The Representational Structure of Feelings

Joëlle Proust

The word "feeling" denotes a reactive, subjective experience with a distinctive embodied phenomenal quality. Several types of feelings are usually distinguished, such as bodily, agentive, affective, and metacognitive feelings. The hypothesis developed in this article is that all feelings are represented in a specialized, non-conceptual "expressive" mode, whose function is evaluative and action-guiding. Feelings, it is claimed, are conceptually impenetrable. Against a two-factor theory of feelings, it is argued, in the cases of affective and metacognitive feelings, that background beliefs can circumvent feelings in gaining the control of action, but cannot fully suppress them or their motivational potential.

Author

Joëlle Proust
joelle.proust@ehess.fr
Ecole Normale Supérieure
Paris, France

Commentator

Iuliia Pliushch
pliushi@students.uni-mainz.de
Johannes Gutenberg-Unversität
Mainz, Germany

Editors

Thomas Metzinger
metzinger@uni-mainz.de
Johannes Gutenberg-Universität
Mainz, Germany

Jennifer M. Windt
jennifer.windt@monash.edu
Monash University
Melbourne, Australia

Glossary

Feeling	"Feeling" denotes a reactive, subjective experience with a distinctive embodied phenomenal quality and a formal object, which may or may not coincide with the embodied experience. Feelings typically express affect and valence in sensation.
Reactive	"Reactive" means that feelings are closely associated with an appraisal of a present property or event.
Formal object	"Formal object" of a feeling is the property in the triggering event that elicits the reactive feeling.
Metacognitive feelings	Metacognitive feeling are experienced while conducting a cognitive task: the agent may find the task easy or difficult, anticipate her ability or inability to conduct it. Once the task is completed, the agent may have the feeling of being right, or have a feeling of uncertainty about the outcome of her endeavour.
Affordance	Affordances are positive or negative opportunities, expressed in feelings: an affordance-sensing swiftly and non-reflectively motivates the agent to act in a particular way.
FS Affordance	FS Affordance$_a$ [Place$_a$=here], [Time$_a$=Now/soon], [Valence$_a$=+], [Intensity$_a$=.8 (comparatively specified on a scale 0 to 1)], [motivation to act of degreed according to action program$_a$].
Transparency	A mental state is transparent if, when it is activated, its intentional content is accessible to the subject who entertains it.
Incidental and integral feeling	Metacognive feelings are called "incidental" when they are not based on valid cues about the cognitive task at hand, and hence, have no predictive value. They are called "integral" when they actually carry information about cognitive outcome.

1 Introduction

"Feeling" denotes a reactive, subjective experience with a distinctive embodied phenomenal quality and a formal object, which may or may not coincide with embodied experience. Feelings typically express affect and valence in sensation. "Reactive" means that feelings are closely associated with an appraisal of a present property or event. The term "reactive" is crucial. The term "feeling" is sometimes used to refer to a non-reactive, perceptual experience. For example, when one perceives an object through touch, it is common to say that "one feels one's key in one's pocket". But "feeling", in this context, does not refer to a reactive phenomenon. It rather refers to the feedback of one's own key-touching activity. This type of perceptual feeling is expected to result from one's action and, hence, does not belong to the domain of re-active feelings. What is called the "formal object" (see Kenny 1963) of a feeling is the property in the triggering event that elicits the reactive feeling. For example, the formal object of fear is some threatening property detected in the perceptual field.

Feelings can be pleasant or aversive, strong or weak, short-lived or long-lasting, or have an arousing or depressing character. They motivate distinctive dispositions to act, whose urgency is entailed both by the feeling experience and the context in which it is experienced: feeling an intense pain disposes the person to promptly locate and remove the cause of the pain; except, for example, when it is self-inflicted, or when it is part of a ritual.

Most theorists of feelings agree that they are associated with—or, for those who identify

emotions with conscious experiences[1] consist of —specialized, internally generated bodily sensations, such as an increase in heart rate, contractions or relaxations of the facial muscles, visceral impressions, tremors or tears, impulses to run away, etc. As will be seen below, some feelings, however, do not express emotions., i.e., they are not affective. A feeling tends to be more explicitly felt as bodily when it has a body-related function; that is, the phenomenology makes the need to be served salient (feeling tired, feeling a pain in the joints) in order to motivate action. In affective feelings, in contrast, the bodily phenomenology tends to recede to the fringe of consciousness (feeling in love with *A*, feeling angry with *B*).[2] From this observation, it is easy to infer that types of feelings differ in their respective meanings: they in some sense *express what they are about*. In affective feelings, an experience of "feeling toward" is supposedly present: the emotion is felt as being about an object, a person, or a situation—the objects, rather than bodily sensations, are the focus of one's emotional attention. Affective feelings also include mixed cases where one seems to both experience a strong bodily feeling at the same time as the intentional content that this feeling seems to refer to, as when Marcel Proust's narrator reports experiencing an acute pain in the chest when thinking about his beloved deceased friend, Madame de Guermantes.[3] It is unclear whether metacognitive (also called noetic, or epistemic) feelings are affective or non-affective (see section 7 below). They are experienced while conducting a cognitive task: the agent may find the task easy or difficult, and may anticipate her ability or inability to conduct it. Once the task is completed, the agent may have the feeling of being right, or may have a feeling of uncertainty about the outcome of her endeavour. Take the case of a person who feels unable, presently, to remember what she had for dinner last night. Her feeling of not remembering is correlated with activity in a facial muscle, the corrugator supercilii (Stepper & Strack 1993). Her feeling, however, is not about her disposition to contract or relax this or that muscle, of which she is certainly unaware. It is, rather, about her present disposition to remember what she had for dinner. Epistemic feelings seem to be "feeling-toward" experiences, and have cognitive dispositions or contents as their object.

Descriptive phenomenology, however, does not offer in itself an account of the intentional structure of feelings. We need to understand how feelings in general gain their real or supposed aboutness, and how they relate to action-guidance as a function of context; i.e., we need to provide a functional analysis of feelings. Section 2 will begin to provide such an analysis, and will address a preliminary issue—namely, Do the phenomena that are usually called "feelings" share a property that makes them a natural kind? In section 3, the specific informational structure of feelings will be seen to account for their generic characteristics. Section 4 will clarify the account by way of addressing various objections. Section 5 will attempt to show that the proposed account fares better with experimental evidence than a cognitivist account of affective and metacognitive feelings. Section 6 will examine whether or not metacognitive feelings have an affective valence.

2 Are feelings a natural kind?

Paul Griffiths has claimed that *emotions* do not constitute a natural kind, in the sense that they do not form "a category about which we can make inductive scientific discoveries" (2004, pp. 901–911). One can agree with latter claim, however, without concluding that *feelings* do not constitute a natural kind. First, feelings are not only affective ingredients in emotional awareness. Some feelings, such as feeling cold or sick, or feeling that one is acting, have nothing to do with affective episodes. Second, there are evolutionary reasons to distinguish, within emotions, two classes of sub-

---

1 From the viewpoint of the somatic feeling theory of emotions, emotions can be explained as a somatic change caused by the perception, real or simulated, of a particular object. See James (1884, p. 190), and Damasio (1994, 2003). Other theorists of emotion, however, consider that the conscious experience of having an emotion includes propositional attitudes, and not only feelings. See sections 4 and 5 below. Moods are long-term affective states, and will not concern us here.

2 On this concept, see Mangan (1993, 2000) and Reber et al. (2002).

3 See the analysis of this example in Goldie (2002), p. 56.

jective appraisals. Emotion theorists usually contrast *feelings* expressed in primary emotions —fear, anger, happiness, sadness, surprise, and disgust—with *various appraisals cum conative dispositions* associated with higher cognitive emotions, such as envy, guilt, pride, shame, loyalty, vengefulness, and regret. The first are phylogenetically and ontogenetically prior to cognitions. They belong to the ancient limbic system, which is present in some form in most animals. A quick route from the retinal image to the amygdala through the thalamus allows affective information to control behavior (see LeDoux 1996). Primary feelings are thus triggered independently of concept possession and motivate specific responses. Secondary affective experiences, in contrast, might have evolved on the basis of social constraints in relation to cooperative action among humans. Indeed (with the possible exception of pride and shame) they are not present in nonhuman *primates*.[4] They activate newer brain structures; they require concept possession, depend on background beliefs, and do not generate characteristic behaviors. Finally, primary feelings are clearly embodied, while secondary emotions seem to have no proprietary somatic markers. An interesting idea, suggested by Jesse Prinz (2004, p. 95), is that the facial or somatic correlate of secondary emotions, *when they have one*, involves a blend of the somatic markers for primary feelings.

In summary: emotions differ, among other things, because of the unequal role that feelings have in the two classes of emotions just discussed. The wider scope of feelings, when understood as "reactive, subjective experiences with a distinctive embodied phenomenal quality", seems to be more unified than emotions, and making feelings seem like plausible candidates for a natural kind.

We need, however, to turn this tentative definition into a general functional characterization that presumably holds for all feelings (beyond affective ones) and only for them. Here is a proposal: feelings constitute the sensitive part of predictive and retrospective processes of non-conceptual evaluation of one's own and others' well-being and actions. Being essentially evaluative, feelings are always the output of a comparator: in other terms, they are crucial *monitoring* ingredients in self-regulated adaptive control systems. In such systems, the specific function of a feeling consists in detecting how much a current *observed* value of a parameter *deviates from its expected value*, on one or several dimensions relevant to survival (see Carver & Scheier 2001). Their formal object, when they have one,[5] (such as being afraid *of the bear in front of me*) cannot be analyzed independently of the monitoring function they serve within a specialized control loop.[6] Relevance to well-being, however, extends to bodily condition, goal achievement, and availability of preferred goods of all kinds (food, partner, social status). The relevant dimensions of variation that feelings track may accordingly be of a sensory, proprioceptive kind (feeling thirsty, cold, etc.), social-affective (feeling angry), or agentive (goal-related). Goal achievement, however, involves either epistemic or instrumental success, respectively generating epistemic feelings (feeling interested, bored, epistemically uncertain) and agentive feelings (feeling of happiness, of agentive confidence, of ownership of one's action, etc.). Feelings, in summary, are the outcomes of comparators in a control loop; they carry non-conceptual information about how much one's present condition deviates from the expected condition. From a functional viewpoint, they form a natural kind insofar as their function is to indicate a comparative outcome through a dedicated embodied experience.

Note, however, that there are comparators that trigger no feelings at all: these non-sensitive comparators may either work outside consciousness (for example, error signals driving immediate correction[7], not to mention comparators that work at the cell level), or they can take concepts as their input, rather than react-

---

4 On this contrast, see Frank (1988), Griffiths (1997), and Prinz (2004, pp. 82-83). On whether they qualify as emotions, see Ekman (1992).

5 As observed by Goldie (2009), some feelings, for example, [feeling anxious] or [feeling depressed], seem to lack a formal object, which is typically the case with moods. As indicated above, moods will not be discussed in this article.

6 Bechara et al. (2000) make it clear that the somatic marker theory applies to action, whether it engages affects or not.

7 see Logan & Crump 2010 and Nieuwenhuis et al. 2001

ing to percepts or situations (for example comparators of currency or of educational value).

As far as feelings are concerned, they are directly related to a presently-perceived context (or an imagined or remembered context, but in a "present-like", indexical mode): one can feel too hot, too cold, or too tired (or feel "OK", which usually means a tolerable deviation from the expected value). One can feel the fright one has had, even after the frightening event has ended. The outcome of a feeling-based appraisal, from a functional viewpoint, has to consist in some disposition to act that is adaptive, relative to the input to which the feeling is a reaction. Granting that feelings, as sensitive comparators in a control system, form a natural kind, there should be common properties cutting across the various types listed above. In fact we find three types of functional relations between feelings of a given kind and the associated disposition to act. First, feelings, according to their embodied valence, typically determine actions of approach or of avoidance. Some dictate caution, others boldness. Some encourage self-restraint, others self-assertion. Fear promotes a flight tendency, hunger a tendency to approach food. Second, they have a specific orientation in time: some feelings have a *predictive* function, and thus induce a behavior that is based on contingencies to be *further* displayed in the present context. For example, fear, when directed at a possible danger, increases the readiness to flee in case the danger concretizes. Others have a *retrospective* function, and induce corrections to the commands one has previously used, or to one's previous preferences. For example, feeling nauseous *after* food ingestion induces food avoidance, i.e., a change in the agent's preferences. In contrast, feeling disgust at the sight of some food may prevent the agent from approaching it. A subset of feelings, such as feeling happy, have both temporal orientations. Third, according to their embodied dynamics and intensity (which is called their "level of arousal"), feelings can provoke an elevation in the energy available to the system: they provoke excitement, agitation, power in the coming response; or, on the contrary, they

may have a soothing effect and diminish the tendency to act.

One major functional property of feelings, from the viewpoint of information extraction and use, is that they can very rapidly extract and synthesize multiple cues from perception. This rapidity is a consequence of the automatic and encapsulated character of the control mechanism whose output they express. Feelings are automatically triggered by a specific type of input (which is the definition of informational encapsulation).[8] Automaticity is associated with feelings being inescapable, at least for those feelings that have been allowed to develop within a culture, granting normal development.[9] The mechanism that generates somatic, noetic, or affective feelings from inputs (perceptual, imaginative, or memorial) does not require one to have specific beliefs or intentions.[10] Informational encapsulation explains why transitive feelings persist when the agent finds out that the situation is different from what she thought to be the case. Just as an optical illusion such as the Müller-Lyer effect does not immediately dissipate when it turns out that the segments are equal, a feeling of anger does not disappear as soon as the agent realizes that its formal object is not exemplified.

Automaticity and informational encapsulation seem also to characterize agentive feelings (see Pacherie 2008). Feelings generated in the course of a physical action come in two varieties: generalized or specialized. Some, such as feelings of agency, of initiation of action, of ownership and of motor control, are indicators monitoring action in progress: they concern "who" is performing the action, and "how" the action is being conducted (see Proust 2000). Others concern the evaluation of an action in one's own repertoire: a professional carpenter or an experienced musician, for example, have feelings telling them if an action sequence (whether their own or another agent's) in this

---

8 Automaticity in appraisal is central to Ekman's analysis of primary emotions (1992). See also Griffiths (1997), Prinz (2004), and Zajonc (1980). On informational encapsulation, see Fodor (1983).

9 For example, fearlessness in the presence of danger may result from a disturbed childhood.

10 Some affective feelings, however, can be intentionally controlled in the long run, through cultural learning. See Murata et al. (2013).

repertoire sounds or looks right, even before they identify why they have this feeling. These feelings are also the outputs of a comparison between motor anticipations and observed properties of the action (a "forward model of action" supposedly stores the expected values of crucial parameters; Wolpert et al. 2001). They can predict the likelihood of completing an action (when the question arises, in difficult or non-routine cases), or evaluate—on-line or in retrospect—how swiftly, effortlessly, or unhesitatingly an action was performed. Agentive feelings thus have an essential role in regulating the fundamental properties of physical actions, such as the quality of the outcome,[11] and the ownership of the action.[12]

Noetic feelings, finally, are functionally similar to somatic, affective, and agentive feelings—although their evolutionary pattern seems to be different from the other three kinds. While most organisms have proprioceptive, affective, and motor control, and hence, presumably, somatic, affective, and agentive feelings, few are able to control their cognitive decisions through metacognitive feelings (see Beran et al. 2012 and Proust 2013). The latter are generated when trying to perceive, to remember, or to plan a cognitive task (in particular, when trying to plan how long to study material in order to master it).[13] They are also relied upon when trying to reason or to solve a problem; when conversing, feelings of effort, and of informativeness, are monitored by speakers and hearers in order to maintain a common level of relevance. Like other feelings, they have two distinctive temporal orientations. Some have a predictive function. A feeling of knowing (FOK) may arise when trying to remember an item—for example a proper name—that one has not yet retrieved: having a strong FOK reliably predicts that one will finally retrieve the searched content (Koriat & Levy-Sadot 2001). A feeling of having a name on the tip of one's tongue (TOT) both signals

the fact that a word is not presently available, and, according to its onset, valence, and intensity, whether it is worth or not worth pursuing one's effort to retrieve it (see Brown 1991 and Schwartz et al. 2000). Feelings of fluency are the sense of ease of processing one may feel or fail to feel when attempting to perceptually discriminate objects with a given property, or to retrieve items from episodic or semantic memory. A feeling of familiarity is particularly salient, in human adults, when no further fact about the target can be retrieved. It offers useful information about the epistemic status of the target: that it is not new, but nevertheless not fully recognized. A feeling of familiarity, then, motivates, among others, an attempt to recognize what or who a target is. Other metacognitive feelings have a retrospective function. When a name is retrieved, a feeling of rightness (FOR) motivates the agent to consider her response the expected one.[14] Various feelings of uncertainty, based on fluency, coherence, plausibility, informativeness, or relevance, also have retrospective functions: their valence and intensity tell the agent whether she should accept or reject a cognitive outcome. These parameters are expressed through specialized somatic markers, such as increased activity in the facial muscle involved in smiling, the zygomaticus major—for positive valence—or the corrugator supercilli (involved in frowning)—for negative valence (Winkielman & Cacioppo 2001).

Taken together, these considerations are compatible with the view that somatic, agentive, metacognitive, and "primary" affective feelings, even if they differ in their formal objects, form a natural kind. Our attempt above at a functional characterization focused on the general relations of feelings to inputs, outputs, and mediating evaluative mechanisms. From this characterization, it emerges that feelings are gradients in comparators that are felt subjectively, rather than being propositional states describable in analytic, objective terms. These observations, however, suggest that, in order to express a specialized and fine-tuned reactivity to one or several formal objects, and to motiv-

---

[11] Non-conscious error signals can also guide corrective steps, without the agent noticing them.

[12] Pat Haggard et al. (2002) have demonstrated the crucial role of the temporal binding between felt initiation of action and output in the sense of being the agent of an action. See, among other articles, Haggard et al. (2002).

[13] This prediction involves judgments of learning (JOL). See Koriat & Ackerman (2010).

[14] On FORs, see Thompson et al. (2011).

ate adapted behaviors, in order to be remembered and conveyed to others feelings must have their own representational format. We now turn to the following question: What is the structure of the information that is extracted and expressed in a feeling?

3 What kind of information do feelings express?

The above question is important for clarifying the relation of feelings both to their formal object, when they have one, and to the action that they motivate. In the case of metacognitive feelings (M-feelings), the difficulty is particularly pregnant: it stems from the fact that, if we grant that M-feelings do not require concept possession to be felt, then it is unclear how their formal object should be construed: What are they about? Let us take a feeling of uncertainty, felt while trying to remember a proper name. Is this feeling about a memory *state*, or about a *disposition* to retrieve a proper name? If a feeling is about a memorial state or a disposition, its intentional content needs to include concepts of memory, of correctness, and of uncertainty. Empirical evidence, however, demonstrates that animals with no mindreading ability, and hence that are deprived of concepts of perception or of memory, are able to monitor their perception and memory as reliably as humans do.[15] Furthermore, human children, from early on, are sensitive to the contrast between familiar and unfamiliar faces and environments. This supports our claim above: one can feel cold or anxious or uncertain without having the corresponding concepts of those feelings. A propositional format does not seem to apply to feelings in general.[16]

How do feelings fulfill their particular embodied, subjective way of representing—a mode we will call the "expressive mode"? The broadly functional characterization given above provides

useful clues. Expressive representations comprise exclusively non-conceptual, perceptual, and evaluative (gradient- and valence-based) elements, which taken together express a subjective relation to the environment (internal or external) and a given tendency to act. It should be emphasized, however, that adult humans can obviously entertain *simultaneously* expressive and conceptual representations. The present hypothesis, in conformity with the literature on dual-processing, is that the expressive system processes information and influences decisions on the basis of its own narrow range of associations and norms; while the conceptual system takes advantage of background beliefs and inferential reasoning to make decisions in light of a broader set of norms. Let us take the case of an agent feeling joy after having won the lottery. A human adult normally has [lottery] in her conceptual repertoire, along with some of the inferences that can be made on its basis. However, the agent's reactivity to the winning event falls under the expressive mode of representation, because this is the mode in which evaluation of the opportunities is conducted. This feeling representation presumably enlightens and orients the concept-based reasoning that can be conducted concerning the same event, such as wondering how to spend the money, or whether quitting her job is a good idea. We propose to call "affordance-sensing" the information that a feeling expresses. Affordances are positive or negative opportunities, expressed in feelings: an affordance-sensing swiftly and non-reflectively motivates the agent to act in a particular way. Departing somewhat from Gibson's use of this term within his ecological theory of perception, "affordance" is used here to refer to a non-conceptual and entirely subjective appraisal of the environment by the agent: an affordance is a perceived utility, which can be positive (something to approach and grasp) or negative (something to avoid and from which to flee).[17]

The corresponding representation has an indexical structure, because it has an essential

---

15 Rhesus monkeys have been found to opt out of more or less challenging perceptual or memory trials as a result of trial difficulty. For a summary of the results and a methodological discussion of their significance, see Beran et al. (2012), Chapter 1, and Proust (2013), Chapter 5.

16 For a defense of emotional representations as nonconceptual and action oriented, see Griffiths & Scarantino (2009).

17 See Proust (2009, 2013). Prinz (2004) briefly discusses this idea in connection with the intentional content of emotions (p. 228). See also Griffiths & Scarantino (2009): in emotion, "the environment is represented in terms of what it affords to the emoter in the way of skillful engagement with it."

relation to an occurrent represented property. Indexicality, however, has to be understood here in a non-referential sense. What is indexed is an *occurrent* (relational) affordance, rather than an individual event or object. Here is our proposal for what a given feeling structure (FS) looks like:

- FS   Affordance$_a$ [Place$_a$=here], [Time$_a$=now/soon], [Valence$_{a=+}$], [Intensity$_{a=.8}$ (comparatively specified on a scale 0 to 1)], [motivation to act of degree$_d$ according to action program$_a$].

The subscript "$_a$" is meant to indicate that all the elements that have this subscript are representational cues, i.e., ingredients, in present affordance-sensing a. Note that the strength (or degree) of the motivation to act does not depend only on the fitness significance, i.e., on the valence and intensity of the affordance. Other factors, such as the physical condition of the agent and her prior arousal level (her mood) also modulate her motivational level (Schwarz & Clore 2007). The specification of the location of the affordance may vary, depending on the way the feeling was generated, but indexicality and reactivity suggest that the relevant affordance is often sensed to occur where the feeling is experienced. As will be seen later, however, M-feelings do not involve a specification of place.

The feeling structure proposed above includes somatic markers, even if they are not made explicit: these markers are the substrates for the information of valence and intensity. This information is carried by neural activations and associated bodily changes, such as a sudden sensation of pleasant muscle relaxation, or of unpleasant muscle contraction, or of visceral contractions associated with fear. Intensity of affordance, i.e., the arousal produced by a feeling, is also felt through the comparative amount of bodily reactivity to the affordance. These somatic markers, as emphasized above, are themselves part of a monitoring system designed to predict and assess one's relations to the environment along the relevant dimensions listed

above (agency, individual and social well-being, preferences, and metacognition).

Let us consider further how to read the feeling structure given above. It is meant to reflect not only what is presently felt, but also what is stored in memory when a feeling is experienced, what can be imagined, and what can be conveyed to others in expressive behavior. The central idea is that feelings sensitively express *a subjective, embodied relation to an opportunity* in an input from the environment (understood in a broad sense as including external and bodily properties relevant to well-being). This primitive intentional relation is best captured by the term *affordance-sensing*. Feelings express this affordance as their focus (or formal object), along with its graded valence—ranging from very unpleasant to very pleasant—and with its intensity gradient, which ranges from small to large.[18]

As often emphasized, reactivity to an affordance occurs very rapidly in a processing sequence—even before the perceptual processing has been completed—and well before a concept-based judgment can be made (see Dolan 2002, p. 1191; Griffiths 1997, pp. 77; LeDoux 1996, pp. 174; Prinz 2004, pp. 60, and Zajonc 1980, pp. 153). This suggests that an alternative, evaluative informational system screens the input with its own independent memorial structures.[19]

An affordance does not need to have an objective counterpart to be sensed, i.e., for a feeling to arise: it is enough that the agent anticipates it (even wrongly), imagines it, or remembers it, for the corresponding feeling to be expressed. A feeling, thus, does not presuppose

---

[18] For a review of the theories of valence, see Prinz (2004), Ch. 7. Prinz takes valence to be a different determinate experience in each feeling. On valence as determined by overall value, from a consumer semantics viewpoint, rather than as an experience of pleasure/displeasure, see Carruthers (2011), pp. 127–130. This view, however, does not build on the nonconceptual information being felt, but rather on its being represented "in an abstract and amodal way", which, nevertheless, is motivating.

[19] These expressive representations do not require a system to have the capacity to form propositional representations. They are close to what Strawson called "a featural representational system", allowing an animal to navigate with no propositional thinking (1959). On the comparison between the two representational modes, see Proust (2013). The question of the penetrability of feelings by propositional thought is explored below, in section 5.

a conceptual appraisal of the context, but rather it indexes in an embodied way a direct evaluative registration. Given that an affordance does not aim at characterizing the world, one cannot say, when the expressed affordance has no objective counterpart, that a feeling "misrepresents" the world as having a given affordance, or reciprocally that an existing affordance was "missed" by the agent when the latter failed to detect it. For misrepresentation to occur, a system must be equipped to attribute properties to individual objects, that is, it must be able to apply concepts. The expressive system, however, does not refer to objects as independent entities. Hence, affordance is not literally what a feeling is about, because aboutness presupposes that what is represented is independent from the representational system. Being relational, affordances cannot be grasped independently of the experience of a sensitive agent. When saying that a feeling "expresses" an affordance, we mean that it "resonates" to it (or that it monitors it). Resonance is a neural-somatic reactivity: it carries indexical and evaluative information, but it does not refer to the world or attempt to describe it.

It is possible, however, to objectively characterize what a feeling functionally refers to, and to pinpoint cases of misrepresentation, by re-describing the feeling structure above in non-subjective, non-evaluative propositional terms. Taking advantage of her perceptual and background beliefs, the agent can claim to have mistaken a piece of wood for a snake, for example, and to make explicit that there is no reason to be afraid of a piece of wood.

Our analysis of FS helps us to clarify why "feeling one's keys in one's pocket" does not belong to reactive feelings. Recognizing through touch the object in one's pocket as being one's keys, or merely having a proprioceptive experience in fact caused by one's keys, are two ways of perceiving one's keys, involving respectively cognitive and sensory proprioception. But neither needs as such to involve an affordance of a given intensity and valence. In contrast, let us suppose that the perceiver believes wrongly that she has forgotten her home keys, which are in some distant location, and will not be able to

get back home. Feeling her keys in her pocket immediately triggers a positive affordance, opening up the field of possible actions.

4 Questions and objections

The present proposal raises a number of additional questions and objections. Let us start with the most radical objection.

4.1 Are feelings representations?

Granting that feelings, affective or not, can be pure "physical effects of objects on the nerves", in William James' terms (1890, vol. 2, p. 458), they do not need to have any genuine representational value. James invites us to take the case either of purely somatic feelings or of objectless emotions when they are generated by a pathological condition—such as the precordial catch syndrome (PCS) which is a feeling of pain in the chest that usually goes away without treatment, but can lead the victim to think he or she is suffering a heart attack. In this case, the emotional experience of dread, James says, is "nothing but the feeling of a bodily state, and it has a purely bodily cause" (1890, vol. 2, p. 459). From this, one might conclude that a feeling is a merely peripheral phenomenon: it does not have a function to represent, nor does it express anything in particular. What can be said, in response, is, first, that feelings have a crucial evaluative function, which they perform thanks to their expressive structure. In PCS, the patient's experience of dread has valence and intensity, expressed through sudden breathlessness, chest constriction, blurred vision, tingling sensations in the skin, an elevated heart beat, and a disposition to crouch. These feelings are not only a matter of sensory "peripheral" experience: they are also used by the patient to collect her existing Bayesian correlations, and to monitor with their help the present affordance expressed. A second illustration of the representational nature of feelings is that they can arise in the absence of the sensory basis they seem to have. For example, illusory feelings of being touched—a reactive somatosensory feeling about a change occurring on one's body surface

—can be created by manipulating the coherence of the intermodal inputs from vision, touch, and proprioception. In the so-called "rubber-hand illusion", participants feel that their hand is being touched with a paint brush, when in fact it is an artificial hand, not theirs, that they see being touched. They also, after a while, "feel as if their (real) hand is turning 'rubbery'" (see Botvinick & Cohen 1998). This experiment is evidence that feelings are informational states, which monitor inputs, and, in extreme cases like this, cause the brain to try to reconcile contradictory multimodal input. In the proposed interpretation, however, seeing one's hand being touched is a reactive feeling, while actively touching an object generates a percept—which plays quite a different role in cognition.

4.2 What does "resonating to an affordance" mean?

Second, speaking of "subjective resonance" to an affordance (see the discussion of how a feeling "resonates" to an affordance in section 3 above) may look improperly metaphorical.[20] This is meant, however, to mark the difference between feeling and perceiving. While percepts allow recognition and identification of external objects and properties, feelings express specific affordances in a perceived, imagined, or remembered situation. For example, one can feel cold right now, or simulate being cold when planning a polar trip; one can remember how angry, or bored one was in a given episode and context. Feelings give agents prompt access to the relevant features of a new situation through sensed changes in their experience. Importantly, resonance is also an apt term for empathy, i.e., for the propagation of feelings from an agent to an onlooker, based on expressive behavior (Decety & Meyer 2008; Dezecache et al. 2013). Brain imagery suggests that the perception of pain in another individual largely overlaps with the regions activated when experiencing pain oneself (Jackson et al. 2005). Such empathy, in the present proposal, exemplifies how a feeling structure can be communicated through a set of

congruent behavioral cues associated with a given affordance (here a painful stimulus), with a valence and intensity that are bodily conveyed.

4.3 Non-conceptual content as a common feature of feelings and percepts

Third, one might object that a common feature of feelings and percepts is that they include non-conceptual contents. This is true; but notice the difference between the two types of non-conceptual content: while non-conceptual ingredients in perception are related to objective, external contrastive cues such as shapes, edges, colors, volumes, and auditory patterns, which can be static or dynamic, but are always purely descriptive, non-conceptual contents in feelings only include evaluative states, which combine the general type of the affordance, its valence, its intensity, the proper action program, where all constituents are "bodily marked", i.e., expressed through somatic markers. Therefore we cannot say that feelings "perceive" affordances, for this would suppose either that feelings have direct sensory access to the world—which they don't, for they extract their inputs from sensory perception—or that they have direct sensory access to the body, which they don't have either—feelings are the subjective counterpart of bodily changes. Therefore we cannot say that agents "perceive affordances" when they experience a feeling, for this would suppose either that feelings have a direct sensory access to the world, which they don't, for they extract their inputs from sensory perception, or that they have direct sensory access to the body, which they don't have either. Feelings are the subjective counterpart of bodily changes.

Neuroscientific research about the role of emotion in perception offers evidence in favor of this view. An affordance is made immediately salient by the system's ability to sensitively react to a (half-)perceived element in a given known context.[21] We speak of "half-perception"

---

20 In a similar vein, William James writes that, in emotions, "the whole organism is a sounding board" (1890, vol. 2, p. 450).

21 For a defence of this view in terms of situated cognition, see Griffiths & Scarantino (2009). The authors emphasise the environmental scaffolding that makes possible affordance detection in emoters.

on the basis of what is known about the timing of object perception. Affordance predictions are made only milliseconds after visual sensations register on the retina, i.e., before the categorisation of perceived objects is completed (Barrett & Bar 2009). The orbitofrontal cortex (OFC; involved in emotion and reward in decision making, thanks to projections from the thalamus) is able to extract an affordance in the first 80ms of the visual process, merely on the basis of low spatial frequency and magnocellular visual input (Lamme & Roelfsema 2000). What happens to perceptual access when a perceiver cannot extract affordances? Barrett & Bar (2009) have shown that the lack of emotional reactivity in early perception impairs object categorization. A patient who accidentally lost his visual ability when three years old received in adulthood a corneal transplant. In spite of his recovered ability to extract visual information from the world, this perceiver had trouble categorizing what he saw. The authors' suggestion is that reconstituting the internal affective context associated with past exposures to an object (which was lacking in this particular case) is "one component of the prediction that helps a person see the object in the first place" (Barrett & Bar 2009, p. 1325).

In summary: the medial OFC uses early low-level visual output to match the affordance associated with it in past experience of the object: somatic markers are thereby activated, and the appropriate action is prepared. A FS enables an object to be more swiftly categorized at higher perceptual levels. This evidence suggests that affordances are extracted from perception, but that feelings are not themselves perceived.[22] On the contrary, they offer a separate kind of feedback to cognitive perceptual processes.

4.4 Respective role of somatic markers and formal content

Let us turn now to one of the most central questions that our proposal raises. How does it explain the respective roles, in expressive inten-

tional content, of somatic markers, on the one hand, and of the represented formal objects on the other? Cognitive theorists take emotions to represent both salient aspects of the agents' own bodily changes and an evaluative belief about an external fact, with, possibly, a causal relation between this fact and the experienced bodily change (see Gordon 1987; Tye 2008 and Solomon 2007). For example, when perceiving a bear in the near vicinity, one's experience is taken to be about a complex of subjective bodily impressions (a pounding heart, trembling legs, etc.) and about the perception of a bear as being the cause of these changes. Such a construal of the intentional content of feelings only makes sense within a propositional mode of thought. Can our expressive mode reflect or approximate the information contained in this complex causal structure?

Clearly, FS does not *explicitly* convey a causal relation between situation, somatic markers and subjective feeling. It carries this causal relation implicitly, however, as a consequence of the control architecture that produces feelings. In an emotional control loop, a perceived affordance causes (rather than being represented as causing) its expressive evaluation through its specialized sensory feedback. Emotional awareness expresses this functional relation. An external event (made accessible through a perceived affordance, as detailed above) is immediately followed by subjectively experienced somatic cues of a given intensity and valence. In functional terms, this sequence makes sense in the following way. When an associated forward model has been selected (often automatically, on the basis of an environmental, somatic, or cognitive affordance), the associated sensory cues (the somatic markers in this particular episode) are automatically activated in order to monitor how this affordance is to be processed and reacted to. As has been shown elsewhere, monitoring implicitly carries information about the command (or the affordance) that is being monitored (see Proust 2013). This explanation is particularly detailed and convincing in the case of motor representations of action; the feelings of agency that result from the comparators associated with a given feedfor-

---

22 When we say that a feeling is felt, "felt" is not intended to mean "perceived", but, rather, "entertained".

ward model express (among others) whether the emoter is, or is not, the author of the action currently attended to (see Wolpert et al. 2001 and Pacherie 2008). The present proposal generalizes the functional significance of feelings throughout their diverse types (reviewed in section 2). As the outcome of sensory comparators, feelings always carry a structured information set about the type of affordance they contribute to regulating, about its amount, and about which actions are appropriate. This information, in its own expressive mode, functionally approximates a causal relation that is, when propositionally expressed, represented as a relation between an internal state, an external cause, and a disposition to act.

In summary: Feelings do not gain their aboutness through a propositional thought where the contrast between object and property is semantically marked; they gain their functional (rather than propositional) aboutness (f-aboutness) through the respective roles, in adaptive control, of the selection of an affordance-dependent control model and of the markers that allow comparisons of valence and intensity to be expressed.

4.5 The attribution problem

This account, however, fails to explain observed variability in the production of feelings and the interpretation of what feelings are "about". There are cases where agents misattribute their sadness, their anger, or their happiness to an event that is either not real, or that actually played no role in feeling production. How can such a misattribution be explained on the present proposal? Our first attempt to address this question is based on the subjective grounding of affordances. "Feeling f" normally means that an affordance is sensed, expressed, and subjectively represented as present. This does not mean that the affordance has an objective counterpart. Thus a thirsty traveller can be delighted or relieved when subjected to a water mirage. It is no problem for this view, then, if an event does not have the action potential for a given affordance it is expressed as having.

A trickier problem for the proposal is that a person might feel an f-feeling while she thinks that she has a g-feeling. Is such a situation even possible? To deal with this question, we must first clarify what "transparency" means when applied to feelings. A mental state is transparent if, when it is activated, its intentional content is accessible to the subject who entertains it, while its vehicle properties are not. On the view defended above, feelings are transparent, because their somatic markers are felt in connection with a certain affordance, and because their valence and intensity directly influence the emoter's motivation to act in a given way. Such transparency, however, does not need to entail the subject's ability to verbally report the content of her feeling. First, as seen above, a feeling can be felt by a nonhuman or by a child, both of whom lack the requisite verbal and conceptual capacities. Second, even an agent endowed with language can express through somatic markers a feeling with a distinctive FS content while failing to accurately report, in conceptual terms, what her feeling is "about". We saw that [aboutness], i.e., reference to an independent event or object, is not a concept that belongs to FS. When subjects try to infer [aboutness] from their experience, their propositional system of representation (PS) is solicited. Because the latter has an analytic rather than an evaluative function, additional constraints step in. While nonconceptual, intensive (analog) and value considerations and norms regulate FS, conceptual, digital, and instrumental considerations and norms regulate PS.[23]

Hence, when having to report about her feelings, a subject needs to translate one mode of representation into another, with no guarantee that this translation will not enrich or modify FS intentional content. First, she may no longer have access to the rich diversity of her FS experience, because her attention is no longer directed toward the relevant contextually-activated affordance. Second, she has to monitor other goals and their corresponding (so-

---

23 About the nature and role of nonconceptual norms, see Proust (2013).

cial, instrumental, or epistemic) norms. For example, she needs to present her feelings to herself and to others in a socially acceptable way, and to try to justify them rationally. This in turn will depend on her existing background beliefs, on her self-concept, on her capacity for making self-attributions of this particular kind, and on her willingness to perform this kind of introspective report. A number of experiments and novels have documented the wide gap between people's feeling experiences and the verbal report they provide, or the reasons they offer, for having this or that feeling. These considerations suggest, then, that the issue of transparency cannot be adjudicated independently of one's viewpoint about mental architecture.[24] According to the present proposal, an affordance is *first* subjectively recognized through the resonance it produces—through its specific feeling, rather than through a concept-based interpretation.

Let us now return to our earlier question. Can a person actually feel an *f*-like feeling, and mistake this *f*-feeling for a *g*-feeling? According to the present account, this situation would presuppose that an *f*-feeling, as it occurs in the expressive mode, is misdescribed in a verbal report as a *g*-feeling, to finally be genuinely felt to be *g*. On this view, a change in representational form would not only make it possible to reinterpret the initial experience in terms of a different one, but also to feel differently. To see whether this case is plausible, it is worth discussing Schachter and Singer's (1962) adrenaline experiment.

---

24 An alternative proposal by Carruthers (2011) sees as a condition of transparency of an affective feeling, rather, that the corresponding appraisal include the detection of the details of the associated non-conceptual somatic markers, which makes the recognition of a specific emotion possible, as well as its subsequent global broadcast—hence making this information available to the mindreading system. This analytic view of feelings, however, makes it utterly mysterious how a given pattern of autonomic measures is ever recognized, among thousands of similar patterns, as distinctive of an emotion. On the present view, a feeling is produced within a given forward model, which automatically activates the comparator for this affordance. Transparency, then, is effective only when a given forward model is activated, and does not need to transfer to a verbal modality. This seems to be recognized in part by Peter Carruthers, when he concludes that "we can have transparent access to the strength of only our occurrent *context-bound* affective attitudes" (2011, p. 146).

5 Do beliefs influence affective report?

Schachter and Singer's famous adrenaline study aimed to collect evidence in favor of a two-factor theory of emotion, according to which a changed state of arousal leads agents to form feelings with a given valence that depends only on the epistemic/motivational context. Participants' arousal was manipulated by injecting them, under 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 either pretending to be 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 (in the euphoria condition, the results failed to reach significance both for behavior and self-report).

Were Schachter and Singer successful in making the point that valence of a feeling is a matter of attribution of the source of an experienced arousal? Several powerful objections have been raised against this claim. Recall that subjects were asked to what degree they would describe themselves as happy or angry. A first problem is that the questionnaire *suggested* the relevant target categories of emotions, which is disturbingly close to influencing participants' responses (see Plutchik & Ax 1967 and Gordon 1987, p. 100). Furthermore, as noted above, ex post-facto reflective labeling of one's emotion does not need to express one's original feelings. As shown by Nisbett & Wilson (1977), self-reporting is highly sensitive to rationalizations from context. A second problem, mentioned by the authors in the discussion, is that the subjects' verbal reports and emotional behavior failed to confirm expectations in the euphoric condition. A third methodological problem, also

recognized by the authors, is that the student participants had their own independent reasons for feeling anger in passing this longish test, which predisposed them to feel anger. There are, however, more theoretical objections.

On Schachter and Singer's view, the core feeling of an emotion is an arousal change, which can be artificially induced by drugs. Valence is supposedly gained through contextual beliefs and motives. If this view is accepted, why should we expect that contextually relevant beliefs specify the feeling itself (e.g., the anger experience)? Participants may indeed have been led to believe that they were angry when they were actually merely aroused. This does not show, however, that they ever felt anything else than an arousal change (Gordon 1987, pp. 100–101). Schachter and Singer may have only biased self-attributions and self-report toward target emotions. The behavioral changes that were observed and attributed to felt emotion, in addition, can be imputed to social influence, rather than to intrinsic changes.

A final worry is that inducing in a participant a somatic marker normally associated with a given feeling (e. g., increased heart rate), *and* providing the person with a context rationalizing this somatic change, does not amount to an ecological way of producing a feeling. 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 (Gordon 1987, pp. 98–99).[25] As discussed in section 4, the expressive mode has a nonconceptual representation of this causal connection. The architectural relation between feelings and affordances explains why subjects experience a systematic connection between their feeling and what it is "about", much in the same way that an agent experiences a systematic connection

between an intention to move and the goal that is aimed at—that is, without needing to represent conceptually the causal connection between the two. Nothing prevents the emoter, however, from forming a secondary conceptual representation of the emotional experience she has had, and reappraising the context on the basis of her background beliefs. As a consequence of this concept-based reappraisal, the agent may either discount the relevance of her initial feeling (as in the fear-of-snake case), or redescribe it in the richer terms that she now has available (as was done, presumably, by the Schachter and Singer participants).

Taken together, these objections have led most theorists to reject Schachter and Singer's two-factor theory of emotion, and to look for alternative accounts of the role of inferences in self-attribution of feelings. It is interesting to see, however, that a two-factor theory has also been applied to the case of M-feelings.

6 Are metacognitive feelings sensitive to beliefs and inferences?

What are metacognitive (also called *noetic*, or *epistemic*) feelings? Juxtaposing [being metacognitive] and [being a feeling] sounds, at least prima facie, dangerously close to an oxymoron. When Descartes, Locke, and other 17th-century philosophers explored the properties of ideas as being "clear", "distinct", "evident", and "certain" they certainly never took them to be feelings. These notions were taken, rather, to be objective representational properties that the mind, unaided by imagination, is able to detect. David Hume, in contrast, observed in his Treatise that "the vivacity of the idea gives pleasure", and that "its certainty prevents uneasiness by fixing one particular idea in the mind, and keeping it from wavering in the mind of its objects" (Hume 1739/40, 2007, p. 289). Thus Hume was glad to accept that epistemic feelings exist, and that they vary in their vivacity and in their pleasantness, i.e., in their intensity and in their valence. Following Hume's lead, let us test how our analysis of FS above fares with the case of noetic feelings. Here,

---

25 As Gordon observes, "one will not experience fear unless one connects up that cognition with the arousal one feels. To do this requires, according to him, a second cognition: a recognition or belief that is one's being (or taking oneself to be) in a situation of danger that is causing the arousal one feels. This "cognitivist" objection is correct when targeting S and S's theory, who also defend a cognitivist view of feelings. The present view, however, proposes a non-doxastic account of feelings, and is thus immune to this objection."

again, is our proposal about the general structure of feelings.

- FS Affordance$_a$ [Place$_a$=here], [Time$_a$=now/soon], [Valence$_{a=+/-}$], [Intensity$_{a=n}$(comparatively specified on a scale 0 to 1)], [motivation to act$_a$ of degree$_d$ according to action program$_a$].

What is specific to noetic feelings is that the affordances to which the system resonates are "informational" or "metacognitive" rather than environmental. Hence, the affordance does not relate to the external environment (the "here" slot is often irrelevant, except for perceptual affordances, or place-dependent metacognitive affordances, such as concentrating in a noisy spot). Although a cognitive action does not, in general, consist in physical moves towards or away from an affordance, similar decisions are motivated or inhibited in the domain of mental agency: a high retrieval affordance motivates pursuing the memory search, a low one to quit, etc. Hence our FS analysis also applies to noetic feelings.

As already emphasized, the affordances expressed in feelings do not need to be construed conceptually in order to be detected and assessed through their associated somatic markers. A conceptual construal, however, is suggested by the names given, in the literature and in ordinary language, to M-feelings. The term "feeling of knowing" (in response, for example, to the question: "what is the capital of Australia?") implicitly presupposes that the emoter has access to the concept of knowledge. Expressing her feeling verbally, indeed, an emoter might say: "I feel that I know the response to this question". In this sentence, she indeed refers to her disposition to retrieve knowledge and, hence, metarepresents her knowledge disposition.[26] The affordance theory of noetic feelings suggests a different picture. When trying to

remember a proper name, a *feeling of knowing* is a specific experience of having the ability to detect the target, and of predicting its imminent recall. It can be associated with a feeling of tension (Koriat & Levy-Sadot 1999, p. 486). This experience is associated, then, with a graded, intuitive, and affect-like appraisal of a [remembering] affordance. Rhesus monkeys working in experimental labs in comparative psychology show that they can assess their memory affordances (see Beran et al. 2012, Chapter 1).[27] What kind of feedback, then, do monkeys use? A surprising and substantive fact about metacognitive control, first revealed through the pioneering research of Asher Koriat, is that the comparator generating metacognitive feelings (such as a feeling of knowing in a memory task, or a feeling of clearly discriminating in a discrimination task) has no access to the semantic contents stored in memory or made available through perception. In Koriat's words, M-feelings "are mediated by the implicit application of non-analytic heuristics, relying on a variety of cues." These cues "pertain to global, structural aspects of the processing of information", such as ease of processing, time devoted to a task, familiarity, and accessibility (Koriat 2000; Koriat & Levy-Sadot 1999).[28] Therefore, contrary to what epistemologists have always believed, the most common type of epistemic appraisal is not directly based on the content of the thoughts to be evaluated, but on the properties of the underlying informational process.

Neuroscientific research confirms Koriat's claim. Implicit, associative cues are extracted by the working brain to select, in a cost-efficient way, what there is to learn, to retrieve from memory, to extract from perception, or what is worth storing in memory. These are all to do with the dynamics of information processing: with its onset, with the comparative amount of activity in incompatible neural responses, and with the time needed to converge on a threshold value. Indeed, the neural activity

---

26 Arango-Muñoz (2012) claims that feelings of forgetting and feelings of knowing are cases of "conceptual experiences". According to the present view, following the lead of Koriat and colleagues, M-feelings can overlap with judgments, and be redescribed in conceptual terms; they pertain, however, to different representational levels. There are no "conceptual experiences", except in the sense of experiencing the comparative fluency of concepts.

27 As indicated above, rhesus monkeys are able, in a perceptual or memory task, to opt out of more or less challenging trials as a result of trial difficulty.

28 As will transpire below, all these cues are, as far as we know, dimensions or effects of fluency, i.e., of ease of processing.

recorded in rats' OFC when attempting to categorize olfactory stimuli was found to correlate with their predictive behavior (consisting in accepting or rejecting a task trial); similar patterns have been found in other species.[29]

On the FS model, somatic markers have the function of expressing the intensity and valence of the noetic predictions generated from feedback at the neural level. As indicated in section 2, psychophysiological measures (electromyography) provide evidence for the existence of facial markers associated with feelings of fluency and of disfluency (Winkielman & Cacioppo 2001). Increased activity in the smile muscle, the zygomaticus major, produces feelings with a positive valence. A reduction of fluency is correlated with activity in the corrugator supercilii (involved in frowning), which suggests that this additional effort is felt as unpleasant. Intensity of positive or negative confidence, computed implicitly, is expressed by the corresponding intensity of the noetic feeling. A different somatic marker of memory appraisal is the TOT phenomenon. This often occurs when a search in memory for a specific word fails to retrieve that word within the usual time interval. The informational ingredients of FS are conveyed by the intensity of the activity in the tongue muscle, and by the affective quality of TOT. Taken together, these predict the likelihood of successful retrieval. An implicit cue-based heuristic might thus explain why TOTs have the valid predictive value they do (Schwartz et al. 2000).

---

29 See Kepecs et al. (2008). An interesting account of the predictive activity reflected in noetic feelings is that the dynamic activity in the neurons activated by a given task correlates with the so-called "accumulation of evidence" that is diagnostic of success or failure in that task. For example, in a perceptual discrimination task, where a target might be categorized as an *X* or as a *Y*, evidence for each alternative is accumulated in parallel, until the difference exceeds a threshold, which triggers the perceptual decision. The information that will generate a feeling consists, first, in the differential rate of accumulation of evidence for the two (or more) possible responses, and second, in stored information about the threshold value, computed from prior trials, which the rate of accumulation should reach in order to make a cognitive decision likely to be correct. For a discussion and review of the literature, see Fleming & Dolan (2012), and Proust (2013, pp. 99).

6.1 Two-factor theories of M-feelings

In our FS single-factor model, M-feelings have an intrinsic intensity and an intrinsic valence. Two-factor theories make a different claim, in ways analogous to Schachter and Singer's theory of aboutness in affects: M-feelings have an intrinsic arousal level, but their valence depends on the environment. Jacoby and his colleagues were the first to embrace a two-factor view about feelings of fluency. They manipulated participant's exposure to an item in order to show that enhanced fluency generates an illusory feeling of familiarity. Under conditions of divided attention, reading a list containing both famous and not famous names raised participants' disposition to wrongly judge as famous some names presented in a second list, merely because these names had already been read in the first list. Schachter and Singer's idea was that fluency is a generic feeling, that needs to be interpreted on the basis of goals and current cues, in order to deliver a qualitatively different specific feeling:

> Inherent in the idea that the subjective experience of familiarity arises from an interpretation of cues is the notion that cues can be interpreted in a variety of ways. As noted above, if ease of identifying an item is obviously being manipulated by the experimenter, the resulting perceptual fluency does not give rise to a feeling of familiarity. Attributions are also affected by one's goals. In the context of attempts to remember, people may be more likely to interpret ease of generating an item or perceiving it as familiarity. In the context of other tasks, the same cues may be interpreted in other ways. (Kelley & Jacoby 1998, p. 129)

From their viewpoint, the fluency generated by a given name can, according to the task and the information made consciously available to a participant, be experienced as a feeling of familiarity, or as a feeling of recognition of that name as "old" (i.e., presented in a former list). They conclude that a feeling of fluency (gener-

ated by a perceived name) will be experienced as a function of the alternative ways of interpreting this feeling, on the basis of the agent's goals and the additional cues available.[30]

A similar two-factor theory has been defended in the (Whittlesea & Williams 2000; Whittlesea & Williams 2001) model of M-feelings. According to this model, feelings of familiarity result from the perception of a *nonspecific* discrepancy between the expected and the observed rate of processing of elements in a given context. Valence and the associated action guidance, on the other hand, are based on a conceptual interpretation of what this discrepancy means. For example, you find yourself waiting for the bus next to people you expect to be total strangers. Suddenly, you have an unexpectedly high fluency experience when looking at the face of someone you have already encountered several times—a clerk from the local grocery shop. This unexpectedly high rate of discrepancy-reduction determines an intense feeling of familiarity with a strong motivation to identify the familiar face (see Whittlesea & Williams 2001). Had you seen the clerk in the local grocery store instead, you would have merely had a feeling of recognition when seeing the clerk.

To summarize: the core idea in two-factor accounts is that participants have a primary feeling of fluency, which they interpret in more specific terms as a function of their goals and of the context as they consciously represent it to be. Thus, on this view, a feeling partly relies on background knowledge, and partly on a naïve theory concerning the relation between feelings and mental activity (Schwarz & Clore 2007). The naïve theory is as follows: feelings are about what one is doing, so this feeling must be about this event of trying to perceive, or this attempt at retrieving, etc.

As already observed above, a naïve-theory view is incompatible with monkeys' and young children's epistemic evaluations based on fluency. Our FS structure offers an alternative account: cues (associative heuristics) dictate how an affordance is detected, assessed, and exploited in a context, but these cues are not consciously available, and hence do not depend on a naïve theory of the task. The Jacoby and Whitehouse evidence is compatible with a procedural view of engagement in a task through automatic memory processes, and of the feelings of familiarity they generate. A comparator is always activated as a function of a subject having been highly trained in the corresponding first-level cognitive task. Monkeys and humans feel that a memorial or perceptual affordance is present because, if they need to assess whether, for example, an item was seen earlier, the associated comparator produces a feeling of a given intensity and valence indexing the remembering affordance. Thus, it is uncontroversial that a context-dependent factor determines both the task to be performed and the reactive metacognitive feeling about this task.

It does not follow from the context-dependence of a cognitive task, however, that a concept-based interpretation will affect the experienced feeling itself, as maintained by the two-factor theorist. A cue-based, non-analytic heuristic is not inferential in the interpretive, first-person sense. Regrettably, the word "inference" has been loosely used in affective and in metacognitive studies, to refer both to "automatic, non-analytic, largely unconscious and fast associative processes" (Nussinson & Koriat 2008) and to conscious reasoning and theory-building (Schwarz & Clore 2007). These two types of processes (respectively called "automatic" and "controlled"), are now held by many authors to operate independently.[31] While unconscious heuristics rely on implicit associations between cues, inferences comprise deductions from premises to conclusions. Looking back at Jacoby and Kelley's point above, we see that the authors are referring to unconscious cues being recruited for a task: they are thus referring to unconscious associative heuristics rather than to explicit concept-based reasoning. The memory interactions they are exploring,

---

30 Jacoby & Whitehouse (1989) similarly argue that a feeling of fluency can be experienced as familiarity in a memory task, and as confidence in a problem-solving task.

31 For a defence of the distinction see Jacoby & Brooks (1984), Koriat & Levy-Sadot (1999), Recanati (2002) and Smith & DeCoster (1999). Koriat & Levy-Sadot (1999) both emphasize the distinction and use the term "inference" in both cases.

however, typically involve both automatic and controlled processes, which is a source of confusion. As Jacoby and Kelley are eager to show, implicit associations and explicit reasoning lead to different, incompatible predictions. As a result, the evidence they present shows how automatically-generated feelings can be theorized about in controlled processes. It does not demonstrate, however, that feelings depend upon theorization. A theory of the task, in contrast with automatically generated feelings, offers reasons to attribute to oneself beliefs and motivations to act, and, possibly, to reject the relevance of feelings for any particular task.

Our proposal, then, has several advantages over inferential or theory-based accounts of f-aboutness. First, it explains why a feeling of fluency can be experienced, and why it can motivate agents' metacognitive responses in species or individuals with no concept-based attributive capacity (i.e., with no capacity for mindreading). Second, our proposal accounts for the difference between a type of M-feeling (a feeling of fluency) and the various ways in which it is experienced across cognitive tasks. Granting that comparative ease of processing can *always* be computed, and can be used as a reliable indicator of the likelihood of success across a wide range of cognitive activities, it is not surprising that there is a type of feeling based upon it. Fluency can be perceptual, memorial ("retrieval fluency"), or conceptual. It can be used in predictive or retrospective evaluations. If agents are asked to determine which statements are likely to be true or false (presumably a question that only—but not all—humans can understand), felt perceptual fluency will induce a "truth effect". Agents will evaluate a statement as more likely to be true than another merely because it is easier to read.[32] If agents are asked to detect faces of known people (or of stimuli previously shown), felt fluency will generate a sense of familiarity, which motivates agents to try to identify the target. If people are asked to assess the frequency of a given phe-

nomenon, felt retrieval fluency—that is, what comes immediately to mind—will be used to judge what is more frequent. Felt fluency will also have effects outside of metacognition: if agents are asked which particular face, landscape, or picture they prefer, felt fluency will influence their decision. Several affordances, then, may be associated with the same globally expressive *type* of feeling (constructed as the set of feelings with the same type of facial markers for ease of processing, for example). The notion of type of feeling is a technical term, which is useful to distinguish the diverse ways in which fluency is used by the brain. But a type of feeling is never experienced; only tokens of the type are. Tokens of feelings of the same type will differ in the specific affordances that are detected, and in the tendencies to act that the feeling motivates. As a consequence, one cannot say that feelings of fluency "feel the same" to an emoter: fluency experienced in an FOK and in an FOR, for example, apply to different segments of processing, assess different things, and motivate a different action program. You may first have an FOK after a question is addressed to you, and then fail to have the associated FOR after having come up with a response. These differences have nothing to do with an interpretation: they are constitutive of what sensitivity to a given affordance amounts to. Take the case of feelings of familiarity. As summarized above, Whittlesea and Williams claim that fluency is the core of the experience, while familiarity is a conceptual interpretation of this core feeling. It is more economical, however, to suppose that familiarity is a different feeling within the general fluency type, and that it is associated with a different affordance.

In summary: engaging in a particular cognitive task (e.g., trying to remember, evaluating retrieval, assessing frequency) does not need, per se, to involve a naïve theory of the task. It only requires having a salient affordance, and an implicit heuristic for metacognitive predictions in that task.

---

32 There is abundant evidence, however, that M-feelings uncritically guide epistemic decision (i.e., are unopposed by concept-based processes) mostly when the cognitive task is unimportant, when cognitive resources are limited (under time pressure or divided attention), and when agents are in a good mood (Nussinson & Koriat 2008; Schwarz 2004).

6.2 Incidental versus integral feelings

Our proposal also allows us to address in affective terms the issue of incidental versus integral feelings, which, in the literature, is invariably framed in inferential terms (with all the ambiguity relating to this expression). Metacognive feelings are called "incidental" when they are not based on valid cues for the cognitive task at hand, and hence, have no predictive value. They are called "integral" when they actually carry information about cognitive outcome. Granting the universal role of fluency in metacognition, how do people know when a feeling of fluency is relevant to a given task, and which sequence of their cognitive activity needs to be monitored? A frequent answer, in the literature, is that agents believe that fluency applies by default to the present domain of judgment. When, however, agents are led to believe that a feeling of fluency is purely incidental to the task at hand, they will discount it in their decision, on the basis of a theory of the domain of interest (see Schwarz & Clore 2007 and Whittlesea & Williams 2000, 2001). Let us suppose, in what we shall call case (a), that an agent is explicitly told that a given cue, such as the ease of reading a given sentence, is irrelevant to a given task—such as assessing the truth value of the written statement. Or, alternatively, let us suppose—case (b)—that the agent discovers by himself that there is a connection, but with reverse relevance. Perhaps he finds that badly written sentences, involving added processing effort—in a given context— are likely to be true (see Unkelbach 2007 and Unkelbach & Greifeneder 2013). A popular account of these cases is that people will infer respectively, for (a): that the feeling of fluent reading they have had *is not about* the target task, which entails that reading fluency does not predict truth, or, for (b): that what predicts the truth of a written utterance, in this particular context, is disfluent reading (see Schwarz & Clore 2007, p. 394).

According to this two-factor account, M-feelings are cognitively penetrable. They can be suppressed at will, on the basis of a reinterpretation of their being experienced, or can even

be used to predict falsity instead of truth.[33] On the account proposed here, in contrast, M-feelings are never cognitively penetrable. Why, then, do subjects stop trusting their feeling of fluency? Our answer is the following. In the first type of case, subjects do not allow their feelings of fluency to guide their decision because they have received verbal instructions to this effect. In the second type of case, subjects no longer use their feelings of fluency to form an epistemic decision in the proposed task, because they have learned, over time, that these feelings do not predict truth in this task.

In case (a), then, subjects are confronted with a different task. They are no longer asked to express their confidence in the truth of a given sentence (an intuitive, associative task); they are asked to assess the truth of sentences by taking into account the fact that their feelings of fluency are irrelevant. This new task requires the participants to form appraisals based on analytic reasoning. Feelings no longer drive their evaluation and epistemic decision.

In case (b), where bad writing is associated with likely truth, no "theory of the task" needs to be formed, on top of the first-order task, which consists in judging whether a written statement is true or not. A mere change in cue validity can produce, over time, a change in associative heuristics, and, hence, in feelings and in decisions to act. For example, just as our thirsty traveller will eventually learn not to trust an apparent "drinking affordance", an agent will learn, in certain recurrent contexts, not to trust an apparent "fluency affordance". Obviously, cue validity can, in humans, be conveyed verbally; this will considerably abridge the revision process of the associated program of action. We then return to case (a): participants will be able to immediately discount an apparently valid cue, to turn to analytic appraisals, and to refrain from acting on their fluent feeling (which, however, is still there). Cue validity, however, can be learnt implicitly as

---

33 This two-factor account is endorsed by Unkelbach (2007): "the feeling resulting from the discrepancy is non specific, and the discrepancy triggers a search for an explanation […]. The experienced variations are not attributed to prior exposure, resulting in a feeling of familiarity, but to some other quality of the statement, namely, that a statement is true."

well, which weakens the case for a theory-laden view of feelings.

These observations suggest that feeling-based and analytic appraisal, as hypothesized in this proposal, "tap separate databases representing knowledge in different formats."[34] A feeling of fluency, as a result, can survive being discounted in decision-making. Another finding points in the same direction. There is evidence that, even when an M-feeling has been explicitly discounted (i.e., shown to agents to unduly bias their epistemic assessment), the initial feeling remains unaffected, and is able to promote further epistemic decisions. In Nussinson & Koriat's (2008) study, agents exposed to unsolved anagrams and to anagrams accompanied by their solution, were asked to rate the difficulty of these anagrams for naïve participants with no prior access to the solution. The participants' ratings were influenced by the differential fluency that the anagrams presented for them: the higher fluency of solved anagrams biased their attributions of difficulty. After being informed of the contaminating effect of knowing the solutions, the participants were invited to correct their attributions by re-rating the difficulty of the anagrams, which they did. However, the participants were subjected to a subsequent test, where, under time pressure, they had to predict which of two anagrams would be harder for others to solve. These other-attributions of difficulty presented, again, the same bias for known anagrams. Being under pressure allowed participants' M-feelings to guide decision. The verbal instruction could shift their controlled responses when re-rating the anagrams, but did not lead the participants to recompute them, as should have been the case if feelings are cognitively penetrable.

In summary: what participants learned (that solved anagrams only *look* easier to process) did not influence what they felt later (higher fluency is diagnostic of ease of solving).

7 Are all feelings affective?

It is often noticed that a phenomenological contrast seems to exist between feelings—that is, they are not equally emotional. Are not M-feel-

ings in general as "cold" as the proprioceptive feeling that my right arm is being extended? Or can they also be "hot"—that is, involve valence, i.e., be pleasant or unpleasant? Our proposal of a common expressive evaluative format suggests that all the feelings vary in affect in roughly the same way, because they all include valence in their informational structure. Stepper & Strack (1993), however, have emphasized that epistemic feelings are "cold". Feelings like effort, familiarity, surprise, or feeling of knowing "have no fixed valence", in the sense that they don't feel particularly good or bad. Linguistic research on the emotional lexicon is invoked as congruent evidence: for words referring to readiness, success, and a desire to deal with new information (like "alert" "confused"), i.e., terms expressing metacognition, affects are not "focal", which implies that they are not centrally emotional (Ortony et al. 1987).

There is abundant evidence, however, that feelings of fluency increase perceivers' liking of the objects perceived. Familiar items (other things being equal) are found to be more pleasant than new ones. An initially neutral stimulus is felt to be pleasant after repeated exposure. This "exposure effect", first demonstrated by Zajonc, has been attributed to increased perceptual fluency (Zajonc 1968). This affective effect of fluency has since been found to apply to any dimension of a perceptual input. The sense of beauty in a symmetrical face or in a landscape, or the pleasure felt in contemplating a picture seem to be inherent to the feeling of fluency generated in the perception. As noted above, psychophysiological measures in the facial muscles provide additional evidence for the affective character of the feeling of fluency (Reber et al. 2004; Winkielman & Cacioppo 2001; for a review see Oppenheimer 2008).

An interesting, untested, speculation intended to explain the presence of cold and hot versions of feelings is that valence, although never fully absent from monitoring, is modulated by dynamic aspects of the task under evaluation (Carver & Scheier 1990; Carver & Scheier 2001). On this view, affective feelings can appear in physical and cognitive action, and probably also in somatosensory experience,

---

34 A quote from Smith & DeCoster (1999), p. 329, who offer a strong defence of this view.

when certain dynamic conditions for affective reactions are present. But what are these conditions?

Let us first examine an area where these dynamic conditions seem to have a minimal role. This is the area of first-order motor control (including the initiation of an action, the monitoring of its development, and of goal completion). As with any other form of control, motor control involves specialized feelings, in the above sense of subjective experiences with a distinctive embodied phenomenal quality (see Pacherie 2008). At first glance, these feelings do not typically seem to be affective.[35] Why is this so? According to Carver and Scheier, this can be explained by the dynamics of a monitored activity that generates feelings. Affective feelings are part of a second-order type of feedback, having, in their terms, "the meta-monitoring function" of "checking on how well the action loop is doing at reducing the behavioral discrepancy that the action loop is monitoring". This meta-loop, then, monitors a particular aspect of one's progress in relation to one's distal goal: it represents "*the rate of discrepancy reduction* in the behavioral (monitoring) system over time". This dynamic representation is what a feeling is equipped to offer: the intensity and quality of a positive, or a negative, feeling express how far above, or how far below, the observed *rate* of discrepancy reduction is, with respect to some reference value. One consequence of this view, if it turns out to be experimentally validated, is fascinating and deep: affect in action does not depend merely on the amount of discrepancy being reduced. An agent may be an inexperienced performer in a task; if the velocity of her progress to the goal is higher than expected, she will feel more confident, and have retrospectively more positive feelings when reaching her goal than a competent performer whose progress to the goal is as steady as predicted.

There is a second type of affect, according to Carver and Scheier, that the dynamics of prediction can generate. Acceleration is the rate of change of velocity. Feelings express such acceleration when the rate of discrepancy reduc-

tion *increases* beyond expectancy—a sense of exhilaration then occurs. Lucky athletes, who break several records within days, experience this. Symmetrical feelings of sinking, or despair, arise when the rate of discrepancy reduction *decelerates* unexpectedly and falls below the expected threshold more quickly than anticipated. In summary, cold motor feelings are generated when one is routinely acting on the world, when things develop as expected, except for small motor adjustments. Hot action feelings are generated when action monitoring involves unexpected dynamics of reduction or increment of likely success or failure.

How does this theory apply to M-feelings? A similar contrast may exist in M-feelings. Carver and Scheier's model allows us to predict that M-feelings can have colder and warmer varieties, depending on the dynamics of the discrepancy reduction that they express. As seen above, there are two varieties of M-feelings, distinguished by their function. Some, like FOKs, have a predictive function. Others, like FORs, perform retrospective evaluation. Neuroscientists explain these feelings through the rate of the accumulation of evidence, measured through the comparative activity of the neural assemblies involved in cognitive decision. (This rate of accumulation has to be compared with a stored standard in order to produce a reliable feeling of confidence.) From this widely accepted model, it follows that the rate of reduction of discrepancy toward a confidence threshold is automatically computed, and plausibly expressed through somatic markers that themselves have a varying intensity.

If this reasoning is correct, then although all M-feelings do not often have a definite "hot" quality comparable to fear and love, they always have a valence, according to whether they predict an agent's progress towards or away from her cognitive goal. To find more intense M-feelings, however, one needs to look at the dynamics of *meta-monitoring*, which is when an agent expects a given rate of reduction of the discrepancies toward her cognitive goal, and either observes a rate that is well above the expected rate or well below it. In these cases, the sense of confidence that the positively surprised

---

[35] Even in this domain, however, an error signal, when conscious, is associated with an unpleasant feeling.

agent experiences is modulated by an intense, highly motivating affect of joy and renewed passion for the associated cognitive activity; while the uncertainty of the negatively surprised agent is associated with an intense, highly demotivating affect of discouragement, or loss of interest. Note how crucial an intense feeling of this kind can be, especially with regard to future motivation. It can precipitate in children a passion for learning; or it can lead them to reject an activity, or even a whole group of similar activities, because of the threatening affect associated with the activity, often combined with a still more threatening social affect (the sense of being an inferior, incompetent performer, or of being stupid). This kind of meta-monitoring cognitive affect, important as it is in predicting and fuelling epistemic motivation, is not easily observable in experimental settings, because it is elicited in middle or long-term forms of cognitive tasks, such as studying at school in a given grade, learning algebra, etc. This may in part explain why Stepper and Strack have failed to encounter it.

To summarize: noetic feelings, like all feelings, have an evaluative function. They are the output of a monitoring process, which expresses how likely it is that an agent's cognitive preferences or goals will be (or have been) fulfilled in a given task and context. They all have a valence, but their affective tonality is more intensely felt in special cases that arise when meta-monitoring makes "intensively new" affordances salient. The rate or the acceleration with which an observed initial discrepancy differs from a predicted standard value may either exceed the expected value, thereby producing positive feelings of confidence or feelings of knowing, or be insufficient to reach this value, producing negative feelings of uncertainty. The intensity of positive or negative affect in M-feelings thus depends on particularly unexpected properties of the underlying cognitive activity.

8 Conclusion

On the present proposal, "feelings" are not isolated sensory events. They are, rather, the

ingredients of a nonlinguistic expressive mode that allows organisms to evaluate and predict environmental changes and affordances. This expressive mode is of a relational, intensive kind that is not suitable for a predicative, concept-based representation of the world. As a consequence, feelings are not themselves judgments about the world or about one's own thoughts. They are not "about" anything in the objective, referring sense of the term. Feelings are able to approximate (in their own mode) the guidance offered by full-blown judgments, and hence can be re-described in conceptual terms when the latter are available to the emoter.

The importance of the duality between an expressive and a propositional system of representation has generally been overlooked. Even dual-processing theorists rarely appreciate that the two systems involved in cognitive evaluation and in reasoning have their own independent, although asymmetrical, role to play. A purely automatic, reactive type of evaluation is possible, and is present in non-humans and young children. It is prone, however, to generating throughout life illusions of competence and reasoning errors. A conceptually-controlled type of evaluation, on the other hand, can partially inhibit the influence of the expressive system, but it still depends on the latter to weigh the impact of context on ability, and to assess the trade-off between ease of processing and informativeness—that is, relevance—that is crucial in communication and in problem solving.

A major practical consequence of the duality between the two target representational modes concerns pedagogy. Children cannot learn what they are *not* motivated to learn. Their motivation heavily depends on their subjective experience of what a school context affords them. Their feelings of confidence, i.e., the feedback from the cognitive tasks they engage in, have to be sufficiently positive and appropriately calibrated in order for them to form their own realistic and motivating cognitive goals. No amount of analytic reasoning can replace a positive experience when learning.

Acknowledgement

References

Arango-Muñoz, S. (2012). The nature of epistemic feelings. *Philosophical Psychology*, *27* (2), 193-211. 10.1080/09515089.2012.732002

Barrett, L. F. & Bar, M. (2009). See it with feeling: Affective predictions during object perception. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364* (1521), 1325-1334. 10.1098/rstb.2008.0312.

Bechara, A., Damasio, H. & Damasio, A. R. (2000). Emotion, decision making and the orbitofrontal cortex. *Cerebral Cortex*, *10* (3), 295-307. 10.1093/cercor/10.3.295.

Beran, M. J., Brandl, J., Perner, J. & Proust, J. (Eds.) (2012). *The foundations of metacognition.* Oxford, UK: Oxford University Press.

Botvinick, M. & Cohen, J. (1998). Rubber hands 'feel' touch that eyes see. *Nature*, *391* (6669), 756-756. 10.1038/35784.

Brown, A. S. (1991). A review of the tip-of-the-tongue experience. *Psychological Bulletin*, *109* (2), 204-223. 10.1037/0033-2909.109.2.204

Carruthers, P. (2011). *The opacity of mind. An integrative theory of self-knowledge.* Oxford, UK: Oxford University Press.

Carver, C. S. & Scheier, M. F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psychological Review*, *97* (1), 19-35. 10.1037/0033-295X.97.1.19

——— (2001). *On the self-regulation of behavior.* Cambridge, UK: Cambridge University Press.

Damasio, A. (1994). *Descartes' error: Emotion, reason and the human brain.* New York, NY: Putnam.

——— (2003). *Looking for Spinoza: Joy, sorrow and the feeling brain.* Orlando, FL: Harvest Book Harcourt, Inc.

Decety, J. & Meyer, M. (2008). From emotion resonance to empathic understanding: A social developmental neuroscience account. *Development and Psychopathology*, *20* (04), 1053-1080. 10.1017/S0954579408000503

Dezecache, G., Conty, L., Chadwick, M., Philip, L., Soussignan, R., Sperber, D. & Grèzes, J. (2013). Evidence for unintentional emotional contagion beyond dyads. *PLoS One*, *8* (6), e67371-e67371. 10.1371/journal.pone.0067371

Dolan, R. J. (2002). Emotion, cognition, and behavior. *Science*, *298* (5596), 1191-1194. 10.1126/science.1076358

Ekman, P. (1992). An argument for basic emotions. *Cognition & Emotion*, *6* (3-4), 45-60. [10.1080/02699939208411068](10.1080/02699939208411068)

Fleming, S. M. & Dolan, R. J. (2012). The neural basis of metacognitive ability. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *367* (1594), 1338-1349. 10.1098/rstb.2011.0417

Fodor, J. (1983). *The modularity of mind.* Cambridge, MA: MIT Press.

Frank, R. H. (1988). *Passions within reasons: The strategic role of the emotions.* New York, NY: Norton.

Goldie, P. (2002). *The emotions: A philosophical exploration.* Oxford, UK: Oxford University Press.

——— (2009). Getting feelings into emotional experience in the right way. *Emotion Review*, *1* (3), 232-239. [10.1177/1754073909103591](10.1177/1754073909103591)

Gordon, R. (1987). *The structure of emotions.* Cambridge, UK: Cambridge University Press.

Griffiths, P. E. (1997). *What emotions really are.* Chicago, IL: The University of Chicago Press.

——— (2004). Emotions as natural and normative kinds. *Philosophy of Science*, *71* (5), 901-911. [10.1086/425944](10.1086/425944)

Griffiths, P. E. & Scarantino, A. (2009). Emotions in the wild: The situated perspective on emotion. In M. Aydede & P. Robbins (Eds.) *The Cambridge handbook of situated cognition* (pp. 437-453). New York, NY: Cambridge University Press.

Haggard, P., Clark, S. & Kalogeras, J. (2002). Voluntary action and conscious awareness. *Nature Neuroscience*, *5*, 282-285. [10.1038/nn827](10.1038/nn827)

Hume, D. (2007). *Treatise of human nature.* Oxford, UK: Clarendon Press.

Jackson, P. L., Meltzoff, A. N. & Decety, J. (2005). How do we perceive the pain of others? A window into the neural processes involved in empathy. *NeuroImage*, *24* (3), 771-779. 10.1016/j.neuroimage.2004.09.006

Jacoby, L. L. & Brooks, L. R. (1984). Nonanalytic cognition: Memory, perception, and concept learning. *The Psychology of Learning and Motivation*, *18*, 1-47. [10.1016/S0079-7421(08)60358-8](10.1016/S0079-7421(08)60358-8)

Jacoby, L. L. & Whitehouse, K. (1989). An illusion of memory: False recognition infuenced by unconscious perception. *Journal of Experimental Psychology: General*, *118* (2), 126-135. [10.1037/0096-3445.118.2.126](10.1037/0096-3445.118.2.126)

James, W. (1884/1890). *The principles of psychology.* New York, NY: Dover.

Kelley, C. M. & Jacoby, L. L. (1998). Subjective reports and process dissociation: Fluency, knowing, and feeling. *Acta Psychologica*, *98* (2), 127-140. [10.1016/S0001-6918(97)00039-5](10.1016/S0001-6918(97)00039-5)

Kenny, A. (1963). *Action, emotion and will.* London, UK: Routledge & Kegan Paul.

Kepecs, A., Naoshige, U., Zariwala, H. & Mainen, Z. F. (2008). Neural correlates, computation and behavioural impact of decision confidence. *Nature*, *455*, 227-231. 10.1038/nature07200

Koriat, A. (2000). The feeling of knowing: Some metatheoretical implications for consciousness and control. *Consciousness and Cognition*, *9* (2), 149-171. 10.1006/ccog.2000.0433

Koriat, A. & Ackerman, R. (2010). Metacognition and mindreading: Judgments of learning for self and other during self-paced study. *Consciousness and Cognition*, *19* (1), 251-264. 10.1016/j.concog.2009.12.010

Koriat, A. & Levy-Sadot, R. (1999). Processes underlying metacognitive judgments: Information-based and experience-based monitoring of one's own knowledge. In S. Chaiken & Y. Trope (Eds.) *Dual-process theories in social psychology* (pp. 483-502). London, UK: The Guilford Press.

——— (2001). The combined contributions of the cue-familiarity and accessibility heuristics to feelings of knowing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *27* (1), 34-34. [10.1037/0278-7393.27.1.34.](10.1037/0278-7393.27.1.34.)

Lamme, V. A. & Roelfsema, P. R. (2000). The distinct modes of vision offered by feedforward and recurrent processing. *Trends in Neurosciences*, *23* (11), 571-579. [10.1016/S0166-2236(00)01657-X](10.1016/S0166-2236(00)01657-X)

LeDoux, J. E. (1996). *The emotional brain.* New York, NY: Simon & Schuster.

Logan, G. D. & Crump, M. J. (2010). Cognitive illusions of authorship reveal hierarchical error detection in skilled typists. *Science*, *330* (6004), 683-686. 10.1126/science.1190483

Mangan, B. (1993). Taking phenomenology seriously: The "fringe" and its implications for cognitive research. *Consciousness and Cognition*, *2* (2), 89-108. 10.1006/ccog.1993.1008

——— (2000). What feeling is the "feeling of knowing"? *Consciousness and Cognition*, *9* (4), 516-537. 10.1006/ccog.2000.0488

Murata, A., Moser, J. S. & Kitayama, S. (2013). Culture shapes electrocortical responses during emotion suppression. *Social Cognitive and Affective Neuroscience*, *8* (5), 595-601. 10.1093/scan/nss036

Nieuwenhuis, S., Ridderinkhof, K. R., Blom, J., Band, G. P. & Kok, A. (2001). Error-related brain potentials are

differentially related to awareness of response errors: Evidence from an antisaccade task. *Psychophysiology*, *38* (5), 752-760. 10.1111/1469-8986.3850752

Nisbett, R. E. & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological review*, *84* (3), 231-259.

Nussinson, R. & Koriat, A. (2008). Correcting experience-based judgments: The perseverance of subjective experience in the face of the correction of judgment. *Metacognition and Learning*, *3* (2), 159-174. 10.1007/s11409-008-90

Oppenheimer, D. M. (2008). The secret life of fluency. *Trends in Cognitive Sciences*, *12* (6), 237-241. 10.1016/j.tics.2008.02.014

Ortony, A., Clore, G. L. & Foss, M. A. (1987). The referential structure of the affective lexicon. *Cognitive Science*, *11* (3), 341-364. 10.1207/s15516709cog1103_4

Pacherie, E. (2008). The phenomenology of action: A conceptual framework. *Cognition*, *107* (1), 179-217. 10.1016/j.cognition.2007.09.003

Plutchik, R. & Ax, A. F. (1967). A critique of determinants of emotional state by Schachter and Singer (1962). *Psychophysiology*, *4* (1), 79-82. 10.1111/j.1469-8986.1967.tb02740.x

Prinz, J. (2004). *Gut reactions. A perceptual theory of emotions.* Oxford, UK: Oxford University Press.

Proust, J. (2000). Awareness of agency: Three levels of analysis. In T. Metzinger (Ed.) *The neural correlates of consciousness* (pp. 307-324). Cambridge, MA: MIT Press.

——— (2009). The representational basis of brute metacognition: A proposal. In R. Lurz (Ed.) *Philosophy of animal minds: New essays on animal thought and consciousness* (pp. 165-183). Cambridge, UK: Cambridge University Press.

——— (2013). *The philosophy of metacognition. Mental agency and self-awareness.* Oxford, UK: Oxford University Press.

Reber, R., Fazendeiro, T. A. & Winkielman, P. (2002). Processing fluency as the source of experiences at the fringe of consciousness. *Psyche*, *8* (10), 1-21. 10.1155/6152

Reber, R., Schwarz, N. & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? *Personality and Social Psychology Review*, *8* (4), 364-382. 10.1207/s15327957pspr0804_3

Recanati, F. (2002). Does linguistic communication rest on inference? *Mind & Language*, *17* (1-2), 105-126. 10.1111/1468-0017.00191

Schwartz, B. L., Travis, D. M., Castro, A. M. & Smith, S. M. (2000). The phenomenology of real and illusory tip-of-the-tongue states. *Memory & Cognition*, *28* (1), 18-27. 10.3758/BF03211571

Schwarz, N. (2004). Metacognitive experiences in consumer judgment and decision making. *Journal of Consumer Psychology*, *14* (4), 332-348. 10.1207/s15327663jcp1404_2

Schwarz, N. & Clore, G. L. (2007). Feelings and phenomenal experiences. In A. W. Kruglanski & E. T. Higgins (Eds.) *Social psychology: Handbook of basic principles* (pp. 385-407). New York, NY: Guilford.

Smith, E. R. & De Coster, J. (1999). Associative and rule based processing. In S. Chaiken & Y. Trope (Eds.) *Dual-process theories in social psychology* (pp. 323-336). New York, NY: Guilford.

Solomon, R. C. (2007). *True to our feelings: What our emotions are really telling us.* New York, NY: Oxford University Press.

Stepper, S. & Strack, F. (1993). Proprioceptive determinants of emotional and nonemotional feelings. *Journal of Personality and Social Psychology*, *64* (2), 211-220. 10.1037/0022-3514.64.2.211

Strawson, P. F. (1959). *Individuals.* London, UK: Methuen.

Thompson, V. A., Prowse Turner, J. A. & Pennycook, G. (2011). Intuition, reason, and metacognition. *Cognitive Psychology*, *63* (3), 107-140. 10.1016/j.cogpsych.2011.06.001

Tye, M. (2008). The experience of emotion: An intentionalist theory. *Revue Internationale de Philosophie*, *243* (1), 25-50.

Unkelbach, C. (2007). Reversing the truth effect: Learning the interpretation of processing fluency in judgments of truth. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *33* (1), 219-230.

Unkelbach, C. & Greifeneder, R. (2013). A general model of fluency effects in judgment and decision making. In C. Unkelbach & R. Greifeneder (Eds.) *The experience of thinking: How the fluency of mental processes influences cognition and behavior* (pp. 11-32). London, UK: Psychology Press.

Whittlesea, B. W. & Williams, L. D. (2000). The source of feelings of familiarity: The discrepancy-attribution hypothesis. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26* (3), 547-547. 10.1037/0278-7393.26.3.547

——— (2001). The discrepancy-attribution hypothesis: I. The heuristic basis of feelings and familiarity. *Journal*

of *Experimental Psychology: Learning, Memory, and Cognition, 27* (1), 3-13. 10.1037/0278-7393.27.1.3

Winkielman, P. & Cacioppo, J. T. (2001). Mind at ease puts a smile on the face: Psychophysiological evidence that processing facilitation elicits positive affect. *Journal of Personality and Social Psychology, 81* (6), 989-1000. 10.1037/0022-3514.81.6.989

Wolpert, D. M., Ghahramani, Z. & Flanagan, J. R. (2001). Perspectives and problems in motor learning. *Trends in Cognitive Sciences, 5* (11), 487-494. 10.1016/S1364-6613(00)01773-3

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology, 9* (2 pt 2), 1-27. 10.1037/h0025848

——— (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist, 35* (2), 151. 10.1037/0003-066X.35.2.151