 2001).
- They **generalize** their U- responses to new tasks. (Washburn, Smith & Shields, 2006)
- Macaques also use U-responses with **blocked feedback** (Beran, Smith, Redford & Washburn, 2006)



Monkey



Humans



Metacognition in Phylogeny

Initially negative

- **Pigeons** no U-R (Sutton & Shettleworth, 2008)
- **Rats:** Smith & Scholl (unpub.), Smith et al. 2007 (no U-R)
- **Capuchin monkeys:** no SI, no U-R (Beran et al. 2006)

Finally positive

- **Pigeons** U-R opt out (Adams & Santi 2011)
- **Rats:** Foote & Crystal (2007); Kepecs et al (2008) U-R
- **Capuchin monkeys:** U-R (Fujita 2009)
- **Rhesus macaques** (SI & U-R) (Smith et al, Kornell, Hampton))
- **Bottle-nosed dolphins** U-R (Smith)
- **Chimps and orangutans** (SI) and UR (Suda-King 2008)

U-R= Uncertainty response

SI: Search for information

Evidence for experience-based metacognition

In young children

- **20-month:** Goupil, Romand-Monnier & Kouider (2016)(non-verbal request for information)
- **3 yr-olds:**
 - Balcomb & Gerken (2008), (metamemory)
 - Paulus, M., Proust, J. and Sodian, B. (2013) (metamemory).
 - Bernard, S., Proust, J., & Clément, F. (2015) (metaperception).

Revising Koriat's view

What is confirmed: Non-linguistic cognitive agents can regulate (control and monitor) their thinking processes **on the basis of their experience.**

Incompatible new finding: Experience-based metacognition as elicited in nonhumans and very young children **does not** support the claim that **consciousness (and flexible control)** is to be equated with "**knowing that one knows**" (which requires a **concept** of knowing)

Experience-based metacognition **does not** result in "knowing that one knows"

Concept of knowledge

- **absent in the metacognitive nonhumans:** they fail the non-verbal forms of false belief tasks, with a possible exception of apes.
- **also absent in young children, when tested verbally about what they know**

The cross-over principle raises
interesting new questions

The initial cross-over principle between

- **Unconscious vehicle cues** (and associated implicit heuristics), which carry **predictive**/evaluative information
- **Subjective feelings** expressing the **predictive computational output** with respect to a task



Cross-over principle

Beyond the cross-over principle

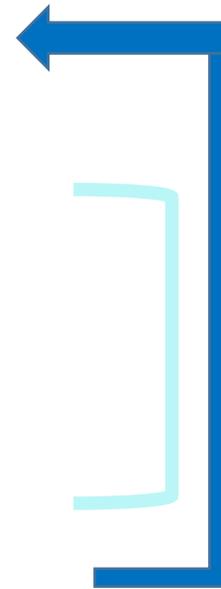
- **Are there conscious** cues identifying **the type of ongoing cognitive task at a given time t?**
- **Unconscious predictive vehicle cues** (and associated implicit heuristics), which carry the basic information about the cognitive affordance, its
- **Subjective feelings** expressing the **predictive computational output** with respect to a given cognitive affordance

Question unaddressed

Cross-over principle

Beyond the cross-over principle

- **Are there conscious** cues identifying the ongoing cognitive task at a given time t ?
- **Unconscious predictive vehicle cues** (and associated implicit heuristics), which carry the basic information about the cognitive affordance, its
- **Subjective feelings** expressing the **predictive computational output** with respect to a task



Unexplained: How are conscious noetic feelings **felt as being about the ongoing task?**

3. Noetic feelings are evaluative attitudes

Proposals

1. Insert feelings in **the representational structure of cognitive actions**
2. Articulating
 - Whether and how noetic feelings help control cognitive decision **on the basis of their experiential aspect** alone
 - how they are entertained when no reference to mental concepts is available.
 - Why they are felt as being about a task **although associated with somatic markers.**

Cognitive actions

What motivates actions does not need to consist in a conceptual goal representation

- Acting requires minimally a sensitivity to one of two types of "**affordances**":
 - opportunities that are available the environment: **world affordances**
 - Opportunities available to the system for acquiring information : **cognitive affordances** (Proust, 2013, 2014, 2015, 2016)

Cognitive action	Predictive evaluation	Retrodictive evaluation
Trying to associate perceptual input with stored knowledge	Feeling of Familiarity	Feeling of confidence
Trying to remember	Feeling of Knowing	Feeling of confidence
Deliberating about P	Cognitive ease or effortfulness, feeling of ability	Feeling of being right or wrong, feeling of competence
Trying to use the correct word	Tip of the tongue	
Planning, justifying	Cognitive ease or effortfulness, feeling of ability	Feeling of Coherence; relevance, exhaustiveness

Differentiation between the two kinds of affordances

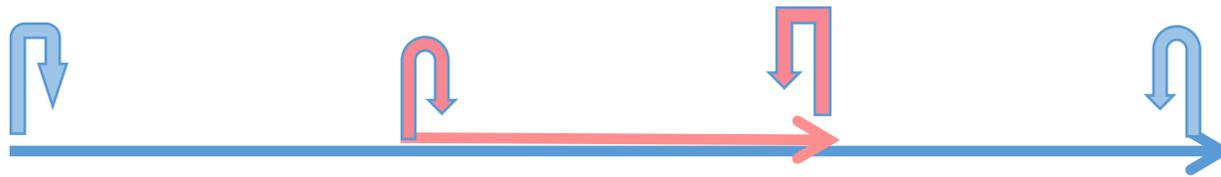
- There is evidence that
 - Evaluating likely reward (sensing a **world affordance**)
 - Evaluating likely cognitive success (sensing a **cognitive affordance**)

are based on different sources of information and processed by distinct brain structures. (Kepecs & Mainen, 2012).

Crucially, however, a single decision to act has to be made, integrating subjective cognitive uncertainty and objective world uncertainty → evaluations must share "a common currency" (Sugrue Corrado, & Newsome (2005) .

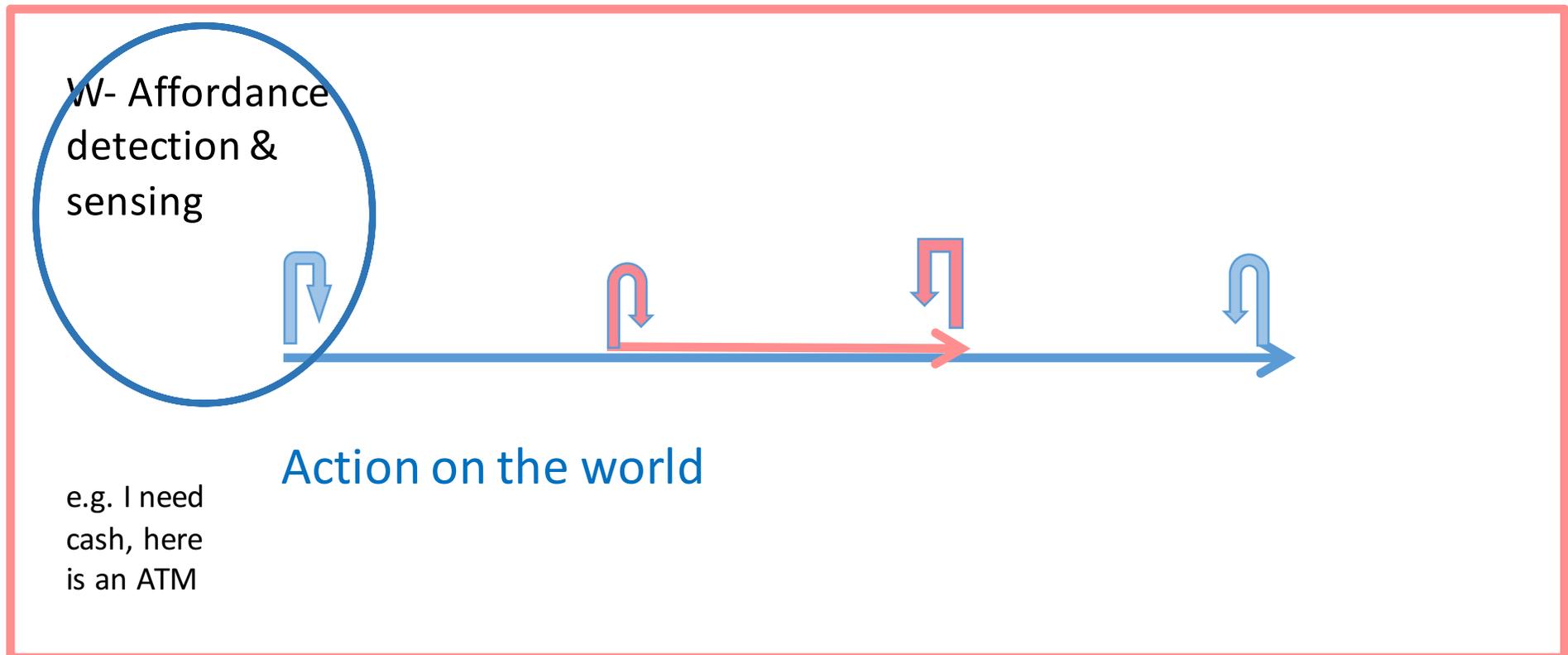
Cognitive actions are **embedded** in world-directed actions

W- Affordance sensing

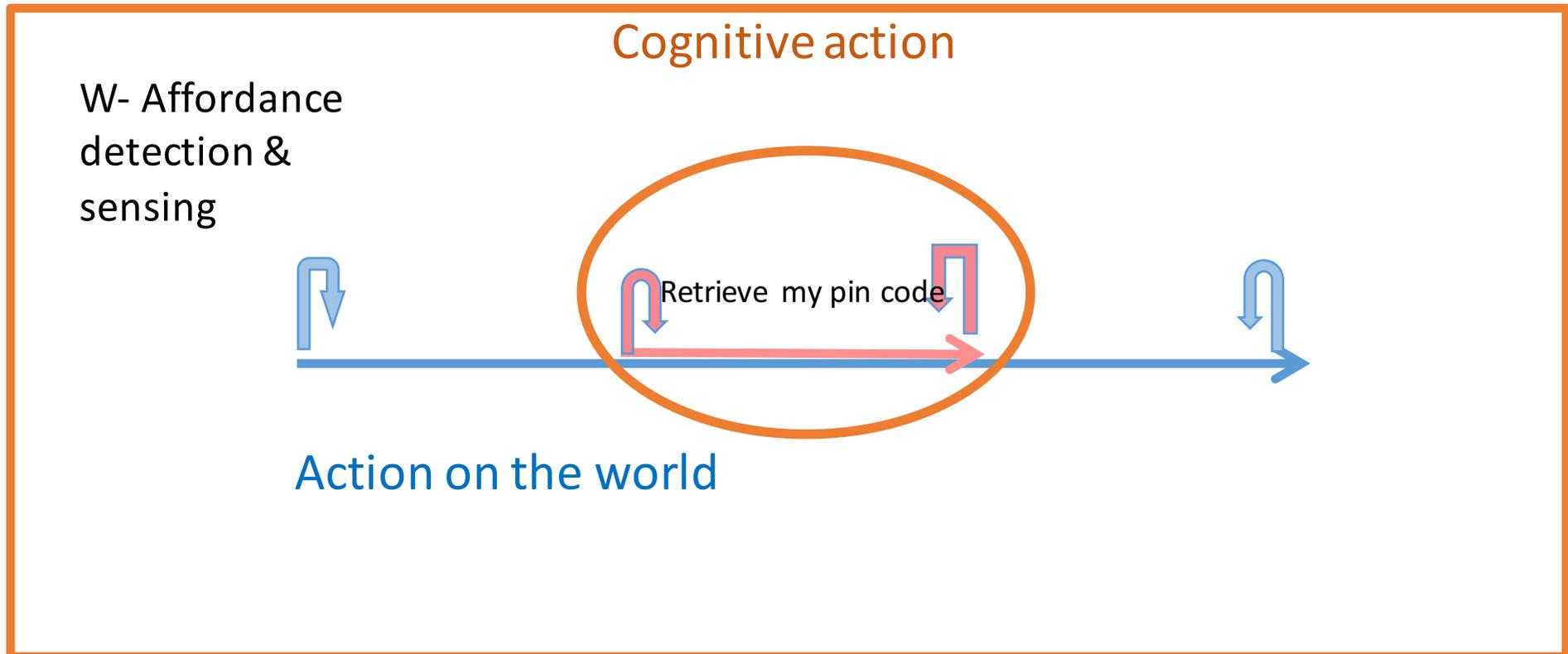


Action on the world

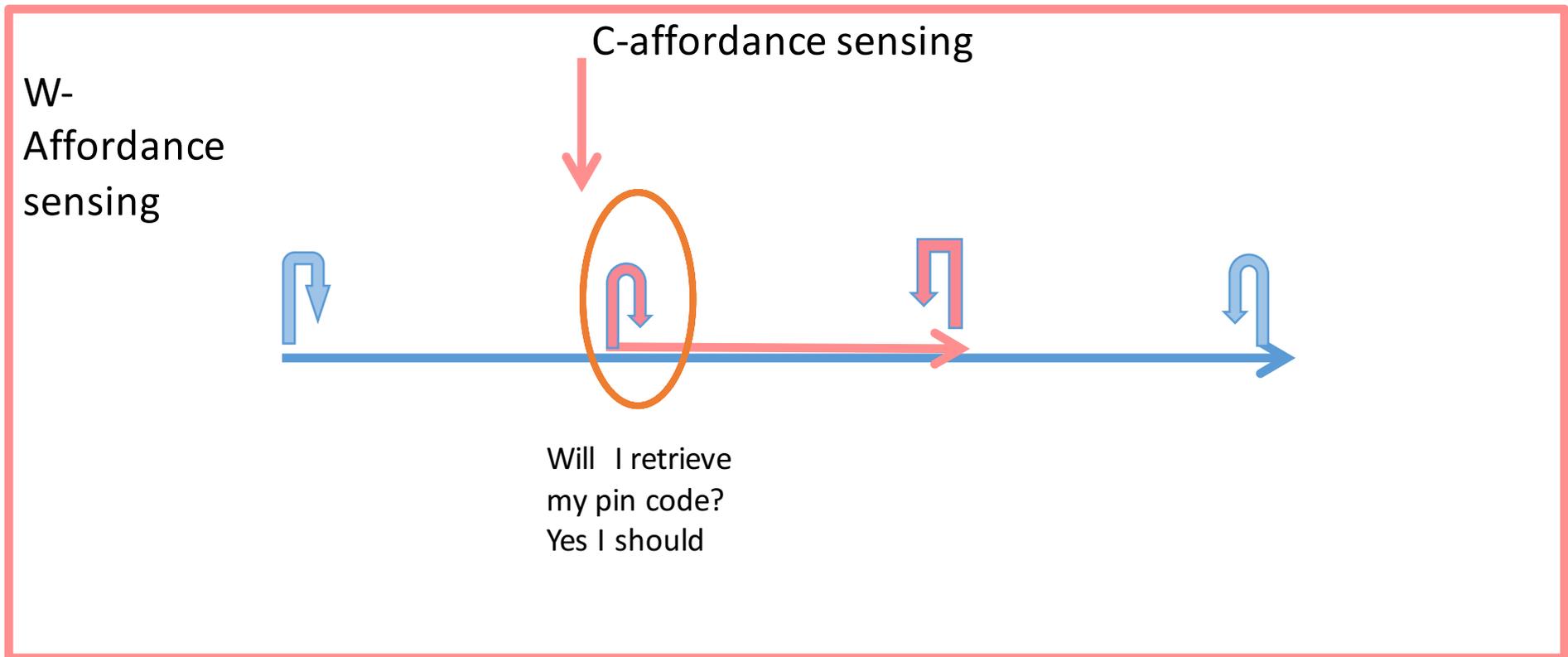
Cognitive actions are **embedded** in world-directed actions



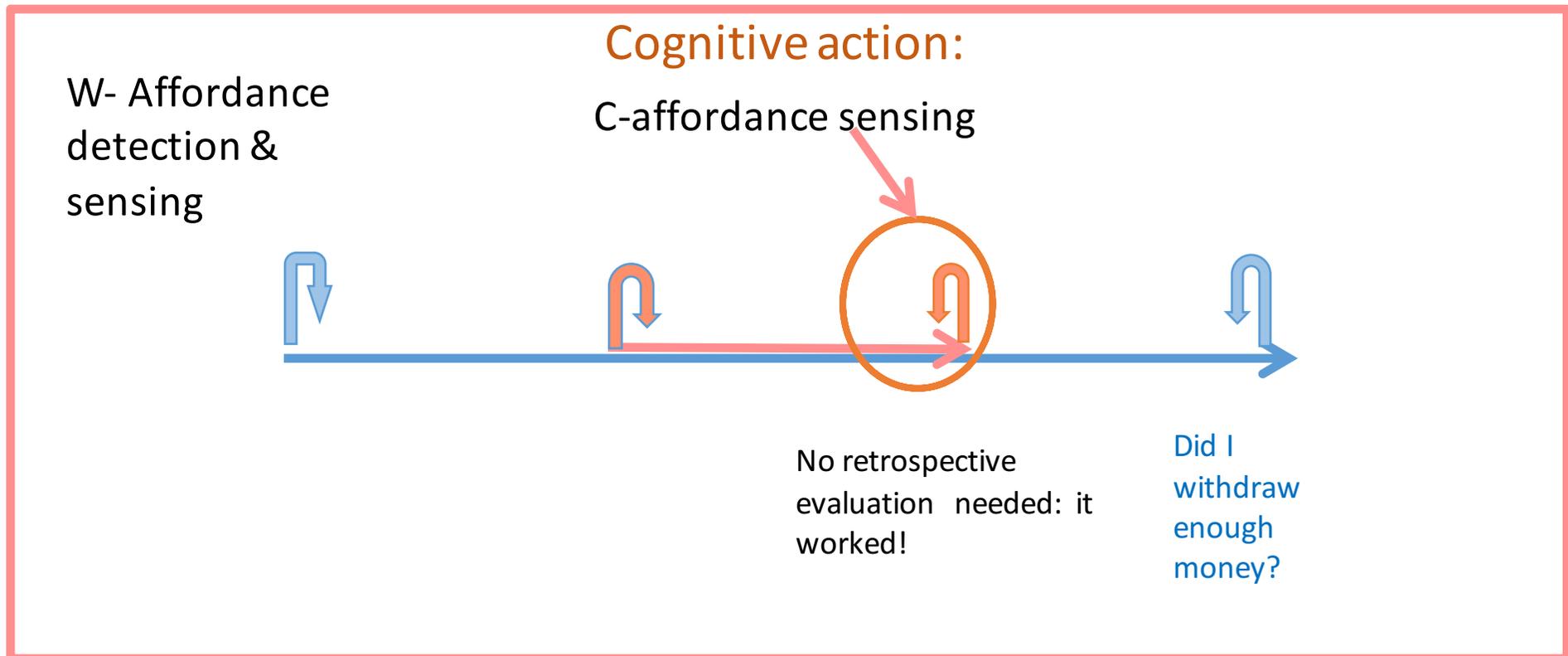
Cognitive actions are **embedded** in world-directed actions



Cognitive actions are **embedded** in world-directed actions



Cognitive actions are **embedded** in world-directed actions



Focus on cognitive affordance sensings"

HYP: They are evaluative attitudes representing whether

- there is enough information for a given cognitive task to be performed,
- or if the task was correctly performed.

CAS meant to explain:

- ✓ subjectivity (what it's like to sense a cognitive affordance)
- ✓ quality (valence and intensity)
- ✓ flexibility in epistemic decision-making through gradient structure
- ✓ recalibration of metacognition
- ✓ motivational power
- ✓ interpretation of noetic feelings in distal terms
- ✓ acquisition of new Critical feelings

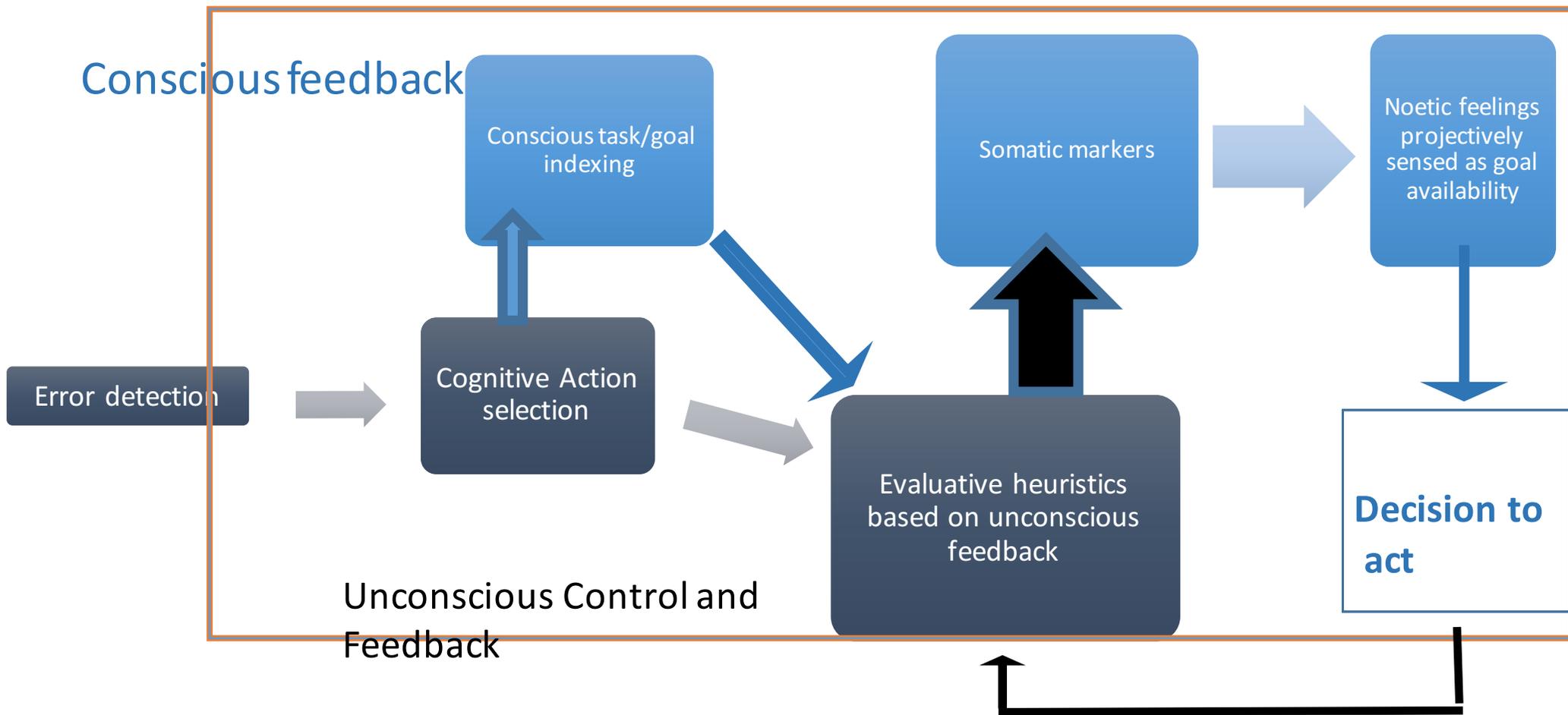
The cognitive affordance sensings are **conscious representations** including the following elements:

- **Type of task:** indexing conscious marker
- **Evaluation of cognitive affordance for this task measured through its**
 - **valence** + or - : *motivational gradient scale*
 - **intensity:** *intensity gradient scale*
 - **On various bodily "affective metrics"** (conscious somatic markers)
- **time:** *present* ("unarticulated constituent")
- **Task Location** *Here* ("unarticulated constituent")
- **Disposition to act:** *persisting, amplifying, opting out*

Proust (2013, 2015, 2016)

On affordance sensings, (under various names): see Bermúdez (2003), Campbell (1993), Cussins (1992), Dreyfus & Kelly (2007), Dummett (1993), **Gawronski & Bodenhausen (2006)**, Gendler (2008), Griffiths & Scarantino (2009), Nanay (2013), B.C. Smith (1996), Strawson (1959).

Conscious vs nonconscious components of affordance sensings



4 – Cognitive Task Indexing

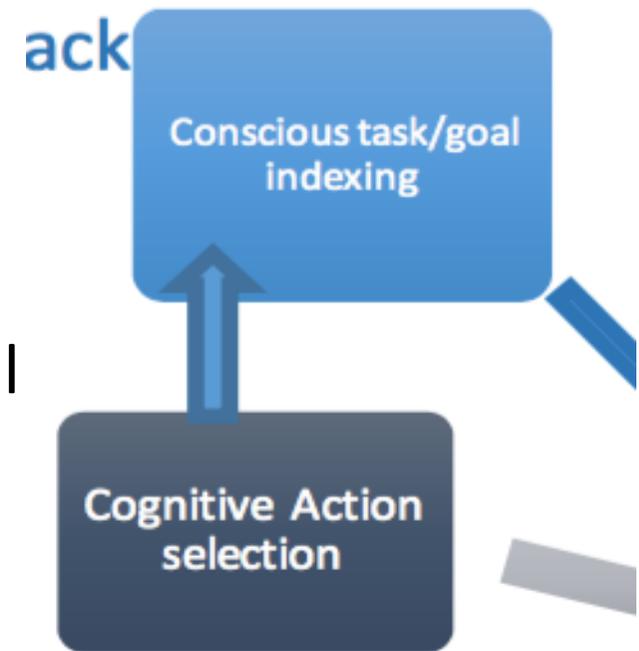
How can this framework help us solve our former two questions:

1. Are there **conscious cues** identifying the ongoing cognitive task at a given time t ?
2. How are conscious noetic feelings **felt as being about the ongoing** task?.

Hyp 1: Task indexing is a conscious signal present in any w- or c- affordance sensing.

Task is indexed by sensory feedback acquired in monitoring tasks of the same kind.

- Task indexing is salient in talking to oneself while planning.
- Mental imagery indexes steps in mathematical reasoning



Indexing a task

Vehicle  task

- phonological-auditory experiences,
- visual imagery
- proprioceptive imagery
- Visuo-motor imagery

Enabling function of conscious indexing

Goal-monitoring of:

- **Conceptual reasoning tasks, including planning**
- **Mathematical tasks, spatial reasoning**
- **Meditation**
- **Sport training, drawing**

Indexing: goal-driven feedback

- HYP: Indexing is conscious because the corresponding imagery was first created by recurrent processing of former cognitive actions and stored in memory.
- As a consequence, it is permanently available for exploration, simulation (mindwandering) and planning purposes.
- This form of non-evaluative goal-driven feedback precedes what Koriat's evaluative 'control-based monitoring' (expected effort) (Koriat, Ma'ayan & Nussinson, 2006)

Indexes point to contents (Jackendoff's puzzle)

- Because they only have a pointing function to goal (attention, computation, planning, etc.), indexes ***do not themselves contain*** the information they point to.
 - Because they are the feedback of a prior action, they are delivered in feedback mode, i.e. **in the mode corresponding to the proximal repertory of the output of the affordance sensing (a specific action)**.
- Internal speech is "heard in their head" by cognizers as a phonological sequence.
- Deaf signing cognizers should rather "see in their head" a hand sign sequence, mathematicians see a sequence of written or printed symbols.

Response to our first question
Are there **conscious cues** identifying the ongoing
cognitive task at a given time t ?

- A **cognitive** task that has been **unconsciously selected** following an error cue is consciously **indexed in working memory through a sensory cue**
- Having this conscious index
 - Offers conscious access to goal
 - Enhances **working memory**
 - enables reportability of one's own reasons

5 – What noetic feelings are experienced as

How can the CAS framework help us solve our second question: How are conscious noetic feelings **felt as being about the ongoing** task?

Hypothesis 2: affordance sensing, as an evaluative structure, is designed to **track affordances via their predictive cues, not conversely.**

How are conscious noetic feelings **felt as being about the ongoing** task?

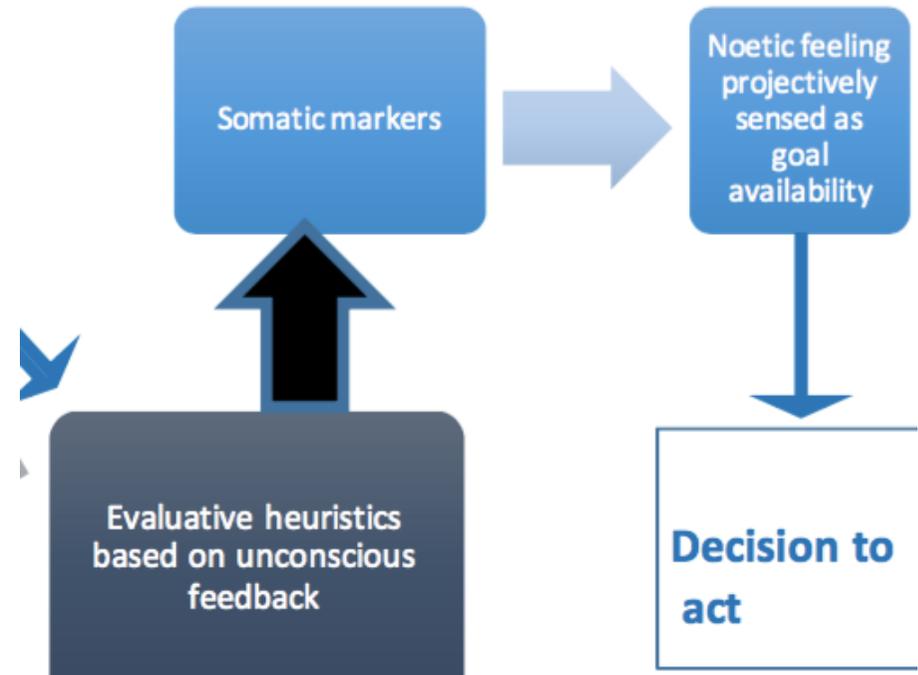
- There are **four types of information** that are successively integrated in **sensing** a Cognitive Affordance, (i.e. having a noetic feeling):
 1. type of cognitive task (with the contextually associated rules and constraints)
 2. Unconscious predictive heuristics
 3. Somatic markers, both unconscious and fringe-conscious
 4. Noetic feeling (eg I have a feeling of knowing this name)

Unsolved problem

How is the cross-over from 2 to 3 implemented (from heuristics to somatic markers)?

The "neural signature" or fluency heuristics (onset, amount of activity, dynamics of convergence to a decision threshold) might either

1. activate in turn somatic markers
2. be combined with somatic heuristics



In faveur of B:

- No evidence that somatic markers *merely* reflect neural dynamics of decision.
- Given that they are also calibrated by feedback from previous cycles, they are probably in a position to independently serve an evaluative function.
- This is suggested by Stepper and Strack's manipulation of participants' confidence in their cognitive decisions by imposing them postural or facial tension/relaxation patterns (1993)

Why are conscious noetic feelings **felt as being about the ongoing** task?

- Argument of Structure: an affordance sensing is meant to express an opportunity, not the bodily correlates of the underlying noetic emotion, or any other predictive component.
- However, the somatic components of a CAS may be
 - present in fringe consciousness
 - used for communicating an affordance sensing to others (and understanding others' perceptible somatic markers)

6 - Conclusion

Cross-over principle defended on new grounds

- Indexing and noetic feelings might be phenomenally conscious **because**, having been relevant to prior cognitive actions (feedback) and proved adequate for action guidance, they have been selected to monitor further thinking and reasoning.
- Indexing: with a control function
- Noetic feelings: with a monitoring (evaluative or predictive) function.
- Both: for their motivational subjective value.

A common function for indexing and noetic feelings

- Only conscious representational elements such as these can secure
 - **Flexible (revisable) control of cognitive action**
 - A **common currency for fusion of affordance sensings** associated with the decision to act.
 - Ability of **internally generated sensory cues** (control of cognition) to compete with **perceptually generated cues** (predicting environmental affordances) to control decision.



THANKS FOR YOUR ATTENTION

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