To believe and *to feel*: The case of "needs"

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Cristiano Castelfranchi
National Research Council - Institute of Psychology
Division of "AI, Cognitive Modelling and Interaction"
Rome, Italy - cris@pscs2.irmkant.rm.cnr.it

Abstract

A crucial aspect of the "(ri)embodiment" of mind is a cognitive account of subjective experience, of "feeling something". I analyse the notion of "needs" -a very interesting kind of motivation- and the difference between needing something or having the need for something (objective need) and "feeling the need for something". I argue that in order to *feel* the need *for* something an *embodied cognitive* agent is necessary since both *self-perception* (information from the body) and *beliefs* and *expectations* are necessary. After discussing some weaker notions of "feeling" and "need", and characterising also "desires", I criticise the current dominant approach to emotions in AI as correct but insufficient. It is necessary to explain and to model the functional role of "feeling" in emotions. The view of emotion as a reactive response modifying the internal state, cognitive processes, attention, and goals priorities, is not enough: why should we "feel" all these internal and external reactions and the preparation to act?

1 Premise

I'm working for a synthetic paradigm in the Cognitive Science, a paradigm putting together in a principled and non-eclectic way, cognition and emergence, information processing and self-organisation, reactivity and deliberation, situatedness and planning, etc. (Castelfranchi, 1997). In this perspective a very crucial role is played by the problem of the "(ri)embodiment" of mind. One aspect of this is particularly important to me. I do believe that cognitive models (in cognitive psychology, AI, and in general CS) put aside for too long time the problem of subjective experience, of "feeling something"; and my view on this issue is quite trivial: to "feel" something is necessarily "somatic": it presupposes having a body (includidng a brain), and receiving some perceptual signal from it. You cannot experience or feel anything without a body. However, current approaches claiming the role of the body, and feelings, emotions, drives, (and several biological mechanisms) tend to put this as a radical alternative to cognition, as incompatible with the traditional apparatus of CS (beliefs, intentions, plans, decision, and so on).

In this work, on the one side, I try to show that to characterise several important mental states (kinds of belief or kinds of goal, like needs) it is necessary to model the bodily information; but on the other side I try to argue that also traditional mental representations are necessary. Of course this is only a limited preliminary attempt of a traditional cognitivist towards the "pineal gland"! Let's start this attempt with a limited but relevant issue: the theory of needs.

In this paper I will follow a strange politics. First, I will argue for a very strong tenant and for a very restrictive and precise notion of "feeling a need"(more precisely "feeling the need for"), claiming that to feel needs not only a body is necessary but also a cognitive agent with its beliefs and goals. Then, I will examine a weaker notion and model of "feeling need" and I will allow that there is an extended notion that does not imply such a cognitive complexity and causal beliefs or models. But I will maintain that cognitive representations (at least in terms of expectations) are necessary. [1] Finally, on the basis of this analysis, I will add something about the relationship between feeling and emotion, and about the functions of the feeling component in the emotional process.

1.1 The claims

In embodied minds a very important kind of goal are *needs*, and in particular "felt needs". Needs in fact are something we can "feel".

In illustrating what are needs and which is the difference between needs and other kinds of goals, and between "having needs" and "feeling needs", I will argue for these claims:

- There is no "*feeling* the need for" without a body. Disembodied agents can "have" needs (as any kind of agent, i.e. goal oriented systems), and they can even know them, but they cannot feel them.
- There is no "feeling the need *for*" without cognition (in particular, beliefs). To feel a need for, "intensionality" is required, and intensionality implies cognitive agents and mental representation of something . More precisely: only embodied *cognitive* agents (agents with explicit beliefs) can really "feel needs for"; other embodied agents can feel some uneasiness, disturbance or pain, and they can be attracted by something, and search for something, but they cannot in strict sense *feel the need for* something! [2]

I will also try to answer some questions that are quite relevant for a theory of needs, such as: Why are needs a kind of motivational representation (goals)? Which is the

[1] Of course, beyond a certain limit the problem becomes only terminological and then not particularly interesting, or it becomes a merely lexicographic issue (which is the correct and non-extended use of the expression). This is not my aim. Starting from the semantically full use of the expression- I'm just aimed at making some interesting aspects of mind explicit, and modelling important features of needs.

[2] My final claim -in the second part- will be that only "anticipatory" agents have some "intensionality" in their needs and in their actions.

role of the body and of self-perception in needs? Why needs are particularly "pushing" motives?

2 What are needs?

Needs are a special kind of goals, or a way of framing and conceptualise goals.

2.1 *Objective needs*

Let's start from the expression: "x *has* the need for y/q (with regard to p)". This is the basic concept of need. Need is an "intensional" notion, it is a need "for" something or "about" something": what is needed by x.
The need (or better the needed resource, condition, action) is a goal of x and also p is a goal of x. x has the need for y/q only *relatively to* p. In fact:

a) First, *only teleonomic, goal-oriented systems can have needs*. If a system does not have goals (in any sense: either internally represented and controlling its behaviour; or as adaptive functions giving a teleonomic perspective to its behaviour, or as artificial functions to be satisfied) it cannot have needs. So a knife may need a good sharpening or a car needs some oil. But a mountain cannot have needs (unless we are attributing it some function-use like "being a good ground for skiing"). Of course this kind of systems can only "have" needs but they cannot "feel" needs, since they do not feel anything. They don't have a body and don't perceive their body.

b) x needs y *for* something (p) which is its internal-goal (desire, intention, objective, etc.) or its external-goal (use, destination, function, etc.) (Conte and Castelfranchi, 1995).

c) Also y is a goal of x, or better the achievement, use of y (the action or situation q) is a goal of x: it is needed (for p). More precisely y/q is an *instrumental* goal, a mean for p. (Goal x p) $\wedge$ (q $\supset$ p); where q = to have/use y; and y is a *resource* for a necessary activity for p. If x is a cognitive agent and (Bel x (Goal x p) $\wedge$ (q $\supset$ p)), it will have the (sub)goal that q: (Goal x q) (relativized to that Bel). If x is not a cognitive agent this belief is the judgement of an observer: x has such a need but it does not know it.

d) The notion of need implies a special perspective on instrumental goals (means). This means is conceived under a negative perspective; the agent or the observer does not conceive the situation in terms of positive contributions but in terms of deprivation and obstacles. When we say that "x needs y/q for p", we say that *if x does not have y/q x will not realize p*. And we usually also presuppose that currently *x has not y/q*: (q $\supset$ p) $\wedge$ (Not q $\supset$ Not p) $\wedge$ (Not q).
In fact "need for y" can be paraphrased with "y is necessary", "necessity", and so on. And "need" is also synonym of "lack of", "deprivation", etc. Thus, the global idea underlying a need for y/q, is that:

- x has a goal p;
- for this goal, q (action or situation) or y (a resource) is needed, q/y is a potential sub-goal;
- x lacks it.
- So, x cannot achieve p.

2.2 *Subjective (perceived) needs*

All the previous analysis remains valid in the case of perceived needs. Before them let us briefly consider an intermediate level: *the awareness of objective needs*, which it is not yet "feeling needs". In fact if x is a cognitive system she can be aware of such a situation, she can believe all that. Consider for example x going to a medical doctor (without any subjective disease or disturb) and the doctor saying her: "You need some calcium, because you are starting to have some decalcification of your bones, and it is better to prevent it". Now x has a need, and knows that she has a need. But notice that she does not feel or perceive this need.
Consider also the following case: you go to a bureaucratic office for a given procedure and the employer says: "OK, but you also need the form A12". Now you know about what you need, however for sure you do not feel the need for the form A12 to be filled!
We can finally arrive to **perceived** or **felt needs**. To feel a need:

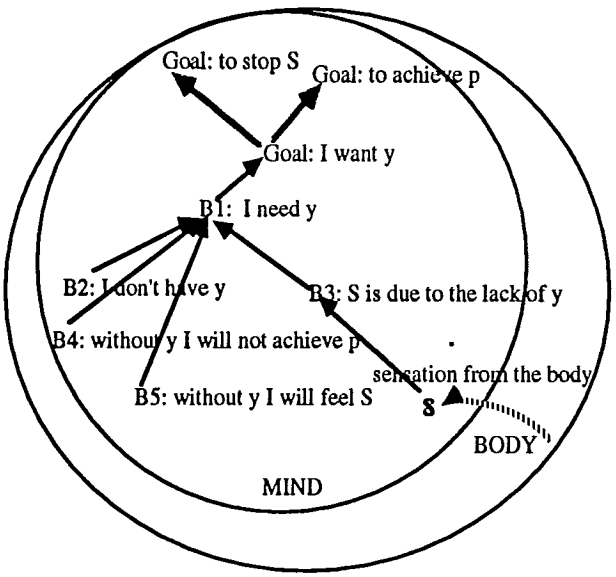
i. x must perceive something from her body, and more precisely some pain, uneasiness, some disturbance or effort, an unpleasant sensation S. Thus, *no disembodied agent can feel needs* although a disembodied agent might *have* needs and *believe/know to have* needs. Notice also that perception is not enough: a robot perceiving the environment but without signals from its body, about its body, cannot feel needs. So, internal self-perception is necessary.

ii. x must believe to have a need for y/q (as previously defined)

iii. x must attribute (by means of some attributional declarative belief or some causal mental model) the sensation S to this lack of y/q; x believes that the pain/disturbance/uneasiness is due to the lack of y/q.
Such a belief is fundamental for "x *feeling* the need *for* y". Without this attributional representation x can feel bad, and can *have* the need for y/q (and even be aware of it), but she cannot "feel" this need. When we feel a need we are feeling something and we interpret it as the lack of what we are lacking.
Thus, a small baby desperately crying with hunger, feels uneasiness or pain, feels hungry, and *has* a need for milk. She might even be expecting and desiring milk (on the basis of associations and previous experience) (see later) but she does not really "feel the need for milk" since she is not subjectively linking her pain to the lack of milk. When, on the contrary we are speaking at a conference and we feel some hoarseness in our throat, we "feel the need for some water", because we *attribute* this bad sensation and difficulty to speak to the lack of water and (thanks to this causal mental model) we look for water in order to stop that sensation and to succeed in speaking.
Analogously, when we go to the doctor for some bad sensation and some disturbance and she says: "in those moments you just need some fresh air", later, when we will feel again that uneasiness, we will "*feel* a need for some fresh air" because of such an attributional belief connecting our perception to that lack. Notice how important is the merely cognitive "creation" through communication of these "felt" needs. This, of course, is not the only or the usual way: we feel our needs on the basis of folk-science and naive models either culturally shared or idiosyncratically constructed on our experience. Notice also that this model allows for the existence of "false needs" i.e.

needs based on a wrong attribution belief or on a wrong belief about what is needed for my goals (induced needs).

In sum, feeling a need presupposes a body and some disturbance signal from the body [3], but also presupposes some mind -endowed with beliefs- attributing this sensation to the lack of a needed resource/action, and motivating in such a way the search for something. The mental structure characterising "felt needs" is as follows:



Mind must also have a representation of the body and of the sensations coming from it, but this representation is not enough for "feeling": a perceptual signal from the body is needed. [4] The (partial) mental representation of the body is important for the causal attributional belief or mental model.

2.3 *A pushing motive*

Now it should also be clear *why needs are particularly "pushing" motives*. They are particularly pushing (compared with other kinds of motivational representation) for four (not completely independent) reasons:

- first, they are conceived as necessary for p, not as optional;
- second, they are conceived (framed) in negative terms, in terms of losses rather than gains (if you don't ...you lose, you will not..) and we know that the avoidance of damages is more influencing than the perspective of gains (*prospect theory*);
- third, they are related to some pain, to a negative emotional experience, which must be stopped or avoided;
- fourth, mental representation with sensory motors components have a stronger impact than very abstract, merely conceptual representations (Miceli and Castelfranchi, 1997).

3 Goals one can feel

Needs are goals but of a special sort. Not only for the above mentioned reasons (negatively framed instrumental goals, etc.) but precisely because we can "feel" them. Notice that *we cannot "feel" all kinds of goal*: we cannot "feel the intention of" or "feel the objective, the plan, the aim, the purpose, the intent, the end of"! Why? and why on the contrary can we feel needs and desires ? (and a bit extensively hopes, expectations, etc.?).
My trivial answer is: because they involve some perceptual component. What I mean is that we cannot feel a goal *per se* (as the anticipatory internal representation driving our action): we can feel some perceptual component related to having a goal (like some uneasiness, or some perceptual representation of the expected results). While notions like "needs" or "desires" focus on these aspects, other goal-notions are more abstract and do not explicitly concern these perceptual aspects.

3.1 To desire something

Desires for example imply some pleasure (Aristotle), but not only the pleasure experienced at the moment of the achievement of the goal and satisfaction of the desire. Desires implies a pleasure at the very moment of "desiring something" as a mental activity. It is a "virtual reality" pleasure. A true desire implies the anticipatory representation of the goal state in a sensory-motor format (let's say an image) and the simulation of the desired situation. This implies some (partial) imagined sensation (for example the taste of a food; the joy of a sexual encounter). What you feel is this sensation: an anticipated part of the sensation you will (would) experience; an illusory gratification. To "desire" is this, and this is why you can "feel" a desire while you cannot feel an intention. The term "intention" does not focus on the perceptual anticipatory representation of the result and of its perceptual components. [5]

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[3] Analogously "to feel the fever" or "to feel the illness that proceeds" implies some mental representation and theory about what we feel: either a causal belief or a mental model. I should believe that my sensation is due to the fever (and not for example to fear); I cannot really "feel" the fever: I can feel some symptom or sensation that is due (and I believe that is due) to the fever. "To feel the illness that proceeds" I should attribute -on the basis of some causal mental model - my sensation to the proceding of the illness.

[4] As I said perception is not enough: a robot perceiving the environment but without signals from its body, about its body, cannot feel needs. Internal self-perception is necessary. If I observe -with some amazement- some tremor of my hands, I do not "feel" it. To "feel" tremor proprioception is necessary.

[5] This is also a possible difference between "to believe to be able of" and "to feel able of" or to "believe that I can succeed" and "to feel" it, or to "believe to have value" and so on. To "feel" to be able can be something more that to "believe" to be able. It can imply :

- either some *self-perception*: to perceive the stress and the strength of the muscles ready for a physical task; to perceive quietness and no fear, as a good premise for the task; these sensations can also correspond to expected and anticipated sensations onf being ready, able (based on previous experience and training)

So my methodological claim would be: *always when we can use the word* [6] *"to feel" some somatic marker* [7] *or some self-perception is involved.* Probably this is too strong, since the language extends and metaphorises the use of words; but it should be basically true. I call this a "methodological" claim because it is useful to assume it as a method, as a preliminary hypothesis, in order to push deeper the analysis of mental states: it is not a law.

4 Weaker "feeling" and weaker "needs for"

After arguing the strongest tenant (no "feeling needs for" without beliefs and without a signal from the body), let me now relax this claim, and accept that:

a) there might be weaker and abstract cases of "feeling" where the sensory information from the body is not so obvious at all;
b) there is a weaker notion of "feeling the need *for*" which does not probably need attributional beliefs and causal thinking, but just associations.

Let's first examine the first point.

4.1 "Abstract" needs, abstract body

Following our languages we can also feel a need for affection, for participation, for (self)-esteem, for justice, for peace, etc. Is there a precise bodily signal, some painful physical sensation in all these cases? These are more "psychological" needs than physical ones. Is this simply a metaphorical use of the word "to feel"? Is it sufficient to represent goals and beliefs to account for such mental states?

There are two possible alternatives: either to say that the use of the word "feel" is extended, and it does no longer imply any perceptual component; or to claim that such a perceptual component is there, but is not an actual and current signal from the body. I believe that the second hypothesis is more promising and generally true. I accept that in those cases there is no current signal, no uneasiness sensation from the body (like in physical needs), but I also "feel" that in those cases mere beliefs and goals are not enough. We "feel" something in the sense that some signal or some perceptual *trace* is associated in the brain to that mental representation (after all also the brain is body!). There are two, not alternative, explanations:

a) either in these feelings (for ex. feeling need for esteem, or for participation) there is some "mental suffering", some "psychic pain" (Miceli and Castelfranchi, 1997) and also psychological pain implies a special signal from the body although at the central (not peripheral) level (Staats, 1990); or
b) Damasio's (1994) "somatic markers" are involved: and in fact "somatic markers" can consist of the cortical traces of previous experienced somatic feedbacks; so, in those examples, there might be central traces of perceptual/emotional experiences associated to those mental representations that allow them to be "felt".

I maintain that, in some cases, there is (also) some current sensation from the body: for ex. in feeling the need for justice I may feel some anger or depression for the lack of justice (and desire a just world); in feeling the need for peace I may feel the physical stress of an unsafe or troubled situation (and desire serenity).

4.2 Drives are not enough to "feel the need for"

Let us now consider another weaker notion of "feeling the need for" which can probably do without attributional beliefs and causal thinking, in that associations will suffice. However, my weaker claim remains "cognitivist" in the sense that also in this case mental representations about x are necessary: precisely the expectation of x. Only anticipatory systems can really "feel the need for", while any reactive system -if embodied- can at most and metonimically "feel a need" without any intensionality (to feel some uneasiness which is caused by an objective need).

When we observe a goal-oriented appetitive behavior in an animal -even in a very elementary animal- towards some x (ex. water, food) we say that "it feels the need for x". I claim that this is simply the "projection" of a human-like subjective experience and its is not a correct description of the drive mechanism. Consider for example Canamero's interesting operational model of "motivations" and drives (Canamero, 97). It is a classical cybernetic model: the function of the mechanism is the homeostasis of some parameter of the internal environment and the viability of the organism. There is an internal signal of some derangement of an internal equilibrium (for example lack of water, ...). The perception of this signal activates/elicits either a "consummatory" behavior (if the needed x is present and perceived) or an "appetitive" behavior (search) if the needed x is not there. Now the problem is: is this search oriented and guided by some representation, expectation, anticipation of the goal? If the search is merely by trial and errors (like in several animals) or mechanically guided by some external signal (like polirized light, humidity, etc.) in which sense is the behavior of the organism directed towards x (this is true only from the functional point of view) and in which sense its need has an "intension"? and it feels the need "for" x? It feels a need, in the sense that it feels the disturbance of the internal signal, it feels the uneasiness which is due to the lack of x; but it does not feel the lack of x.

For starting to have some "intensionality" in needs and action, for the need being subjectively *about* something

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- or some positive *emotion associated* to that scenario and tasks (Damasio's *somatic markers*) as a comforting previous experience. I feel able or ready because I activate positive associated emotions that do not discourage me, and rather confirm and attract me ("I can do it; this is a positive/ successful scenario-experience to me") while I do not associate some avoidance or inhibitory reaction: memory of past experience is projected in the future like a prediction.

In any case there is something "somatic" which enriches the idea of "being able to".

[6] This is especially true in Italian and in other languages; perhaps less true in English where really to "feel" seems quite close to "believe".

[7] In Damasio's terminology a somatic marker is a positive or negative emotional reaction that is associated to in the brain and elicited by a given mental representation or scenario, making it attractive or repulsive, and pre-orienting choice. It may be the central trace of an original peripheral, physiological reaction.

and the action being subjectively *for* something, at least an anticipatory system is needed. Not necessarily it is needed a true and complete "purposive system" in Wiener and Rosenbleuth' sense [8]. I believe that there are weaker forms of anticipatory systems, for example systems based on "anticipatory classifiers" (Stolzmann, 96). In anticipatory classifiers the system executing the action (on a simple reactive condition-action basis) has an expectation about its result and compares the actual result with the expectation (and this is important for reinforcing the rule, for learning). I suppose for example that Skinner's instrumental learning might be modelled in this way (without postulating a real goal-directed, purposive behaviour): the animal, given a certain active drive (for ex, hunger), activates a response (to press the bar) just because on the basis of its previous (accidental) experience it associated this action to this condition as successful, and also associated the expectation of food. It expects the food. At this point, given this anticipatory mental representation of the result of the action, I would like to say that the animal start to act "for" the food, and start to feel the need "for" the food. In fact it not only feels the hunger's stimulus that elicit a behavior, but it associates to this an expectation of x. This anticipatory representation of x related to the disturbance sensation is to me the minimal condition for "feeling the need *for*", it is the forerunner of a full "feeling the need for" which is not only based on an anticipatory association but on an attributional belief: "this uneasiness, this disturbance is due to the lack of x".

In sum, we might distinguish between "feeling a need" (that means just to act under the pressure of a drive due to the lack of x - and it is simply the metonimic description of an observer), and two levels of "feeling the need for" and "search for" that are richer and presuppose some anticipatory representation of x (either as a goal or at least as the expected result of the action). Eventually, the full meaning of "feeling the need for" requires not only a goal (of x) activated by, due to the lack of x , and to the painful "perception" of this; but due to the realisation/ understanding of the lack of x and then to a causal theory of the uneasiness. Thus it requires a fully cognitive agent.

5 Conclusion: from feeling needs to feeling emotions

I think (I feel?) that it is time now for cognitive models to go beyond the functional approach to emotions. The title of the wellknown paper by Frijda and Swagerman (1987) was "Can computer feel?", but immediately the authors clarify that:

> "The question is ambiguous. The word "feeling" refers to a kind of conscious experience and to a process of affective appraisal and response... The paper discusses the second meaning of "feeling". Its main theme can be rephrased as: Can computers have emotions?".

Compared with the title of the paper this is a bit disappointing. Can cognitive science provide any theory of the most relevant sense of "feeling", the subjective, phenomenic experience? Or is this beyond the capability of the cognitive science paradigm? In my view, Frijda's claim that "what is interesting in the phenomena that make one use concepts like 'emotions' and 'emotional' is not primarily subjective experience" (p.236), should be considered now a bit obsolete. One should not abandon either the functionalist approach to emotions or the cognitive analysis of emotions, but one should try to extend the model to cover or to integrate the other very relevant aspects. So the question "Can computer feel?" should be taken seriously. I indirectly suggested in this paper that computers can feel if they have a body (and a brain) not simply a hardware: a real body including self-perception and internal reactions (either peripheral or central); and these somatic reactions should be related -by attributional representations or by association- to mental representations (beliefs, goals, etc.).

It is important to understand that the problem is not only to go beyond a functionalist analysis of emotions to integrate other aspects, but the problem is that *any functional explanation is incomplete if ignores the subjective facet of emotions*. The real problem is precisely the function of the internal perception, of the "feeling" of the bodily peripheral reactions and of the central response. Since a reactive system can do the job of an emotional system, why do we need emotions? why do we need a system which perceives its own reactions? what is the role of this self-perception in the adaptive process?

Let me clarify a bit this point -although emotions are not the focus of this short paper. The classical AI position about emotions remains that enounced by Simon (1967) who explains their function in terms of operating system interrupts that prompt one processing attivity to be replaced by another of higher priority, i.e. in terms of a reactive goal-directed system in an unpredictable environment. As Sloman and Croucher observe, the need to cope with a changing and partly unpredictable world makes it very likely that any intelligent system with multiple motives and limited powers will have emotions (Sloman and Croucher, 1981). I believe that this view is basically correct but seriously incomplete. This function is necessary to explain emotions but is not sufficient; and just AI and ALife can show this. In fact, to deal with this kind of functionality a good reactive system able to focus attention or memory and to activate or inihibit goals and actions would be enough. Current models of affective computing simply model the emotional behaviour and the cognitive-reactivity function. Consider for ex. Picard's nice description of fear in a robot:

> "In its usual, nonemotional state, the robot peruses the planet, gathering data, analyzing it, and communicating its results back to earth. At one point, however, the robot senses that it has been physically damaged and changes to a new internal state, perhaps named 'fear'. In this new state it behaves differently, quickly reallocating its resources to drive its perceptual sensors and provide extra power to its motor system to let it move rapidly away from the source of danger. However, as long as the robot remains in a state of fear, it has insufficient resources to perform its data analysis (like human beings who can't concentrate on a task when they are in danger). The robot communication

[8] Where the representation of x in compared with the current state of the world or with the result of the action, selects the appropriate behavior, and establishes the success (the end) or the failure of the action (see also the TOTE unit by Miller, Galanter and Pribram)

priorities, ceasing to be scientific, put out a call for help." (Picard, 1997) [9]

What is lacking in this characterisation of fear? just the most typical "emotional" aspect: feeling. Feeling is a broader notion: we can feel a lot of things that are not emotions (needs, for ex.). However, feeling is a kernel component of emotion: if we cannot feel x, we should/could doubt that x is an emotion (Ortony, 87). This puts out a serious question: since we can account for emotional functioning without modelling feeling, since a reactive changement of the internal state, cognitive processing, and behaviour is enough, why is feeling such a crucial component of human (and animal) emotions? Is it a mere epiphenomenon lacking any causal function in the process? Or which is its function and its reason?

I believe that computational models of emotions should answer precisely this question, which they unavoidably elicit. Let me simply mention what I believe to be the main functions of the feeling component in emotion, i.e. of the fact the the robot shoud sense those changes of its internal state and of its behaviour (energy allocation, disturbance and distraction from the task, fast movement of avoidance, etc.). I believe that the main functions of feeling in emotions are the following ones:

- felt emotional internal states work as *drives* (Parisi, in press; Canamero, 97) to be satisfied, i.e. to be bring back to the equilibrium (omeostasis) through action; Mower (1960) postulates that in learning the animal learns precisely what behavior serves to alleviate the emotion associated to a given stimulus;
- felt emotional internal states work as positive or negative *internal reinforcements for learning* (they will be associated to the episode and change the probability of the reproduction of the same behaviour); [10]
- felt emotional internal states associated to and aroused by a given scenario constitute its immediate, unreasoned, non-declarative *appraisal* (to be distinguished from a cognitive evaluation - Miceli and Castelfranchi, in press).

Let me leave to a longer paper the argumentation of all this.

In conclusion. The cognitivist dominant paradigm cannot neglect any longer the necessity for modelling subjective experience and feeling. The relation with a body seems to be crucial: beliefs, goals, and other mental (declarative) ingredients do not seem to be enough. Nevertheless, beliefs, goals, expectations are necessary. For example, one cannot account for the intensional aspect of "feeling the need for something" without beliefs about what is needed and about the origin of some sensation of pain or uneasiness. Also a better and convincing functionalist analysis of emotions requires precisely to explain the functional role of "feeling": cognitive appraisal, modification of attention and of cognitive processes, reactive changes of goals priorities, are not sufficient.

[9] A similar view in (Webster 1997) about depression in robots.

[10] I assume, following along tradition on emotional learning, that in general positive and negative emotions are reinforcers; but notice that this does neither imply that we act in order to feel the emotion, which is not necessarily motivating us (it can be expected without being intended); nor that only pleasure and pain, or emotions, are rewarding (Staats, 1990).

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