Enactive Theorists Do It On Purpose

On why the enactive approach demands an account of goals and goal-directedness

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Abstract

The enactive approach to cognitive science involves frequent references to "action" without making clear what is intended by the term. In particular, no definition or account is offered of goals which can encompass not just descriptions of biological maintenance, but the range of social and cultural activities in which human beings continual engage. The present paper briefly surveys some of references to goals and goal-directedness in the cognitive scientific literature in an attempt draw out an account which might successfully fill this gap in theory. Finding no easy answer, some suggestions are made as to how such a theory might be developed in the future.

Introduction

We've been hearing a lot, recently, about how the mind is much more active than traditional cognitive science gives it credit for. Much is being made of how the mind should best be understood as dynamically embodied – deeply and inextricably embedded in its environment, in constant negotiation with context.

Of course, the *mind* in traditional (computational and representational) theories of mind was never a passive thing. It developed, manipulated, transformed and pondered representations from dawn to dusk (and mulled over dreams in between). It is the reintroduction of the body that has challenged the largely received view of the representational mind – it is the body (and its movements in space and its metabolic relationship with the world) that has become much more actively involved in the mind than it used to be.

For some, once the body is properly into the picture the need for representations, and the off-line computation that they may afford, is reduced or eliminated. Representations, for these radical embodiment types, need not play a necessary rôle in explanations of cognitive phenomena. (For

claims of this kind across cognition generally see Varela, Thompson & Rosch, 1991; Maturana & Varela, 1987; Thompson, in press. For claims which restrict the anti-representationalist move to the more basic processes of perception see O'Regan & Noë, 2001a; Noë, 2005.) This shifting of emphasis from representation and computation of the right sort (whatever sort that may be), to behaviour and embodiment of the right sort might smack to some of a return to behaviourism (see e.g. Block 2001). How can movement be my thinking, except insofar as that movement is a representation or expression of a computation of some sort?

Some proponents of the active mind (the dynamically embodied mind) would defend themselves against such criticism by pointing out that the passivity that so plagued behaviourism is nowhere to be found in this new take on things. An emphasis not just on behaviour but on action is prevalent throughout the various related literatures of the dynamically embodied mind.

Though a number of related (and in many ways allied) approaches to this embedding of agent in context will be mentioned through the course of this paper, It is the enactive approach as outlined initially by Varela, Thompson & Rosch (1991) and developed in the subsequent literature that is its particular focus. The approach begins with a stark acceptance of the mutual dependency between a cognitive agent (which must exist in some world) and the world (which can only be perceived or conceived by a cognitive agent). The enactive approach as set forth originally in Varela, Thompson & Rosch's (1991) *The Embodied Mind* had five principles. Adapted from Thompson's (in press, p.9) summary, these five principles are:

1) Living beings are autonomous. They actively generate and maintain themselves, and in doing so “bring forth” their own cognitive domains. This is to say that all cognitive systems must be agentive systems, having some capacity to direct and control themselves, in order to maintain their own living existence.

2) The nervous system is an autonomous dynamical system. A nervous system is not like a symbolic computational system, which accepts information from the “outside world” and processes that information in some way. Rather, it is governed by its own internal dynamics

(the complex tangle of feedback loops between its neurons). Thus, the state of a nervous system cannot be determined by external events, it can simply be perturbed by those events, and its activity at any given time is a complex result of its own activity and those perturbations.

3) Cognition is the exercise of skillful know-how in situated and embodied action. Cognition never occurs in abstraction, but rather in some context which includes not only the agent's environment by their own embodiment. Cognition is the adaptive coordination and control of actions, but thus cannot be discussed or considered without reference to both the physical instantiation of the agent, and that agent's own environment.

4) The world of the agent is not a prespecified external realm, represented internally by the agent's brain, but is a relational domain “brought forth” by the agent's autonomy and coupling with the environment. This “bringing forth” is also referred to as “sense making”, the agent's ability to give meaning to its environment. There is simply no way to specify external reality without making at least implicit reference to the perspective, capabilities and intentions of the agent. Any description of the world must always acknowledge the perspectival nature of any such description.

5) Finally, experience is not a scientific afterbirth, slightly disturbing but ultimately possible to ignore while the science goes on. Experience must, rather, play a central rôle in our understanding of cognition and mind, it must be part of the fundamental data of an adequate mind science.

These principles support a view of the mind-world relationship which gives neither a clear primacy over the other. Rather, an agent exists in a world which is “brought forth” or “enacted” by its own embodied actions. The world we live in, for instance, has light and sound and texture, but these things can only be conceived, perceived and described because there are a range of actions we can take to explore those very phenomena, actions both enabled and constrained by the kinds of bodies that we have (in fact, the kinds of bodies that we *are*).

Against possible accusations of behaviourism, an enactive agent does not simply behave, it acts. Yes, cognition is tied more closely to behaviour and more wound up in context than traditional accounts, but this is not a disempowering relationship. Our agency and autonomy are not threatened by such an approach because, under the enactive approach autonomy and agency are *necessary*, basic requirements for the identity and existence of a cognitive system (Varela, Thompson & Rosch, 1991; see also DiPaolo, Rohde & De Jaegher, in press). The relationship between an agent and its world is not one of dominion of the latter over the former (as in behaviourism), but rather one of interdependence. Those actions produce distinctions and perceptions which in part create the very world in which it lives. This act of creation (termed “bringing forth” or in the enactive literature) is not one of divine *creatio ex nihilo*, but more similar to our creation of either a pair of faces or a vase through an act of perception in the classic ambiguous figure. It is an emphasis on action (and enaction) that saves the enactive approach from being behaviouristic. The behaviours involved in enaction are not passive responses to an environment. They are actions which are driven by the agent's own autonomy – they are governed by norms rather than by laws of behaviour.

One central implication of adopting the enactive approach is that autonomous action is the key in the making of meaning for the agent. Enactivism holds actions as a relational concept, a changing of the relation between the agent and the world in some way. Varela *et al.* (1991) argue that it is the autonomous agent's ability to act that underlies sense-making, what they call a “bringing forth” of the world. DiPaolo, Rohde & De Jaegher (in press) examine this issue of sense-making in a little more depth. They argue that underlying the capacity for sense-making is the creation of value in the interaction between the agent and its world. That value cannot be “hard-coded” into the system in any way (as a bald evolutionary approach might suggest) as it is in the specific context of individuals, not in the general trends of genetic lineages that these values are expressed. Though a particular behavioural repertoire may have evolved, for example, to support a group activity (perhaps even to the detriment of the individual), the motivation to perform the actions, the value in *that specific performance* must still arise in the given individual for the action to take place. Many

evolutionary researchers are not interested in the fact that this value for the individual must occur, preferring to take a gene's eye view which is blind to the individual organism. As cognitive scientists, however, it behoves us to explain all behaviour and not just species-typical patterns. While evolutionary history matters, it will not be enough to comprehensively characterise the values expressed by individual organisms. To allow the value to be imposed entirely from without the agent (e.g. by the evolutionary history of their species) violates the principle of autonomy of the enactive approach. They argue that value must emerge dynamically from the embodied interaction of the agent with their environment.

DiPaolo, Rohde & De Jaegher (in press) define value as follows:

> the extent to which a situation affects the viability of self-sustaining and precarious process that generates an identity
>
> DiPaolo, Rohde & de Jaeger, in press, p. 14

with identity being defined as

> generated whenever a precarious network of dynamical processes becomes operationally closed.
>
> DiPaolo, Rohde & De Jaegher, in press, p.5

For DiPaolo *et al.*, values organise and give meaning to the disparate processes that compose the agent, and provide a means by which the agent enacts a world. Essentially, value is the implication of the environment for the agent.

DiPaolo *et al.*'s discussion of values, however, remains at a fairly low cognitive level – the level of biology (or simulated biology). The emphasis in the literature has been on biological identity, and value something to be considered in terms of what will or will not allow an organism to continue living – a sparse implication, and one that offers little of the complexity we associate with "meaning" at more personal, psychological levels of usage. The term value fits with our intuitions of such long-term, consistent principles of activity. At the so-called higher levels of cognition,

however, the principles governing our activities are much more fluid. What is more, values in the domains – psychological, social, cultural – in which these various activities are engaged are subject to wide variances and, unlike biological values, are likely to change radically within the lifetime of an individual organism. This fluidity and complexity, however, does provide for the possibility of both depth and breadth in the implications that more configurable value systems might engender.

We generally call these values which structure our actions over varying time-scales “goals”. Whether they govern immediate bodily actions (such as “pick up the cup” or “keeping jogging to that next set of traffic lights”) or are more mediate in the execution (“achieve a good career in Cognitive Science”), they are our goals, and are habitually drawn on in explanations of people's behaviour.

DiPaolo, Rohde & De Jaegher argue strongly that the enactive approach must be developed and deployed in our accounts of higher level cognition. Nevertheless their analysis of value is largely grounded in basic biological considerations. This largely includes their own analysis of social interaction, which advances the enactive approach, but mainly through the illustration of the importance of lower level embodied values in normal person to person interaction. There is certainly no denying the influence of the body and biology on social interaction. However, the values that human beings deploy to make sense of their worlds are not always either low-level or long-lived. It is a significant characteristic of human beings that our values can and do change dramatically from moment to moment, as our goals change. Many of our values are not to be explained directly in terms of biological homeostasis (or similar concepts), but need to be framed in more psychological terms – the terminology, I suggest, of goal-directedness.

The enactive approach does not shy away from such terms (see the discussions of “intrinsic teleology” and agency in Weber & Varela, 2002, or DiPaolo, 2005, for instance). It has not hitherto deployed these terms in the higher level psychological domain that I am suggesting it needs to. DiPaolo *et al.* (in press) warn that the enactive approach is not just a foundation of embodied dynamics upon which to build more traditional, computational or representational accounts of mind.

The present work seeks to respond to their call to develop the enactive approach across the breadth of cognitive scientific endeavour.

Getting into the details of the philosophy of action is beyond the scope of the present paper. By defining actions as norm-governed behaviours, I seek to highlight the idea that actions are not neutral movements or transitions of some system. Rather, they should be understood in terms that allow for the distinction between success and failure (achievement or error), and which acknowledge the active and interested rôle of the agent (thereby acknowledging the autonomy of the agent) in action.

When we talk in common sense terms about action the norms that govern them are our intentions, our goals in performing the action. There are a plethora of tangled concepts here, which are the subject of significant literatures: intentions, reasons, mental causes, goals, purposes and so forth. The enactive literature has generally avoided these “high level” terms, however, in favour of more basic conceptions of what a norm might be.

The foundational norm for the enactive approach is that of autopoiesis. Autopoietic is a technical term which is used to identify a process (or system of processes) which have as their product their own organisation. That is, a system of processes which are organised so that the product of that system is the system itself, is an autopoietic system.

Weber & Varela (2002) offer the following definition of an autopoietic system:

> An autopoietic system is organized (defined as unity) as a network of processes of production (synthesis and destruction) of components such that these components:
>
> 1. continuously regenerate the network that is producing them, and
> 2. constitute the system as a distinguishable unity in the domain in which they exist
>
> Weber & Varela (2002 p.115)

They argue that autopoiesis provides a basic norm and the basis of teleology. The organisation will form a functional boundary in that the recursiveness of the system entails a distinction made *by* the

system. That distinction is the distinction between the system itself and its environment (the system is a figure against the ground of its environment).

Autopoiesis is a norm for an autopoietic system because the system must either maintain autopoiesis or cease to be a system. It is a very coarse and rather bare norm, a binary choice of continuity or disintegration. Nevertheless, the behaviour of the system maintains the system itself and thus performs an action – the maintenance of autopoiesis.

What an appreciation of autopoiesis provides is the foundation for an understanding of the relationship between a cognitive agent and its world. But it is only a foundation, and it is the bareness of autopoiesis as a norm that concerns me, as it concerned DiPaolo (2005).

Under the enactive approach, our world is created in our actions, in our maintenance of our identity as an autonomous living thing. The behaviours of an autopoietic system are all structured by the norm of autopoiesis. DiPaolo (2005) notes, however, that the bareness of autopoiesis, its all-or-nothing nature, does not allow for the kinds of complexities of action, nor the subtleties of sensitivity that we see in living things. Real living things do not simply live or die but are continually threatened and redeemed, stressed and relieved, they fall ill and recover. Living is not a continuous plateau but a constant gauntlet between stasis and disintegration. But bare autopoiesis cannot account for such sensitivities. Autopoiesis in its simplest description cannot be threatened or healthy – it either is or it isn't. Our actions as living, complex, cognitive agents obey norms that may be built on but must be more than autopoiesis.

DiPaolo (2005) argues that the ingredient missing from autopoiesis (Weber & Varela's characterisation in particular) is adaptivity. In adaptivity a more flexible system can vary in its behaviour from the safe to the lethal. With a system capable of such variety (a system not just capable of autonomous self-production, but autonomous suicide) we have a more rich and textured system not just capable of maintaining autopoiesis but, in a way, capable of appreciating it.

If an autopoietic entity makes a distinction between itself and its environment, an adaptive entity

makes distinctions between healthy and unhealthy relationships with its environment.

I am far from the first to suggest that we need to consider more carefully the concept of goals in dynamical accounts of the mind and action. Dynamical systems researcher Elliot Saltzman (1995) has also argued that higher level concepts such as goals should be drawn into our accounts of the structure of intentional behaviours. Saltzman has argued that we require not just an account of the bodily dynamics of an actor, but the task dynamics. The emergence of successful bodily action is not just a product of the bodily effectors and articulators that make up the embodied agent, but include the particular demands of the task the agent is trying to achieve. Unlike basic biological values, these may vary radically from situation to situation.

Saltzman uses the act of speech production to show that the organisation of the different articulators involved, and their responses to perturbation, are not just a matter of biomechanical or neuroanatomic coupling, but are specific to the particular utterance. That is, in addition to bodily dynamics, if we are to adequately explain actions we must be able to give a clear description at the more abstract level of task dynamics. I will suggest later that a further broad and abstract dynamical landscape may be required for explaining human actions.

The development of a clear and mathematically precise dynamical systems account of psychological processes consistent with the enactive approach is a decades-long commitment and beyond the scope of the present work. Nevertheless, if we are to answer the call made by DiPaolo, Rohde & De Jaegher (in press) to develop the enactive approach across the breadth of cognitive science, then some first steps to providing a framework of a theory of goals will be required. If meaning and value are structured not by the world alone, nor by the agent alone, but in the higher level task dynamics of goal-directed interaction between the two, then an account of human-level, person-level meaning must be scaffolded within a framework of goals that encompass such high level activity.

Allied Approaches and the Call to Action

Despite its continual reference to action and teleology, the enactive literature to date has not offered an explicit and encompassing account of goals and motivation to round out its account of the mind. In search of a useful theory to fill this lacuna we might turn to the more mainstream cognitive scientific literature where the topic has been given some significant attention. Unfortunately, the kinds of view of goals extant are largely inconsistent with the very fabric of the enactive approach.

The most influential conception of goals and goal-directedness in Cognitive Science has been the concept of the basic negative feedback regulatory system. Initially introduced as a description of purpose by Rosenblueth, Weiner & Bigelow (1943) it was famously expounded and expanded by Miller, Galanter & Pribram's (1960) *Plans and the Structure of Behaviour* (Miller *et al.*'s test-operate-test-exit components are each effectively a single negative feedback circuit). This cybernetic view of goal-directedness has been seen as a very positive thing by cognitive scientists. It gives us a mechanistic description of purpose, one which suits well the computational theory of mind. Goals can be considered set points maintained (or homed in on) by the feedback system, goal-directed behaviour reduced to behaviour governed by such regulatory mechanisms.

This mechanistic view is apparent in more and less explicit forms in a wide variety of popular cognitive theories. From Newell & Simon's (1972) classic (and still largely dominant) view of problem solving as goal-state representation with the use of operations to reduce the difference between that and the present state, to Daniel Wegner's (Wegner & Wenzlaff, 1997) ironic processes model of mental control (though the parallels there are mitigated by the negative nature of the ironic monitor in Wegner's theory). The cybernetic model is also clear in the domain of personality and social psychology, where “idea selves” form the basis of the feedback system's set point (references) and behaviour regulation is considered explicitly in negative feedback terms (Carver & Scheier, 1998).

As long ago as 1972, though, Margaret Boden raised concerns with a simple negative feedback model of goals. Such a description of goal-directedness does no justice to the forward-driven nature

of many of our motivations. Boden highlights the poor provisions in a cybernetic model for the intensional, perspectival characteristics of motivation which are expressed in such forward striving. Rosenblueth *et al.* (1943) themselves mentioned the possibility of feedforward actions, but only as an aside in the case of ballistic movements such as a snake striking at prey. With that single exceptional set of cases, "[a]ll purposeful behavior may be considered to require negative feedback" (p.119).

The enactive approach shares Boden's concerns (which have not, since 1972, been adequately addressed). More needs to be said about our striving than simply that it is a negative feedback system. Context is demanded in all cases, as to how set points emerge, how the factors involved – those proper to the organism and those imposed by the environment – interact to structure the behaviour of the agent as actions rather than happenings. What is more, the values in question, for reasons noted earlier, cannot be simply hard-wired into the system but must be constructed in the operation of the system.

The kinds of descriptions of behavioural regulation and goal-directedness extant in the cognitive scientific literature do not, then, offer us an easy solution to the problem of an account of goals for the enactive approach. We must turn to some other framework for a scaffold. Recent non-mainstream approaches to mind, related to the enactive approach, have had slightly more to say on higher cognitive functions. Might the embodied cognition or dynamic sensorimotor approaches offer some help to close this gap in the enactive literature?

Bodies of Thought: The embodiment approach to cognitive science

An emphasis on contextualised, dynamic bodily interaction between an agent and its environment is one of the hallmarks of the "embodiment" or "embodied cognition" approach to cognitive science. Though the approach is disunified and somewhat diverse, often the key motivation for embodiment researchers is the avoidance of abstract, off-line, representationalist descriptions of cognition (e.g. Brooks, 1991a,b; vanGelder, 1995). Insofar as it shows the importance of contextualised bodily action, embodiment research can often be used to support the enactive view. The concept of action

as vital almost invariably makes an appearance in such embodied accounts, though action does not necessarily play the constitutive rôle that it does in the enactive (and, as we shall see, the dynamic sensorimotor) approach.

Andy Clark, one of embodiment's most vocal and prolific proponents, claims the following:

> At root, our minds ... are organs for rapidly initiating the next move in real-world situations. They are organs exquisitely geared to the production of actions, laid out in local space and real time.
>
> Clark, 1997, p.8

Clark notes that in being bodily agents we are primed for bodily action, and our minds have the task of coordinating that action. That coordination is not the dictatorial direction of some central executive, however. Rather, our entire bodies exhibit what he refers to as a “problem solving poise” (Clark, 2002, p.190), which colours our perceptions and readies our various systems of response. Clark offers no clear account of what this “problem solving poise” is, though, and suggests that in fact it might be best considered in terms of more traditional, off-line memory and reasoning. It would appear that Clark's “organ for rapidly initiating” actions might be given its parameters of operation by a traditional, representational cognitive system that cannot be supported within the enactive approach.

Arthur Glenberg (1997, 1999) also argues that the mind is “for” bodily action, that cognitive processes are to guide and support the performance of real world, situated activity, rather than abstract or general information processing. The mind is for the controlling of real action in real settings but the parameters of control, what is success and what failure, are left implicit. Glenberg (1997) suggests that evolution has programmed us correctly, that our valuing of the world is simply hard-wired in – all we have to do is put those values to use. But this is unsatisfactory, failing to offer us any real explanation of how the individual person, rather than the genetic lineage, appreciates such generically defined values. How individuals perceive, interpret and evaluate in a manner that is clearly widely variant across individuals just doesn't have an adequate explanation in simplistic

evolutionary terms. Value and how people draw meaning from their worlds must surely be described at the level of the individual agent, and not the genetic lineage (Collier, 2000).

Gallagher (2005) suggests that the individual agent's goals are fundamental to perception. Similarly to Clark, he suggests that something about our goal-directedness structures and colours our awareness of our world. Gallagher argues that such structuring is what he calls “prenoetic”, implicit, bodily and prior to consciousness:

> The fact that I may feel the object as hot rather than as smooth, for example, will depend not only on the objective temperature of the object, but on my purposes. Thus physiological processes are not passively produced by incoming stimuli. Rather, my body *meets* stimulation and organises it within the framework of my own pragmatic schemata.
>
> Gallagher, 2005, p.142

Gallagher's notion of pragmatic schemata, suggests that how our goals are structured is deeply implicit, but that they nevertheless enforce some kind of structure on the manner in which the body operates. Gallagher, does not offer a worked out account of goals, but reminds us that we must conceive of them in terms that are both distributed and bodily, and that basic cognitive processes require them – our perception of the world is not just interpretted in light of our goals, for Gallagher, but is structured and constrained *á priori* by them.

Gallagher's work in collaboration with Anthony Marcel (Gallagher & Marcel, 1999; see also Marcel, 1992; 2003) raises an important issue that is worth mentioning at this stage. Actions may be structured *á priori*, our goals but those goals come in a variety of scales and their interaction with actual bodily movement no simple thing. Marcel's work on the rehabilitation of people with ideomotor dyspraxia. Marcel points out that a number of patients with this difficulty cannot perform certain tasks when asked to do so (such as touch their nose, or lift a cylindrical object), but can perform them more fluently in more pragmatic circumstances (such as scratching their nose or lifting a glass to drink). Gallagher & Marcel (1999) identify three levels of personal engagement in task, what they call three “intentional attitudes”. The simplest, where the focus is on the movement

itself, is abstract or decontextualised. Abstract or decontextualised actions are unlikely in the normal case, and are performed purely in order to comply with an explicit request, such as in clinical assessment. There is no broader goal of which the movement is a part. Lifting an object on the request of a clinician would be an example of such a movement. While it is certainly the case that abstract actions are contextualised within a form of social context – that of obeying the experimenter – the action or movement itself is almost immaterial to the event, all that matters is that a response be made to the experimenter.

The second form of intentional attitude are intentions that are pragmatically contextualised. Such actions make sense given the immediate personal context of the actor. They involve movements which are contextualised by the immediate intentions of the person in question. Lifting a glass to take a drink of water is one example – the movement is almost identical to that of lifting the object at the request of a clinician, but is contextualised within the individual's personal goals of taking a drink and quenching their thirst.

A third, deeper form of contextual embedding is that of socially contextualised intentional actions, which are performed not just to satisfy personal goals, but to take part in cultural and social practices, such as serving drinks to guests.

Marcel (1992) notes that these three forms of intentional attitude often show marked differences in fluency and successful performance, the more contextualised the action the better its execution. What is particularly interesting is that normally while other people are present self-consciousness often impairs a person's performance. While this is still the case with contextualised actions, when a person is not self-*conscious* but who's actions are nevertheless more richly integrated into a pragmatic self, more fluid actions are observed. Examining these issues in greater detail is work for another time. What is clear, though, is that understanding how our activities are organised is no simple negative feedback system. The dynamics of goal-directedness are more tangled than we might like, and although we are developing a more nuanced description of the dynamics involved, it remains unclear as to just what a goal is in these cases.

The overall organisation of behaviour by some set of implicit goals is also present in the work of Esther Thelen and Linda Smith (1994). They offer a dynamical systems perspective which explicitly addresses the individual differences in the development of motor and cognitive function. Their taking of a complex systems perspective is a positive one for the enactive view, and highlights the dynamical “on-going” nature of a child's learning about their world, learning that is not preprogrammed but emerges out of the specific interactions between child and their environment. Take, for instance, their famous contrasting of the development of reaching in two children, Hannah and Gabriel.

Hannah and Gabriel both have quite different behavioural characteristics, what Thelen & Smith (1994) refer to in this context as their *intrinsic dynamics*. Intrinsic dynamics mean that neither Hannah nor Gabriel are blank slates in terms of motor movement as they come to learn to reach for a given object. Rather, starting from markedly different patterns of behaviour, in order to reach successfully both must converge on some basic reaching action. Hannah they describe as deliberative and careful in her movements, generally producing slower arm motions. Gabriel, in contrast, produced many energetic arm flappings. The task for both in learning to reach was to modulate their arm movements so as to successfully make contact with a desired object (operationally defined as making hand contact with the object while making eye contact with the object). Learning to reach for both Hannah and Gabriel were thus quite different tasks, both enabled by their bodies (the fact that they had arms in the first place) and constrained by their intrinsic dynamics, which were clearly not controlled by some central pattern generator of motion, but involved the modulation of on-going patterns of activity. The patterns of adaptation were individually appropriate for each child, given their quite different intrinsic dynamics.

Thelen & Smith (1994) note that the explanation of reaching requires more than just the embodiment of the children itself. The task dynamic description must perforce include some reference to goals, but that goal need not be complex or richly detailed – surprisingly complex behaviours can be produced by surprisingly simple constraints on the dynamics of behaviour

(Thelen & Smith, 1994, p.269). They suggest that goals should be considered as attractors in the behaviour phase space which will be just enough to get the self-organising processes of embodied action going.

This analysis of goals is a productive one for the enactive approach. It suggests the beginnings of an account of goals which appropriately acknowledges both emergence and embodiment, and which avoids the necessity of symbolic representations guiding the whole process. Thelen & Smith (1994) offer only the first tantalising hints at a fully developed account, however, their focus in their work being the addressing of the processes of development rather that the construction of value and meaning. Nevertheless, their behavioural attractor model of goals is an important first step. We would do well to note, though, that behavioural dynamics will not be able to get us all of the way to our goal. The dynamics of embodiment and low-level task demands (such as keeping your eye on the target) in actions such as reaching might be enough to describe a task-space such as those called for by Saltzman (1995). Nevertheless, this can only be part of the solution – as any fully developed account of goal-directedness will need to account not only for how such actions such as reaching are performed, but also *why* they are performed. In something as simple as reaching, beyond the task-dynamics of body, target and intention to reach, is the question of why reaching *now*, and why reach for *that*? These are things which require not just a task dynamics (how goals get put into practice), but some more like a *goal dynamics*, how we adopt, revise, drop and achieve, goals. As noted above in the discussion of Saltzman's call for task dynamics, it will be beyond the present work to develop a precise account of such goal dynamics. Nevertheless, some broad framework which might allow us to make headway on the matter is required.

The work of embodied cognition researchers offer us some suggestions on how our account should look, and what constraints we should obey, but no theory of goals is already extant. A second related approach to the enactive view, that of dynamic sensorimotor cognitive science, describes cognition in terms of skilled action. Might that approach help us define a theory of goals suitable for the enactive perspective?

Thought in the Act: The dynamic sensorimotor approach to cognitive science

Often referred to as enactive in the literature, the dynamic sensorimotor approach to the mind is nevertheless distinguishable from the enactive view.[1] While the approach has at its heart the claim that cognition is the exercise of sensorimotor skills, its proponents often define "skills" in terms of "knowledge" or "know-how", owned, possibly stored and deployed in some way by the brain or brain-body system. This is a tad less radical than the enactive approach of Varela, Thompson & Rosch (1991) or Thompson (in press).

The most vocal proponents of a dynamic sensorimotor approach are Alva Noë (2005; see also O'Regan & Noë 2001a,b) and Susan Hurley (1998; see also Hurley & Noë, 2003). The approach goes a step further than the more general embodiment view, seeing cognition not simply as action-oriented but as existing in the action. More specifically, cognition is in the exercising of sensorimotor skills (the exercising of a mastery of sensorimotor contingencies, see O'Regan & Noë, 2001a; Noë, 2005). Such an approach is largely compatible with the enactive view, and indeed much of the work of dynamic sensorimotor theorists can be plugged into an enactive account with little alteration. Insofar as the enactive approach includes the claim that cognition is the exercising of sensorimotor skills, then it encompasses (if goes slightly further in its commitments to autonomy and reciprocal determinism than) the dynamic sensorimotor view. This also means, however, that many criticisms levelled against the dynamic sensorimotor view are also likely to affect the enactive. With these facts in mind, we turn to some of the dynamic sensorimotor theories in order to draw out any implications theory may have for a framework for understanding goals.

Probably the most famous of the theories within the dynamic sensorimotor stream of research is O'Regan & Noë's (2001a) sensorimotor account of vision and visual consciousness. This seminal article in *Behavioral and Brain Sciences* created waves in Cognitive Science thanks to a confluence of important elements. Firstly, the basic message was both clear and radical. Visual perception does not depend upon or even use well developed internal representations, but is rather a matter of exercising what they would term "mastery of the laws of sensorimotor contingency" (see O'Regan

& Noë 2001a, p.943 and p.945). Secondly, the article drew upon a host of empirical evidence supporting the view that vision is an action performed by the agent, not an operation conducted by a cognitive module in the brain, or anywhere else. This is a dramatic step away from the received view on the psychology of vision, a shift well away from the idea that vision is the result of some form of information processing based on input through the eyes. Noë (2005) puts the new approach starkly:

> The main idea of this book is that perception is a way of acting.
>
> Noë. 2005, p.1

> To see is not just to have visual sensations, it is to have visual sensations that are integrated, in the right sort of way, with bodily skills.
>
> Noë, 2005, p.4

These “bodily skills” constitute the “mastery of sensorimotor contingencies”. Initially, this view might seem to suggest that their account involves some inherent conception of goal-directedness. The concept of skill, both in common usage and as it is used by psychologists entails an ability to achieve goals in a given domain or situation. However, in both Noë (2005) and O'Regan & Noë (2001a), the concept of skill (bodily skill, sensorimotor skill) is defined as a form of knowledge (implicit *know-how*), rather than goal-directed activity.

It may be queried whether there must always be some goal present for a skill to be deployed. Is it not possible for me to recognise food when I am not hungry, for instance? Surely the less committed concept of skill as “knowledge of sensorimotor contingencies” is more useful here. But while it is certainly possible to recognise food without being hungry it remains unclear whether that recognition is taking place outside of any motivational context or goal-directed activity (whether that recognition does or does not ultimately depend on some goal-driven activity other than hunger). To take a related example, if I stare at my bookshelf for a period of time, I may not be *looking* for anything. In such a state I may be surprised by a particular book that I would like to read, or had

forgotten I owned. Where is the goal here? We must first answer the question of, where is the skilled action? Both the embodiment and the dynamic sensorimotor approach continually remind us to be sensitive to the context in which a particular process is occurring. Goals may vary in their specificity, as noted in the discussion of Thelen & Smith's work above. What is more, I may have more than one motivation at any given time. If I am staring listlessly at my bookshelf, it may be precisely to distract myself from work I am having difficulty with, or an attempt to remind myself of what books I own. The work of dynamic sensorimotor theorists exhorts us to consider perception as a skillful activity (Hurley & Noë, 2003, p.146). It need not be committed to those skills being deployed or structured at a given level of description.

Noë (2005) uses the definition of skills as a form of knowledge as one defence against an over-emphasis on the fine details of the body, what Andy Clark (2002; also Clark & Toribo, 2001) refers to as “sensorimotor chauvinism”. Clark claims that O'Regan & Noë's (2001b) statement that their approach...

> ...allows for the possibility (indeed the necessity) that where there are physical differences, there are also qualitative differences.
>
> O'Regan & Noë. 2001b p.1013

... commits them to a explanation of vision which is too tightly bound up with the details of the bodies of the agents doing the seeing. He suggests that the O'Regan & Noë (2001) must claim that if one person's eyes saccade slightly fast than another's, then there is by necessity a qualitative difference in their consciousnesses. Noë (2005) argues that the emphasis is not on the fine details of the body, but on the *sensorimotor knowledge* of the agent. Once knowledge of the right kind is successfully deployed, then vision (or any other form of perception) is in use.

Other authors have taken issue with O'Regan and Noë's use of the concept of skills as knowledge or “know-how”, however. Mark Rowlands (in press), for instance, has criticised O'Regan & Noë (2001a) for drawing on a conception of knowledge without adequately explicating the concept's use

in this context (after all, what might such practical know-how be, if it is not *knowing that* of some kind, nor dependent on goal-directed activity?). Rowlands argues that we must draw on a new form of representation in order to sort out these confusions, but the enactive approach eschews representations as explanatory.

Unfortunately, the enactive approach cannot easily appeal to knowledge as explaining what perception and cognition might be either, precisely because of its basic claim that cognition is skilled activity (Thompson, in press, p.9). Nevertheless, the work of Noë (2005) and O'Regan & Noë (2001a,b) remains largely consistent with the enactive approach and we should draw from it both encouragement and some direction toward valuable future research in the area. In a search for goals, though, it has little to say. More promising, perhaps is some of the work of Susan Hurley.

Hurley's (1997) dynamic sensorimotor approach does not pivot so much on either the pragmatic terms “skill” or “knowledge”. Her argument is that the mind, rather than being buffered from the world by perceptual processes on the one hand, and behavioural or action processes on the other, is constituted in a “dynamical singularity” of complex feedback loops. Some of these loops are internal to the organism, but some of them extend into the environment in closer or looser chains of causation which characterise the mind. Actions can influence perception non-instrumentally, that is, without that influence depending on the actual alteration of the perceptual field by bodily movement. For example, changing the perceptual field by moving the eyes is instrumental, while changing a perception by changing one's *intentions* is non-instrumental (think of intending to see the faces, rather than the vase). As such, the simple distinctions between inside and outside the mind based on the parallel distinction between inside and outside the body (or brain, or wherever one might take the mind to “reside”) are ill-conceived.

This has some dramatic implications for how we develop a framework for a theory of goals within the enactive approach. Hurley's work (1997) exhibits the emphasis on dynamical systems and embodied action that characterise the enactive approach, though she does not fully engage with the concepts of reciprocal determinism that form the “fundamental circularity”. While her approach is

thus not fully enactive, it holds some important implications concerning how we might consider intentions and goals within the enactive approach. When we draw on dynamical systems descriptions of the mind, the tangle of interactions characteristic of cognition are not all contained within the skull. Once more, the mind is spread over a wider canvas than intuition might suggest.

Hurley's argument that the mind should be examined as a dynamical system rather than a structure with given states suggests, though, that a fully detailed account of goals may not be necessary in order to explain the kinds of meaningful psychological states that we are interested in. In the complex ninth essay of her (1998) *Consciousness in Action*, Hurley argues for precisely this. In this essay Hurley argues that the content of mental states is not fixed by neuroanatomy or states of the world, but by the emergent result of interacting constraints. She does not draw on the notion of values or intentions here, but notes that different sensory channels, motor intentions and social cognition may give rise to differing accounts of what is going on in the world. If those accounts conflict, there is pressure to adapt. This is the case, for instance, with perceptual adaptation to inverting goggles, where a person's vision adjusts over time in the context of goal-directed actions and conflicting reports from other perceptual modalities. The state which Hurley refers to as “complete adaptation” is that state where all of these constraints on content are satisfied, and should be enough to specify the contents of consciousness.

However, examining Hurley's claim, it should be noted that this “complete adaptation” itself exists in a broader context which is worthy of comment. The limits of perceptual adaptation are unclear, and just how completely intentions may adapt to suit sensory stimulation would be difficult to assess. Nevertheless, that a conflict can exist, that there is some potential in the system which “seeks” this state of constraint satisfaction called complete adaptation, needs to be accounted for if Hurley's view is to avoid off-loading too much work into the broader causal forces “which explains why any subpersonal vehicles of a certain type, or any mental states of a certain type, exist at all” (Hurley, 1998, p.7).

Hurley's arguments highlight again the need to address the existence of basic value for a system,

and while it supports a rôle for goal-directedness (for example, in that intentions can affect perception non-instrumentally) that rôle remains somewhat vague without a dynamical account of goals that would give us a clear picture of why mental contents exist at all. Hurley herself notes that *Consciousness in Action* is not a "full dress development" of her theory, but more a grounding of the view and an unseating of the older orthodoxies of the mind, world and their relationship.

The concept of cognition as skilled and dynamic activity is a central one for the enactive approach. The work of Noë, Hurley, O'Regan and others is a useful basis from which to develop the idea, as their work sets the stage for the conception of higher psychological functioning as skills of the right kind. What will clearly be necessary is to try to explicate the concept of skill in a manner more immediately amenable to the enactive approach.

Toward an enactive theory of goals

If we are to provide an enactive account of goals and goal-directedness we will need to be in for the long-haul. If the enactive approach aims to encompass not just low-level biological and immediate bodily activities, then a framework which makes clear the relationship (more, the continuity) between basic biological processes such as autopoiesis and more cultural structured activities such as "aiming for a good career" needs to be built. Such a framework needs to be able to rationalise the relationship between dynamical systems descriptions of behaviour championed by the enactivists (along with the embodiment and dynamic sensorimotor theorists) and personal, social and cultural processes which are just as much a part of our (human) experience as are straight things, round things and red things. This complexity and richness is not a fundamental challenge for the approach – any domain in which we are capable of acting we are capable of sense-making for the enactive view. It is time to make these more "high level" domains, and the actions which bring them forth, explicit.

I am optimistic about such an encompassing enactive account. Conceptual tools are available to begin the task. Alicia Juarrero (1999), for example, has argued in favour of a dynamical systems account of goals and action which would largely seem commensurate with the enactive approach

(though it is not without its challenges). Similarly, Merlin Donald's (1991, 2001) arguments concerning the evolution of the mind make explicit the range of different ways in which we engage with our world, from the immediate and basic to the mediate cultural. Like Juarrero's work Donald's is not without challenge for the enactive approach (his emphasis on different forms of representation, for example, rather than an emphasis on different forms of action), but such challenges need not be too daunting. Finally, in addition to the variety of tools already extant in the enactive methodologies repertoire – computational modelling (Bourgine & Stewart, 2001; Varela, 1997; DiPaolo *et al*. in press) and neurophenomenology (Varela, 1996; Lutz & Thompson, 2003) for instance – we might confidently engage with and deploy the methods of ecological psychology (see e.g. Gibson, 1979; Heft, 2001 for a taste of the concepts and methods involved), supporting as it does the emphasis on interaction between an agent and their environment. With the proper use of such methods and one eye on how it should all fit together in the big picture, enactive research should continue to develop in both strength and value.

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1 The use of the term "enactive" is likely for two reasons. Firstly, the full implications of Varela *et al.*'s (1991) *entre-deux* often do not seem to be deemed integral to the view. As a result, any approach emphasising action as vitally important to our understanding of the mind would seem to qualify as sufficiently "enactive" to warrant the term. Secondly, "dynamic sensorimotor" is a mouthful, "enactive" is much snappier. Alva Noë (2005) refers to his theory of vision as enactive, but takes care to distinguish his view from that of Varela, Thompson & Rosch. In the hope of avoiding confusion, I will refer to Noë's work as dynamic sensorimotor.

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