

# Metacognition & Metarepresentation workshop

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## Noetic feelings and mental agency

Joëlle Proust  
Institut Jean-Nicod  
Paris

<http://dividnorm.ens.fr>



# Goal of the present talk

Elaborate a view of noetic feelings aimed to

- clarify **their function** in mental agency
- articulate **their specific representational format within a general theory of feelings.**

# The puzzle of noetic feelings

- Human children and adults and non-human agents form feelings of familiarity, of knowing, of discriminating with varying intensity and valence.
- Do they need to form beliefs about the world and about their own minds to experience these feelings, as claimed by cognitivist theories of emotions?

# Outline

1. What is a mental action and how is it monitored?
2. The informational content of feelings: a proposal.
3. Objections from, and response to, cognitivist views on feelings.

1 - What is a mental action?

# Examples of mental actions

## Purely Epistemic

Perceptual attending  
Directed reasoning  
Directed memory  
retrieval  
Directed visualizing  
Directed imagining

## Non purely epistemic

Planning  
Reflective deciding  
Controlling emotion  
Preference management

How do epistemic actions contribute to world-directed action?

- An epistemic action is usually embedded in an instrumental (world-directed) action. For example:
  - In order to shop for food, I need to remember the items on the list (which I forgot to bring with me).

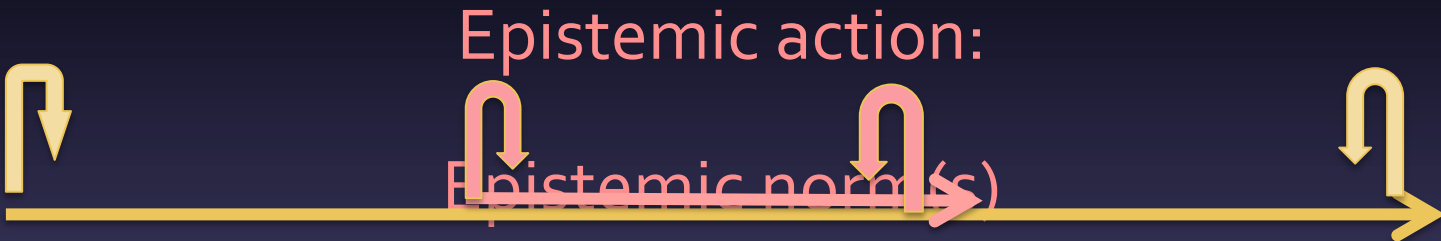
# Example:

- The particular strategy of remembering (exhaustivity/accuracy) is selected **for instrumental reasons.**



# Distinct epistemic norms constitute distinct mental actions

- Accuracy (memory, reasoning)
- Comprehensiveness or exhaustivity (memory, reasoning)
- Coherence (fiction, demonstrative reasoning)
- Consensus (negotiation, deference to authority )
- Relevance (conversation)
- Intelligibility or fluency (perceptual judgment, epistemic vigilance)



Instrumental action: norm of utility

Hence mental actions are objectively regulated by two sets of norms

- **Instrumental norms** determine what mental action, if any, should be performed given the agent's ultimate goal.
- **Epistemic norms** determine the conditions of satisfaction of a particular, selected action.

# Action monitoring has two temporal dimensions

- One is predictive: am I able to perform this action?
- The other is retrospective: is the action performed correct?

# What is action monitoring

- Action monitoring, in the case of physical action, consists in checking whether a planned action, once selected,
  - can be performed,
  - is being performed as predicted,
  - has been successful in attaining its goal
- in the case of physical action, monitoring is based on stored/observed sensory feedback with respect to a represented goal.

# Mental action monitoring

- Action monitoring, in the case of mental action, also consists in checking whether a planned action, once selected,
  - can be performed,
  - Is being performed as predicted,
  - has been successful in attaining its goal
- Pb: what kind of information can a subject use to compare what to expect and what is observed in monitoring her mental actions?

# Predictive: Self-probing

Before trying to act mentally, one needs to know  
whether, e.g.,

Some item is in memory (before trying to retrieve it)

One has epistemic competence in a domain  
(before one tries to predict an event)

One is sufficiently motivated to act in a certain way  
(when planning)

# Retrospective: Post-evaluation

- Performing a mental action entails the ability to evaluate its success
- One needs to know, e.g., whether
  - ✓ The word retrieved is correct
  - ✓ One's reasoning is sound
  - ✓ One does not forget a constraint while planning



# Varieties of epistemic norms

- Note that the problem of what information to use is complicated by the fact that you don't evaluate all the mental actions in the same way, because they are regulated by different epistemic norms.

# Central examples of metacognition

- **Prospective monitoring** (evaluating one's ability to carry out a cognitive task)
- **Retrospective monitoring** (judging the adequacy of a cognitive response)
- **Ease of learning judgments** (reducing uncertainty on time needed to learn)
- **Judgments of learning** (assessing how well material will be retrieved after a delay)
- **Knowing judgments** (evaluating own uncertainty about belief accuracy)

# Noetic Feelings

- Are experienced before and after an epistemic action,
- Are functional ingredients in metacognition
  - They clearly have the function of monitoring epistemic actions

# 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

# Problem re-defined

- What kind of information do noetic feelings express?
- Are noetic feelings genuine feelings?
- To address this question in a non-question-begging way, it is useful to consider feelings in general

2 - Proposal for a theory of content for  
feelings

# What are feelings, in general?

- "Feeling" denotes a reactive, subjective, embodied experience with a distinctive embodied phenomenal quality and a "formal object", which may or may not coincide with the embodied experience.
- "Reactive" means that feelings are closely associated with an appraisal of a present property or event.
- The reactive experience has a given intensity and valence

# The function of feelings

- Feelings constitute the sensitive part of predictive and retrospective processes of non-conceptual evaluation of one's own, and others', well-being and actions.
- In such evaluations, the specific function of a feeling consists in predicting outcome (well-being, success) based on comparing the current *observed* value of a parameter *with its expected value*, on one or several dimensions relevant to survival.



# Types of feelings

- Relevance to bodily well-being
  - Sensory, proprioceptive feelings: thirst, pain
  - Resources and risks: fear, disgust, surprise
- Social condition (present/expected): anger, love, envy
- Agency
  - Mental: Noetic feelings
  - Physical: Agentive feelings: ownership of action, agentive confidence, happiness

# Response/activity-dependent reactivity

- You can only have a noetic feeling if you are engaged in a particular cognitive activity
- Primary emotions, moral and aesthetic emotions are **response-dependent**.

# A proposal

- Feelings are nonconceptual representations which analogically predict affordances.
- Affordances are opportunities of action
  - Feelings constitute a modular type of nonpropositional representational format

# Representational structure of feelings

- A feeling is indexing an *occurrent* (relational) affordance, rather than an individual event or object.
- Affordance<sub>a</sub> [Place=here], [Time= Now/soon], [Valence<sub>a=+</sub>], [Intensity<sub>a=.8</sub> (on a scale 0 to 1)], [motivation to act of degree<sub>d</sub> according to action program<sub>a</sub>].

## Contrast of FS with propositional format

- In FS, an affordance is represented as exemplified or "incidental", with no sense of a contrast between a representing subject and a represented object.

See Strawson (1959), Cussins (1992), Campbell (1993),  
Dummett (1993),

Bermúdez (2003), B.C. Smith (1996), Glouberman, (1976).

# Aboutness of feelings?

- Feelings do not gain their aboutness through a propositional thought where the contrast between object and property is semantically marked
- they have an innately designed “functional aboutness” : they are about affordances, express them through their valence and intensity, and prepare actions congruent to them.

# Representational structure of feelings

- all constituents in FS are "bodily marked", i.e., expressed through somatic markers (Damasio, 1994).
- These somatic markers are the vehicles of non-conceptual content.

# Feelings are autonomous from conceptual representations

- Affordance predictions are made only milliseconds after visual sensations register on the retina, i.e. before the categorisation of perceived objects is completed.
- Affordances are detected in the first 80 ms of the visual process, merely on the basis of low spatial frequency and magnocellular visual input. ( Barrett & Bar, 2009).
- .



# Summary: content of feelings is constituted by

- A predicted **affordance**,
- An affective **valence**
- A **quantity or, intensity** on a gradient scale,
- An **action program**
- A present **time** and neighboring **location**

Extending FS to noetic feelings

**Proposal: noetic feelings have a gradient representational structure similar to that of other feelings** (Proust, 2009, 2013, in print 2014)

Noetic feelings express *an epistemic affordance* as being incident (at a time): *e.g.*,

Now, poor (excellent etc.) A-ing affordance where A-ing is the future or past success of a current cognitive performance: remembering, discriminating, etc.

- Content triggers the associated *cognitive program* (trying to remember, accepting as valid and deciding what to do, etc.)

What are the functions of noetic feelings?

# Noetic Feelings

## Predictive

- cognitive effortfulness
- Familiarity
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incoherence

## Retrodictive

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

# First function : prediction & evaluation

Consists in **evaluating correctness**, which involves **comparing** an observed with an expected value.

- In Self-probing: they predict **how feasible** the cognitive action is, given a stored standard
- In Post-evaluating: they report **how successful** the action has been, given a stored standard

## Second function: motivation to act

Once a performance is appraised, noetic feelings are supposed to **motivate a decision in agreement with the appraisal** (e.g., launch the cognitive action/accept its cognitive output)

This second step involves “control sensitivity”:  
agents can have reliable feelings of confidence in a performance, and fail to apply them adequately.

# Third function: epistemological

- Noetic feelings allow agents to **reliably** evaluate their epistemic states
- They are the potential basis of agents' being **entitled** to taking their perception, memory, etc. to be valid.

Burge (2003), Proust (2008)



# The third function: epistemological

To be reliable, however, noetic feelings must be:

- **Well-calibrated**: the standard (expected value) for a cognitive task must be based on previous sufficient, unbiased recurring feedback. (*Loussouarn et al. 2011*)
- **Relevant** to a given epistemic acceptance
- **Sufficiently informative** for an appropriate decision to be taken.

# Feelings are autonomous from conceptual representations

- Bayesian Hypothesis: The informational input for predictive « noetic affordances » consists in the structural, dynamic properties of the mind while it prepares to act mentally, or once it has acted, eg:
- Processing onset, latency, intensity and increased coherence of cognitive activity over time **predict cognitive success.**

# Objections from a cognitive theory of feelings

On a cognitive view , feelings result from a **judgment about** one's ability or performance

- Cognitivists about emotions claim that emotions involve propositional attitudes. (Solomon 1993).
- Thus noetic feelings should be attitudes directed at one's own cognitive dispositions or (memorial, perceptual, reasoning) outputs.

On a cognitive view , feelings result from a **judgment about** one's ability or performance

- One can't be angry with **someone unless one**
  - **believes** that person guilty of some offense,
  - and experiences one's anger as caused by the offense.  
(Gordon 1987)
- Similarly, one can't be uncertain about one's perception **unless one believes that one is currently trying to perceive something**, and that one's feeling of uncertainty is caused by one's trying to perceive.

In a cognitive view of NFs, they result from a **judgment about** one's ability or performance

- An attitude of this kind in turn presupposes having concepts about the kind of cognitive activity being assessed (e.g. perception, memory, etc.) and about the norms involved in it, such as truth, accuracy, etc.

In a **cognitive view** of NFs, they result from a **judgment about** one's ability or performance

- The feeling of knowing that one knows something involves a metarepresentational state of knowledge such as "I know what the capital of Australia is".
- This theory calls for a substantial theory of introspection (Dokic, 2012)

# A popular form of cognitivism: Two-factor theories of feelings

- The core feeling of an emotion is an arousal change, which is a reactive “physical” experience.
- Valence is gained through contextual beliefs and motives.





# Schacter and Singer's adrenaline study (1962)



- Participants' arousal was manipulated by injecting them, under a pretext, with adrenaline or a placebo. Only a subgroup of the adrenaline participants were informed that they had received a drug that would modify their arousal level.
- Participants were subsequently invited to stay in a waiting room where a confederate was pretending to be either euphoric or angry.

Participants' emotional responses, observed in their behavior and subsequent self-report, differed in the various conditions:

- those unaware of having been injected with adrenaline, and placed in the anger condition, felt angriest, followed by the placebo + anger subjects. The least angry were the adrenaline informed participants.
- In the euphoria condition, misinformed adrenaline participants were "somewhat" happier, adrenaline informed ones somewhat less happy (the results failed to reach significance both for behavior and self-report).

# Objections to S & S: method

1. this questionnaire *suggests* the relevant target categories of emotions, which is disturbingly close to influencing participants' responses.
2. ex post-facto reflective labeling of one's emotion does not need to express one's original feelings.
3. the student participants had their own independent reason for feeling anger in passing this longish test, which predisposed them to feel anger.

# Objections to S & S: philosophical (Gordon, 1987)

1. Participants may have been led to believe that they were angry, when they were actually merely aroused. This does not show, however, that they never felt anything else than an arousal change
2. A cognitivist theorist of emotion will insist that the mere association between a physiological cue of the feeling  $f$  and a context, does not amount to the realization, by a participant, that she feels  $f$  because she is in such and such a context.

# Two-factor theories of **noetic** feelings

- In our single-factor theory, M-feelings have an intrinsic intensity and an intrinsic valence.
- Two-factor theories claim rather, in analogy with Schacter and Singer's, that:
  - M-feelings have an intrinsic arousal level, but their valence 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 naïve-theory view is incompatible with monkeys' and young children's epistemic evaluations based on fluency (Beran et al. 2012)

# Objection 1 to the two-factor account of noetic feelings

Granting FS, a context-dependent factor may determine both the task to perform and the reactive metacognitive feeling about this task, without the agent needing to represent them conceptually

## 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 it: Cf. Nussinson & Koriat's (2008) anagram experiment.

## Objection 2 to the two-factor account of noetic feelings

→ Even when a M-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.

Discussion: why cognitivism fails to account  
for having noetic feelings

# How does a cognitivist theory account for the three functions of NF?

- **Control and monitoring:** metarepresentation generates additional control & monitoring capacities.
- **Motivation:** Having assessed one's reasons to believe with a given degree of certainty motivates one to decide how to act.
- **Explicit access to** one's reasons to judge one's performance to be correct is a condition for epistemic justification

# Why NFs do not need to involve propositional attitudes

Animals and young children do not have concepts of mind and self, and little if any of the world, yet:

- they have emotions such as fear, disgust, etc.
- they have NFs, such as feelings of familiarity and of uncertainty.

Furthermore, having the relevant propositional attitudes does not need to produce noetic feelings.

One may believe/know that one's cognitive performance is correct without having the corresponding feeling (ex: mathematical proof).



# How does a noncognitivist theory of NFs account for their three functions?

- **Control and monitoring:** the noetic feelings directly reflect the difficulty inherent to processing the task (effort heuristics).
- **Motivation:** Feelings motivate one to decide to pursue or stop current activity based on structural features of the task.
- **Epistemic entitlement** grounded in the externalist consideration that noetic feelings reliably correlate with task success

The end

Questions and objections welcome !

# A neo-cognitivist theory of noetic feelings: Koriat & Nussinsson (2009)

A new theory, however, has been issued to explain how putative noetic feelings could apply to judgments of learning.

# A neo-cognitivist theory of noetic feelings: Koriat & Nussinsson (2009)

Noetic feelings can result from two independent sources of feedback

- from the vehicle of cognitive activity (as in James and in Koriat 2000)
- from the control of cognitive activity

# Feedback associated with monitoring the vehicle of cognitive activity

Includes a variety of cues that are generated by the activity:

- Bodily changes (e.g., in facial muscles)
- Time comparatively spent in performing the task
- Coherence of responses activated by the task

# Feedback related to control of activity

- Under time pressure, learners tend to allocate more study time **to the easier** rather than to the more difficult items (« goal-driven regulation »).
- In self-paced tasks, learners tend to allocate more study time to the **more difficult items** (« data-driven regulation »)

# How is one type of feedback selected as a source of NFs in JOLs?

- « Because of the opposite implications of the two types of regulation to JOLs, an attribution process must be postulated in which effort is attributed in different proportions to the two sources in making recall predictions. » (Koriat and Nussinson, 2009)

# Hence neo-cognitivism ?

- « Participants **can be induced to adopt different and even opposite theories about the implications of processing fluency,** and these theories, in turn, modulate participants' judgments » (Koriat & Nussinson 2009)



## How does the double feedback theory account for the three functions of NF?

- **Control and monitoring:** the noetic feelings reflect the difficulty inherent to the task, in both its control and monitoring aspects, as determined by an attribution process
- **Motivation:** Feelings motivate one to decide to pursue or stop current activity based on interpreted structural features of the task.
- **Epistemic entitlement** grounded in the externalist consideration that noetic feelings reliably correlate with task success, given a rational attributional process.

# Discussion

- Koriat's resulting hybrid theory of noetic feelings defeats the « cross-over principle » defended in his (2000):
- It's no longer the case that unconscious heuristics causally determine conscious feelings. Feelings are also determined by a conscious attributional process.

# Two questions

- How to explain that noetic feelings can bear information about an occurrent disposition to solve a cognitive problem without an associated metarepresentational ability?
- Is it the case that feelings can also be present when metarepresentations of the task are engaged?

A particular noetic feeling is constituted by fine-grained dynamic properties, including:

- **Relative intensity of a cognitive affordance**  
(calibrated across similar past episodes)
- **Temporal profile** (onset/duration, intensity/time)
- **Associated motivation for acting.**

# Example: TOT feelings (Schwartz et al., 2000): feedback from vehicle

Appraisal processes

Peripheral expression

Action tendencies (« affect programs »)

Subjective feelings

- Word within reach or not
- Muscular activation in tongue
- Motivates longer search in memory
- Variable in
  - Intensity,
  - Emotional content,
  - Sense of imminence

# TOT : Schwartz et al., 2000

More intense

- higher resolution rate
- Higher recognition rate
- FOK

More emotional

- better recognition,
- not better resolution  
(retrieval blocking)

With feeling of Imminence

- better resolution
- better recognition.

# NFs and the dynamics of the neural vehicle

Why are NF reliable in tracking cognitive affordances?

Because dynamic cues can, in a number of cases, be extracted from the associated vehicle and used to evaluate future/past performance.



# The neural correlates of procedural metacognition in rhesus monkeys

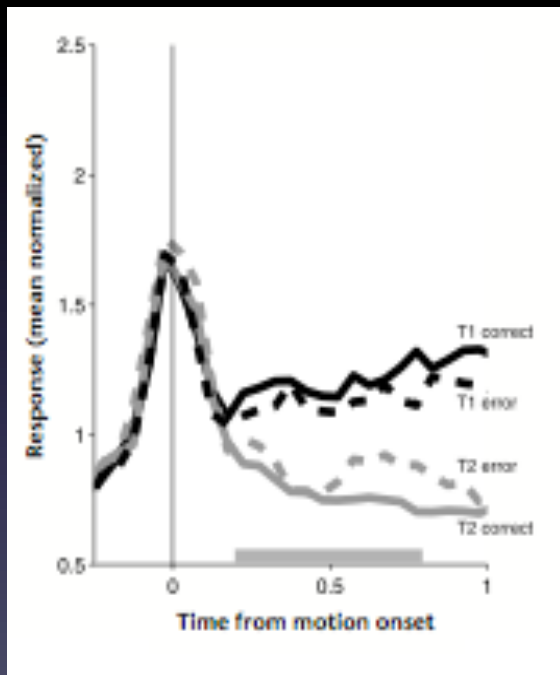
were studied in an opt-out task, where monkeys must

- discriminate whether a shortly presented stimulus is moving left or right.
- respond, after a delay, with an eye movement.
- “Sure bet” option available in some trials

(Kiani & Shadlen, *Science*, 2009)



# How to implicitly access one's own uncertainty?



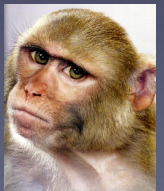
- Neurons predicting a saccade in a given direction respond less strongly in the erroneous decisions (dashed lines).
- This difference is the basis for judgments of confidence about decision.

Kim & Shadlen, 2009



# Kiani & Shadlen, 2009

- They found that the firing rate of neurons in the lateral intraparietal cortex (LIP) correlates with the accumulation of evidence, and the degree of certainty underlying the decision to opt out.
- This result fits nicely with an accumulator model of judgments of self-confidence.



# The accumulator model

. Evidence for the two alternatives is accumulated in parallel, until one of the evidence totals reaches a criterion value, and the associated response is emitted.

Vickers & Lee, 1998

# The accumulator model

An adaptive accumulator is a dynamic comparator, where the values compared are rates of accumulation of evidence relative to a pre-established threshold for each possible answer.

# How is calibration performed?

- A secondary type of accumulator, called "control accumulator", accumulates positive and negative discrepancies between the expected and the observed levels of confidence in two independent stores.
- If, for example, a critical amount of overconfidence has been reached, then the threshold of response in the primary accumulator is proportionally reduced (Vickers & Lee, 1998).

# How does this featural account for the three functions of NFs?

- **Control and monitoring:** control inherent to affect program associated with the NF. Monitoring inherent to the intensity of the affordance
- **Motivation:** derived from the valence and intensity of the affordance constituting the NF.
- **Epistemic entitlement** grounded in the reliability of the detection of epistemic affordances in the system (amount of feedback, calibration)

# Summary

- Nonconceptual representations of FBS carry information about cognitive affordances through dynamic properties of the vehicle
- Cognitive effort/ease of processing are assessed on the basis of activity onset, duration and intensity
- NFs are not rooted in a critical understanding of the cognitive contents involved.
- They are activity-dependent



# Noetic feelings: why are they emotional phenomena?

- Emotions are not evaluative judgments, but evaluative nonconceptual registerings that motivate an organism to act in a certain way.
- The nonconceptual registerings distinctive of emotions involve graded valences corresponding to graded affordances.

Are there noetic feelings that are not  
based on fluency?

# The hierarchy of feelings

- Is fluency the only source of noetic feelings?
- Two views:
  1. There may be noetic feelings at any level in the hierarchy of self-evaluative thoughts (Arango, 2012)
  2. Noetic feelings only occur in feature-based representations of affordances, but they are called, wrongly, feelings of knowing.

# Noetic feelings are based on fluency (ease of processing)

- Comparative fluency is the property, for a stimulus, to be processed more or less quickly and adequately, with respect to what is expected, in a kind of task
- This property is a gradient on a normative scale: it works as an indicator for what successful processing should be like, for a task in a context.

# A striking contrast in ways of appraisal

1. Vehicle-sensitive noetic feelings (sensitivity structured by the neural properties underlying fluency) influence a range of epistemic decisions.
2. Content-sensitive epistemic decisions do not seem to elicit sui-generis feelings.

Different decisions are made by each  
«evaluation system »

# Koriat & Ackermann, (2010)



A judgment of learning is one that predicts how well the learner will be able to remember a particular studied item after a delay.

- Subjects are asked to provide such judgments either
  - after having performed the task or not
  - concerning their own or others' performances

# A remarkable dissociation

## Off-line evaluation

- participants rely on the naïve, **incorrect theory** that longer study time predicts better performance
- in a self-paced learning task, devoting more time to a pair of words is taken to predict **better retrieval** for that pair.

## On-line evaluation

- participants **judge correctly** that longer study time predicts poorer performance
- "memorizing effort heuristic", based on dynamic cues such as time spent and rate of accumulation of evidence.

(Koriat & Ackermann, 2010)



# Similar results for metaperception

## Off-line evaluation

- participants rely on the naïve, **incorrect theory** that they can accurately and rapidly detect changes in a perceptual lay-out: “change blindness blindness”  
(Levin et al., 2000)
- Plausible folk belief: A longer search time predicts a more accurate perceptual judgment (**not tested**)

## On-line evaluation

- participants **judge correctly** that a longer search time predicts poorer detection performance
- “perceptual effort heuristic”, based on dynamic cues such as **time spent and rate of accumulation of evidence.**

(Loussouarn , Gabriel & Proust,  
*Consciousness and Cognition, 2011*)

# The converse dissociation: Schwarz (2004)

How do you rate your memory?

- If invited to retrieve 12 childhood events, subjects rate their memory as less reliable than when having to retrieve six events → **effort heuristics does not correlate with memorial ability**
- A yoked participant attributes **a higher memorial ability** to subjects retrieving more events.

# A non theory-laden explanation

- Norms such as fluency are automatically associated with a type of task.
- Subjects don't need to have « a theory » about what to do: control automatically uses the feedback that, in the past, was predictive of success.

# Overruled, not suppressed

- Noetic feelings can be overruled by beliefs on what to decide.
- However: they cannot be suppressed (automatic, inflexible)
- As a consequence of their representational format, they are not open to:
  - Inference
  - revision

## Conclusion

A two-system view of metacognition?

# A contrast between norms.

- Fluency is a norm that is inherent to processing, and that gives rise to specific feelings (familiarity, confidence in perception or in memory)
  - Other norms, such as truth or plausibility, are inherent to evaluating a cognitive content.
- Contrast between two forms of metacognitive norms: experience-based (procedural) and concept-based (analytic).

# The 2-system view revised

- Granting that System 1 generates nonconceptual contents in a featural format, the contrast with System 2 is one between two ways of forming and using representations.

# System 1

- Vehicle-based
- Inflexible
- Economical
- Nonconceptual
- Gradient structure
- Modular
- Non inferential

# System 2

- Content-based
- Flexible
- Costly
- Conceptual
- Componential structure
- Non-modular
- Inferential



# Inflexibility

- Inflexibility has nothing to do with the fact that feelings are « generated by subpersonal processes ». All our flexible thoughts are also generated subpersonally.
- System<sub>1</sub> inflexibility derives, rather, from the *nonconceptual format of representation that is used to drive decision.*

# What kind of binding is there between $S_1$ and $S_2$ ?

- The binding between the two systems is the same as that studied in the philosophy of perception between nonconceptual protopropositional content, and propositional content.

# What kind of binding is there between $S_1$ and $S_2$ ?

- The nonconceptual content of perception is inserted within a propositional format including terms for concepts and objects.
- Analogously, children's NFs are redescribed in conceptual terms.

# What kind of binding is there between $S_1$ and $S_2$ ?

- When a System 2 is present, agents have access to propositional representations of their cognitive goals, and can assess their cognitive resources under new types of norms.
- Although this assessment may take marginal advantage of NFs (e.g.: intelligibility), it is not mainly based on cognitive emotions.

THANK YOU FOR YOUR  
ATTENTION!