

explanation of both neonatal imitation and a complex and double answer to Molyneux's question. At the same time it supports an externalist and embodied account of perception. The traditional negative answers to the Molyneux question usually implied a theory of perception in which access to a meaningful external world is not direct but mediated in a process that necessitates an acquired capacity to synthesize sensations belonging to different sense modalities in a process of intellectual abstraction. On this view, much of what we perceive is internally constructed, a production of the apprehending mind that shapes sensory data and goes beyond the primary qualities of the objects perceived. The double answer that I have outlined above, however, is quite consistent with the idea of a more immediate perceptual access to the world on the basis of an innate intermodal system in which different sense modalities are already in communication. Perception is less the result of an internal processing of sense information, and more the result of an interaction between the body and its environment.

8

Complex Structures and Common Dynamics of Self-Awareness

If the behavior of young infants can be characterized as involving a primitive form of self-awareness (Ch. 3), one might suspect that self-awareness and our capacity for self-reference are quite simple and robust in their basic structures. In this chapter I want to explore a variety of issues that pertain to the structure of self-awareness and the capacity for self-reference. These considerations will demonstrate just how complex and fragile these phenomena are. Although their complexity is for the most part hidden away within the normal range of motor and cognitive behaviors, it is nonetheless possible to discover the details of such structures in various pathological cases where self-awareness and self-reference break down. For example, in certain positive symptoms of schizophrenia specific aspects of self-awareness are disrupted. These symptoms include delusions of control in regard to bodily movements, thought insertion, and auditory hallucinations. In this chapter my intention is to sort out these aspects, and to explore their underlying mechanisms. The structures that we discover here are quite ubiquitous; they characterize not only movement organized by body-schematic processes, but human experience more generally.

In this chapter we will be led to another important qualification to be made in regard to the concepts of body schema and body image. These concepts have been thought to be too static, and inadequate for capturing the dynamic processes that characterize experience at both phenomenological and neurological levels (Kinsbourne 2002; Sheets-Johnstone 2003; also see Jeannerod and Gallagher 2002). The following discussion of schizophrenia, however, will reveal certain features of embodied experience that can only be described as dynamic, and as involving a body-schema system best understood in terms of its temporal structure.

The Dynamics of Agency and Ownership in Motor Action

Pre-reflective self-awareness may include a *sense of agency* (a sense of being the initiator or source of a movement, action, or thought) and a *sense of ownership* (a sense that it is I who am experiencing the movement or thought).¹ As we

¹ See Ch. 2. The phenomenological distinction between sense of ownership and sense of agency correlates with the distinction made by Graham and Stephens (1994) between 'attributions of subjectivity' and 'attributions of agency'. Graham and Stephens explain these attributions, however, to be the

previously noted, in the normal phenomenology of voluntary or willed action the sense of agency and the sense of ownership coincide and are indistinguishable. When I intentionally reach for a cup and say that this is *my* action, I mean both that this action is the movement of my own body and that I caused it to happen. When I think about the cup, I don't discriminate between the fact that this thinking is occurring in my stream of consciousness, and that the thinking was initiated by me. In the case of *involuntary* movement, however, it is quite possible to distinguish between the sense of agency and the sense of ownership. I may acknowledge ownership of a movement—for example, I have a sense that I am the one who is moving or is being moved. I can thus self-ascribe it as my movement. I may rightly claim, however, that I am not the author of the movement, because I do not have a sense of causing or controlling the movement—I have no sense of agency for it. The agent of the movement is the person who pushed me from behind, or, for example, the physician who is manipulating my limb in a medical examination.

Likewise, in the case of involuntary *cognitive* processes, I may acknowledge that I am the one who is thinking, but claim that the thoughts are not willfully generated by me. For example, certain unbidden thoughts or memories may impinge on my consciousness, even if I do not intend for them to do so, or even if I resist them (see Frankfurt 1976; Graham and Stephens 1994). We are all familiar with melodies that stay in our heads when we would rather think of something else. In such cases, of course, we may not want to say that there is a specific agent for thinking. It is not that I think someone else is causing my thoughts or my experience. Nonetheless, my claim of ownership (my self-ascription that I am the one who is undergoing such experiences) may be consistent with my lack of a sense of agency.

Certain symptoms of schizophrenia seem to involve a disruption in the sense of agency, but not the sense of ownership, and it will be helpful for understanding these concepts to examine them in the context of this pathology. In this regard, Christopher Frith's (1992) cognitive model of schizophrenia as a disruption of basic self-monitoring processes provides a possible explanation of how the sense of agency may be subject to errors of identification. Frith's basic thesis is that the schizophrenic's hallucinatory and delusional experiences are due to a breakdown of self-monitoring. He is led to this view from observations of motor behavior in schizophrenia.

Chronic schizophrenic patients suffer from a variety of movement disorders.² Most relevant to our concerns, they sometimes make mistakes about the agency of

product of an introspective inference. One attributes agency to oneself, for example, on the basis of a reflective acknowledgement that one has caused the action. In contrast, I understand the senses of ownership and agency to be first-order, phenomenal aspects of experience, pre-reflectively implicit in action. In regard to movement, they are generated in the subpersonal processes of body schematic control, and specifically in the processes of motor preparation and the sensory feedback that results from the action (see Gallagher 2000a, b, forthcoming a). Thus it is important to note that *senses* of ownership and agency refer to a first-order pre-reflective self-awareness. *Attributions* of subjectivity and agency involve a higher-order, reflective introspection. For example, I would reflectively acknowledge and report that the action is in fact mine only on the basis of having a sense of agency implicit in the action.

² Such disorders include peculiar involuntary movements and grimaces with lips and mouth (Crow *et al.* 1982; Frith 1992; Owens, Johnstone, and Frith 1982) and the loss of synchrony between finger tap and

various bodily movements. Patients suffering from delusions of control may report that their movements are made or caused by someone or something else. Frith (p. 66) provides an example from a patient: 'The force moved my lips. I began to speak. The words were made for me.' The motor action responsible for the speech is in fact the patient's own motor action, and the patient acknowledges that they are his lips that are moved, but he makes an error of identification concerning who produced this motion. Here the sense of agency, rather than the sense of ownership, is disrupted. That is, the patient knows that they are his lips and that he speaks, but seemingly his lips were moved, and the words were generated by someone else. Another example provided by Mellor (1970: 17) makes this clear: 'A 29 year old shorthand typist described her actions as follows: "When I reach my hand for the comb it is my hand and arm which move, and my fingers pick up the pen [*sic*], but I don't control them"' (cited by Spence 1996: 82).

How can one explain this disruption in the sense of agency? The classic theory in this regard involves the notion of a hypothetical brain mechanism termed the *comparator*. Comparator models originated as ways to explain body-schematic processes responsible for motor control. When a motor command is sent to a set of muscles, a copy of that signal, the efference copy, is also sent to a comparator or self-monitoring system. Held (1961) suggested that efference copy sent to a comparator is stored there, and then compared to reafferent (proprioceptive or visual) information about the movement that is actually made. This sensory feedback, however, would arrive slightly after the fact of movement, and at best serve as verification that it was I who was moving.³ For reasons outlined below, it is unlikely that the sense of agency is based on this sensory-feedback model (although it may be reinforced by such feedback).

This *sensory-feedback* model is consistent with ecological explanations of motor action and self-awareness. The control of motor action depends in part on proprioceptive and visual-proprioceptive feedback, and more generally on an ecological sense of one's own self-movement (Gibson 1987). If something seems to be going wrong with the action, it is quite possible to correct for it on the basis of this concurrent sense of movement.⁴ Our ecological sense of moving through the world is rich and complex in the sense that it involves not only pre-reflective proprioceptive awareness and working memory, but also a non-observational and pre-reflective

rhythmic auditory stimuli (Manschreck 1986). Schizophrenics sometime suffer from poverty of action, often manifested in poverty of speech, and this may involve a problem with self-generated action (Frith 1992).

³ This verificationist explanation is clearly put by Campbell (1999a: 612) '[I]n the cases in which we do have a sense of agency, in which the movement performed is felt to be your own, what grounds that sense of agency is match at the relevant comparator between the efferent copy and the sensory feedback you have about the movement. What explains the feeling that it is you who moved your arm is that at the comparator, an efferent copy was received of the instruction to move your arm which matches the movement you perceive.'

⁴ Concurrency here is defined as falling within the same specious present, rather than as an absolute simultaneity. Here it is a matter of hundreds of milliseconds.

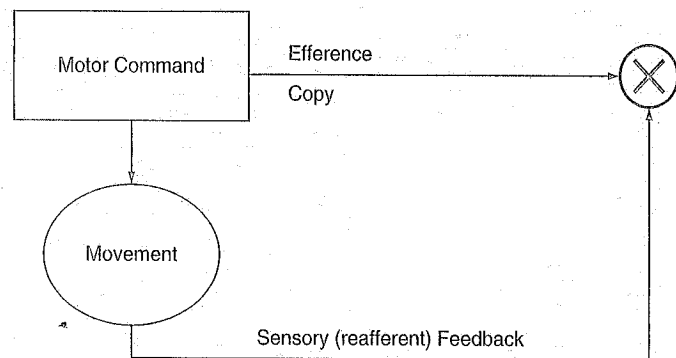


FIG. 8.1. Sensory-feedback comparator.

differentiation between self and non-self, and a sense of one's own capacities for action (see Chs. 3 and 4).

There is a second control mechanism involved in the normal control of movement, however, and this can also be interpreted in terms of a comparator model. This comparator mechanism is understood to be part of a premotor system operating *prior to* the actual execution of movement and *prior to* sensory feedback. This 'forward' motor control, which does not depend on sensory feedback, not only helps to generate the action, but it is likely responsible for generating a conscious sense of agency for action (Georgieff and Jeannerod 1998; Jeannerod 1994). The forward comparator monitors the efference copy of the motor command as correctly or incorrectly matching motor *intentions* and makes automatic corrections to movement prior to any sensory feedback (see Fig. 8.2). This *forward comparator model* is consistent with evidence for an anticipatory, pre-action aspect of motor action. Pre-action neuronal processes, which serve part of automatic body schematic control, anticipate the actual motor performance and provide an online sense of agency that complements the ecological sense of self-movement. In one's immediate phenomenology during action, agency is not represented as separate from the action, but is an intrinsic property of action itself, experienced as a perspectival source (Marcel 2003). Experimental research on normal subjects supports the idea that such agential awareness of action is based on motor processes that precede action and that translate intention into movement, rather than on actual feedback from movement or from peripheral effort associated with such movement.⁵ The content of the experience of voluntary action, then, includes a sense of agency for the action, generated in processes that lie between intention and performance.

⁵ Fournier and Jeannerod (1998); Marcel (2003). Research that correlates initial awareness of action to recordings of the lateralized readiness potential and with transcranial magnetic stimulation of the supplementary motor area, strongly indicates that one's initial awareness of a spontaneous voluntary action is based on anticipatory or pre-movement motor commands relating to relevant effectors (Haggard and Eimer 1999; Haggard and Magno 1999).

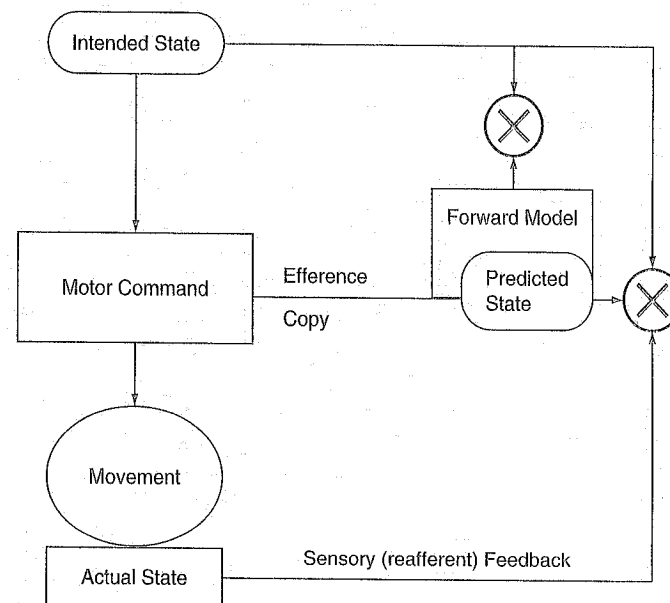


FIG. 8.2. Forward model.

Schizophrenics have problems with the forward monitoring of movement, but not with motor control based on sensory feedback. In one experimental situation, non-schizophrenic subjects are required to use a joystick to follow a target on a computer screen. The experimenter can introduce an apparent directional bias into the subject's response, and subjects are able to use either visual feedback or the pre-action, more automatic process to correct their movement. In one situation, to correct for the apparent mistake the subject depends on visual perception of her hand (vision tends to override proprioception in such cases). When subjects see an error they correct it. If visual perception of the hand is unavailable, however, the normal subject makes a quicker and smoother correction using, presumably, the forward control mechanism. Schizophrenic patients, however, have a problem monitoring their own motor intentions at this body-schematic level (Malenka *et al.* 1982). Like normal subjects they correct the error when visual feedback of their hand is provided, but, unlike normal subjects, they often fail to correct the error when deprived of visual feedback (Frith and Done 1988). These findings are consistent with controlled studies that show abnormal pre-movement brain potentials in schizophrenia, which Singh and his colleagues associate with elements of a neural network involving supplementary motor, premotor, and prefrontal cortexes (Singh *et al.* 1992).⁶

⁶ For more on the involvement of the prefrontal cortex and its complex interrelations with other cortical areas, see Goldman-Rakic and Selemon (1997). For the role of the supplementary motor area in the anticipation and preparation of action, see Passingham (1996) and Tanji and Shima (1994).

In schizophrenic delusions of control there is a loss of a sense of agency, but not a loss of a sense of ownership. The schizophrenic feels that he is not the agent of his own actions, and that he is under the influence of others—other persons or things seem to be moving his body. In some regards, this experience is similar to involuntary action. That is, when someone does control my movement (giving me a push, for instance), I know that it is my body that is moving, but I do not have a sense of agency for the movement. Indeed, I would attribute the agency to the person who pushed me.

The lack of a sense of agency makes good sense in the case of normal involuntary action where a subject does not intend the action; there would be no pre-action preparation, no intention registered at the comparator. On the model proposed by C. D. Frith (1992), the loss of a sense of agency in delusions of control is explained as a problem with efference copy in the central monitor, some kind of dysfunction of the forward, pre-action aspect of the body-schema system. Something goes wrong with the efference copy or with the forward comparator mechanism. As we see from the experiments, the schizophrenic is still able to correct movement errors if sensory feedback is available. Likewise, in the case of involuntary action, the ecological sensory-feedback system still seems to do its job, providing a sense that I am moving (Gibson 1987). This suggests that the distinction between ecological, sensory-feedback control and pre-action forward control corresponds to the distinction between sense of ownership and sense of agency, respectively. That is, both in the schizophrenic's delusions of control and in the normal experience of involuntary action, the ecological sensory feedback system tells the subject that it is he who is moving or being moved (providing a sense of ownership for the movement). Absent efference copy at the forward comparator, or absent any pre-action preparatory processes at the neurological level, however, the body-schematic system will fail to register a sense of agency, a sense that it is the subject himself who is the willful generator of the movement.⁷

From Embodied Movement to Cognition

Can something like this model of motor control be applied to cognition? C. D. Frith (1992) thinks so (see Blakemore *et al.* (2000) for a good summary). Let's take a closer

⁷ Marcel points out that often in schizophrenia, as well as in Tourette's syndrome and obsessive-compulsive disorder, an action is itself experienced as owned, but the source of the action, an intention or command, is disowned. Indeed, stimulation of the central thalamic nucleus produces hand movements, and although subjects have no idea why they did them, the actions themselves are not disowned (Hécaen *et al.* 1949). Having an intention, or having a sense of agency, is not crucial to having a sense of ownership for movement (Gallagher and Marcel 1999; Marcel 2003). The forward model is not the only neuronal-level candidate for generating the sense of agency. Following the distinction between sense of ownership and sense of agency (Gallagher 2000a), a number of researchers have been searching for the neuronal correlates for the sense of agency for embodied action, with some consensus forming around the contrastive functions of the right inferior parietal cortex and the anterior insula bilaterally (see discussion below).

look at the specifics of his model. His conception of the monitoring system in terms of subpersonal comparator mechanisms derives from an explanation of visuo-motor coordination. The visual system can distinguish between movements on the retina that are due to movements in the world, and movements on the retina that are due to movements of the perceiver's own body. In the latter case stability of the visual image is achieved by the motor system sending efference copy 'to some monitoring system at the same time as a message is sent to the eye muscles' (C. D. Frith 1992: 74). The efference copy alerts the visual system to compensate for self-generated or self-initiated movement. Frith refers to this as a monitoring of *intentions to move* (pp. 74, 81). 'To have an intention to move would surely signify something voluntary, or as Frith says, 'self-initiated' (p. 43). His analysis focuses precisely on such self-generated or willed action. Our considerations of motor action indicate that for the normal subject the sense of ownership for action and the sense of agency coincide in the case of willed action. The schizophrenic, however, may experience a loss of the sense of agency when in fact he is the agent, and, as we have seen, this can be explained by a failure of the forward model.

As Frith points out, this sort of self-monitoring mechanism is traditionally used in explaining motor, perceptual, and linguistic behavior (e.g. Sperry 1950; von Holst and Mittelstaedt 1950). Following Feinberg (1978), however, he postulates a similar mechanism for cognition—specifically, for thought and inner speech. He suggests that defects in such mechanisms can explain hallucination and delusion in the case of schizophrenia. Phenomena such as thought insertion, hearing voices, perceiving one's own acts as alien, etc., suggest that something has gone wrong with the central monitoring mechanism.

Thought insertion, for example, might be explained thus: 'Thinking, like all our actions, is normally accompanied by a sense of effort and deliberate choice as we move from one thought to the next. If we found ourselves thinking without any awareness of the sense of effort that reflects central monitoring, we might well experience these thoughts as alien and, thus, being inserted into our minds' (C. D. Frith 1992: 81). Frith's model assumes not only that thinking is a kind of action, but that, as in the case of a motor action, we experience an *effortful intention*. The intention to think, according to Frith, is the element that bestows a sense of 'mineness' on the thought, or perhaps more precisely we should say, a sense of agency for the thought. If the cognitive system is like the motor system then efference copy of the generation of thought (originating, let's say, in some thought-generating mechanism, or TGM) is sent to a feedback comparator, which also registers the occurrence of the actual thought. The efference copy also goes to a forward comparator, and there is a quick match between what was intended and what was generated (Fig. 8.3). So if efference copy is somehow blocked from reaching the forward comparator, thought occurs which seems not to be intended by the subject. If efference copy is blocked or goes astray, or is not properly generated, thinking still occurs, but it is not registered as under my control—it appears to be an alien or inserted thought. There is no match between intention and thinking.

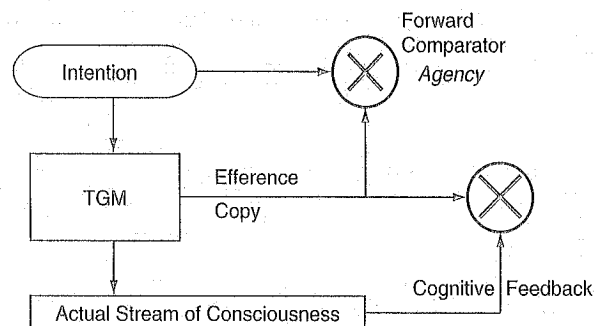


FIG. 8.3. Cognitive comparators. Match at the forward comparator identifies thought intended.

Some Phenomenological Problems with Christopher Frith's Model

Conscious Intention

Several aspects of Frith's model are phenomenologically problematic. A first set of problems pertains to Frith's characterization of the intention to think. In the case of thinking or conscious experience, what role does something like an 'intention to think' or efference copy play? It is difficult to conceive of an intention to think prior to thinking itself, unless it is entirely a conscious preparation, as when I might decide to sit down and start thinking about this issue. In that case, however, the intention to think is itself a thinking, and an infinite regress begins to loom: do I require an intention to think in order to intend to think? Frith (1992: 86) speaks of a conscious feeling of effort for a willed intention to think, and he equates this with a conscious monitoring of efference copy. Frith's analysis relies, not just on an intention to act (move or think), but an awareness of the intention to act, and he defines this awareness as a case of 'metarepresentation'. Metarepresentation is a second-order reflective consciousness, 'the ability to reflect upon how we represent the world and our thoughts'. This is part of what it means to monitor our actions and, he claims, it is precisely what is missing or disrupted in the schizophrenic's experience.

Surely, however, most cases of normal thinking are neither prefaced by conscious intentions to think, nor followed by an introspective metarepresentation.⁸ In the

⁸ Kinsbourne (1995: 214) suggests, with regard to intentions to move, that such intentions do not persist long enough to be included in awareness, and that the movement itself 'rapidly supervenes and supplants the intention'. Stephens and Graham (2000) consider this issue, but not in relation to Frith's analysis. Rather they discuss an objection raised by Akins and Dennett against Hoffman's (1986) account of alien voices. Akins and Dennett (1986: 517) suggest that the idea of having an intention to think leads to a 'never-beginning regress of intentions to form thoughts'. Stephens and Graham point out, however, that Hoffman's account concerns only the kind of thought that might be called inner speech, and just as we might accept the idea that someone may have an intention to say something, it is not so odd to accept the idea that someone may have an intention to say something in inner speech. They agree, however, that

normal phenomenology, at least in the large majority of cases, there is not first an intention and then a thinking; nor thinking plus a concurrent but separate awareness of intention to think. Even in the case of intentional action it is not clear that there is always an intention to act, at least in the sense of a distinct psychological state (Anscombe 1983).

Campbell (1999a) suggests, in contrast to Frith's characterization, that efference copy is not itself available to consciousness. On his view, efference copy is part of a subpersonal and non-conscious process that generates an awareness of effort as thought itself is generated. As a first attempt to get the phenomenology of this model right, let us say that as thoughts are generated by the TGM (and I suppose this can happen in any number of ways) efference copy is normally sent to a comparator. Such processes, however, are subpersonal processes that subtend the thinking process. That is, following Campbell's suggestion, whatever there is of intention to think or efference copy are moved underground; they do not make an appearance in the subject's actual phenomenal experience. Ultimately they are to be cashed out in terms of neuroscience rather than phenomenology.

Unbidden Thoughts

What Frith calls 'intention to think', then, may be part of a subpersonal, non-conscious process, which, when it works properly, generates a sense of agency for our thoughts. Does the disruption of this process, however, explain the phenomenology of inserted thoughts? As with movement, it is not always the case that my thinking is characterized as something I intend. There are unbidden thoughts that, as Frankfurt (1976: 240) puts it, 'strike us unexpectedly out of the blue; and thoughts that run willy-nilly through our heads'. I may just find myself thinking of something. I may just find, without a conscious act of recollection, particular memories coming to the fore, invading or disrupting my thoughts with elements of my past that may or may not be relevant to my present circumstance. Is there any kind of intention to think in such cases, or when, for example, someone suddenly starts shouting instructions at me and causes me to start thinking?

In such cases, of course, I retain a sense of ownership, a first-person sense which tells me that it is I who am experiencing the thoughts. Similar to the case of movement, a preliminary or preparatory non-conscious intention to think, if necessary for a sense of agency, seems unnecessary to guarantee a sense of ownership—a realization that I am the one who is thinking, or having the thoughts. Yet, in cases of unbidden thoughts, without an intention to think, and without a sense of agency for generating the thoughts, I do not attribute my thoughts to someone else.⁹ Importantly, this means that the problems with the intention to

not all intentional thinking could be described as inner speech, and that the idea that there is an intention to think in every case would be unacceptable.

⁹ Of course it is possible to attribute thoughts in my mind to someone else, but in a very ordinary way—for example, in listening closely to a speaker, one might say that the speaker's thoughts are being inserted into one's mind.

think and efference copy are not doing all the work that Frith would like them to do in the case of schizophrenia. The absence of an intention to think, and hence, the lack of match at the comparator level do not explain anything more than a relatively normal lack of a sense of agency. It does not explain the misattribution of thought to another agent, or why some thought might seem inserted for the schizophrenic.¹⁰ At best, in the absence of an intention to think we have unbidden thoughts, but not inserted thoughts.

Redundancy of Efference Copy

A more basic question: what purpose could *efference copy* have in the realm of thinking? In the case of the visuo-motor system, efference copy serves a pragmatic, control function rather than a verificational one. In effect, the motor system informs the visual and vestibular systems to make adjustments, with very practical effects—for example, stability of the visual field, postural balance, and so forth. The function of efference copy is to inform the visual and vestibular systems that the organism, rather than the world, is moving. Even in the case where the motor system is simply updating and correcting itself, the purpose of efference copy is for motor control. Its purpose is not to verify (simply for the record?) that movement is taking place.¹¹ Nor is it *primarily* an information stream that discriminates between intended movement and non-intended movement. Its purpose is rather to instruct the motor or sensory system to make important adjustments. Is there anything like this happening in the thinking process?

One can certainly distinguish different cognitive systems—memory systems, perceptual systems, and so on. But we are not talking of efference copy playing a communicative role among these systems. It does not seem to be a communication between two different systems, unless, of course, one creates an extra system and calls it the comparator or central monitor. On the Feinberg–Frith model, consciousness seems to be sending *itself* messages. Thus Campbell (1999a: 616) suggests, following Feinberg, that efference copy has the primary function of keeping thoughts on track, checking ‘that the thoughts you actually execute form coherent trains of thought’. To keep thoughts coherent and on track, however, could only mean to keep them on a semantic track, that is, on a certain track of meaning or on a line of logical reasoning. It is odd, however, to assign this task to a subpersonal, non-semantic mechanism when, simply put, we are consciously aware of our thoughts and can keep track of them, and keep them on track, at a conscious, and specifically pre-reflective, first-order, phenomenal level. Simply put, when I think, I consciously think. So the question is whether one really needs a subpersonal comparator (Campbell) or anything like an observational metarepresentation (Frith) to verify that I myself am doing the thinking.

¹⁰ Stephens and Graham (2000) point this out in their critique of Frith’s model. Yet they fail to give an adequate account of this misattribution in their own account (see Gallagher 2004).

¹¹ This is very much in contrast to the idea that efference copy performs a verificational role (Campbell 1999a; Held 1961).

Campbell has argued that Frith’s model provides the most parsimonious explanation of the sense of agency for cognition.¹² Yet Frith’s model would make the normal sense of agency for thinking the work of a separate mechanism—a comparator. Is this necessary in a system that already involves consciousness? The matching process at the comparator would supposedly involve a curious and confusing mix of conscious and non-conscious elements. If we follow Campbell rather than Frith, efference copy is not something of which we are conscious; the other element of the match, however—the stream of thought itself—is already a matter of consciousness. Supposedly the *outcome* of the match, the sense of agency, must also be conscious in some way—a conscious sense that I am the one who is generating the thoughts. One might suppose, however, that the verifying match in the subpersonal comparator would not be conscious (otherwise there would have to be a consciousness of something that remains non-conscious—efference copy).

Hyperreflection

Despite its subconscious status, Campbell describes the comparator process as involving a form of introspection: ‘it is the match between the thought detected by *introspection*, and the content of the efferent copy picked up by the comparator, that is responsible for the sense of ownership of the thought’.¹³ Campbell’s use of the term ‘*introspection*’ in this context is, I think, relatively innocuous. He is following a tradition that uses the term to mean something like an immediate reflexive access (‘from the inside’), which allows one to report ongoing experience, rather than anything like a full-fledged act of reflective introspection.¹⁴ Frith, however, invokes the notion of metarepresentation, as a full-fledged higher-order act of reflection. But a metarepresentational introspection again threatens infinite regress; I would have to ask, Is this my metarepresentation? Metarepresentational introspection is itself a thinking process and my intention to metarepresent would have to generate its own efference copy, to be matched up on top of the original

¹² ‘On reflection, it also seems that this is not just one possible theory; it is the simplest theory which has any prospect of explaining the sense of agency, and we ought to work from it, introducing complications only as necessary’ (Campbell 1999a: 612).

¹³ Campbell (1999b)—emphasis added. He also states: ‘You have knowledge of the content of the thought only through introspection. The content of the efferent copy is not itself conscious. But it is match at the monitor between the thought of which you have introspective knowledge and the efferent copy that is responsible for the sense of being the agent of that thought. It is a disturbance in that mechanism that is responsible for the schizophrenic finding that he is introspectively aware of a thought without having the sense of being the agent of that thought.’

¹⁴ This use of the term can be found in Shoemaker (1986). Although Shoemaker begins by discussing Hume’s reflective-introspective search for the self he criticizes the perceptual model of introspection as an ‘inner sense’ that would take primary consciousness as an object, or that would involve an identification of self. He is not committed to regarding introspection as a separate act of reflective consciousness. Shoemaker’s notion of introspection is clearly stated by Cassam (1995: 315): ‘introspective awareness, properly so called, is a form of awareness that serves as the basis for making first-person statements in which the first-person pronoun is used as subject. First-person statements in which “I” is used in this way are those that, in Shoemaker’s terminology, are immune to error through misidentification relative to the first-person pronoun.’

match. It would be an extra level of consciousness added to the comparator's verification process. Again, in the case of thinking, which is already conscious, it seems to me that either the metarepresentation or the comparator's match (or both) is (are) redundant.

Not only does the requirement of metarepresentational verification not seem phenomenologically parsimonious in normal thought processes, it runs counter to some clinical accounts. Some theorists suggest, in contrast to Frith's notion that there is a *failure or lack* of metarepresentation (central monitoring) in schizophrenia, that there may be *too much* of it in schizophrenia. In principle, at least, it seems possible for metarepresentation to go wrong in at least two ways. First, as Frith emphasizes, it can fail in such a way that the schizophrenic can be left without the ability to monitor his own experience. Second, however, as Sass (1998) suggests, metarepresentation can become hyperreflective, and as a result, the schizophrenic can over-monitor aspects of his own experience. The failure of self-monitoring may be that there is too much of it going on (Sass 1998; Zahavi and Parnas 1998).¹⁵ It is also possible that the disruption of metarepresentation can be selectively Frithian and Sassian. As a result of a failure to monitor certain aspects of his experience the schizophrenic may hyperreflect about what is absent from or odd about his experience. A schizophrenic may have great difficulties with attention, not because of a complete lack of attention, but because he is attending in a high degree to certain aspects of his experience that are different. To develop this suggestion, however, we need to think of this failure of monitoring, not on the Frithian model, as a failure of metarepresentation, but as a failure of some aspect of pre-reflective self-awareness (see below).

Temporality and the Episodic Nature of Positive Symptoms

A further set of problems with Frith's model involves its static nature. Frith takes no account of the temporal flow-structure of thought. To be clear, Frith may very well understand that the subpersonal comparator mechanisms involve issues of timing (for example, when does efference copy arrive at the comparator relative to registration of the conscious thought; or when precisely does the comparator do its job?).¹⁶ What he does not account for, however, is the temporal structure of the thinking itself, which is part of the input to the central monitor.

¹⁵ 'What happens here [in the case of the schizophrenic] is that the *ipseity*, the normally tacit or unnoticed "myness" of the experience, which is a precondition or a medium of any natural, spontaneous and absorbed intentionality, is deranged, and becomes an object of introspective intentionality' (Zahavi and Parnas 1998: 700).

¹⁶ Georgieff and Jeannerod (1998), referring to the same kind of comparator model in the context of explaining motor action, describe it in implicitly temporal terms. Efference copy is said to create an 'anticipation for the consequences of the action'. Their description raises a number of issues that need to be explored: does efference copy reach the comparator prior to the registration of the motor action so that there is a real basis for anticipation; or does it reach the comparator simultaneously with the registration of the motor action, so that a simultaneous matching occurs? Spence (1996) raises a slightly different set of issues involving timing.

It is quite possible to incorporate temporality into Frith's model (see below) and I think to do so would help to address another serious objection that can be raised against it. If, in the case of schizophrenia, one of these comparator mechanisms goes wrong or is put out of operation, why do not all thoughts seem alien?¹⁷ If either the TGM fails to generate efference copy or the central monitor fails to register efference copy, how do we explain that these mechanisms do seem to work normally sometimes, since not all the schizophrenic's thoughts are experienced as inserted thoughts? I will refer to this as *the problem of the selective or episodic nature of positive symptoms*. Selectivity involves the fact that when a particular thought seems inserted, there are other aspects of conscious experience that necessarily do not seem inserted. Either simultaneously with, or immediately after, the thought that seems inserted, there is the sense or feeling or realization that it is inserted. But this sense or feeling or realization does not itself feel inserted. That is, the subject, in recognizing a thought as inserted, does not claim that his recognition of this fact is inserted. He is rather speaking 'in his own voice' when he complains about the inserted thought. That this is the case is clear, not only from empirical reports by patients, but by logical necessity. The subject's complaint that various thoughts are inserted depends on a necessary contrast between thoughts that seem inserted and those that do not seem inserted—and at a minimum, the thoughts that constitute the subject's complaint cannot seem inserted. If all thoughts were experienced as inserted by others, the subject would not be able to complain in his own voice. He would not maintain a sufficient sense of ownership for his cognitive life, or a sense of cognitive 'space' by which to define an insertion. The selectivity problem cannot be explained by a failure of a comparator, since such a failure should also affect the sense of recognition that the thought is inserted. A theory that would credit a higher-order cognitive process (a metarepresentation, or an evaluative introspective judgment) runs into the same problem. It would need to explain why a higher-order cognition that fails to generate a sense of agency for a particular thought or experience is itself experienced as self-agentive. Why is it that a subject can have a sense of agency for one thought, but not for the other? Quite obviously the phenomenology here needs to constrain the cognitive explanation.

The Problem of Specificity

A further problem for Frith's model involves the specificity of positive symptoms. In this regard, in clinically described cases of thought insertion, specific kinds of thought contents, but not all kinds, appear to be thought inserted. It is not simply

¹⁷ This objection was raised by Louis Sass at the NEH institute on Mind, Self, and Psychopathology, Cornell University, 1998. One can see this problem in Frith's (1992: 93) description of the neurophysiology associated with the positive symptoms of schizophrenia. 'Positive symptoms occur because the brain structures responsible for willed actions no longer send corollary discharges to the posterior parts of the brain concerned with perception. This would be caused by disconnections between these brain regions.' One would need to explain why these disconnections are manifested only in some and not all instances.

that in experiences of thought insertion patients occasionally experience thoughts coming into their minds from an outside source. Rather, their experiences are very specific, and are sometimes associated with specific others. For example, a schizophrenic may report that thoughts are being inserted by a particular person, and that they are always about a specified topic. In auditory hallucination the voice always seems to say the same sort of thing. Such specificity phenomena seem to have a semantic and experiential consistency and complexity that cannot be adequately explained by the disruption of subpersonal mechanisms alone.

Global Problems

A more general problem with Frith's analysis concerns the global and heterogeneous nature of schizophrenia and its various symptoms. Schizophrenics have problems, not only with movement and self-reference, but also, among other things, with working memory, episodic and autobiographical memory, and narrative construction (Gallagher 2003c). Is it possible to reduce all these problems to one central difficulty with self-monitoring, or to one comparator mechanism that is neurologically ill-defined? If the subject experiences both delusions of control and inserted thoughts, does this mean that two separate comparators—one in the motor system and one in the conscious thought system—malfunction independently? Or is the implication that one comparator covers both movement and thought? Or is something more global involved? At best Frith proposes similar mechanisms for motor action and cognition, but does not clarify how they might be related, or whether the embodied processes of motor control and cognition are connected.

Desynchronization and Subpersonal Explanation

My aim is not to solve all the problems that I have outlined above. I do want to suggest, however, that we can begin to address some of these problems by clarifying how embodied movement and cognition share some of the same temporal (dynamic) structures. My focus in the remainder of this chapter will be on considerations about the temporal nature of experience and how an understanding of the common temporal structures of both body-schematic and cognitive processes offers a way to address several of the problems involved in Frith's account. My more general aim is to show that this common structure means that embodiment is reflected in all aspects of experience.

A better account of delusions of control and of thought insertion can be had by making Frith's model less static, that is, by adding an explicit account of the temporal structure of experience. I want to pursue two strategies in this regard. On the first strategy, I will stay with Frith's model and, by introducing some considerations about temporality, try to work out a solution to the problem of

the episodic nature of positive symptoms. On the second strategy, however, I suggest that even this enhanced model fails, and that an alternative account that involves a different model of temporality would be more successful.

Following the first strategy, the various cognitive processes described in Frith's model must involve time. That is, if we view the thought process to involve a Jamesian stream of thinking, then the underlying cognitive mechanisms would have to take into account the temporal flow structure of that stream. So in a temporally enhanced Frithian model, the stream of thought would have to be in sync with the streams of efference copy and other signals representing intention and thought generation, in order properly to match up at the comparators. If for some reason the signal streams go out of and then back into sync, then *some* thoughts will seem alien (as in the case of thought insertion) and others will not. One possible answer to the episodic nature of thought insertion, then, involves the idea that *on occasion* information streams go out of sync and there is a failure to match. One way this might happen is if one of the mechanisms occasionally sputters, and in the mode of sputtering, either the streams go out of sync, or the signals are not properly generated, or the comparators do not properly register one or other of the signals (see Fig. 8.4). To be more specific, however, if the TGM sputters, then it would seem plausible that both the generated thought and the efference copy would suffer the effects of the sputtering, and there would still be a synchrony between them. Further, the schizophrenic's phenomenology, if we think of it as being somewhat isomorphic with the mechanism of thought generation, does not seem to indicate anything about the thought stream that would suggest sputtering, other than the variation in the sense of agency. It is not a sputtering thought, but a relatively lucid and intelligible thought that seems inserted. If it is not the TGM that sputters, then the problem would seem to be with the signal representing the intention, or some problem in the forward comparator. These alternatives would leave the thought intact, but, lacking a match with efference copy at the comparator, it would be experienced without a sense of agency, and thus as inserted.

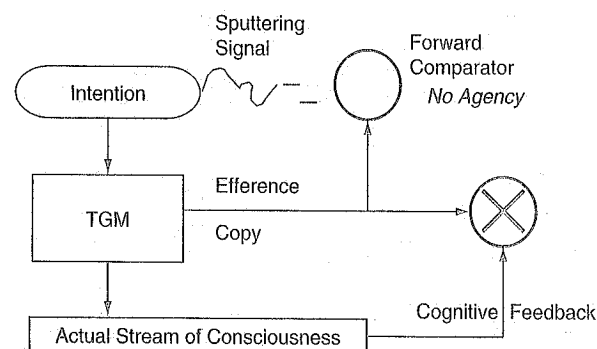


FIG. 8.4. Sputtering mechanism. No match at the forward comparator results in the experience of inserted thoughts.

Whether a sputtering mechanism can account for a desynchronization or not, it is quite possible that one stream simply slows down relative to the other one. There is good evidence that neuronal processes (information processing) may slow down in circumstances of brain injury, and under the influence of alcohol and/or various drugs. Many times these neurophysiological distortions are accompanied by distortions in the experience of time—distortions not unlike those experienced by schizophrenics (see Pöppel 1994; Pöppel, von Cramon, and Blackmund 1975). Quite relevant to the phenomenon of hearing voices, there is evidence to suggest that auditory centers are susceptible to such slowing, on the order of over three times difference from normal (Pöppel 1994). Slowing of such processes, if, for example, they affected one sense modality more than others, or affected specific and strategic neuronal functions, could easily cause a form of 'temporal diplopia' (p. 192) in which efference copy comes to be out of joint with the conscious stream. This discrepancy might also explain the breakdown in experienced continuity suffered in some schizophrenics (Pöppel 1994: 199).

The effects of such subpersonal distortions, however, even if they only occasionally caused the disruption synchrony, would have to involve a relatively sophisticated sputtering or neurophysiological slowing in order to account for the actual phenomenology of the schizophrenic. The selectivity problem of the episodic nature of positive symptoms is complicated by the specificity problem. It is not simply that in thought insertion patients occasionally experience thoughts coming into their minds from an outside source, but in terms of content, their experiences are very specific and are often associated with specific others. Schizophrenics may experience a certain semantic consistency amid the agentive inconsistency of their inserted thoughts. That is, inserted thoughts often seem to be of a similar mind-set. This semantic and experiential consistency cannot be adequately accounted for by a disruption of subpersonal processes.

For example, a schizophrenic will report that a particular person inserts certain thoughts, and that they are always about a specified topic, or that the voice always seems to say the same sort of thing. Frith gives the following example: 'Thoughts are put into my mind like "Kill God". It's just like my mind working, but it isn't. They come from this chap, Chris. They're his thoughts' (1992: 66). Some patients feel controlled by other people, or even by machines (see e.g. Bovet and Parnas 1993). Part of the explanation, then, would seem to depend on the intentional content of the thought, and not simply on a subpersonal disruption of efference copy. If subpersonal malfunctions, or predispositions to such malfunctions, are part of the explanation, then we might have to think of intentional content as a possible trigger that would disrupt such functions.

Thus, a subpersonal explanation does not entirely resolve the specificity or selectivity problems, which may in fact have their proximate cause on the level of personal/semantic/intentional content. What kind of personal-level events could trigger a subpersonal desynchronization? There is good evidence and there are good arguments to show that intentional content has an effect on the temporal structure of experience (Friedman 1990; Gallagher 1998; James 1890). Temporal structure is

not purely formal. Experience speeds up or slows down according to what we are experiencing. Consider, for example, the ordinary experience of how time passes when we are with different people. In some cases time passes too quickly, in other cases too slowly. Complicate this picture with emotion and/or the unconscious (whatever you take that to be). If boredom can slow the system down, and enjoyment and interest speed it up, perhaps anxiety or some such emotion can cause a desynchronization in the system. Would it not be possible that in some schizophrenics, in the presence of certain significant individuals, or in certain kinds of situations, or confronted with certain objects, or on the occasion of an unbidden thought, an unruly emotion, for example anxiety or fear, might trigger (unconsciously) a disruption in predisposed cognitive mechanisms? The result would be a desynchronization brought on by an emotion that prenoetically shades and shapes cognitive processes. The force of the emotion would be cashed out in terms of embodiment. It would involve neurophysiological and autonomic changes, caused by changes in the intentional content of experience.¹⁸ Just in such cases or similar circumstances, frequently linked to an emotional encounter, a schizophrenic subject would then (but not always) experience thought insertion. This kind of explanation would address both the selectivity and specificity problems. One unresolved difficulty with this proposal, however, is the fact that although some schizophrenic patients present with dysphoric mood (depressed, anxious, irritable, or angry mood), in most cases they demonstrate flattened emotional patterns, that is, flat affect rather than a state of emotional upset. I return to this issue in my considerations of an alternative model.

An alternative model is motivated because even the enhanced Frithian model still involves a number of the other unresolved problems: the uncertain status of an intention to think, the redundancy of efference copy in a system that involves conscious thought, the uncertain role of metarepresentation, the fact that the model does not explain misattribution of agency, and the other global problems. Although there is no question of explaining all the complex aspects of schizophrenia, there is an alternative model that addresses many of the problems just mentioned.

An Alternative Model: The Ubiquitous Temporal Structure of Experience

To develop an alternative model it will be helpful to return briefly to the context of motor action. There we distinguished a sense of ownership from a sense of agency, and we suggested that this same distinction could be worked out in the context of

¹⁸ See Ch. 6. Gerrans (1999), and the work of Young (1999) and Damasio (1994) provide some indication of how to think of affect as crossing personal and subpersonal levels.

cognition. In terms of underlying mechanisms, we distinguished two basic models in regard to motor action:

1. an ecological, sensory-feedback model that delivers a sense of ownership for action;
2. an *anticipatory* pre-action or forward model that delivers a sense of agency for action.

I note two things in regard to these *body-schematic* systems. First, both the experiential aspects of intentional motor action, the sense of ownership and the sense of agency, are normally experienced as *intrinsic* to the action. They are *phenomenologically indistinguishable properties of the acting itself*. Second, the pre-action system is *anticipatory*. Alain Berthoz in his recent work on movement, makes much of the ubiquity of such anticipatory mechanisms in the sensory-motor systems. Anticipation is 'an essential characteristic of their functioning', and serves our capacity to reorganize our actions in line with events that are yet to happen (Berthoz 2000: 25). Georgieff and Jeannerod (1998) also emphasize this anticipatory character of motor control: efference copy is said to create an 'anticipation for the consequences of the action'. Neurological and behavioral evidence suggests that the sense of agency for action, which goes awry in pathological symptoms such as delusions of control, is not based on a *post factum* sensory-feedback match occurring subsequent to the action or thought, even if we consider this a concurrent confirmation implicit to action, and as enhancing the sense of agency. Rather, the sense of agency is generated in a control function (the forward model) that anticipates action (see Jeannerod 2001; MacKay 1966; Wolpert, Ghahramani, and Jordan 1995).

As we have indicated, efference copy may indeed play an important practical (control) role in the case of visuo-motor systems, but it is not clear what role it would play in the stream of thought. Alternative and more parsimonious explanations for a sense of agency that is *intrinsic* to thought, and for the loss of the sense of agency in schizophrenic thought insertion, can be advanced by employing a phenomenological model of the retentional-protentional structure of consciousness. Starting with an analysis of this temporal structure developed by Husserl (1991), one can develop a phenomenologically based cognitive model. Husserl finds phenomenological evidence for what he calls 'retentions' and 'protentions' as structural features of consciousness. As part of a cognitive model, these structures may be regarded as prenoetic operations that generate the flow-structure of consciousness and are related in some general way to working memory. They constitute the pre-reflective structure of consciousness. My conscious experience includes a pre-reflective sense of what I have just been thinking (or perceiving, or remembering, etc.) and a pre-reflective sense that this thinking (perceiving, remembering, etc.) will continue in either a determinate or indeterminate way. This phenomenological temporal sense is based on retentional and protentional processes that ultimately need to be cashed out in terms of neurological processes. Although such suggestions go beyond Husserl's phenomenological analysis in the direction of neuroscience, they follow the same logic of time-consciousness that he outlines.

I will explicate in a brief and relatively rough manner Husserl's phenomenology of time-consciousness. I can do this most expeditiously by referring to a diagram (Fig. 8.5). This diagram, and Husserl's theory, not only explain how the perception of temporal objects, such as a melody, is possible, given an *enduring* act of consciousness, they also explain how consciousness unifies *itself* across time.¹⁹ The horizontal line ABCD represents a temporal object such as a melody of several notes. The vertical lines represent abstract momentary phases of an enduring act of consciousness. Each phase is structured by three functions:

- *primal impression* (pi), which allows for the consciousness of an object (a musical note, for example) that is simultaneous with the current phase of consciousness;
- *retention* (r), which retains previous phases of consciousness and their intentional content;
- *protention* (p), which anticipates experience that is just about to happen.

In the now-phase there is a retentioning (r_3) of the previous phase of consciousness. Of course the just-past phase includes its own retentioning of the prior phase. This means that there is a retentional continuum— $r_3(r_2(r_1))$, and so forth—that stretches back over prior experience. The continuity involved in retention has two aspects. The first provides for the intentional unification of consciousness itself since retention is the retention of previous phases of consciousness. Husserl characterizes this as the longitudinal intentionality (*Längsintentionalität*) of retention. But since the prior phases of consciousness contain their respective primal impressions of the previously sounded notes, there is also established a continuity of the experienced

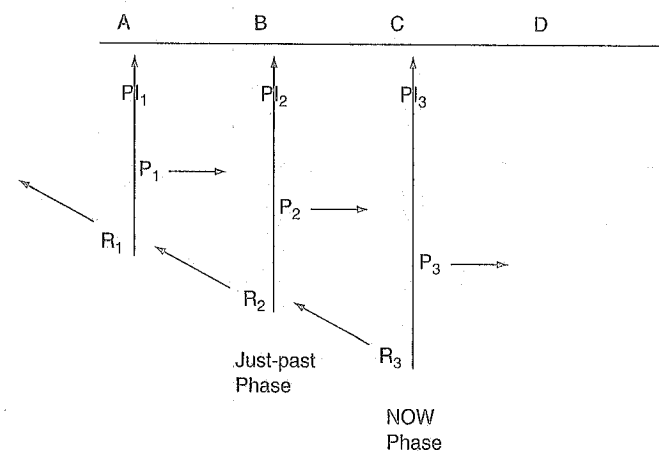


FIG. 8.5. Husserlian model of time-consciousness.

¹⁹ A more detailed account can be found in Husserl (1991). For an extended analysis of Husserl's model and its similarities and differences from James's and Broad's notion of the specious present, see Gallagher (1998).

object. Husserl (1991: 85) calls this the 'transverse intentionality' (*Querintentionalität*) of retention.

The example of speaking or listening to a sentence may help to clarify some things. Consider the beginning of a sentence: 'I often think that Julia...' When in uttering this sentence I reach the word 'Julia' I am no longer saying the previous words, but I still retain a sense of what I have just said. For a sentence to be meaningful, for a speaker or listener, the sense of the earlier words must be kept in mind in some fashion when I am uttering the later words. *Retention*, or what cognitive scientists call working memory, keeps the intentional sense of the words available even after the words are no longer sounded. Built into this retentional (longitudinal) function is the sense that I am the one who has just said these words. The words do not become part of a free-floating anonymity, nor do they seem to belong to someone else; they remain, for me, part of the sentence that I am in the process of uttering, because they remain part of my stream of consciousness. In addition, at the moment that I am uttering 'Julia', I have some anticipatory sense of where the sentence is going, or at the very least, that the sentence is heading to some kind of ending. This sense of knowing where the sentence (the thought) is heading, even if not completely definite, seems essential to the experience I have of speaking in a meaningful way. It helps to provide a sense that I am speaking in a sentential fashion, and not speaking a meaningless set of phrases. Indeed, one might say that this working anticipation helps me to keep my utterances sentential and on track.

Protention provides consciousness with an intentional sense that something more will happen. Although Husserl provides an exhaustive explication of retention, he says very little of protention, except that it is like retention in the direction of the future. Husserl does point out that the protentional aspect of consciousness allows for the experience of surprise. If I am listening to a favorite melody, there is some sense of what is to come, a primal expectation of the notes to follow, and the best indication of this is that if someone hits the wrong note, I am surprised or disappointed. If a person fails to complete a sentence, I experience a sense of incompleteness. This kind of perceptual disappointment is based on a lack of fulfillment of that primal expectation that Husserl calls protention. In some sense we might speak here of a failure to match my anticipation with what actually happens. The content of protention is not always completely determinate, however. Indeed, to the extent that the future itself is indeterminate, the content of protention may approach the most general sense of 'something (without specification) has to happen next'.

Husserl's analysis of protention does not go much further. As we saw above, however, in his analysis of retention he suggests that there is a double intentionality—one aspect of which is directed at the content of experience and another at consciousness itself. This double intentionality involves a structure that is similar to the Gibsonian notion of an ecological self-awareness.²⁰ That is, I am not only aware

²⁰ It would be difficult to explicate the similarities and differences between Gibsonian psychology and Husserlian phenomenology on such points. Gibson (1987: 418) himself was inclined to think of his ecological model as applying to thinking as well as to perceptual and motor functions. Awareness of the

of the melody, I am implicitly self-aware of being aware of the melody—to put it in its adverbial form, I am *consciously* aware of the melody (see Thomasson 2000).

My experience of the passage of a melody is at the same time a non-observational, pre-reflective awareness of my own flowing experience. This retentional self-awareness delivers a sense that this thinking process is *mine*—that I am the one who is listening to the melody or uttering the sentence. Without meaning to suggest any other kind of symmetry, is there not something like a double intentionality involved in protention as well? That is, my anticipatory sense of the next note of the melody, or of where the sentence is heading, or that I will continue to think, is also, implicitly, an anticipatory sense that these will be experiences *for me*, or that I will be the one listening, speaking, or thinking. In effect, protention also has what Husserl calls a longitudinal aspect—it involves a projective sense, not only of what is about to happen, but of what I am about to do or experience.

In the normal case the sense of agency with respect to my own thought comes not retrospectively, as if I had to stop to think whether I am really the one who is thinking (this in contrast to Frith's metarepresentation). Rather, it is a sense that is built into thinking itself. It is part of the very structure of consciousness. The fact that it is not retrospective, or a matter of verification, suggests that it is not initially a matter of the retentional aspect of this structure. Rather, following the clues from our considerations of motor action, I want to suggest that the *protentional* mechanism underlies the sense of agency for thought, or more precisely, that protention is a necessary but not a sufficient condition for the sense of agency. The function of *retention*, on the other hand, is, in part, to provide a sense of ownership for thought.

Consider first that thought may be generated by the subject in a willed and controlled fashion. Problem solving, thinking through a set of instructions, and narrating a story are good examples. I may intend to solve a problem and to do so by following precise steps in a known procedure. I have a sense of where I am going in the procedure, and I push the thinking process along from one step to another in a controlled manner. When I follow a set of instructions, or when I tell a story (perhaps just to myself), I have the same sense that I am promoting my thinking along a path that is, or is becoming, relatively well defined. In such cases, the protentional aspect of consciousness operates to give me a sense of where the thinking process is going *in its very making*, that is, as it is being generated and developed. It provides a sense that the thinking process is being generated in my

persisting and changing environment (perception) is concurrent with the persisting and changing self (proprioception in my extended use of the term). This includes the body and its parts and all its activities from locomotion to thought, without any distinction between the activities called "mental" and those called "physical". If we try to look beyond the different starting points involved in these models, there is one important structural difference. For Gibson, the proprioceptive awareness of the changing self comes about only on the basis of awareness of the changing environment. In these terms, I would be aware of my own flowing experience only as a result of being aware of the changing environment. For Husserl, retention of the past phase of the objective content (transverse intentionality) is possible only on the basis of retention of past phases of consciousness itself (longitudinal intentionality). Translated to Gibsonian terminology, proprioceptive awareness is the basis for the experience of a coherent objectivity.

own stream of consciousness and, to some degree, under my control. Consider what would happen if I had no protentional anticipation of what was to come. In that case I would be left to the mercy of chance and constantly surprised.

A second kind of thinking, however, may be more passive. Unbidden thoughts, memories, fantasies, and so forth, may invade our current stream of consciousness. These are thoughts for which we may have no sense of agency. Still, in such cases, we have a sense that these thoughts are coming from ourselves, rather than from some alien source. Not only do they appear to be part of my stream of consciousness, but, despite the fact that I am not willing them, and may even be resisting them, they still seem to be generated within my own cognitive experience. Protention, in such cases, may be operating perfectly well, providing a sense of where these thoughts are coming from and where they are heading, as they are being passively generated, even within the framework of an unwanted memory or an unwelcome fantasy. Protention may also function to provide a sense of *not knowing* where we are heading, that is, providing a sense of uncertainty, or indeterminacy with respect to where such thoughts will lead. For even though I do not intend such thoughts, nor have a sense of where they are heading, I do feel that they are leading somewhere, and I still have a sense that they are originating and developing within my stream of consciousness. Protention provides some kind of expectancy for them, even if it is completely indeterminate.

What would happen, however, if, just in such cases of unbidden thoughts, the protentional function itself failed? Thinking would continue to happen, but there would be neither a sense of agency, nor a sense that these thoughts were being passively generated in my cognitive system, even though they were appearing in my stream of consciousness. I would be unready for such thoughts. They would appear as if from nowhere, and their occurrence would be sudden and unexpected. I would be able to make sense of them only in their retentional train, in retrospect, but not as something self-generated. Protention normally puts me in the forefront of my thoughts and allows me to take them up as my own product, as they develop. Lacking protention, thoughts would seem to impose themselves on me.

Consider listening to a partial sentence uttered by someone else. 'I often think that Laura...' Normally, protention, and the context, allow me to make sense of the sentence as it is being uttered. I might even be tempted to complete the sentence because I know what the person is going to say. Or, even if I do not know what the person is going to say, I could quickly organize a reasonable end to the sentence—as people often do when someone seems unable to find the right words to finish the thought. But consider a case in which I am caught completely by surprise, as when someone close by, but out of sight, suddenly yells 'Surprise!' In this case, there is no anticipation of the event, even of the most indeterminate kind. The event passes before I realize it is happening. In listening to someone form a sentence, I have a sense of how it is being formed; but in the case of the sudden shout, I catch onto it only as it comes into retention. Absent a properly directed protention, the sudden and quickly formed event is *already made* by the time I come to grasp it. Over the course of a second or two, however, an adjustment of attention

will bring this event and whatever follows into its proper framework; I regain a sense of where the voice is coming from and its significance, and my experience is quickly put back on track.

A similar surprise effect may be had, however, if, instead of an external event catching the protentional function off guard, something goes wrong with the protentional mechanism itself. Imagine my surprise if it was I who yelled 'Surprise', without any expectation on my part of doing so. Or, if in the case of an unbidden thought for which I have no sense of agency, something goes wrong with the normal anticipatory sense of what my own thinking will be, the result will be a sense that the thought is not being generated by me.²¹ Thought generation, like any experience, is normally protentional. Without protention, thought continues, but it appears already made, not generated by me, appearing suddenly, already formulated as it enters into retention. It is a thought that is neither intended nor anticipated; it will seem to be a thought in my stream of consciousness, but not a thought generated by me. In some way I am not open to it; I am not projected or absorbed into it; it feels alien and less than transparent to me.

Indeed, this may also be the case with intended thoughts for which I would normally have a sense of agency. Without protention, whatever intention I may have, whatever sense I would have of where my thoughts will be going, or whatever sense I have of where I will be going with them, or where I will them to go, is disrupted. My non-observational, pre-reflective sense of agency for my own thinking, which is normally based on anticipatory aspects of experience, will be deferred by the lack of protention. That is, my intention will register experientially only after the fact (as it is captured in retention). In this case, I experience thoughts that seem not to be generated by me but seem to have anticipated what I wanted to think. A schizophrenic patient will sometimes report that another person seems to know what she is thinking before she actually thinks it. The thought seems to match up with her own intention, but it still seems to her that she is not the agentive cause of the thought.²²

Thus, *without protention*, in cases both of intended thought and of unintended thinking, thinking will occur within the stream of consciousness that is not experienced in the making, but is nonetheless captured by a retentional structure that continues to function and, in its longitudinal function, to provide a sense of ownership for that stream. I will experience what is actually my own thinking, as thinking that is not generated by me, a thinking that is *already made* or preformed for me, as if I were a receptor of thought. It is only then, on the basis of this first-order experience of alien thought, that a metarepresentational element might be

²¹ Something along this same line happens when one is falling asleep. Both protentional and retentional mechanisms seem to close down. Consider what happens to comprehension when one is falling asleep while reading. In dreaming too, one does not have a good sense of what will happen next, or a good sense of what has been happening. Memory for dream content is limited because retention dissipates too quickly to register in episodic memory.

²² Spence (1996: 82) cites a case that he interprets in this way. He indicates, however, that this kind of experience resembles something that is more frequently found in anarchic hand syndrome, that is, in cases where a subject loses control over a limb.

initiated in the patient, a reflective introspection that is likely to become the hyperreflection characteristic of schizophrenic experience, motivated by something gone wrong with the flow of consciousness. In metarepresentation the patient may start to ascribe the thought to some particular force or individual and report that it has been inserted.²³

We can see good evidence for the breakdown of the protentional function in schizophrenia in an experiment carried out by Frith and Done (1988). It had been demonstrated that a randomly occurring tone elicits a relatively large response in EEG, but that if the tone is self-generated, for example by pushing a button, the EEG response will be of much smaller amplitude (Shafer and Marcus 1973). In the latter case, the protentional anticipation of the tone, linked to the subject's own agency, obviously diminishes the evoked response. Frith and Done tested schizophrenic patients with positive symptoms using the same paradigm. They verified that for 80 per cent of these subjects the evoked responses to self-generated tones were similar in amplitude to the evoked responses to randomly occurring tones. That is, compared to controls, the relatively high EEG response for self-generated tones suggests that the schizophrenic patients did not expect the tone, despite their own agency in its production.²⁴

A breakdown in the protentional function is also consistent with the schizophrenic's experience of time. Minkowski, who describes schizophrenia as involving 'acts without concern for tomorrow', 'fixed acts', 'short-circuit acts', and 'purposeless acts', quotes one of his patients: 'There is an absolute fixity around me. I have even less mobility for the future than I have for the present and the past. There is a kind of routine in me which does not allow me to envisage the future. The creative power in me is abolished. I see the future as a repetition of the past' (1933: 277).²⁵

Empirical studies show that schizophrenics experience difficulties in indexing events in time, and these difficulties are positively correlated to inner-outer confusions (manifested in symptoms such as auditory hallucinations, feelings of being

²³ Spence (1996: 81) suggests that thought insertion involves two elements: first, alienation from one's own thoughts; second, 'a delusional elaboration' which seeks to explain the former. The delusional elaboration takes place at the metarepresentational level and follows the initial alienation that has already occurred at the level of pre-reflexive consciousness. This is consistent with the view developed by Parnas (2000) and Sass (2000). The second, but not the first, element is consistent with Stephens and Graham (2000). The first, but not necessarily the second, is consistent with Gallagher (2004).

²⁴ A similar result was found by Posada *et al.* (2001). They showed their subjects colors appearing on a computer screen in a fixed temporal order. The subjects were able to learn the sequence of colors easily, by watching and repeating the color names verbally. During the learning process they were instructed to press a key each time a given color appeared on the screen. As a subject learnt the order, the time to press the key sharply decreased so that after a certain time, the key was pressed in anticipation *before* the color was shown. Schizophrenic patients were able to learn the sequence normally, but in contrast to a normal control group, they proved to be impaired in using their explicit knowledge to produce anticipatory responses. Differences were not due to differences in reaction times.

²⁵ This explanation may also account for the perseverative repetitious responses that are often found in schizophrenic patients. A failed protentional mechanism may explain difficulty in generating spontaneous actions, a negative symptom in schizophrenia, as well as difficulties in performing self-directed search (see Frith 1992: 48).

influenced, delusional perceptions, and so forth), problems that involve distinguishing between self and non-self (Melges 1982; Melges and Freeman 1977). Other studies suggest that future time-perspective is curtailed in schizophrenia (Dilling and Rabin 1967; Wallace 1956). Schizophrenics have difficulty planning and initiating action (Levin 1984) and problems with temporal organization (DePue, Dubicki, and McCarthy 1975; Klonoff, Fibiger, and Hutton 1970). Bovet and Parnas (1993: 584) describe these problems in general terms as an 'impairment of self-temporalization' and they are certainly symptoms we might expect if the protentional mechanism malfunctions. It is suggestive, and perhaps important, that Singh and his colleagues have linked these temporalization problems with the same neurological dysfunctions involved in the schizophrenic's voluntary movement (Singh *et al.* 1992; also see Graybiel 1997).

The temporal structure that is shared by consciousness, cognition, and action is evidenced in the precise timing that is covertly present in coordinated movement and consciousness of that movement. If I am asked to tap my foot simultaneously with movement of my finger, the two movements are experienced as precisely simultaneous, when in fact the foot moves slightly before the finger in objective time. This temporal discrepancy in movement accommodates the extra time it takes for proprioceptive signals from the foot to reach the brain (Jacques Paillard, private correspondence). If this precise timing were disrupted to a significant degree, it is likely that the subject would experience the self-generated movement as alien.

Consider a report made by Cole, Sacks, and Waterman (2000). They explain how during an experiment with robotic arms at NASA's Houston Space Center they were led to misidentify the robotic arms as parts of their own body. It is to be noted that Jonathan Cole and Oliver Sacks both have normal proprioception; Ian Waterman, as we know from Ch. 3, does not.

The robot's arms have joints which move like human arms and three fingers on each hand. The arms are viewed by the human subject through a virtual reality set placed over the eyes, with robot cameras set in the robot's head, so that one views the robot arms from a similar viewpoint as one views one's own arms. No direct vision of one's own body is possible, as one sits across the room from the robot. A series of sensors are placed on one's own arms which in turn control the robot arms' movement. Then when one moves, the robot's arms move similarly, after a short delay.

Then one sees and controls the robot's moving arms, without receiving any peripheral feedback from them, (but [for JC and OS] having one's own peripheral feedback from one's unseen arms). We transferred tools from one hand to another, picked up an egg and tied knots. After a few minutes we all became at home with the feeling of being in the robot. Making a movement and seeing it successful led to a strong sense of embodiment within the robot arms and body. This was manifest when one of us thought that he had better be careful for if he dropped a wrench it would land on his leg. Only the robot arms had been seen and moved, but the perception was that one's body was in the robot. This feeling was present in able-bodied people who have tried the robot and in a subject [IW] with a large fibre sensory neuropathy without the sensations of movement/position sense or light touch below the neck. (Cole, Sacks, and Waterman 2000: 167)

Cole, Sacks, and Waterman note the existence of a short delay between motor command and robotic movement. The question is, how long could that delay become before the sense of agency breaks down?

To answer this, and to see the importance of timing to the sense of agency, consider a different set of experiments. Jesper Brøsted Sørensen, a psychologist at the University of Copenhagen, asked me to help test an 'alien hand' experiment that he designed (see Sørensen 2005). The apparatus he was using was actually a very old one, originally used by Nielsen (1963) (see Fig. 8.6). As the subject in the experiment I look through a scope to see a piece of paper on which I am going to draw a straight vertical line from point A to point B. Through the scope, however, I cannot see point A, although I can see point B and the space between A and B. Point A is visible to me only before looking into the scope, and I set the point of my pen at A prior to the start of the test. I wear a glove on my right hand, which is the hand with which I am going to draw. The task is very simple and I perform it without difficulty on the first three trials. On the fourth and subsequent trials, however, something goes wrong. My hand veers off to the right and draws a line that misses point B by about 10 degrees. Not only do I see my hand veer off to the right, but the proprioceptive feel is as if my hand is being pulled to the right, against my will. It turns out that this is an illusion in which vision distorts proprioceptive awareness. The experimental apparatus allows the experimenter to play some tricks on the subject. Jesper, invisible to me on the other side of the apparatus, has the matching glove on his left hand and is drawing a line 10 degrees to the left of a different point B. A mirror set at 45 degrees has been shifted in such a way that when I look through the scope I actually see Jesper's hand drawing his line. Both my vision and my proprioception are fooled.²⁶

The illusion concerns self-awareness of self-generated action. Throughout the experiment, my sense of ownership and sense of agency for the action remained intact, despite the feeling that some force was pulling my hand off course. Deprati *et al.* (1997), however, using a similar design, showed that at a discrepancy of above 10–15 degrees normal subjects start to suspect that the hand they see really isn't their own. For schizophrenics, the divergence has to approach 30 degrees. In those cases where movements of the alien hand were close to identical to the subjects, non-schizophrenic subjects were unable to tell that it was not their hand 30 per cent of the time; but for schizophrenics who suffered from delusions of control, the percentage was closer to 80. But what happens if, instead of a spatial discrepancy, we introduce a temporal discrepancy? An experiment conducted by Franck *et al.* (2001), based on Nielsen's (1963) original paradigm, introduces a time delay. In cases where

²⁶ Vision is the primary component of this illusion. If, as I started to draw my line I also closed my eyes, proprioception on its own would tell me that I was drawing a straight line toward point B. And in fact, I would be drawing a straight line toward point B. With my eyes open, however, proprioception works intermodally with vision, and vision controls. Vision tells me that I am veering towards the right, and on that basis I attempt to correct, trying to keep my hand moving towards the target. As a result, the line that I actually draw goes to the left of point B. The proprioceptive sense of my arm being pulled or forced to the right is generated by my effort to correct the line in opposition to what visually continues to be a veering toward the right.

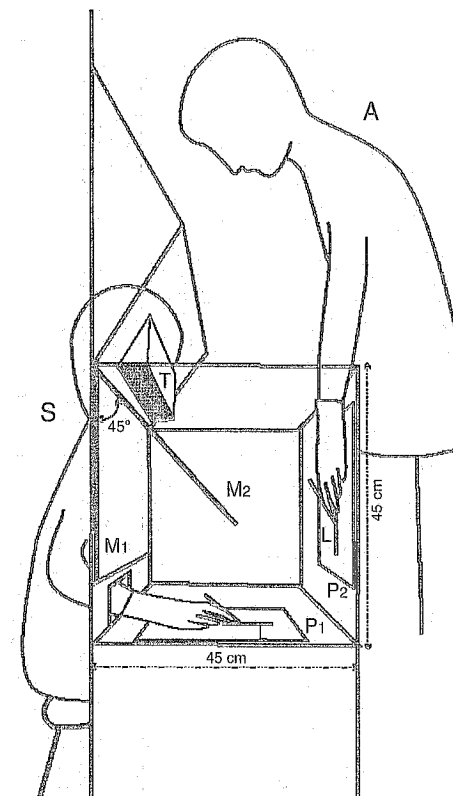


FIG. 8.6. The alien hand apparatus. Source: Sørensen 2005.

normal (non-psychotic) subjects see a computer image of their action at delays up to 150 msec. they judge the observed action to be their own. When the delay is over 150 msec., however, they start to judge the action not to be their own.²⁷

This suggests that in non-schizophrenic experience the protentional anticipation of self-generated movement, and the sense of self-agency, start to dissipate in discrepancies that extend beyond 150 msec. Although I still know that I have moved (I retain a sense of ownership for my action), outside this temporal window what I anticipate as the result of my initiation of action is left unfulfilled; the

²⁷ Schizophrenic subjects, however, don't make that judgment until closer to a delay of 300 msecs. The interpretation of these results is complicated, however, by a number of factors, as noted by the authors—including the fact that the subjects were on medication, and that schizophrenics have difficulty in perceiving slight temporal differences. As we have seen, in some cases, schizophrenics who suffer from delusions of influence seem unable to anticipate the results of their own action (Frith and Done 1988). As a result, patients sometimes attribute their own actions to others ('underattribution'). In other cases their sense of self-agency seems to extend beyond the protentional frame (Franck *et al.* 2001). This results in 'overattribution' in which patients self-attribute the actions of others.

action that is in fact generated by me fails to register within the protentional frame as the one that I generated, and it seems alien to me. If we introduce a delay on this order of magnitude into the NASA experiments with robotic arms, it is likely to produce that same sense of alienation. As Cole, Sacks, and Waterman (2000) suggest, our senses of self-agency and ownership are fragile structures. This fragility reflects the more general frailty of the temporal structures of self-awareness outlined here.

Emotion and Intersubjectivity

This alternative, phenomenologically guided account begins with evidence about the structure of experience, but also lends itself to the explication of subpersonal mechanisms and brain processes that may be responsible for that structure (see the following section). If the episodic nature of positive symptoms, and the specificity problem, require something more than a subpersonal account, however, we need to re-examine the idea that there is a personal-level trigger for this disruption of the temporal structure of experience. So again we must ask what could cause the malfunction of protentional mechanisms that would lead to schizophrenic symptoms? One suggestion, outlined above, is that content has an effect on the temporal structure of experience. Affective content, that is, experiential content that generates prenoetic emotional effects, complicates both the phenomenological and neurological pictures. So again, it is quite possible that in schizophrenia, unruly emotions such as anxiety or fear might trigger a disruption in cognitive mechanisms, specifically a disruption of protention. This may happen in the presence of certain significant individuals, or in a certain kind of situation, or confronted with a certain object, or in rehearsing certain thoughts. In those cases or similar circumstances, and in line with the episodic and selective nature of positive symptoms, a subject would then (but not always) experience thought insertion or similar loss in the sense of agency. It is also possible that this disruption of the protentional function could cause a looping effect that would reinforce the affective trigger. Without protention, for example, it is quite possible that patients would experience the world as being invasive, 'on top of them', too close, etc., which are, in fact, experiences reported by schizophrenics.

Schizophrenic patients manifesting these symptoms do not always appear to be emotionally upset, although in some cases they do. Here I think it is important to distinguish between overt emotional states that may be the result of positive symptoms, and prenoetic disruptions of affective experience that may not always manifest themselves in emotional attitudes. Examples of the former can be found in patients who suffer and report terror (Eilan 2000) or anguish (Sass 2000) as a result of their delusions or their inability to cope with reality. Instances of prenoetic disruptions may lead to just such emotional manifestations, or, in complete contrast, to flattened affect (traditionally classified as a negative symptom). For

understanding the possibility of a breakdown of protentional structure, the idea of a prenoetic disruption of affect is important.

The retentional-protentional structure of consciousness (specifically in its longitudinal aspect) is constitutive of self-identity within the changing flow of consciousness; it generates the basic sense of *auto-affect* or *ipseity* (Parnas 2000; Sass and Parnas 2003). This is the feeling of identity, of being the perspectival origin of one's own experience, which is a basic component of the experienced differentiation of self from non-self. This feeling is an 'affective tonality' that is implicit to the structure of the stream of experience.²⁸ We might say that there is *something it feels like* to be me; something that is sometimes set askew, as when I'm sick I might say that I don't quite feel myself today. This includes the sense that *I am the one who is experiencing*, explicated in terms of my senses of ownership and agency. As Depraz (1994: 75) describes it, in auto-affect, 'I am affected before knowing that I am affected. It is in that sense that affect can be said to be primordial.' This affective tonality is tacit in the sense that I am not usually or explicitly aware of it. Rather, I notice it when it is not there. A short-term disruption motivates reflection on this normally tacit dimension; in the case of the schizophrenic, it can motivate hyper-reflection (Sass 2000).

Some illness, some trauma, some personal-level event may trigger the original disruption of auto-affective protentional functions—functions that in some people, in terms of their neurological underpinnings, may be genetically or developmentally predisposed to disruption. This original disruption may be further reinforced by subsequent emotional reactions. The various positive symptoms are not affectively neutral (even if the content of thought is not overtly emotionally charged), but are characterized by specific affective dispositions, which in some cases involve a lack of or alienation from affect. Such symptoms may lead to hyperreflective behavior, to the fragmentation of meaning, to transformations of intentionality, to a lack of attunement with the world, to abnormal feelings of saliency, or to negative symptoms such as flattened affect.

If the protentional mechanism is essentially linked to affective tonality, and if affective tonality is, as Varela suggests, 'a major boundary and initial condition for neurodynamics' more generally (Varela 1999a, b), then a disruption of protention is likely to involve widespread cognitive and emotional problems of the sort found in schizophrenia.²⁹ As Parnas (2000: 122) indicates, any disturbance in this tacit, auto-affective dimension of ipseity 'is likely to have subtle but broadly reverberating effects; such disturbances must necessarily upset the balance and shake the foundations of both self and world'. Let's add to this, not only self and world, but self and other.

²⁸ This analysis links up closely to Francisco Varela's explication of protention in terms of a primordial affective tonality. Following Husserl (also see Depraz 1994, 1998), Varela (1999a, b) bestows on protention the function of providing a felt tension or readiness for action. See Gallagher and Varela (2002).

²⁹ The emotional problems include incongruity of affect, and flat affect (athymia) (DSM-III-R). Bovet and Parnas (1993) summarize a number of premorbid characteristics of schizophrenia patients, which include difficulties in interpersonal relations, anxiety, neophobia, and defective emotional rapport.

Through all this the one thing that has not been explained is why in schizophrenic symptoms of delusions of control and thought insertion the subject misattributes agency to someone else. The idea that problems with protention can reflect or contribute to problems with the integration of information in the nervous system (and in the next section I suggest that this is the case on a global dynamic scale) and that this can lead to problems with recognizing self-agency, is perfectly consistent with a number of recent brain imaging studies (some conducted by Frith) that attempt to track down the neural correlates of the sense of agency.

Here I will mention one theoretical model that is based on a promising and ongoing empirical research project. This model is usually referred to as the 'Who' system (Georgieff and Jeannerod 1998). Overlapping brain areas, or 'shared representations', in the motor, premotor, and prefrontal cortexes are activated in the following conditions: during motor action, during the observation of another's motor action, and during the imaginative enactment (conscious simulation) of my own or another's motor action. That is, the same neuronal areas are activated when I engage in intentional action and when I see or imagine such action performed by another person. In itself the model of shared representations suggests that there is occasion for a confusion concerning who is doing the action. Jeannerod and his colleagues point out, however, that the distinction between my own action and the action of the other may depend on the non-overlapping areas of this neural matrix. On this model the sense of agency would be generated in those brain areas that are activated when I engage in intentional action but are not activated when I see or imagine someone else similarly engaged, and vice versa. A number of recent studies have fleshed out this model.

Neuroimaging experiments by Farrer and Frith (2002), for example, have shown contrasting activation in the right inferior parietal cortex for perception of action caused by others, and in the anterior insula bilaterally when action is experienced as caused by oneself. Such activation is consistent with the idea that actions performed by others are perceptually mapped in allocentric coordinates (Jeannerod 1999). Farrer and Frith (2002; 601) note that 'there is strong physiological evidence that the inferior parietal cortex [involves this] kind of [allocentric mapping]... to generate representations of body movements [by others] in allocentric coordinates'. In contrast, the anterior insula involves information that is specified in egocentric spatial coordinates. Specifically, the anterior insula involves the integration of various kinds of self-specifying signals generated in self-movement: proprioceptive, visual, and auditory ecological information about movement, and the efference copy (or corollary discharge) associated with motor commands that control movement. It is likely, as Farrer and Frith conclude, that a 'close correspondence between all these signals helps to give us a sense of agency' (p. 602).³⁰

³⁰ Studies by Farrer *et al.* (2003) support this conclusion. Note that in the experiments mentioned here the authors have adopted the same concept I have defined above as the sense of agency, and as outlined in my 2000 paper in *Trends in Cognitive Sciences* (Gallagher 2000a). Other empirical studies consistent with the findings mentioned here have also used this definition (see e.g. Blakemore *et al.* 2000; Chaminade and Decety 2002; Fournier *et al.* 2001; Jeannerod 2003; Ruby and Decety 2001; van den Bos and Jeannerod 2002; Vogeley *et al.* 2001; Vogeley and Fink 2003).

It is also likely that protentional problems in schizophrenia could disrupt the integration of these signals. We also know that in schizophrenic patients the feeling of alien control during a movement task has been associated with an increased activity in the right inferior parietal lobe (Spence *et al.* 1997). Accordingly, if for the schizophrenic some neurological component (the 'Who' model) responsible for the differentiation between self and other has been disrupted, then it is quite possible that some sense of alterity is already implicit in his first-order phenomenal experience. In this case, the attribution of agency to another is not the result of a metarepresentational confabulation that would read into first-order experience something that is not there. Rather, the misattribution of the action or thought to another is a genuine report of what is truly experienced in the pathology.

The Common Structure of Embodied Action and Cognition

The alternative to the Frithian account that I have outlined here requires no mechanisms over and above those that account for the temporal structure of consciousness itself. One does not need to postulate the additional system of a central monitor—self-monitoring is built into consciousness as the longitudinal aspects of the retentional-protentional structure. I do not need a separate stream of efferent copy to verify that I am the one who is thinking; the sense of ownership is already included in the original stream of consciousness. The 'intention to think' is not something separate from thinking itself; it is included in the very structure of thought. The schizophrenic does not discover alien thoughts by means of a metarepresentational introspection; rather he has an immediate, non-observational sense that something is wrong, a first-order phenomenal-level experience that motivates and results in the hyperreflective effects of metarepresentation.

A more complete story about the failure of protention needs to include a subpersonal and neuroscientific account. In terms of traditional cognitive science, the task would be to identify a certain set of subpersonal mechanisms and to cash them out in terms of specific neurological functions. This approach would be partially consistent with Frith's attempt to identify the cognitive mechanisms responsible for the positive symptoms of schizophrenia. That is, one would attempt to identify specific dysfunctions or disconnections in brain structures responsible for integration of signals, or delivery of efference copy to relevant parts of the brain. Affect, however, has a deeply rooted biological basis; affective tonality or disposition may be tied to more global neuronal dispositions, or abnormal levels of neurotransmitters such as dopamine.³¹ Affective attunement can be entirely reordered,

³¹ Parnas indicates that basic auto-affectivity 'is on a biological level, heavily dependent on the evolution of capacities for intra-modal binding of disparate Gestalt features, as well as on the capacities for inter-modal sensory and sensor-motor integrations. Intact intracortical and cortico-cortical connectivity is a necessary condition for such developments' (2000: 143 n. 28). For recent work on the relation between hyperdopaminergic states and hyperreflective, aberrant degrees of saliency for one's own experience and environmental events, see Kapur (2003).

leaving a subject specifically indisposed for experience or action by neuronal events and changes in the balance of neurotransmitters. If, as Varela suggests, affective tonality is, 'a major boundary and initial condition for neurodynamics', then on the neurological level, the sort of mechanism that underlies protention is more appropriately thought of in terms of widely distributed and dynamical processes than in terms of localized functions (Gallagher and Varela 2001; Varela 1999a). This also appears to be in line with the fact that schizophrenia involves global, widespread cognitive and emotional problems. As a result, the conceptual framework for thinking about the neurological mechanisms responsible for symptoms of schizophrenia is likely to be quite different from one focused on such concepts as comparator, central monitor, efference copy, etc. It is likely to involve a more pervasive function such as working memory. A disruption of information-processing in the neuronal mechanisms that underpin working memory could be responsible for the disruption of temporal structures.

It also follows that there is a certain ubiquity to the temporal structure we are here considering. Schizophrenic patients feel alienated not just from thought and action; they also feel alienated from affects, from their own body and skin, from their own saliva, from their own name, etc. (Louis Sass, private correspondence). It seems unlikely that all these phenomena can be explained by problems involving local failures of efference copy—problems that may in fact be secondary to a more global or structural dysfunction. The more general fact is that the temporal, auto-affective structure that shapes cognitive experience also shapes embodied action.³² In the first place, if part of what is at stake in self-generated action is precisely a *sense* or experience of agency, it is likely that the protentional-retentional structure has a role to play in the conscious registration of that sense of agency for movement, or in its failure, for example, in delusions of control. More than this, however, motor action itself, in its prenoetic body-schematic performance, has the same tacit and auto-affective structure that involves the retention of previous postures, and the anticipation of future action.³³

In his original definition, Head noted that the body schema is retentional in that it dynamically organizes sensory-motor feedback in such a way that the final sensation of position is 'charged with a relation to something that has happened before' (Head 1920: 606). He uses the metaphor of a taximeter, which computes and registers movement as it goes. Merleau-Ponty (1968: 173) borrows this metaphor from Head and associates it with temporality—movement is organized prenoetically according to the 'time of the body, taximeter time of the corporeal schema'. And this includes a retentional component: 'At each successive instant of a movement, the preceding instant is not lost sight of. It is, as it were, dovetailed into the present. . . . [Movement draws] together, on the basis of one's present position,

³² Merleau-Ponty recognizes the auto-affective aspect as essential to the body schema: 'The corporeal schema would not be a *schema* if it were not this contact of self with self. . . .' (1968: 255).

³³ Again, more pervasively, across both motor and cognitive functions that pertain to action, Jeannerod points out the involvement of the prefrontal cortex, which is associated with working memory and anticipation (Jeannerod 2001).

the succession of previous positions, which envelop each other' (Merleau-Ponty 1962: 140).

This retentional component is important to keep in view. With the recent emphasis on forward models in the neuroscience of movement the role of reafferent sensory feedback seems to be reduced. But it is essential that reafferent information about current posture be represented in motor preparation. One can say that reafferent signals are not actually present in the forward representation of action (see e.g. Jeannerod 2001) only if one regards that representation as part of a static model, and ignores previous movement. Clearly, specifications about the current posture of the body, which is the result of the just previous movement, must be included in the representation for a movement that I am just about to effect.³⁴

We have also seen good examples of anticipatory or prospective control of movement. The mouth of the newborn anticipates the hand; the grasp of a reaching hand tacitly anticipates the shape of the object to be grasped, according to the specific intentional action involved. Empirical research has shown that protentional or prospective processes are pervasive in low-level sensorimotor actions. Eye-tracking involves moment-to-moment anticipations concerning the trajectory of the target. Reaching for an object involves feed-forward components that allow last-minute adjustments if the object is moved. Since these prospective processes are present even in infants, the 'conclusion that [anticipatory or protentional processes] are immanent in virtually everything we think or do seems inescapable' (Haith 1993: 237).

The emphasis placed on anticipatory aspects of motor control by neuroscientists (Berthoz 2000; Georgieff and Jeannerod 1998; Jeannerod 2001) has served as a good clue to the alternative model we have now formulated. This alternative model points to the common temporal structure of embodied movement, action, and cognition—a structure that breaks down in cases of schizophrenia. We see the disruption of this auto-affective, temporal structure reflected in the cognitive symptoms of thought insertion and delusions of control, leading to loss of a sense of agency for thought and action. But we also see it in the loss of automatic skills, in the disruption of the smooth flow of motor activity, and in symptoms that involve abnormal somatic sensations (see Sass 2000).

In the same way that cognitive disruptions can lead to an introspective hyper-reflection that exasperates and complicates the symptomatology of schizophrenia, somatic and motor problems lead to a hyperreflection that brings to the forefront those prenoetic processes that normally remain in the background. As Sass (2000: 167) suggests, such hyperreflection can generate a body image that exaggerates proprioceptive and kinesthetic sensations, and interferes with the normal functioning of the normally tacit body schema.

³⁴ The importance of dynamical models with respect to body schematic processes has been made clear to me by Francisco Varela and Marc Jeannerod (see Gallagher and Varela 2002; Jeannerod and Gallagher 2001). Given the temporal nature of the body schema as outlined by Head and Merleau-Ponty, the traditional view of these things may not be as static as Jeannerod, Kinsbourne (2001), and Sheets-Johnstone (2003) think. They nonetheless offer an important criticism by emphasizing a more dynamic view in regard to embodied experience.