Motivation and Emotion: An Interactive Process Model

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In this chapter, I outline dynamic models of motivation and emotion. These turn out not to be autonomous subsystems, but, instead, are deeply integrated in the basic interactive dynamic character of living systems. Motivation is a crucial aspect of particular kinds of interactive systems — systems for which representation is a sister aspect. Emotion is a special kind of partially reflective interaction process, and yields its own emergent motivational aspects. In addition, the overall model accounts for some of the crucial properties of consciousness.

Representation

I begin with representation, and outline a model of representation as a fundamental solution to the biological problem of action selection.

Interaction Selection in a Complex Interactive System. Any complex organism must solve the problem of action selection — what to do next. In sufficiently simple systems, a triggering relationship may suffice, in which environmental inputs directly trigger particular actions. In some bacteria, for example, if they find themselves swimming up a sugar gradient, they continue swimming, but if the inputs correspond to their swimming down a sugar gradient, they stop swimming and tumble for a moment (D. Campbell, 1974, 1990).

In more complex circumstances, however, simple triggering cannot suffice. The action and interaction potentialities for the organism are too numerous, and the reliability of those actions and interactions is too weak. A frog, for example, may see a fly, and, therefore, have the potentiality of flicking its tongue in a certain way followed by eating. But it may simultaneously see the shadow of a hawk overhead, in which case it also has the selection option of jumping into the water. Both potentialities must be somehow indicated to or for the frog so that a selection between them can occur.

Furthermore, if the hawk shadow is not present and the frog misses the fly, it may be advantageous to detect that failure of the tongue flicking action and, on the basis of that detection, to make a further selection of interaction. That further selection might be to try again, or might be to move to a different location where flies are perhaps more numerous or slower. It can be advantageous, in other words, to be able to detect failures of actions, as well as to be able to select among potential actions.

A slight addition to the ability to indicate potential interactions suffices to allow such error detection. In particular, if interaction potentialities can be indicated, then so also might the internal outcomes of those interactions be indicated in association with them. That is, it is not only the interactions per se that are indicated as potentialities to select among, but also the internal outcomes that can generally be expected if they are in fact selected.

Furthermore, such an indication of outcomes provides the basis for making such interaction selections in the first place: if the outcomes are related to current goals, then select the associated interactions. Then, if the indicated outcomes are not attained, that constitutes the detection of error, and can influence further processing, including further selections of interactive processes.

A simple digital architecture that would permit such indications is that of pointers, as in a standard computer. A more biologically realistic process would involve a more continuous process of preparation for further interactive processes together with the ability to detect when those preparations fail to be prepared for the actual course of interactive flow. The preparations themselves constitute the indications of potentiality, while the failure of preparation to be in fact prepared constitutes the failure of the interactions to yield the outcomes, the interactive flow, for which they were selected. Elsewhere I discuss details of such a continuous preparation process, called microgenesis (Bickhard and Campbell, 1996). The possibility of such continuity is important for some later issues in this discussion, but I will not elaborate the architectural and dynamic specifics here.

An important question at this point is: how are indications of interactive potentiality set up? What determines what is potential at any particular point in time? The answer is relatively simple: the outcomes of prior interactions serve as the basis for indicating what will be the next interactive potentialities. Conversely, the indication of an interactive potentiality will in general be conditional on the outcomes of particular prior interactions. The logic of such indications is based on the fact that interactions with an environment can serve to differentiate that environment. The internal course of an interaction will depend both on the organization of the subsystem engaged in the interaction and on the environment being interacted with. If a subsystem is capable of, say, two possible final internal outcome states (two for simplicity of discussion), A and B, then actually arriving at A will differentiate the current environment as of the type that yields outcome A, and as different from the environmental type that yields outcome B. Outcomes of interactions, then, differentiate the environments with which the interactions have taken place. Environments of type A, in turn, may also be environments in which further interactions Q, R, and S, are possible, each with its own associated set of indicated outcome states. Each of those outcome states, for one further step, may indicate — if arrived at — some further set of interactive potentialities.

That is, indications of interactive potentialities may branch, with multiple possibilities being indicated, and can iterate, with each potential outcome serving to indicate still further potentialities. These branching and iterated indications (not to mention the possibilities if continuous outcome spaces are taken into account) can link into vast and complex webs of conditionalized indications of interactive potentiality.

In general, then, an interactive system will be continuously interacting, and continuously preparing for further interaction on the basis of prior interactive flow.

Those preparations constitute indications of potentiality, among which further selections of the course of interactive processes are made in accordance with any relevant goals.

Representation. The discussion of interactive systems and the selection of the course of interaction has made no mention of representation. Nevertheless, I claim that an outline of the emergence of representation has already been given. That is, representation emerged naturally in the evolution of interactive systems as a solution to the problem of interaction selection.

In particular, the indication of potential interactions is the point of emergence of the crucial properties of aboutness, truth value, and content. First, the indication of the potentiality of particular interactive processes in an environment is an indication *about* that environment — an indication that it is appropriate for those interactions. It is an implicit predication that this environment is appropriate for these interactions. Similarly, conditionalized indications constitute general predications — type A environments are subsystem Q type environments.

Second, that indication might be false. The environment might not in fact support reaching one of the indicated internal outcomes. Furthermore, if none of the indicated outcomes is reached, that indication is thereby falsified for the system itself. There is system detectable error — system detectable *representational* error.

Third, there is the emergence of content. Some patterns of environmental properties will support an interactive indication and some will not. Such an indication, then, predicates some one of those sufficient patterns of properties to the environment, and those properties constitute the content of the representation. Content in this form is implicit, not explicit as in most models of representation, a difference that I argue elsewhere has powerful consequences, such as resolving the frame problems (Bickhard and Terveen, 1995).

Challenges. This is a very primitive form of representation — appropriate perhaps to flatworms and maybe frogs — and it is subject to its own challenges. Such challenges have been addressed in detail previously, but there are two that I will respond to here.

The first is a potential circularity: representation has been modeled making use of a notion of goal, and if goals, in turn, are themselves necessarily representational, then representation will have been modeled in terms of representation. The goals needed here, however, are not necessarily representational. They need only have the character of internal set points that regulate the internal flow of control in an interactive system. Such set points may, or may not, correspond to something — blood sugar level, for example — but need not represent it. Once representation is emergently available, of course, then goals might themselves make use of them.

The second challenge is to the adequacy of this interactive model of representation: can it account for more familiar forms of representation in addition to these primitive action potentiality indications. One such familiar kind of representation is that of small physically manipulable objects, such as a child’s toy block. The complex webs of interactive indications can form representations of such objects. A toy block, for example, offers the potentialities of multiple visual scans, multiple manual manipulations, chewing, dropping, and so on. Furthermore, every one of these potentialities indicates the potentiality of all the rest, perhaps with intermediate interactions along the way, as if a visual scan indicates the potentiality of another visual scan so long as the appropriate turn of the block has occurred. Such a subweb, then, is internally completely reachable.

It has one additional critical property. The entire web of potentialities will remain invariant under a large class of additional interactions. The toy block will continue to offer its interactive possibilities — will remain invariant — under putting the block away in the toy box, moving to another room, hiding it, and so on, though it will not remain invariant under crushing or burning. Such reachable invariances among interactive webs constitute the representation of small objects. Clearly, this is basically a Piagetian model of object representation.[1]

The interactive model of representation captures several characteristics of phenomenological awareness that should be mentioned. The model is of a continuous flow of interactive process that is inherently contentful — that exhibits aboutness and intentionality. It is necessarily from a point of view, and is correspondingly deictic and indexical. It is inherently embodied: disembodiment renders interaction impossible. It is inherently temporal: successful interaction is as much a matter of coordinated timing of interactions as it is of sequence of actions. Even this relatively simple elaboration of the model, then, captures important properties of consciousness (Bickhard, 1998a, in press-a).[2]

Encoding Models of Representation. Standard models of representation do not look much like the interactive model. Standard models, in fact, do not require any interaction at all. Most focus only on one aspect of the overall interactive process, the differentiations that, in the interactive model, ground the representational indications.

In particular, a simple form of interaction is one with no outputs — a passive processing of inputs. Such a passive process will differentiate environments according to which internal states are produced, just as will full interactions, though in general with less overall differentiating power. Furthermore, it is clear that the sensory systems of complex organisms engage, at least in part, in precisely such passive input processing.

But, whereas the interactive model gives such processes the function of differentiating environments, of providing ongoing sensitivity to the environment, so that appropriate indications of interactive potentialities can be set up, standard models ignore that output aspect of interaction and construe the differentiations themselves as being representational. The differentiating internal outcomes are deemed to represent, to encode, whatever it is that they have differentiated (Bickhard, 1993; Bickhard and Terveen, 1995).

In the interactive model, differentiations are not assumed to have any content, are not assumed to be representational themselves at all. A differentiating outcome of an interaction does not announce what it is that it has differentiated, nor, for that matter, that it is a differentiation at all. All that the interactive model requires is that it has *in fact* differentiated environments in a way that is *in fact* useful for the indications of further interactive potentialities. There is no need that what has been so differentiated be known or represented.

But these factual differentiations also constitute, in any particular case, factual correspondences between the internal states and whatever has been differentiated, and these correspondences are typically offered as models of representation. Such correspondences may be postulated in differing forms — as causal, as lawful, as informational, and so on — but some such type of correspondence is supposed to constitute representation.

There are myriad multifarious failures of logic and of naturalism in such models. I will briefly mention only two: emergence and error. The central characteristic of representation is content. Content is what determines what a representation is *supposed* to represent, and, therefore, it is what determines whether a particular application of a representation to a particular situation or target (Bickhard, 1993; Cummins, 1996) is true or false. Content is the normative aspect of representation. Accounting for the nature and emergence of content is, thus, the central problem.

Unfortunately, current correspondence or encodingist models make little progress in accounting for content in any naturalistic way. They attempt to capture the specifications of content in a strictly externalist manner, with little or no attention to how content, especially its normative character, could be dynamically realized. If some element is in a favored kind of correspondence — causal, informational, lawful, etc. — with something else, then that something else is proposed as the content. But there is no model of how content could exist, could emerge — of how the crucial information about the correspondence could be available — in the processes of the supposed epistemic system itself.

But representation did not exist at the moment of the Big Bang, and it does exist now, therefore it has to have emerged. Therefore, any model that cannot account for such emergence is falsified.

It is often acknowledged that we have no model for content, for mental representation, e.g., “we haven’t got a ghost of a Naturalistic theory about [encoding]” (Fodor, 1987, pg. 81). Instead of taking this as a refutation of current models, however, the failure to account for representational emergence is taken as a premise in arguments for the necessary innatism of all content. If content can’t emerge in learning in development, then it must be innate (Fodor, 1981; Bickhard, 1991). But if it can’t emerge, then it can’t emerge in evolution either, and Fodor’s argument begs the question — “What I think it [the *Language of Thought* argument] shows is really not so much an a priori argument for nativism as that *there must be some notion of learning that is so* *incredibly different from the one we have imagined* that we don't even know what it would be like as things now stand." (Fodor in Piattelli-Palmarini, 1980, pg. 269).

The general failure to account for content has many manifestations. One of them is a failure to account for the normativity of representation, in particular, to account for the possibility of representational error. In encoding models, there are only two possibilities: either the favored correspondence exists or it does not exist. But, if it exists, then the representation (supposedly) exists, and it is correct, while if it does not exist, then the representation does not exist, and *it cannot be incorrect*. There are three representational possibilities that must be accounted for — exists and correct, exists and incorrect, and does not exist — but there are only the resources of two kinds of cases to do the job. It's impossible.

Much effort has been devoted to finding a way out of this dilemma, but they all fail to naturalize content and error. To determine what a representation is supposed to represent requires, in current models, the assessment of complex evolutionary or learning histories (Dretske, 1988; Millikan, 1984, 1993) or the equally complex assessment of complex relations among counterfactuals (Fodor, 1990; Loewer and Rey, 1991). None of these are remotely reasonable as a model of content in a simple epistemic system. Then to assess whether the representational instance is true or false requires comparing those inaccessible contents to what is actually currently being represented. But representing what is currently being represented is the original problem all over again.

These models are realizable, if at all, only by an external observer to the epistemic system at issue, an observer who can, at least in principle, make the complex assessments of history and counterfactuals to determine the "content" and who has, again at least in principle, independent representational access to the environment so that he or she can compare the deployed content with what is actually out there in the world — who can determine that the COW representation is being used for what is in fact a horse on a dark night, and, therefore, is false. Such a dependence on an external observer fails to naturalize representation. Among other problems, it fails to account for the representations of the observer, except by initiating a vicious regress.

Some models attempt to make a virtue out of this necessity for an observer by construing the problem of representation as one of accounting for how it is useful to use the language of representation. That is, they construe representation as a manner of speaking, having no further ontological nature, and address issues of when it is explanatorily useful to make use of such a manner of speaking or writing (Bogdan, 1988; Clark, 1997; Dretske, 1988). Clearly there are some phenomena, including normative phenomena, that are emergent only in the realm of social practice: marriage and money come to mind. But the relationship of the individual to the realm of social practice is already a normative, a representational, relationship, so representation cannot be subsumed *into* social practice without committing to a full social idealism. That is not only a failure of naturalism, it is internally incoherent.

There are many more failures of such models (Bickhard, 1993; Bickhard and Terveen, 1995), but, although they are frequently acknowledged, the usual assumption is that some form of encodingism is the only possibility and that the problems will be overcome eventually. I argue that the failures are inevitable so long as representation is not understood as a dynamic phenomena of pragmatic action and interaction, not just a spectator phenomena of input processing (Bickhard, 1993, 1996, 1998a, 1998b, 1999; Bickhard and Terveen, 1995).

Motivation

Representation has been modeled above as an aspect of an underlying interactive system ontology. Representation is the aspect of indicating further interactive processing potentialities; the aspect of anticipating the flow of interaction. My claim is that, just as representation is an aspect of such a system ontology, so also is motivation a different aspect of the same ontology.

Before elaborating on that claim, I first need to address what is taken as the problem of motivation. A classical construal of motivation has been as that which induces a system to do something rather than nothing. The organism is assumed to be inert unless motivated to do something, thus motivational metaphors such as various kinds of pushes and pulls, drives and “motivations” (such as competency motivation). That is, the organism is assumed to be inert unless some sort of “energy” is provided to make it move.

But organisms are alive, and living beings cannot stop, cannot be inert, without simply ceasing to exist as living beings. Living beings *cannot* do nothing. So the problem of motivation cannot be that of what makes an organism do something rather than nothing. The problem of motivation must be what makes an organism do one thing rather than another — what are the processes of the selection of the course of further activity, of further interactive activity (Mook, 1996).

Rather clearly, that is precisely the interactive system function that representation was proposed to subserve. That is, anticipation of what’s possible — representation — serves the function of selecting what among those possibilities to select next — motivation. Motivation is the aspect of selection of processes, and representation is the aspect of anticipation in the service of such selection (Bickhard, 1997).

This is a minimal model of motivation, as is the initial model of representation, and requires similar attention to more complex and more familiar kinds of motivation. Not all motivation is simple selection or goal directed selection. As for representation, this minimal model holds perhaps for flatworms and maybe frogs. Some more subtle versions of process selection — of motivation — will be outlined later as emergents of more complex processes.

Learning

I will not focus on learning in this chapter, but I do need one property of learning for the model of emotion to follow. Learning requires a monitoring of ongoing interactive processes. Learning introduces variation when things are not going well, and stability when they are proceeding according to plan. In this case, "plan" is the anticipations of the microgenesis process. If microgenesis, the set up for the next interactive processing, is destabilized when failure to anticipate occurs, and is stabilized so long as the anticipations are successful, then we have a minimal model of learning: such a system will tend to stabilize on interactive processes that proceed successfully according to the anticipations and goals of the system.

Note that even with this minimal model, we can account for several phenomena. If an input path into the central nervous system is neurally wired so that inhibitory interactions with the inputs are possible, and if an actual input stream is restricted to such a pathway, then it is possible for the system to learn to interact with such an input stream strictly via such neural inhibitory anticipations of the flow of that input stream. This is classical habituation (Staddon, 1983). A well habituated simple tone doesn't progress higher than the first cochlear nucleus — the anticipatory interactive processes can be completed at that level. A more complex tone, however, may require a small participation of the temporal lobe in order for the interactive anticipations to succeed. That these are anticipations rather than crude pathway inhibitions is evidenced by the fact that reducing the volume of the tone, for example, produces arousal — the volume anticipations fail.

Suppose now that the input flow does not remain in one modality. Suppose, in fact, that it crosses from sound, a tone of some sort, into pain — a foot shock, say — where pain is, among other things, a form of input for which no successful interactions are possible (to a first approximation: Douglas, 1998; Eccleston and Crombez, 1999). Now to successfully anticipatorily interact with this flow, something must be done about the shock. The only way to successfully interact with the shock is to avoid it, so the proper response to the tone is to remove oneself from the grid at the bottom of the cage. The full interaction now involves skeletal muscles. Classical conditioning is a direct result of the ongoing stabilization only on successful anticipatory interaction.

For one further elaboration, consider an input that originates from low blood sugar, perhaps in the hypothalamus.[3] Again, to a first approximation, there is no direct inhibitory interaction possible, but, nevertheless, some form of successful interaction is possible. In particular, interaction that results in raising blood sugar will successfully interact with this input. What will succeed in raising blood sugar will, in general, depend on multiple additional differentiations and representations about the environment. Refrigerators usually work fine, if available. Hunting may be involved if in the wild. In any case, we have a model of instrumental conditioning.

Most learning is more complex than these examples, at least in mammals. Most learning is heuristic. Accounting for heuristic learning requires a more complex model than has been outlined here (Bickhard and Campbell, 1996), but these points suffice for my current purposes.

Emotion

A creature that had available only interaction and learning would, if in a sufficiently variable environment, suffer a potentially serious limitation. In an encounter with a novel situation, the only possible responses would be direct interaction or learning trials. Microgenesis would, by assumption, be not fully defined — would not set up clear and dynamically well organized anticipations of interactive potentiality. That is the dynamic side of the assumption of novelty. But the only monitoring of such uncertainty of microgenesis is by the learning process. Such interactive uncertainty is what learning is supposed to correct.

But learning, even heuristic learning, is at best a trail and error process, a process engaged in evolutionary epistemology. A first encounter with a tiger on a jungle trail might evoke interactions of foot wiggling, or an attempt at a handshake, or various other learning and interactive trials, but there is, in an organism limited to interaction and learning, no other possibility. In particular, there is no way for such an organism to develop general modes of interactive response to situations of interactive (microgenesis) uncertainty — it is only the learning process that has access to any information or signal of such uncertainty.

Nevertheless, the learning process does involve the generation of some version of such a signal, and if (a copy of) that signal could be fed back into the interactive system as an input, then the interactive system would be in a position to potentially be able to interact with its own conditions of uncertainty similarly to interacting with environmental conditions. The interactive system would learn, would stabilize, on forms of interaction that tended to be successful in interacting with internal uncertainty in the same sense in which it would learn to interact with tones and shocks and hunger. With such a capability, the organism could develop general ways of dealing with kinds of uncertainty situations, such as running whenever strange and large animals are encountered.

The modeling proposal is that emotions *are* such interactions with internal dynamic uncertainty. As is by now familiar, this is a minimalist model, appropriate perhaps to reptiles, and elaboration is required to account for familiar cases.

Negative and Positive. First, I address the distinction between negative and positive emotions. A simple mode of successful interaction with uncertainty would be an interaction that succeeded in eliminating the uncertainty, perhaps by leaving or by altering the situation. Notice, however, that the situation that produces the uncertainty is not identical to the situation that the organism interacts with — the organism is interacting with its own uncertainty in addition to the external environment per se. If the response to that uncertainty is more uncertainty — uncertainty about how to deal with the uncertain situation — then the overall uncertainty increases. Uncertainty can create anticipations of more uncertainty. A runaway feedback of uncertainty creating more uncertainty is a kind of panic attack, and is a paradigm for a negative emotion.

On the other hand, suppose that the situation is uncertain in the sense that no particular interactions are already known to succeed in this kind of situation, but that the general *kind* of uncertain situation is well known in the sense that procedures are known that tend to reduce or eliminate *this* kind of uncertainty. I don't know how to solve this math problem, but I do know how to go about figuring out how to solve it. If successful interactions tend to be stabilized, and if resolution of uncertainty is a successful interaction (which it is by the model as developed so far), then uncertainty situations in which there is anticipation of resolution of that uncertainty should be stabilized in learning. Uncertainty for which there is strong anticipation of resolution is the model for positive emotions.

The distinction between negative and positive emotion, then, turns on the anticipations involved about the potentialities for resolving the uncertainty. Situations of interactive uncertainty are of strong adaptive importance, and anticipations of success or failure in resolving such uncertainty are constitutive of the positive or negative character of that importance. Further differentiations of kinds of emotions will occur depending on what sorts of categorizations of uncertain situations are learned and what kinds of interactive styles come to be associated with them.

Biological, Developmental, and Social Aspects of Emotions. It would make adaptive sense, in this view, for evolution to have created innate supports for some basic uncertainty response styles, for some basic emotions (Ekman and Davidson, 1994), but it does not follow in this view that all emotions would be blends of such basic emotions. Learning has full power to develop further differentiations of emotion situations and emotion interactive processes associated with them, including some that will be largely culturally specific (Harré, 1986). It would also make adaptive sense, in this view, for emotional expression and emotion recognition, at least in complex social species, to be strongly involved in social interaction and social cognition (Ekman, 1984; Ekman and Davidson, 1994), though, again, it does not follow that these functions would constitute the most fundamental ontology of, or adaptive reason for, emotions.

Modeling the typical developmental differentiations of emotions should, in this view, capture the development of more and more refined forms of uncertainty situation categorization, response styles, and regulation skills (Gross, 1998), beginning with a relatively undifferentiated arousal (Scherer, 1984; Thayer, 1989). After an initial differentiation of positive and negative, negative arousal seems to differentiate into fear and anger, and so on (Harlow & Mears, 1983; Saarni, Mumme, & Campos, 1998; Sroufe, 1984, 1995). Later emotional possibilities emerge with the capability for reflexive consciousness at about age four. Reflexivity is possibly involved in such emotions as guilt (Taylor, 1987).

The Space of Affectivity. Emotions are interactive processes with anticipations of uncertainty about successful interaction with regard to some particular situation. That is, there is generally a cognitive focus for emotions (Nissenbaum, 1985). There is no constraint in the model, however, to prevent uncertainty about successful interaction, and anticipations or lack thereof concerning the resolution of uncertainty, to occur more globally, without any particular focus. Such unfocused "emotional" processes provide a potential model for moods (Rosenberg, 1998).

Emotions as designated in English are occurrent phenomena. A readiness or propensity to experience some particular emotion might be characterized as a personality style if it is generic to multiple kinds of situations, and a mood if it is relatively continuously ongoing, but, if it is tied to specific cognitive foci, we tend to describe it as an attitude — a propensity to have particular emotional reactions to particular kinds of objects or situations. The emotions model, then, yields rather readily candidate models of moods and attitudes.

The space of processes and dispositions that is differentiated by the occurrent and non-occurrent distinction and by the focus and unfocused distinction is a relatively continuous space, not a pair of dichotomies. Depression, for example, is relatively ambiguous between mood and emotion, while we at times refer to emotional dispositions — non-occurrent — as personality characteristics or styles: an angry person, for example, or an angry mood, even if not at all angry at this moment.

Some Emergent Motivations. Successful forms of interaction will be learned and will be sought. This includes successful forms of emotional interaction. Positive emotions, then — interactions with forms of uncertainty situations for which there is strong anticipation of resolution — will be sought, and, therefore, situations that are expected to yield positive emotions will be sought.

The expectations of resolution of uncertainty, or the lack thereof, are learned just as much as the uncertainty categorizations and response styles per se. Positive and negative emotional stances toward particular objects, then, are not necessarily responses to intrinsic characteristics of phenomena. One person, for example, may learn that mathematics problems pose an interesting challenge that is fun to address, while another may learn that the same problems offer only further frustration and failure. Similarly, new learning may allow bringing new forms of exploration to an object — new forms that offer new resolvable uncertainty: Toddlers sometimes like to play with grass, picking it and tossing it, and so on, but the novelty soon wears off. Later, however, that same toddler might become a botanist and discover many new ways in which grass can be fascinating.

Intrinsic characteristics of an object or phenomenon, however, can limit the novelty that it can offer. Nursery rhymes relatively quickly lose their interest to an adult. But others can offer essentially unlimited novelty — there is always something new to hear and experience in Beethoven's Ninth or avant-garde jazz.

Learning to seek such experiences constitutes learning a kind of process selection, and, thus, a kind of motivation. We name these variously as competence motivation, mastery motivation, or esthetic motivation. These are emergent kinds of motivation, emergent from the inherent dynamics among interaction, learning, and emotions.

Some other motivational phenomena are also emergent in these dynamics. For example, as mentioned above, the living system is always active, always doing something. If sufficiently driven by inputs that require full resources for successful interaction, such as pain or hunger, those forms of interaction will dominate. If such “external” driving of the central nervous system processes is minimal or absent, the processes do not simply cease. They continue, and continue to seek forms of successful interaction, including uncertainty interaction. The individual will seek situations and objects that offer resolvable uncertainty. Exploration, curiosity, and esthetics are examples of the kind of motivational phenomena that emerge if not displaced by more demanding forms of process (Maslow, 1962).

Furthermore, such explorations of what is most satisfying will tend to discover and emphasize not only what provides the greatest opportunity externally, but also what fits best with prior kinds of talents and experience in the individual. That is, such explorations will *tend* to develop the potentialities of the person, so long as they are not precluded or blocked by more demanding forms of process. Such a tendency to actualize the potentialities of the person is sometimes referred to as a motivational process itself (Csikszentmihalyi, 1990; Holdstock & Rogers, 1977; Maddi, 1996; Mook, 1996), but it is not so much a direct matter of selection of further activity as it is an emergent tendency of consequences of such selections.

A Few Comparisons. The model outlined here is a dynamic model, based on a recognition of the necessarily open dynamics of any living system. Emotions are a particular kind of dynamics — forms of interaction with the system’s own internal dynamical uncertainty about how to proceed and how to anticipate the interactive flow. Emotions are, in this view, an adaptation to a basic informational property of the organism-environment relationship — uncertainty — and, as such, manifest their own adaptive rationality (de Sousa, 1987; Lazarus, 1991). The effects of emotional processes are, of course, not always beneficial, but representation and motivation too can be in maladaptive error.

The uncertainty that gives rise to emotion processes is a kind of evaluation (Frijda, 1986; Oatley, 1992), but it is not an evaluative process that is independent of, or follows on, the interactive representational processes. Instead, it is an aspect of the flow of representational and motivational interaction. The differences between this model of evaluation and notions of evaluation in alternative models turn largely on the difference between interactive and encodingist models of the nature of cognition and representation. If representation is constituted as encoding elements, then setting up or activating such elements in perception and cognition will necessarily be distinct from evaluating and judging the situation thus represented. In particular, this model is in stark contrast to models of emotion as particular kinds of propositional attitudes (see Griffiths, 1997, for a discussion).

The model is consistent with strong biological supports for some basic kinds of emotions — evolution is likely to have scaffolded the development some of the most important general forms of uncertainty interaction — but it is also consistent with a ubiquitous involvement of social and cultural learning in emotions, and even the social and cultural ontology of some of them in which the basic categorizations of situations are themselves inherently socially constituted. In this, the model is closer to the dynamic and developmental framework endorsed by Griffiths (1999), for example, than the emotional programs notion in Griffiths (1997). Emotional expressivity in social species should, in this view, be expected to be of basic importance to the character and regulation of social interaction, but, again, constitutes neither the basic ontology of emotions nor their most basic adaptive function.

Conclusions

The model of emotions outlined here makes sense only on the foundation of the interactive model of representation and motivation. It is not possible to develop the intrinsic notions of evaluation of uncertainty with the same properties in an encodingist cognitive framework. A primary moral of the model, then, is that such phenomena cannot be approached independently of one another: in this case, assumptions about cognition have major implications and impose major constraints on models of emotion.

Within the model, representation, motivation, and emotion are all aspects or kinds of interaction. They are integrated in an intimate way that is necessarily fragmented in encodingist models. In this integration, the model makes contact with multiple facets of emotions research and theory, such as biological bases for “basic” emotions, developmental aspects of emotions, the social construction of emotions, and the importance of emotional expressivity and recognition, without reifying any particular such facets into the ontology of emotion.

The larger framework of the model is a dynamic systems model of living beings as far from thermodynamic equilibrium systems (Bickhard, 1993; 1998b). As such, the model makes contact with other dynamic systems approaches (Port and van Gelder, 1995; Thelen and Smith, 1996), but without ignoring representation (Bickhard, in press-b). Persons are complex dynamic open systems with multiple emergent properties, such as representation, motivation, learning, emotions, consciousness, language, and so on, and will not be understood without honoring that fundamental dynamic nature.

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Endnotes

[1] Another representational challenge concerns representations of abstractions, such as of numbers. A similarly Piagetian model accounts for such kinds of representations, but requires additional elaborations of the model that I will not pursue in this chapter (Campbell and Bickhard, 1986).

[2] A number of additional properties, such as those of qualia, require (I argue) a model of reflexive consciousness, in addition to simple conscious awareness. I will not address those issues here (Bickhard, 1980, 1998a; Campbell and Bickhard, 1986).

[3] Hunger signals are a form of vicariant or surrogate for the maintenance of the biological integrity of the organism (Brown, 1990; Campbell, 1974; Christensen, 1996; Christensen, Collier, Hooker, in preparation). Such vicariants — e.g., hunger, thirst, pain, and so on — are fundamental to successful interacting: no organism can calculate, even heuristically, back to the basic criterion of biological integrity, and must, therefore, depend on such surrogates. I will not focus on these points in this chapter, though the general nature of the functioning of a few of them are indicated in passing.