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Chapter 2

Material Surrogacy and the Supernatural: Reflections on the Role of Artefacts in 'Off-line' Cognition

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Coupling and the material world

Naturalized philosophy of mind, at least in the major analytic traditions of the last century, has tended to marginalize the study of bodily form, real-world action, and the scaffolding of material culture. In recent years, this trend has been identified and, increasingly, resisted. The result is a plethora of work on what has become known as embodied cognition. (Some related terms in current use include 'situated cognition', 'distributed cognition', and 'the extended mind'.) Work in this new, loosely knit field depicts thought and reason as in some way inextricably tied to — indeed intermingled with — the details of our gross bodily form, our habits of action and intervention, and the enabling web of social, cultural and technological scaffolding in which we live, move, learn and think.

The key insights are practical and straightforward, highlighting the many ways body, action and material surround can simplify and transform the problems that face the biological brain. As embodied agents, able to move and act in a persisting material world, we are demonstrably able to profit from a variety of strategies that make the most of bio-external sources of order and information (for some surveys of this terrain see Clark 1997; Wheeler 2005). Nonetheless, as 'born-again Cartesian' skeptics such as Grush (2003) point out, the bulk of these strategies seem confined to the class of what might be dubbed 'coupling-friendly' phenomena. These are cases involving the (usually time-pressured) unfolding of a behaviour that can be cannily regulated by an ongoing perceptual link with some external goings-on. For example, running to catch a fly-ball in baseball, where complex planning and trajectory estimation can be replaced by fixing on a simple perceptual invariant (roughly, run so as the ball appears to move in a straight line in the sky: see McBeath *et al.* 1995). But such cases, the skeptic may insist, are cognitively marginal. The proper explanatory targets for the sciences of genuinely *mental* activity involve modes of thought and reason that target distal, absent, highly abstract, or even impossible, states of affairs. Good explanatory frameworks for the highly coupled cases look far less promising, it is often claimed, in these more elusive and rarified arenas. In this brief exploration, I hope to respond to this skeptical challenge by attending to the role of material culture in providing 'surrogate targets' for thought, reason and learning.

It is certainly true that many of the really compelling accounts to emerge from the stables of dynamical and embodied cognitive science involve the use of a perceptuo-motor routine whose operation exploits the continuing presence of some tangible target. In cases such as these we confront a characteristic mix of constraints and opportunities, that we may label the 'basic signature'. The basic signature involves a task that requires the agent to keep track of a situation unfolding in some constraining (absolute) time-frame, so that real timing (not just sequence) is essential to success. And it involves the use, to accomplish the task, of body, motion and world as integral aspects of the problem-solution. For example, the use of head and eye motion and 'just-in-time' sensing to retrieve information from the visual scene, thus 'using the world as its own best model'.

This signature mix of constraints and opportunities is indeed lacking in many cases of high-level human problem-solving. We can plan next year's family vacation or design a new 100-storey building. In such cases we are forced to think and reason in the absence of the target situation. The vacation is not until next year. The building does not exist (and may even be impossible). Instead, we seem forced into a mode of 'off-line reasoning'. The tools, principles and strategies that work so well for the on-line cases may falter, it is feared, in the face of such new demands and challenges. It is in this general context that it makes sense

for critics such as Grush to make much of the *apparent* fact that off-line reason is entirely brain-based, involving representational circuitry firmly located within the organismic shell. The biological brain, Grush assures us 'can silently contemplate, dream, plan, all as a matter of the play of representations — pretty much everything Descartes thought the mind could do even in the absence of the world' (Grush 2003, 87).

It is no part of my own present or future agenda to reject the claim that we often do lots of stuff (dreaming, planning, musing) entirely in our heads, using inner surrogates for absent states of affairs. But it is surely worth noticing (and especially in the present context of thinking about the cognitive life of things) just how much of our cognitive activity is *not* like that, and not just in the cases where we are in the presence of the very states of affairs with which we are attempting to deal. On the contrary, it often seems that brains like ours (though there is considerable room for individual differences in these regards) will go to extraordinary lengths to *avoid* having to resort to the kinds of fully environmentally detached reflection that Grush places at the centre of the cognitive stage.

Thus consider the use of 'surrogate situations' (Clark 2005). By a surrogate situation I mean any kind of real-world structure that is used to stand in for, or take the place of, some aspect of a certain 'target situation'. By a target situation I mean an actual, possible, or at least superficially possible, real-world event or structure that is the ultimate object of my cognitive endeavour. For example, suppose I use a dotted line, or a small stick, to indicate, on a rough drawing, the proposed location of a supporting strut on a bridge that I am about to build. The target situation is the (as yet non-existent) bridge and the surrogate situation is the context provided by the drawing (and the stick, if I am using one).

Real-world processes of design, as Gedenryd (1998) has argued in great and persuasive detail, are marked by the use of multiple complementary uses of surrogate situations. Examining cases as diverse as designing a power tool, a bridge or a building, or laying out a magazine cover, Gedenryd details the different uses of sketches, prototypes, thumbnails, storyboards and scenarios, to name but a few. What these all have in common is that they allow human reason to cope with *coupling-resistent* (absent, counterfactual, even impossible) targets by means of local *coupling-friendly* surrogate material structures. Such surrogate structures allow human reason to reach out to that which is absent or distal or otherwise unavailable while at the same time providing a concrete arena in which to deploy perceptuo-motor routines of a fundamentally world-engaging kind. In such cases, human reason is disengaged from its ultimate target (the final copy, the unbuilt bridge) yet continues operating in a nonetheless highly situated, world-exploiting fashion.

While it is no doubt obvious that we often rely on such procedures, their pervasiveness, variety and importance, and the complexity of the processes they support, enable, and participate in, are all too easily overlooked. Considered in the light of the typical worries about 'scaling up' the embodied approach to higher human cognition, such procedures are revealing indeed. The mock-ups (etc.) serve no primary purpose other than that of allowing human reason to get a stable grip on what might otherwise prove elusive or impossible to hold in mind. In cases such as these the one thing the agent *cannot* do is to 'use the world as its own best model'. A non-existent building cannot act as its own best model, nor can a (merely) proposed route for a new road. Grush (2003, 86) rightly draws our attention to the fact that in many cognitively central cases we simply cannot let the world serve as its own best model, for the simple reason that the target situation is not yet present. But the alternative, we can now see, is not always to advert to a fully head-bound strategy. Instead, in a great many real-world cases, we prefer to *let a real, physical model serve as its own best world.*

Surrogacy and the supernatural

In a provocative, though still preliminary, investigation, Day (2004) suggests that religious artefacts have played a major role in enabling brains like ours to explore (for better or worse) the space of ideas concerning the supernatural. Day's account is inspired in part by work on the 'extended mind' (Clark & Chalmers 1998) and in part by the work of cognitive archaeologists and cognitive anthropologists (such as Mithen 1996; Donald 1991; Hutchins 1995) on the role of material culture in the amplification and transformation of human cognition.

Day's claim is that 'the broad spectrum of rituals, music, relics, scriptures, statues and buildings [may] represent central components of the relevant machinery of religious thought' (Day 2004, 101). This idea fits very well, it seems to me, with the notion of artefacts as thought-enabling elements one of whose key roles is to create and maintain surrogate situations. For the way the religious artefacts participate in the cognitive act is, Day suggests, by creating tangible frameworks in which on-line cognition, safely coupled to anchoring real-world structures, can reach out towards the realm of the invisible, the untouchable, and the barely conceivable:

> By introducing tangible features of the world that can be physically manipulated and tracked in real-time ... the cognitive scaffolding that religious culture affords seems tailor-made for allowing people to exchange the intricate 'off-line' problems that arise from dealing with invisible, counter-intuitive supernatural agents for the kinds of 'on-line' cognitive tasks they are naturally good at (i.e. recognizing patterns, modeling simple worldly dynamics, and manipulating objects). (Day 2004, 101)

Day makes the now-familiar (see e.g. Boyer 2001; Dennett 2006) claim that the gods we have reflect the minds we have. But he adds a crucial twist. The twist is that those minds are not just functions of our brains, but of these broader cognitive niches populated by all manner of artefact, practice, ritual and symbol. Day suggests that this explains the sheer wealth of material culture associated with religion, as (to put it in my terms) the need for situational surrogacy increases with the sensory ineffability and coupling-resistance of the target. (As an aside, the very same explanation may be given for the wealth of material scientific culture, science too being mightily concerned with stuff that is distant in space or time and/or just plain hard-to-get at, and hence highly coupling-resistant.)

We should not underestimate the claim at issue. For while all parties will surely grant the broad representational significance of religious material culture, Day means to defend a bolder proposition. It is that the customary division between thinking about religious thought (the province of theologians, philosophers and theorists of the religious mind) and thinking about religious material culture (the province of archaeologists, anthropologists and historians) is misleading. If he is right, then:

> ... the classic anthropological features of religious communities would turn out to be more than the media of transmission — they would also be the media of thought. Without these elaborate layers of cognitive technology the gods would be, to one degree or another, unthinkable. (Day 2004, 117)

I think this is right, but that we need to do a lot more work if we are to display just how these layers of material culture do the job. With that in mind, I turn next to two unobvious features of surrogate situations.

Selective concretization and temporal relaxation

Two interesting but unobvious features of many surrogate situations are: (1) the way they highlight key features by *suppressing* concrete detail; and (2) the way they relax temporal constraints on reasoning.

Concerning (1), it is important to stress that surrogate situations are not simply miniature versions of the real thing. Rather, they are usually selected so as to allow us to engage specific, and often quite abstract, aspects of what Gedenryd calls the 'future situation of use'. For example, a four-foot eye-level simulation of a walk-through a new living and teaching space may be selected to address the need to develop a 'safe and inspiring environment for 4–6 year olds'. In a similar fashion, page-layout designers use a variety of very rough thumbnails to work out potential relations between graphic and textual objects, and are explicitly counselled to omit distracting detail.

In fact, despite certain recent educational trends that over-emphasize the creation of rich and realistic teaching contexts, it may well be that our fluency with surrogate situations depends, to a certain extent, on actively keeping the level of non-essential detail quite low. DeLoache (1991), in a well-known study of symbolic functioning in very young children, found that the more realistic the surrogate situation, the harder it became for children to use it as a tool to understand a target problem. In a series of experiments, DeLoache and her co-workers had children (2–3 years old) watch as a model toy is hidden under a model piece of furniture. They are then told that the real toy is hidden in the same place in the real room. Despite ensuring that the children understood the instructions, the experimenters found that more realistic models actually degraded performance. For example, children performed better when shown a two-dimensional picture rather than a three-dimensional scale model. And with the scale model, performance could be improved by placing it behind glass, thus impeding full physical interaction. Deloache suggests this is because as the mock-up's physical properties become more salient, and afford a wider range of interactions, the child's ability to use it as a symbol decreases. Related findings in adult performance include Markman & Gentner's (1993) demonstration that grasp of abstract relations improves when the richness of the representation of the related objects is decreased, and Goldstone & Sakamoto's (2003) demonstration that transfer of learning of abstract principles is often better when concrete details (and hence many superficial similarities) are suppressed in the original learning situation. One important lesson is thus that surrogate situations should be purpose-built to serve specific cognitive needs, and that any pre-theoretical commitment to maximal detail and realism (though what that would mean in the supernatural case is moot!) is premature and may prove counter-productive.

Turning now to (2), much attention has been paid in the literature to the way good models, aids and mock-ups constrain action and reason in productive ways (see e.g. work on graphical represen-

tations, such as Scaife & Rogers 1996). But equally important, though less noticed and much harder to study, may be the way such stand-ins alter and relax the temporal constraints on ordinary performance. Recall that many of the classic cases of environmentally coupled perceptuo-motor action involve non-negotiable temporal restrictions: the tennis player must deal with a serve whose speed is determined by the opponent, the catcher must reach the fly-ball before it hits the ground, and the diving plover must penetrate the water in time to catch the fish. By contrast, routines applied to a model or mock-up seem relatively unconstrained by fine demands of timing. It really doesn't matter precisely how fast I move the model car into position, or how slowly I draw the lines in the sand describing a new football strategy. In one whole, and very important, class of cases, I actively create, as I go along, the very structures to which I then respond. I am here thinking of cases where I create my own model or mock-up, by drawing lines on a page or laying items out in front of me. In these cases, the agent is in charge of the temporal generation of the items that then structure and guide her own problem-solving. Evidently, there is much scope in such cases for an agent to time the production or encounter of symbols or other artefactual stand-ins in ways that are maximally conducive to her own success.

It is possible (though this is sheer speculation) that this temporal relaxation allows us to begin to deploy a phylogenetically more recent set of neural cognitive strategies: ones that make richer contact with episodic memory systems and explicit stored knowledge, and are known to be major players in time-delayed as well as imagination-based responses. Surrogate situations may thus provide both new arenas for focused situated interaction *and* cognitively potent relief from the more richly time-constrained couplings that constitute the bulk of our daily world-engaging activity.

In sum, there exist clear qualitative differences between surrogate situations and normal situations, both in terms of content (the surrogates profit from idealization, abstraction and the omission of much concrete detail) and in terms of timing (surrogate situations help relax some of the temporal constraints on normal real-world response). It would be interesting, I think, to try to apply these lessons to the religious case study described in the previous section. The more general suggestion, however, is that it may be worth examining (these and other) *differences from the target situation* as we attempt to understand the power and fruitfulness of our best artefact-enabled cognitive unfoldings.

Augmented Fish Reality

I want to end by briefly raising and addressing a foundational question that is as elusive as it is (arguably) crucial. The question is: can things (candles, statues, relics) really be *parts of the machinery of thought?* What can this kind of bold assertion actually mean, and how could it be true?

We can start with the unproblematic (but correlatively less interesting). The presence of material culture certainly affects both what we do and what we think. In the presence of a 15'9" gold Buddha, I stop dead in my tracks and think thoughts that, as it happens, I would not have thought otherwise (that there is a very large, very gold Buddha in front of me is perhaps the most obvious of the bunch).

It seems quite possible, too, that the presence of material culture may enable me to come to believe things that I would never otherwise come to believe. Apart from the trivial cases (perceptual beliefs about the objects, as above), I may come to believe that the sun will set tomorrow at 3 pm, or that the log of 2,000,999 is (6.30124687). In these latter cases, as Ed Hutchins and others have powerfully argued, material means may enable me to use basic biological skills of perception and manipulation to penetrate cognitive domains that I, at least, would otherwise find impassable.

Is this enough to warrant the claim that the material objects are parts of the machinery of thought and reason? I am, quite frankly, not sure. To begin to marshal some intuitions, it may help to consider, in a spirit of playful exploration, the rather wonderful installation of Ken Rinaldo known as *Augmented Fish Reality*. This is an art installation featuring real Siamese fighting fish. Each fish is housed in an eco-friendly bowl (featuring peace lilies to filter waste products) attached to a rolling platform. Infra-red sensors sensitive to fish motion allow the fish to control their own robotic bowls: they can move the bowls forward or backward, and rotate them. A fish that swims to the edge of its bowl activates the rollers that move the bowl in that direction. The fish have good eyesight (colour vision, with a love of yellow) and can see well outside their bowls. They are said to be socially intelligent, though males are aggressive to each other, often fatally so.

Rinaldo's aim was to give the fish 'the ability to virtually leave the tank and to meet each other by moving it around' (see http://accad.osu.edu/~rinaldo/). But the point I want to draw out is that despite this superficially dramatic fish-cyborgization, it strikes the observer (well, this observer) that *the fish mind is here left just as it was*. The robotic bowl functionality does not seem to have altered the social, affective or

cognitive world of the Siamese fighting fish, whose basic take on reality seems quite unaffected by their new existence in this inverse-Matrix. Certainly, the presence of the self-controlled wheeled platforms alter what the fish, in some thin sense, can *do*. And the new motions alter the flow and timing of the percepts that the fish form, and the flow (if any) of fish-y thoughts. But (or so I'd like to suggest) such effects alone are not enough.

By contrast our ways of thinking and understanding seem often transformed by the wrap of material culture. In ways that we have yet to fully understand, our best tools and artefacts enable us, unlike the fish, not just to act and perceive differently but to think about the world in brand new ways. To take a perfectly mundane example, it is inconceivable, it seems to me, that we could think about music the way we now do were it not for the technologies of sampling, stopping, dilating, looping, slowing-down, speeding-up, warping and just generally mixing that both reveal hidden structures in musical forms and provide a means of manipulating those structures in real-time, while monitoring the sounds produced. Thinking musically while commanding such new tools is as transformative, it seems to me, as thinking verbally while in command of pen and paper. These are not just new tools for old minds, but in some real sense provide the material leverage for new kinds of tool-enhanced thinking to emerge and to be maintained. Notice too that in this case the role of the tools and artefacts is not really to represent that which is absent, but rather, to bring into being new tangibles that transform our relation to the items (pieces of music) that populate the target domain.

Material culture, then, may sometimes be seen as participating in the *construction of new modes of thinking*. There is no sign of the emergence of such new modes in the case of the Siamese fighting fish. The material wrap (the robotic platform and sensors) enables many new kinds of action, bluntly conceived. But it does not visibly transform any fish-y modes of thought. Whereas material religious culture, if Day is correct, may have done just that, by opening the door to whole new ways of thinking: ways that target the supernatural, the ineffable, and the otherwise almost-incomprehensible.

It may still be objected, of course (see e.g. Adams & Aizawa 2001; Rupert 2004) that even if material culture sets the scene for new ways of thinking, the thinkings themselves are always fully internal, and brain-bound just as tradition has it. Two quick closing comments on this popular compromise.

First, there is no obvious reason why, when the right external stuff is present, it should *not* play an active role as part of the physical substrate of thinking. As Hurley (1998) notes, the skull is not a magical membrane beyond which physical stuff obtains some special property that makes it (just then and not a moment before) capable of implementing thought and reason. Instead, if we are broadly speaking functionalists about the role of physical organizations in supporting thought, it must be at least possible that the relevant functional wholes should sometimes extend beyond the ancient confines of skin and skull, and include inextricable tangles of feedback, feed-forward and feed-around loops that promiscuously criss-cross the boundaries of brain, body and world. Something of this ilk may indeed occur, it seems to me, in the case of the musical cognizer mentioned above.

Second, even if (mistakenly rejecting the considerations above) we choose to treat the organism alone as the physical substrate of all genuinely cognitive activity, it is still open to us to hold that the role of certain props and artefacts is essential to explaining how *that very* organism can manage to think the thoughts it does. For it may be that without the use of artefact-involving modes of stabilization, targeting, feature-highlighting, time-dilating and attention-sculpting, certain thinkings would be impossible either to attain or to maintain. Material culture, on this only slightly more deflationary view, would still be massively cognition-enabling. Either way, material culture penetrates deep into the cognitive fold.

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