

## CHAPTER 15

# TEMPORAL EXPERIENCE

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### 1. INTRODUCTION

WE are temporal beings. We have histories, we experience those histories in stages, we keep a running record of our histories as they unfold, and we act with an eye to the future. Time as we encounter it in experience is very different from time as conceived by physics. Time as conceived by physics is very simple. There is no intrinsic difference between past and future.<sup>1</sup> Change and movement are represented as static relations between different parts of time. All of the parts of time exist in a fixed set of relations to one another. As we encounter it in experience, by contrast, time is intrinsically directed and in continuous flux. There are differences between past and future in how much we know about them, in whether we can affect them, and other ways that have come under examination in this volume. The past seems fixed, but there is a sense of openness about the future. Change and movement are the rule rather than the exception. We are almost irresistibly inclined to describe time in dynamical terms. We say that one event gives rise to the next, that time passes or flows, that we cannot stop the fleeting moment from being incorporated irretrievably into the past. Some of this dynamical terminology is the product of misleading mental pictures, but it arises so naturally and spontaneously that one suspects it captures something about the way we experience time. What are the psychological sources of the temptation to speak of time as flowing? Why does it seem to have a direction? What leads us to regard the past as fixed and the future as open? Any attempt to reconcile the physical conception of time with the way that time is encountered in experience has to begin with an analysis of the temporal experience.

The experience of time has been a mainstay of discussion in the phenomenological tradition, but has received relatively little attention in the analytic tradition. But every aspect of our psychological lives is pervaded by the fact that we have histories, that

<sup>1</sup> And this is linked to the fact that the dynamical laws are symmetric under reflection in time.

we experience those histories in stages, that we remember the past and anticipate the future. A good part of the complexity of temporal experience has to do with the interaction between temporal perspectives. I'll begin with a schematic description of the history of an historically extended consciousness when its parts are plotted in a temporal sequence and then switch to a temporally embedded point of view, asking what things look like from the perspective of particular moments in that history and how they differ from the perspective of one moment to the next.

## 2. PHENOMENOLOGY AND PERCEPTION

Phenomenological analysis takes it for granted that there is some neurocognitive story to be told, but studies only the structures that arise at the personal level, that is, structures that are present to consciousness, introspectively available to the subject.<sup>2</sup> Consciousness has many elements, from sensory experiences and bodily sensation, to non-sensory aspects such as volition, emotion, memory, and thought. At any waking moment we are aware of patterns of sound, light, color, sound, kinesthetic sensations, and internal moods and emotions. We are also aware of a way the world is presenting itself to us perceptually: we see and hear events occurring in the space around us, we see objects arranged in and moving through the space around us, we feel the motion of our own bodies, and experience some of that motion as governed by volition. We also have memories in the form of recollected images of past events, as well as knowledge of our own histories, and a body of semantically structured belief that can be accessed more or less on demand.

If we focus for the moment just on perceptual consciousness, a simple and natural view would have it that the sensory surfaces register information about the environment and relay it to the mind where it produces experience, in the way that a video camera registers and relays information to a screen, so that we have real-time covariation of states of the world and states of the screen. One representational state replaces another, each reflecting the more or less occurrent state of the environment. Although a person watching the screen will remember the passing images and piece them together to arrive at an idea of how the screen changed over time, there is no representation of time on the screen itself, and no accumulation of information on the screen over time. If perception were like that, the representational content of perceptual experience at any given moment would be an instantaneous state of the world at, or immediately before, the moment that the experience occurs.<sup>3</sup> The content

<sup>2</sup> The notion of personal level representation, first proposed by Dennett in 1969 and quickly became an entrenched distinction in the cognitive science literature. It is used here to refer to the level of representation that is available to consciousness.

<sup>3</sup> Representational content is what would be reported in the that-clause in sentences of the form "I see that there are three cars in the road/that there is an apple on the table . . .".

would ordinarily have three spatial dimensions—it would depict material objects in a spatial configuration—but it would have no temporal dimension.

The first conspicuous challenges to this idea came from James and Husserl. Both of them defended versions of the Doctrine of the Specious Present.

The Doctrine of the Specious Present (SP): says that if we consider a particular temporal cross section of experience at a point  $t$  in time (call it a  $t$ -section), the content carried by the  $t$ -section has temporal breadth. It spans a finite interval of time centered on  $t$ .<sup>4</sup>

The two primary texts are James' *Principles of Psychology* and Husserl's *Lectures on Internal Time Consciousness*.<sup>5</sup> James attributes the term 'the specious present' to the psychologist E. R. Clay. But he introduced it to the philosophical literature, and his own discussion is so vividly written that is still the classic text on the specious present. Husserl's is perhaps deeper, but it is exceedingly hard to read. Exegetical difficulties stemming from the complexity of his view are compounded by the fact that the text was not published by Husserl himself, but culled by his secretary (Edith Stein) and student (Heidegger) from notes on time consciousness penned between 1901 and 1917, a period throughout which his own views were in flux.<sup>6</sup>

The most common misunderstanding of SP is to fail to realize that it is a claim about content, and does *not* entail that sensation comes in discrete pulses. James was quite explicit that aside from periods of unconsciousness and sleep, there is no discontinuity in experience at the level of phenomenology. We experience trajectories as smooth and change as continuous.<sup>7</sup> A ball moving across a table from point A to point B appears to pass through all points in between. A bowl of soup doesn't go from hot to cold without passing through all temperatures in between.<sup>8</sup> As James says:

[experience] does not appear to itself chopped up in bits. Such words as 'chain' or 'train' do not describe it fitly as it presents itself in the first instance. It is nothing jointed; it flows. A 'river' or a 'stream' are the metaphors by which it is most naturally described.

It was well known even in James' time that the phenomenological continuity is partly the product of extrapolation by the brain. Much in the same way that the mind artificially glosses over the blind spot we have in the vision-field of each eye (created by the break in the sheet of photoreceptors where the optic nerve enters the eye) the brain extrapolates a temporally continuous stream of events out of a well-timed

<sup>4</sup> Whether the doctrine was clearly and distinctly conceived in exactly this manner by either is a question I'll bracket. I've sharpened up the basic insight and given it the most defensible expression. See also Poidevin references in Poidevin for more traditional ways of understanding the specious present.

<sup>5</sup> From volume, *On the phenomenology of the consciousness of internal time*, translated by John Brough of *Husserliana Brand X* (Rudolph Boehm, ed.).

<sup>6</sup> I'm indebted to Rick Grush here for an especially lucid exposition of Husserl's views (Grush 2006).

<sup>7</sup> For models that take seriously the hypothesis that experience is not continuous, but discrete, see Dainton (2000) and Grush (2006).

<sup>8</sup> See Grush (to appear) for a survey and comparison of neurocognitive models of temporal perception empirical support.

set of discrete events. There is a certain frequency of experience at which distinct events blur into a single continuous duration. This frequency of events is known as the Continuous Flicker Frequency (CFF), at which the experience of a flickering light becomes an experience of a continuously burning light. Depending upon variables such as size of the light source and the characteristics of the observer, the CFF can vary between 2 and 80 cycles per second, but the standard recognized CFF, often used in cinema to turn many still images into an illusion of a motion picture, is 60 cycles per second. Brain activities are, at their basis, coordinations of action potentials, and action potential firings have beginnings and ends. Each flicker of a movie projector sets off a complex perception event, in which many neurons have discrete moments of action and then inaction. The experience, however, is one of continuous motion on the movie screen with much longer duration than any action potential's firing.

SP is not always clearly distinguished from a claim about the minimal duration *occupied by* an episode of perceptual awareness.<sup>9</sup> To think otherwise is to confuse semantic levels—to mix up what's true of the representational content with what's true of the representational vehicle. This is a confusion we're especially prone to in the case of time. We are not apt to suppose that the brain represents spatially separated objects by means of spatially separated perceptions, or red surfaces by red perceptions. But there is a long tradition of thinking that time is special precisely in that the temporal relations between events are represented in experience by the temporal relations between the events that represent them. Helmholtz expresses one when he writes,

Events, like our perceptions of them, take place in time, so that the time-relations of the latter can furnish a true copy of those of the former. The sensation of the thunder follows the sensation of the lightning just as the sonorous convulsing of the air by the electric discharge reaches the observer's place later than that of the luminiferous ether.<sup>10</sup>

There is some degree, clearly, to which temporal subdivisions of the perceptual stream correspond to temporal subdivisions of its content. If you eat breakfast before you get dressed, you experience breakfast eating before you experience getting dressed. SP does not deny this. It simply places a limit on the correspondence, holding that we can't go on subdividing the stream of perceptual consciousness into components that correspond to parts of time up to the level of points. SP claims that every perceptual content, even at the finest level of resolution, is awareness of a finite temporal interval. Even if we consider the content of instantaneous temporal cross section of experience, the representational content of that cross-section will span a finite interval of time. It is

<sup>9</sup> When Wittgenstein asks "If I see the picture of a galloping horse, ... Is it superstition to think I see the horse galloping in the picture?—And does my visual impression gallop too?" (Wittgenstein (1999), p. 202). The answer is that the galloping is part of the representational content of the picture along with the three-dimensionality of the horse, and the space that contains it. And the same should be said about the experience of a galloping horse.

<sup>10</sup> Helmholtz (1910), p. 40.

analogous in this respect, as James remarks, to spatial perception. We are never aware of an instant of time but only of some finite interval, just as we are never aware of a point in space but only of some finite spatial volume. The minimal unit of perceptual awareness has both spatial and temporal breadth. This doesn't mean that we can't arrive at the concept of an instantaneous state. It means simply that we get that idea by carrying the process of subdivision to its limit, and what we have left when we do so is empty of any experiential content.<sup>11</sup>

This is connected to another way of misunderstanding SP. To say that the specious present represents an interval with past, present, and future parts does not mean that the specious present has temporal parts lying in the past, present, and future, but that the content *represents* an interval of time as a temporally ordered whole centered on the present. To see the difference here, consider the spatial analogue when you perceive a cathedral. Although the cathedral itself is composed of stones laid out in different parts of space, your *percept* of the cathedral is not composed of percepts of stones that are located in different parts of space. That would leave the spatial relations outside the scope of any percept. To see them arranged in cathedral configuration, in that case, there would have to be a further seeing that spans those parts and relates them to one another. SP asserts that the most elementary contents incorporate lower-level elements that might be separated by analysis, but are themselves highly structured. Husserl refers to the past, present, and future components of the specious present, respectively, as retention, primal impression, and protention. James describes the structure with a memorable image,

The unit of composition of our perception of time is a duration, with a bow and a stern, as it were—a rearward—and a forward-looking end.

He continues, emphasizing the synthetic character of the content;

It is only as parts of this duration-block that the relation of succession of one end to the other is perceived. We do not first feel one end and then feel the other after it, and from the perception of the succession infer an interval of time between, but we seem to feel the interval of time as a whole, with its two ends embedded in it. The experience is from the outset a synthetic datum, not a simple one.<sup>12</sup>

The best introspective evidence for SP is the perception of motion or change. When you see a ball thrown across a room, you don't see instantaneous representations of the ball's position, you see movement. The motion, which is not present in any instant of the series, falls in the scope of your percept. You may be able to break it into smaller components, but even the smallest includes some motion, and so even

<sup>11</sup> 'And here again we have an analogy with space. The earliest form of distinct space-perception is undoubtedly that of a movement over some one of our sensitive surfaces, and this movement is originally given as a simple whole of feeling, and is only decomposed into its elements—successive positions successively occupied by the moving body—when our education in discrimination is much advanced.' James (1890, p. 622).

<sup>12</sup> James (1890, p. 610).

the smallest has temporal breadth. When you hear a descending pitch, you don't just have a descending series of impressions of notes, you *hear the descent*. Which is to say that the descent, which is not present in any instantaneous part of the series, falls in the scope of your percept. And notice that when you perceive motion, you don't just perceive motion in a certain direction (a ball was first here, then there), you see *how fast* it occurs, that is, how long it took to get from here to there. This perception of the speed involves perception of *quantity* of time. It imposes not just an order, but a metric on the perceived process, and the order of the parts and metric are part of the content of the impression. The same goes for other modalities. A potter at the wheel feels the motion of the clay in his fingers. The passenger on a train feels the vibration of the rails as they pass under his car. This perception of movement includes both order and quantity. In all of these cases, the movement and the speed are both part of the content of the experience. This bears emphasis. In order to have experiences of succession, movement, or duration, the contents of those experiences must have temporal breadth. It is not enough for experience itself to be extended in time, there has to be a temporal dimension in the representational content. This is a generalization of Kant's oft-cited observation that successive experiences are not an experience of succession. To have an apprehension of temporal order, it is not enough to apprehend instants of time individually in succession. That leaves the relation of succession outside the scope of apprehension of any experience. We have to apprehend them together, rather, as an ordered collection. And to get a measure of amount of time, it is not enough to apprehend instants of time individually over some period. We have to apprehend the period itself in a single act. This primitive perception of a minimal unit of time can then serve as a yardstick in terms of which we conceive of longer units of time.

It's not hard to incorporate SP into a modern conception of the mind. We are blind to the subpersonal processes that generate perceptual awareness, but this doesn't mean that the brain is passively conveying information from the sensory surfaces to the conscious part of the mind.<sup>13</sup> When simple stimulus response mechanisms in the human brain incorporate more complex forms of mediation between input and output, we start to talk about sensorimotor loops. Collections of these get cobbled together, sometimes in a manner that is regulated by a superloop, and these in their turn are collected under the partial supervision of further loops. At every stage, there is filtering, transformation, integration, and what is *given* at one level, is *constructed* or *restructured* by the levels below.<sup>14</sup> The emergence of personal level representational states is a late development on the phylogenetic scale that involves the emergence of a new kind of superloop that selectively integrates information from lower-level sensorimotor loops to generate an overarching conception of a spatiotemporally ordered world. What one is consciously aware of at the personal level—that is, what is given immediately and without inference in the contents of personal level

<sup>13</sup> Personal level representation is representational content that is introspectively available to consciousness.

<sup>14</sup> By 'constructed' we mean arranging, assembling, imposing a new order on.

perceptual states—is the product of is that integration. The lower-level processing supplies the embedding structure that organizes the complex, cross-modal patterns of sensory qualities into a conception of an orderly, three-dimensional reality viewed from the spatial vantage point of an embodied subject. A unified frame of spatial and temporal reference is supplied; temporally separated and qualitatively distinct images are strung together into the world-lines of places and objects that are reidentified across experiences, viewed from different angles, and apprehended through different modalities.

The movie projector model leads us to believe that structures that are present in our perceptual state at a time are a simple mirror-like reflection of structure that is present in the stimulus. This picture suggests something quite different. When you stand on a street corner looking out at the world, you may be aware of a multi-dimensional pattern of light and color, sound and smell, but *what you see* is cars whizzing past, people walking by, speaking to one another, a streetlight changing color. What you see—that is, the representational content of your experience—is an evolving three-dimensional space in which lights, sounds, and smells are related to one another and to the vantage point of your own eyes. The spatiotemporal structuring of experience, which is given in the representational content, presupposes an embedding structure that imposes strong constraints over vast tracts of experience. The unification of the sensory manifolds, the separation of space and time, and the conception of oneself as a material presence in the landscape are all parts of the embedding structure, but they impose more structure than is present in the occurrent stimulus. It's a very Kantian idea that concepts of self and world and space and time all get sorted out together as part of a categorial framework that brings order to experience.<sup>15</sup> But it's one that to this extent is borne out by what we know about the way the brain processes sensory information.<sup>16</sup>

One might accept that the representational content of any given temporal cross section of experience has both spatial and temporal dimensions, and still wonder whether there is reason for thinking that perceptual contents have a *protentive* component. This is one of the most interesting implications of SP. Both James and Husserl asserted it, but neither of them spends much time on it. Rick Grush has argued that there is empirical evidence for the existence of a protentive component coming from experimental work on temporal illusions, and has developed a neurocognitive model for perceptual processing that incorporates SP. He writes

The basic idea that perception involves constructing representations that are based, in part, on sensory information, is fairly standard, and has been for some time. But part of this standard view has been that the job of the perceptual system is to produce representations of states of the environment. I want to suggest, though, that we should reconceive the job of the perceptual system as producing representations

<sup>15</sup> These concepts aren't definable in sensory terms: they function rather as primitives whose application imposes order on experience.

<sup>16</sup> Questions about how the cognitive mind is implemented in the brain are unsettled. Analysis of the structures that arise at the personal level can mostly avoid them.

that attempt to capture temporally extended *processes* (or, synonymously, *trajectories*) in the environment.<sup>17</sup>

One of the most innovative aspects of Grush's account is that trajectory estimates don't just represent parts of processes that are already completed, but anticipate the direction at the next moment. His reasoning is that we need to initiate behavior designed to react to future states of the world before we actually receive information that we are reacting to. Perceptually guided behavior exhibits sensitivity to the temporal features of trajectories: it can adjust to the speed and anticipated duration of processes as they unfold. When Santonio Holmes caught the winning touchdown in the 2009 Superbowl, there was no conscious calculation of where the ball would be. His brain was moving his body to where the football would descend *before* his senses registered its presence there. If Grush is correct, Holmes didn't see where the ball was and *infer* where it would be, he literally saw both where it had been and *where it was going*. There was no time for inference, and no conscious awareness of having made any inference. The forward and backward looking part of the trajectory was all part of the instantaneous content of his visual state—it was given to him immediately in the content of the experience. George Bush was able to duck out of the path of a flying shoe *before* he registered its presence where he had been standing because he *saw* where it was going. Your hand is able to catch the bag of peas as it falls out of the freezer not only because you see where it is, but where it will be. We are always in this sense *reacting* to what we *foresee*, acting to fend off, forestall, divert trajectories in process, but uncompleted.<sup>18</sup> If SP is correct, those actions are guided by the protentive component of experience.

### 3. MEMORY

So far, I've spoken only about perceptual consciousness. Perceptual consciousness, however, isn't the whole story. To fill out our portrait of a psychological history, we need to embed perceptual consciousness in a psychological stream whose full description includes the contents of memory. What we do at the personal level in forming a conception of history to some extent mirrors what perceptual processing does on a very small scale in forming a conception of change over the interval of a specious present. The term 'memory' covers quite a large variety of phenomena. There is what is sometimes called 'habit memory' or 'procedural memory', a label for embodied skills such as typing, playing golf, using a knife and fork, or solving jigsaw puzzles. These are not directly representational forms of memory. They do not represent the world as being a certain way. Among representational forms of memory, we distinguish between short-term and long-term memory. Short-term memory acts

<sup>17</sup> Grush (to appear), p. 15.

<sup>18</sup> That is, the anticipatory component is learned rather than hard-wired and gives us the practical flexibility we need in new environments. Repeated exposure to different patterns of events leads to new behavioral expectations.

as a scratch-pad for temporary recall of the information under process. For instance, in order to understand a sentence you need to hold in your mind the beginning of the sentence as you read the rest. Short-term memory has a limited capacity and decays rapidly (200 ms.). Long-term memory is intended for storage of information over a long period. There is little decay for information in long-term memory. Information from the working memory is transferred to it after a few seconds. Among the forms of long-term memory is semantic memory which is memory of fact, the accumulated fund of particular and general belief acquired through book-learning, hearsay, and all of the other ways that we pick up information about the world. It is usually impersonally expressed and stored in a propositionally structured form, a vast internal encyclopedia of knowledge that includes the fact that water contains hydrogen, that Wittgenstein was Viennese, and that elephant tusks are made of ivory. The kinds of memory that are most relevant here are personal memories of past experience. These come in two forms. When I think about the first time I visited Cairo, I can remember what it felt like stepping into the desert air. I remember the smells and sounds, the date palms right next to the taxi rank. I recall the sensory field almost as I experienced it. These kinds of recollected images of past experiences are *episodic* memories. They are representational, but not propositional in form. They are singular and image-like. They have qualitative properties that resemble the experiences they represent, and they don't involve any explicit representation of time or self. Like a photograph taken at a particular time, they represent the view of a space at the time at which they were taken, but neither the time nor photographer (ordinarily) appear in the image. I also remember that the trip was in 1987, that we stayed the first few nights at the Hilton, that there was a restaurant at the Hilton that became our haven, that I visited Minia, then the Sinai, then Dhahab . . . These memories, by contrast, are propositional in form: they explicitly portray me as subject and ascribe certain experiences to me in a particular order. They are the products of autobiographical memory, whose function it is to weave the collection of episodic memories into a portrait of personal history.<sup>19</sup>

Episodic and autobiographical memory work together. Episodic memory allows information from past experience to collect in the mind by making records of past experiences, and autobiographical memory gives that information form summarizing, constructing, interpreting, and condensing life experiences, to produce a coherent narrative sense of a personal past. Autobiographical memory is the psychological source of the conception of self as temporal continuant. The psychological sense of continuity depends on the fact that I remember my past and expect in the future to remember my present. One's sense of self extends as far into the past as one's memories, and as far into the future as one expects to remember the present. Autobiographical memory opens up the psychological space for a conception of self that spans a whole life. Without autobiographical memory, psychological life would consist of a series of psychological episodes—one thought or experience and then another—with

<sup>19</sup> To say that a representation is explicit is to say that it falls within the scope of the representational content of a state. No further explication is possible without a full-blown theory of content.

a temporal horizon no longer than a specious present. A being with autobiographical memory, by contrast, has the capacity to survey its past from the earliest recollected moment in childhood at any point in the course of its life.

There is no one better than Proust at evoking the thin-ness and ephemerality of the sense of self supported by the specious present, and the role that memory plays—as he says ‘like a rope let down from heaven’—integrating specious presents into a personal history. Early in *Swann’s Way*, for example, he writes:

When a man is asleep, he has in a circle round him the chain of the hours, the sequence of the years, the order of the heavenly host. Instinctively, when he awakes, he looks to these, and in an instant reads off his own position on the earth’s surface and the time that has elapsed during his slumber; but this ordered procession is apt to grow confused, . . . [there were times when] I lost all sense of the place in which I had gone to sleep, and when I awoke in the middle of the night, not knowing where I was, I could not even be sure at first who I was; I had only the most rudimentary sense of existence, such as may lurk and flicker in the depths of an animal’s consciousness; . . . but then the memory not yet of the place in which I was, but of various other places where I had lived and might now very possibly be—would come like a rope let down from heaven to draw me up out of the abyss of not-being, from which I could never have escaped by myself; in a flash I would traverse centuries of civilization, and out of a blurred glimpse of oil-lamps, then of shirts and turned down collars, would gradually piece together the original components of my ego.<sup>20</sup>

There’s the lone thought, which first situates itself as part of the community of connected memories that form a single life. This jumble of memories then shakes itself into an order that is embedded in the larger narrative of history. And all of this structure—the occurrent thoughts and experiences, the episodic memories, the personal history, and the impersonal history in which it is embedded—are all present—in a more or less definite, more or less explicit form—in every momentary part of the psychological life of a consciousness with autobiographical memory. This structure is not always part of the foreground of thought, but it is present in a form that allows it to be accessed more or less on demand. The contents of memory are like psychological time capsules, providing each momentary cross section of an evolving consciousness with a compact, backward-looking representation of its own past.

#### 4. THE STREAM OF CONSCIOUSNESS

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Intuitive understanding of perspective is strongly shaped by the spatial case, which suggests the need for an *owner* of perspective, a spatially extended occupant of space that retains its identity across changes in spatial location and whose movement corresponds to changes in spatial perspective. Carrying the analogy over to the case of time

<sup>20</sup> Proust (1988, p.56).

would require a *temporally extended occupant of time that moves through time, retaining its identity across changes in temporal location*. This picture is rife with confusion,<sup>21</sup> but most of us nevertheless retain some version of it when we think about time. Either we think of time as forming a fixed background and ourselves as moving through it, or we think of time as, in some objective way flowing past us, bringing our ends ever nearer. The schematic structure above gives us a way of thinking of transitions between temporally embedded perspectives inside a life, without slipping into the idea that we move through our lives occupying now one, now another temporal perspective in it, and allows us to begin to explore the psychological structures that underpin temporal experience. In what follows I'll review abstract description of what the history of a normal human consciousness looks like from the outside, and then we'll turn to temporally embedded perspectives within that history.

I've said that the stream of perceptual contents is embedded in a psychological context lined with memory. The contents of memory grow by 'accretion of fact' moving up the temporal dimension of a psychological history with the addition of new memories. The contents associated with each temporal cross section of that history include a backward looking portrait of its past. The result is an asymmetric arrangement, with information accumulating in memory along the temporal dimension in an almost profligate reification of structure, representation, and re-representation of the same events in every momentary cross section of experience. Rehashing, reevaluation, reorganization occurs at each stage. That rehashing and reorganization is the conscious counterpart to the subpersonal processing that generates perceptual contents. It is an ineliminable part of practical reasoning. Whether I decide to take another drink depends not only on how many I've already had, but on whether I believe I'm slipping into an unhealthy pattern, and that is a judgment that takes some consideration. Whether I decide to abandon a partner or friend depends on my understanding of my history with him or her, the loyalties, resentments, and affections that have been formed, memories of expectations realized or relinquished, fears and hopes and aspirations recalled as they were experienced and viewed through the lenses of later events. All of this is woven into the history of the relationship itself, and plays into decisions about how to act in the here and now. And it is something that requires constant rethinking. Each momentary content of consciousness contains, alongside information coming in from observation, a remembered image of the preceding state. And that image of the preceding state contains an image of its predecessor nested in it. And that one, likewise, and so on like a string of Chinese boxes, each containing a reproduction of its predecessor.

Autobiographical memory doesn't extend indefinitely into past or future: the sequence is bounded by birth on one end and death on the other. And everything we know about the transformative effects of both memory and self-observation should caution us against a naive presumption of either accuracy or completeness. Memory is notoriously reconstructive and this business of representing one's past is not

<sup>21</sup> See Price, this volume.

necessarily veridical.<sup>22</sup> Each moment is only very partially and selectively reified in the next, and reification doesn't merely copy, but transforms its objects: filtering, shifting, and sometimes distorting in an attempt to bring them into sharper focus.<sup>23</sup> But we do represent our pasts, and re-represent them with very passing moment, re-examining, re-evaluating, and reorganizing them in an ongoing process of self-definition. Some of us do this more than others, but all of us do it to some degree. No other animal so far as we know has the cognitive infrastructure to support a reflexive conception of its autobiographical memory with anything that approaches human complexity.<sup>24</sup> And no animal so far as we know engages in this complex process of reflexive self-definition.

Compare this structure with the representational history of a system without a memory—a robot, for instance, navigating by an internal map of space, but not representing its past. The epistemic states of such a system follow one another in an ordered sequence, but the representational content does not have a temporal dimension. There is no retention of information. Each replaces the next: there is no representation of time at any point in its history, no representational state that spans the contents of these specious presents and integrates them into a history in which they are simultaneously represented in a temporally ordered form, no internal *point of view* whose temporal horizon includes past, present, and future. And compare both of these to the psychological life of an even simpler, sentient system that reacts to stimulus in ways designed to produce adaptive behavior, but represents neither time nor space. All that exists for such a system at any point in time is the occurrent contents of consciousness. The concept of a world distinct from experience extended beyond the boundaries of that state is not provided for. There is change—each is different from the preceding state—but no preservation of information across change. If there are causal connections between one state and the next, there will be continuity that is visible from the outside—that is, to a perspective from which multiple states are simultaneously visible—but there is no retention of information in the explicit content of the states. The continuity won't be visible from the embedded point of view within such a life. The system itself does not have a point of view that spans its temporal parts. At no point in its own psychic history are its temporal parts present simultaneously to consciousness.

Because we represent both space and time, our psychological states have both spatial and temporal content. In the first case described above, we have a system whose states have spatial content but no temporal content. And in the second case, we have a system whose states have neither spatial nor temporal content. I'll leave it open whether those states are properly ascribed objective content at all. We know for a fact that we can

<sup>22</sup> The relevant notion of veridicality is something more than forensic accuracy. An honest or fair representation employing thick ethical concepts is a more subtle matter than a bare transcription of fact (if such there be).

<sup>23</sup> 'Observation' and 'memory' are not used here as success terms. There is no assumption of veridicality. We can replace them, respectively, with 'process which generates representations of the environment', and 'process which generates representations of the past'.

<sup>24</sup> See the old, but still excellent collection by David Rubin (1986).

construct systems whose cognitive lives (in the deflated sense of ‘mental’ that refers to cognitive processing and applies to robots and computers) conform to the first and second diagrams which do remarkably well at navigating complex environments and completing practical tasks necessary to survival. So the practical advantages of explicit mental map-keeping and calendar-making (i.e. of explicit representation of space and time) are subtler than we might think.<sup>25</sup> But it is an innovation that makes all the difference in the world to the internal character of a psychological life.

## 5. LOOKING FORWARD

I spoke earlier of the anticipatory component of the specious present. There’s a much more far-reaching anticipatory representation of the future, a forward-looking analogue to autobiographical memory that represents events both closely connected to the here and now, and events that are far away in space and time. I’ll bundle our representations of the future together under the heading ‘expectations’, though this term conceals a great deal of variety. Some representations of the future are predictions, but there are also hopes, aspirations, fears, and intentions, . . . and each one of these has its own epistemic caste. There are great differences between our representations of the past and our representations of the future that bear more careful analysis. They’re not very well understood, though in psychological terms, the asymmetry between past and future is embodied in the differences between memory and expectation.

When we pull all of the pieces together, the schematic picture we get of the contents of an evolving consciousness is this. Experience is continuous, which means that we can consider the contents of any temporal cross section of experience at any moment in the conscious waking life of a cognitively normal human subject. If the subject is attending perceptually to the world, those contents will include a sensory field carrying a perceptual content spanning a finite interval centered on the present. And it will be embedded in a psychological context containing a backwards-looking self-image on one side and anticipatory representations of the future on the other. The backwards-looking self-image will be a collection of episodic memories woven into an autobiographical history, and the forward-looking representation of the future will be the mixture of predictions, hopes, fears, aspirations, and intentions I have called ‘expectation’.

There is a great deal of variability among persons, and over time, in the history of a person in how the schema gets realized. How much of the past and future is represented, in how much detail, in what terms, and how faithfully? How much thought is given to the past and future, and how does it figure in practical reasoning? But any complete account of the contents of a normal human consciousness at any point in time would have a temporal dimension organized in roughly this way. Memory would

<sup>25</sup> Ismael (ms) is an examination of these advantages. See also Ismael (2006: last chapter).

have the recursive structure described above (each containing a partial, not necessarily accurate reproduction of the contents of memory at the preceding time, with all of the nested images of preceding contents that it contains). If we look up the temporal dimension, comparing the contents of consciousness at different moments in the history of a consciousness organized in this way, we see the whole structure centered on different moments of the internal timeline we provide for our own histories.<sup>26</sup>

Because we update both memory and expectation as we learn and evolve, what we remember and what we expect varies from one moment to the next, as does the line between events represented in memory and events represented in expectation. So if we move up the sequence, keeping our eye on an event that starts out as expectation (say the wedding day of a daughter), it will get progressively closer to the line, eventually crossing and passing into memory. The slow shift of balance within a life that starts out light in memory and heavy in expectation and ends relatively heavy in memory and light in anticipation is a poignant and inevitable feature of growing old.

Now that we have some sense of what the history of a self looks like from the outside, we can switch points of view and ask what things seem like from the embedded perspective of a moment within a life. And we can also ask how things change with changes in perspective, in the same way we can ask what things look like from a particular point in space, and how that changes with changes in spatial perspective.<sup>27</sup> The temporal perspective here is given by the moment on the internal timeline on which the temporal content is centered, that is, given by the moment on our internal timeline that we call ‘now’.

Let’s consider a very simple example and try to describe the phenomenology. It’s common to use auditory experience, and the perception of music in particular, in discussion of temporal phenomenology, because it provides a highly simplified setting that abstracts from all but reflexive content. So imagine yourself immersed in a warm bath, stop up all your senses except for your ears, make your mind a blank slate, attach a stranger’s iPod to the stereo and hit ‘play’. Suppose that as it happens, what comes on is a recording of Bach’s Cello Suite #4 in E flat. Before the first sound emerges from the earphones, you don’t expect silence over sound, Janis Joplin over John Cage. Once the first note is sounded, registered, and recorded, even if you have no conscious memory of having heard the piece before, you have at least some memory and some new expectation. You have probably increased your expectation of hearing more cello and lowered your expectation of hearing Janis Joplin in the next moment. A second note is registered and added to memory. Your earlier expectation is confirmed. A new note is registered, compared against expectation from previous cycle, added to memory, new expectation is generated, and new, more definite expectations begin to take shape.

<sup>26</sup> Since we conceive of our histories in objective terms, this will also be the objective timeline of history.

<sup>27</sup> The analogy holds perfectly so long as we are careful not to slip into thinking of transitions between epistemic perspectives as suggesting that there is any *thing* that undergoes those transitions. See Ismael (2006).

The cycle repeats, with memories accumulating, and expectations becoming more definite at every stage. The mind begins to discern patterns, recognize motifs. It jumps ahead and completes a theme before the notes register. It is either satisfied, or surprised by what it hears, delighted, or disappointed. At the first stage, the mind registers a note and forms a very indefinite sort of expectation. There's nothing at this stage yet in memory. At the next stage, the note and expectation registered at the first stage are incorporated into memory and form the psychological backdrop against which the second note is heard. A newer, more definite expectation is formed that draws both on the note that is being currently registered and the contents of memory. And so it goes, at each stage, the contents of the previous stage being incorporated into memory, a new note being registered, and a new expectation formed that draws on the whole accumulating stock of information being registered perceptually and incorporated into memory.

The sort of system that keeps an evolving record of its past and forms expectations for the future encounters every note as a partial revelation of an extended structure that will be eventually apprehended in its entirety. It encounters each note essentially as part of a melody in progress, a partially recollected and partly anticipated whole. The notes themselves occur one at a time. They are not co-present in physical space, or co-represented in auditory experience, except on the very small dimensions afforded by the specious present. It is in the memory and expectation of the subject that they are brought together on the larger scale of the piece as a whole, setting up the cross-temporal pattern of resonance and reverberation that makes them musical.<sup>28</sup> It's not simply that the parts of the song need to be simultaneously represented in memory to permit apprehension of patterns and recurrences. That is one part of it, but that is available also to the person looking at a musical score. And notice that it doesn't matter, for purposes of perception of these regularities whether he reads the score front to back or back to front. But it is essential to the musical experience that listening *itself* is a process, that is, that the song is revealed in stages, and in stages that follow a particular order. And that is because it is essential that each note is encountered from a different temporal perspective, in a psychological context lined with different memories and different expectations. Changes are wrought in the listener at each stage in the listening process. In physics, we would say that the listener doesn't 'return to his ground state' after each observation, but that memory serves like a cognitive ratchet, saving changes wrought by experience and propelling the listener into an ever new frontier. And these changes don't affect representational content. They make a difference to the *quality* of the experience. The mind that confronts a theme for the third or fourth time hears it differently than a mind that confronts it for the first. Surprise,

<sup>28</sup> The meeting of an expectation is a kind of consonance between a remembered expectation and an observation; surprise, or disappointment, is a kind of dissonance. To have suspense resolved or to recognize a repeated theme, to see a theme developed, these are all cross-temporal relations. Surprise, disappointment (what you expect doesn't come to pass); pleasing or displeasing cross-temporal dissonance. Resolution, satisfaction, repetition (what you expect comes to pass); pleasing or displeasing cross-temporal consonance.

recognition, disappointment... these epistemic attitudes have a phenomenology of their own. That phenomenology is not available to a system without a memory, and it is as much a part of the musical experience as the sounds emerging from the bow. You have to think of the quality of the experience as determined not just by input from perception, but jointly by the input from perception and memory. Now, consider the momentary self that confronts that final note. It has a high degree of internal complexity. It is very much less innocent than the momentary self that crawled into the bath. It has memories of the view from all perspectives that preceded as constituents. That structure has to be built up by passing through those stages: it can't be bypassed by simultaneous apprehension of the notes in a higher dimensional medium, as, for example, by looking at the score. When you look at a score, you see in two dimensions all at once what you hear as a temporally ordered sequence.

Such—at a much higher degree of complexity—are the epistemic states of a system with a reflexive memory. We add the full complement of experiences, with all of their internal complexity, and we extend the sequence to cover a lifetime.<sup>29</sup> Nothing like it is found in a system that doesn't have a reflexive memory. The complexity of these states is appreciated by Husserl,<sup>30</sup> and is vividly in Velleman's discussion of reflexive memory in *Self to Self*. He writes:

I don't just anticipate experiencing the future; I anticipate experiencing it as the payoff of this anticipation, as the cadence resolving the present, anticipatory phase of thought... Within the frame of my anticipatory image, I glimpse a state of mind that will include a memory of its having been glimpsed through this frame—as if the image were a window through which to climb into the prefigured experience.<sup>31</sup>

Not just our epistemic states, but also (and perhaps especially), our emotional responses are closely tied to these cross-temporal patterns of resonance and reverberation, consonance and dissonance, not only among remembered experiences, but among our memories of expectations and expectations of memories reproduced—partially, at least implicitly—inside each momentary part of our lives. Think, for example, of the complexity of sadness at the memory of years of regret attached to expectations for a relationship in light of what actually came to pass. You have no difficulty attaching both a phenomenology and a content to that state, but it has an exceedingly complex temporal structure of iterated nesting. States with the complexity to support these epistemic and emotional attitudes have the nested structure that arises from reflexive memory. And again, because they have as constituents, representations of the view from different epistemic perspectives, they have to be built up in stages by passing through those perspectives, one at a time, in a particular order.<sup>32</sup> In a world

<sup>29</sup> The example is too simple to support the embedding structure of a spatiotemporally organized world, so the kind of memory here is not yet autobiographical, but merely reflexive.

<sup>30</sup> What I have said is in agreement with the central elements of Husserl's view, but I've refrained from explicit discussion because there's much that I'm not confident of having understood.

<sup>31</sup> Velleman (2005, p. 198).

<sup>32</sup> The view from a particular perspective just is the view with a particular set of memories at one's back, and so the events stored in memory have an intrinsic order.

like ours, building those states is an attenuated process. It requires nothing less than the laborious process of living.<sup>33</sup>

And that brings us to a very salient aspect of the phenomenology of a life lived in time: suspense, not knowing *what comes next*. There is a tension set up in the mind of the subject that represents her own life, in the gaps between anticipation and resolution, when the mind prompted by history has formed an expectation and awaits its resolution. From the perspective of any moment in a life, there's always a space between what is known and what awaits revelation, between what's been stored in memory and what lingers in expectation. We live our lives in that space, perpetually poised between expectation and resolution in the limbo between what is and what might yet be. And the transitions between temporal perspectives are accompanied by impression of possibilities melting away. As we look back over our pasts and forward to the impending end, we have the impression moving away from our pasts and towards the future. In the beginning of life, we are separated from the end by a yawning gap full of possibilities awaiting resolution. That gap is narrowed as we move up the temporal dimension of our lives and possibilities give way to actualities. The space between what is known and what is still to be revealed is closed at the end of life,<sup>34</sup> but we spend our lives in a state of suspended cognitive animation, representing ourselves as captured in the middle of a cycle that has been repeated as far back—quite literally—as time immemorial. It is worth remarking on how to understand this without incoherence. We shouldn't think of ourselves as moving through our lives occupying different temporal perspectives, or thinking of time as flowing past us, as we stand fixed. We should think of the mind as looking back over the changing temporal perspective it has represented in memory and seeing the shift over time.<sup>35</sup> There is nothing illusory about that shift, and nothing illusory about the differences between past and future from an embedded perspective.

In the discussion of music, I have emphasized memory because the temporal breadth of the specious present is small relative to the length of a musical piece, and I wanted to bring out the cross-temporal patterns that stretch over the piece as a whole. They arise within the wider temporal context provided by memory, because it's there that the parts of the song are pieced together and represented simultaneously. But that's not to say that the specious present isn't important to the phenomenology of music. We don't just experience instantaneous parts of notes and piece them together in memory. When I hear one note, the preceding note still lingers in experience and the experience carries an expectation about what will follow. The content of the experience stretches over a temporal interval, and it is this that allows us to hear melody as descending and to experience the quickness of a tempo. If it were not so, that is, if SP were not true, the descent or the quickness could not be part of the content.

<sup>33</sup> In a world like the one that Russell once envisioned, in which the world is created *ex nihilo* with all memories and records of the past intact, things would be different, but in a world of the sort we take ours to be, the process takes time.

<sup>34</sup> Which is not to say that everything gets revealed, but that what ignorance is left, forever remains.

<sup>35</sup> See Ismael (2006, Ch. ??).

Someone ‘looking from the outside’, without the particular set of epistemic limitations that characterize the view from within time, doesn’t undergo the cycle of expectation and resolution, doesn’t experience the accompanying emotional tension and release. For God, as surely as for the cow that has no sense of its past or future, there is no uncertainty, no nostalgia, no anticipation, discovery, anxiety, or expectation. There is no cycle of suspense and resolution; there is only the set of events laid out in time.<sup>36</sup> What this brings out is that it is the combination of autobiographical memory (in its truly reflexive form) and the fact that each of our momentary selves has an epistemic horizon that is essential to the epistemic phenomenology. Things seem different from different perspectives, and there seems to be a definite direction of movement, only because each perspective has a view that is both partial and asymmetric.<sup>37</sup> There is a special phenomenology that arises for a system that represents time, a whole cluster of cognitive, emotional and epistemic attitudes that are essential to the felt character of human life. Those attitudes are not available either to a system without memory (in a form that involves the representation of time) or to an all-knowing god. They are not available to a system without a memory because such a system doesn’t have the states with the complexity to support those attitudes. (Recall what those states look like: just one representation of the occurrent state of the environment after another, like pearls on a string). And they are not available to an all-knowing god, because the psychological history of an all-knowing god does not evolve. There is no development, no change, no difference in how things seem at different times.

## 6. TIME AND THE SELF

Memory lengthens the range of temporal vision from the very small interval afforded by the specious present to the much wider expanse stretching from early childhood to the present. Even though much of the literature on time perception in cognitive psychology has focused on the specious present, phenomenologists like Husserl and Ricouer, and moral philosophers, particularly in the Lockean tradition, recognize that the most interesting and most distinctively human features of temporal experience have to do with the larger dimensions provided by memory, and specifically memory in its autobiographical form. This provides us with a conception of self that stretches across the years, and is a necessary condition for personhood in the legal, political, and moral sense. It is what provides for relationships that grow and evolve, personal

<sup>36</sup> Nor does your dog, if his representational states don’t have a temporal dimension, experience the passage of time. Which means that there are certain experiences—agency might be one as well—that depend on a certain kind of representational setting.

<sup>37</sup> This contrasts with the spatial case, in which there is limitation, without asymmetry: what one sees from a given spatial perspective is a proscribed region of space centered on one’s body, but one doesn’t see more from one perspective than from another (ignoring contingencies like obstacles and so on that limit one’s field of vision).

commitments that stretch into the future, plans and projects that can structure a life. There's been a lot of discussion in recent years calling attention to the role of autobiographical memory and the rendering of one's history in narrative terms in constituting one's awareness of oneself as a temporally extended being. In more radical incarnations of the view, it is said that what it is to *be* (or have) a self is to possess a narrative self-identity. The suggestion is that the very activity of piecing together an inner biography constitutes one as the temporally extended bearer of the biography.

This is an extremely interesting suggestion. It is offered as a potential alternative to the ontological obscurities of traditional Cartesianism and the skepticism of Hume, Nietzsche, or contemporary anti-realists like Dennett. Dan Zahavi, in a recent review of narrativist accounts of self, writes:<sup>38</sup>

Ricoeur, who has frequently been regarded as one of the main proponents of a narrative approach to the self, has occasionally presented his own notion of narrative identity as a solution to the traditional dilemma of having to choose between the Cartesian notion of the self as a principle of identity that remains the same throughout the diversity of its different states and the positions of Hume and Nietzsche, who held an identical subject to be nothing but a substantialist illusion.<sup>39</sup>

The view, however, suffers from a lack of clarity or consensus about what a narrative self-identity is.<sup>40</sup> Proponents of the view seem to have something more in mind than the minimal form of psychological temporality involved in representing one's past. Narrative structure is usually linked with having a 'story-like character'. The impulse to organize the pieces of one's life into a story requires, at the very least, their co-presentation to consciousness and rendering in a temporally ordered form. So the minimal form of psychological temporality that I have described is a necessary condition for narrative structure. It opens up the space within which the narrative impulse finds expression.<sup>41</sup>

I myself am skeptical of monolithic accounts of selfhood, that is, accounts that suppose that there is a single notion of self that will cover all of its uses. But we don't have to adopt narrativism as a monolithic account of selfhood to acknowledge its insights. We clearly do engage in the construction and elaboration of an inner biography. And piecing together an inner biography leaves us with an internal point

<sup>38</sup> For discussion of the narrativist thesis. See Bruner (2002), Carr (1991), and against them Strawson (2005), and Zahavi (2008).

<sup>39</sup> Zahavi, p. 2. Although he's careful to note Ricoeur's ambivalence.

<sup>40</sup> Aristotle and Plato both had accounts of narrative structure and it saw renewed popularity as a critical concept in the mid- to late-twentieth century in literary theory when structuralists argued that all human narratives have certain universal, deep structural elements in common, but that view fell out of fashion, and there's still no generally agreed definition of narrative.

<sup>41</sup> The idea that narrative unity is a requirement of selfhood has been challenged most loudly and persistently by Galen Strawson (2005). He is attacking something stronger than the claim that to be a temporally extended self requires the possession of a point of view that ranges over one's past and future. He is challenging the descriptive claim that we live our lives with our pasts and futures always in full view, acting for the sake of narrative unity. And he is challenging the normative claim that we should strive for narrative unity because a good life is one that is narratively unified.

of view that ranges over the temporal parts of a life. The construction of this point of view is a cognitive achievement, and the idea that it literally brings into existence the self as occupant of that point of view is one that is especially congenial to naturalists because it makes understandable how selves could arise in a natural world.<sup>42</sup>

## 7. METAPHYSICS

Let me close with some remarks about metaphysics. It is sometimes said that physics represents space and time as seen by an all-knowing god ‘looking’ at time from the ‘outside’. The metaphor is misleading in innumerable ways, but we can dispense with it. When we talk about the contrast view of time presented in physics with the view from within time presented in experience, what we really mean to contrast is the embedded view of time from the perspective of a particular perceptual encounter with the world, and a representation that is invariant under transformations between such perspectives. The shift between these two ways of looking at a time—that is, from a point of view that spans perspectives and from the point of view of the various perspectives embedded in it—corresponds to the shift from the view of space presented in a map to the view presented in the visual field or in a coordinate-dependent description of space. They represent the same facts, but the latter in a manner that is relativized to a position in it. Each position (characterized fully enough to provide a frame of reference)<sup>43</sup> corresponds to a (distinct) perspective, and *shifts* in perspective induce shifts in appearance even though nothing in the *field* of representation is actually changing. The visual field changes as you walk around an object—say a table, sitting motionless in the center of a room—even though the object itself remains the same. Here the part of space in which the object is located constitutes the field of representation, and the perspective is given by the position and orientation of the viewer. Part of knowing how to *interpret* the visual field—that is, how to distil out its objective content, how to separate what it’s telling you about the world from what it is telling you about your position in it—is knowing to anticipate and account for changes in appearance due to perspective. It tells you nothing about your position vis à vis the object of representation, and is unaffected by changes in your position. The representational content of a non-perspectival representation, by contrast, is invariant under changes in perspective.<sup>44</sup> The formal relations among representations from different perspectives and between perspectival and non-perspectival (equivalently, frame-dependent and non-frame-dependent) representations are of special importance in trying to understand temporal experience. Formally, a space *S* is a set of elements with a relation defined over them. A frame of reference for *S* is a set of points or elements of *S*

<sup>42</sup> And indeed, *why* they might arise, for the practical importance of the perspective-spanning viewpoint is easy to see. It allows for planning and practical reasoning.

<sup>43</sup> In spaces of *n* dimensions, *n* points are needed to specify a frame of reference. In the spatial case, for example, it’s 3. Since time is one dimensional, only a single point is needed.

<sup>44</sup> See the discussion below in “Metaphysics”.

relative to which descriptions of other elements are relativized (either explicitly or implicitly). A perspectival representation of *S* is one that is relativized to a frame of reference. In an *n*-dimensional space an *n*-dimensional frame of reference is needed to fully characterize a perspective.<sup>45</sup> An invariant representation of *S* is that one that is unchanged by transformations between perspectives.

In physics,<sup>46</sup> time is conceived as one dimension of a four-dimensional manifold whose other dimensions are spatial, and whose structure we aim to describe in invariant terms. We can *represent* space-time in terms that are invariant under transformations between spatiotemporal perspectives, but we can't *experience* it as such. The world as encountered in experience is the world as encountered from a spatially and temporally embedded perspective, that is, from the *here-now* of a particular perceptual encounter with it. The reconciliation of time as conceived in physics with time as encountered in experience is the central problem in the metaphysics of time. A big part of that problem is the reconciliation of time as represented in invariant terms with time as presented to consciousness from different perceptual perspectives.<sup>47</sup> I opened with a catalogue of some of the differences between time as represented by physics and time as encountered in experience. Time as conceived by physics is one dimension of a four-dimensional manifold of events. There is no intrinsic difference between past and future;<sup>48</sup> there is no change or movement; the parts of time exist together, eternally, in a fixed configuration. Time as encountered in experience, by contrast, exhibits a cluster of well-known past/future asymmetries; change and movement are the rule rather than the exception; the world is in the process of becoming, new facts are constantly coming into existence; the past is fixed, but the future remains to be decided.

I have not been concerned with the metaphysical problem directly. I have been concerned, rather, to elucidate the psychological structures that arise in the mind of a being that encounters time from different perspectives and remembers those encounters. The discussion bears on the metaphysical problem, however, in the following way. It makes available to the metaphysician the resources of psychological explanation of elements of phenomenology that don't correspond in any obvious way to features of the spatiotemporal manifold. One of the things that is especially intriguing about temporal experience is how much psychological complexity it presupposes and how much of it is not generated by interaction with the environment, but generated by internal interaction among representational contents. Start with a system that is receiving perceptual input from the environment, add a temporal dimension to its representational states, and allow memory to work recursively on those states, and the result is an internal environment that is a virtual hothouse for the cultivation of

<sup>45</sup> These notions can be generalized to allow for incomplete perspectives and implicit perspectivality. There may be ambiguity among perspectives if the space possesses symmetries.

<sup>46</sup> The physics of time is unsettled. The problems that beset the understanding of time in quantum gravity are wholly new. I am speaking here entirely within the setting of a relativistic understanding of time.

<sup>47</sup> And it is very much complicated by the fact that the representation of time from multiple perspectives are always co-present in consciousness in the form of memories.

<sup>48</sup> And this is linked to the fact that the dynamical laws are symmetric under reflection in time.

increasingly complex psychological structures. We have the specious present with its internal structure, with the long line of nested memories and expectations (and memories of memories, and memories of expectations and expectations of memories ...) superimposed over the specious present in a resonating interaction. All of this structure is co-present in every temporal cross section of consciousness, and can provide the basis for yet further higher level states. It's not that this phenomenology is not perceptual: it clearly is. It arises from continued interaction with an external environment. It's rather that it doesn't fit the over-simple film projector, or property-tracking model of perception. Over time, as one viewpoint is exchanged for another, we get an emergent phenomenology involving the experience of movement and change, and eventually suspense, and the more complex narratively structured emotions: suspense, nostalgia, excitement, regret.

Understanding the different elements of this phenomenology is not, or not purely, a matter of finding objective correlates in the invariant picture of time. Some elements of the phenomenology *do* have objective correlates. A lot of progress has been made in the philosophical literature, for example, on the cluster of past/future asymmetries in terms of the thermodynamic gradient. But others do not. The fixity of the past and openness of the future are real but perspectival effects. From an embedded perspective, it is right to think of ourselves as perpetually in the process of becoming, transitioning from one perspective to the next. It's right to think of the past as fixed and the future as open: transitions between perspectives always close off possibilities that were open in the past. There is nothing illusory about these asymmetries. To say that they are perspectival is to say that they are represented in the temporally unembedded view of reality (i.e. the representation of time that is invariant under transformations between temporal perspectives) by relativization to a point (or frame).<sup>49</sup>

What does all of this teach us about the fraught issue of the experience of flow? We can reject outright the incoherent pictures criticized in other papers in this volume, but link the feeling of flow to the experience of movement and change. It was a penetrating phenomenological insight of both James and Husserl to recognize that movement and change are part of the immediate content of the most basic kind of experience. We arrive at the idea of stasis, of an instant of time, or of a point of space only by analysis, by carrying the process of subdivision to its limit, but the idea of a static state is phenomenologically empty. Of all of the ink that's been spilled over the question of whether, and in what sense, time flows, perhaps what we're really trying to get at when we speak of the flow of time, is the phenomenologically basic experience of a world in perpetual flux. It's appropriate that James should have the last word here:

Empty our minds as we may, some form of changing process remains for us to feel, and cannot be expelled . . . Awareness of change is thus the condition on which our perception of time's flow depends."<sup>50</sup>

<sup>49</sup> And, perhaps, to add that the relevant point (or frame) is undistinguished from others of the same kind in the invariant representation.

<sup>50</sup> James (1890).

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