

ONE

The Composition of *Science and the Modern World*

MOST readers have found a vast difference between Whitehead's earlier works in the philosophy of nature, published 1919–1922, and his later metaphysical writings, starting with *Science and the Modern World* (1925). Why should this be so? The shift in outlook has been variously explained. Nathaniel Lawrence sees Whitehead's later philosophy as gradually emerging out of the tensions and conflicts already inherent in the "idealist" and "realist" strands of his epistemological reflections in the philosophy of nature, conflicts Whitehead was not able to resolve to his own satisfaction until *Process and Reality*.¹

In contrast, Ivor Leclerc questions whether such epistemological conflicts existed in Whitehead's philosophy of nature, and suggests that the different positions he later espouses are due to the different problems he encounters. After 1924, Whitehead explicitly broadens the scope of his endeavor to include metaphysics, which had been rigorously excluded heretofore. In August 1924, in the preface to the second edition of *The Principles of Natural Knowledge*, Whitehead wrote that he hoped "in the immediate future to embody the standpoint of these volumes in a more complete metaphysical study" (PNK ix). This occasioned preoccupation with a different set of problems, those posed by Plato, Aristotle, Descartes, Hume, and Kant, rather than those posed by the breakup of the Newtonian world-scheme, or by the polemic against scientific materialism. This shift in concern, Leclerc contends, led Whitehead to readapt his constructs of "events" and "objects" to a new situation.² But a shift in concern alone need not have brought the far-ranging transformation of philosophical issues that Whitehead's investigations into metaphysics propose. On

the basis of his philosophy of nature, one would have anticipated some sort of "scientific philosophy" closer in orientation to Bertrand Russell's, for example. What actually emerged, however, was something quite different.

We propose a third explanation. The distinctive features of Whitehead's later thought arise not out of epistemological conflicts inherent in the earlier philosophy of nature, nor from the mere shift to metaphysical questions, but from difficulties arising out of his initial metaphysical view. The emergence of Whitehead's metaphysics can be found in the successive revisions Whitehead made of this initial sketch which had been designed as a metaphysics appropriate to his philosophy of nature.

This explanation assumes, as the others do not, that there is a genuine metaphysics of the philosophy of nature, a metaphysics belonging to the earlier philosophy. Both Lawrence and Leclerc assume that the shift to the later philosophy coincides with the shift to metaphysics. For the distinctive features of Whitehead's later philosophy are already present in his first metaphysical writing, *Science and the Modern World*. Ordinarily, in interpreting a philosophical work, we assume it to be written from a single, consistent standpoint. Nearly all commentators, therefore, have assigned *Science and the Modern World* as a whole to Whitehead's later philosophy, and frame their explanations of the shift accordingly. However, this book has a complex history of composition. If we rigorously attend to the *original* layer it contains, we do not find certain basic features characteristic of the later philosophy, except possibly pansubjectivity in a qualified sense. The original Lowell Lectures, delivered in February 1925, constitute Whitehead's first metaphysical synthesis, an extension of his earlier philosophy of nature into metaphysics, quite unlike the developments which were to follow.

1. BASIC CHARACTERISTICS OF THE LATER PHILOSOPHY

To make this thesis more precise, we must describe the three basic characteristic features of Whitehead's later philosophy which particularly mark this shift: temporal atomicity, pansubjectivity, and theism.

(1) *Temporal atomicity*. Unlike the actualities of traditional philosophies, Whitehead's fundamental actualities are not enduring substances but events. Like Democritus and his modern followers, however, he takes these fundamental actualities to be atomic, that is, incapable of subdivision into smaller entities that are equally actual. Just as an elementary particle is incapable of reduction to any "more

elementary" particles (although it is extensive and hence "mathematically divisible"), so an elementary event or "actual occasion" cannot be subdivided into any subevents which are themselves as fully actual and determinate as actual occasions.

While pansubjectivity and theism are topics outside the purview of the philosophy of nature, this doctrine of temporal atomicity directly contravenes Whitehead's earlier emphasis upon temporal continuity. "The continuity of nature is the continuity of events . . . every event contains other events as parts of itself [and] every event is a part of other events" (CN 76).

(2) *Pansubjectivity*. As a direct consequence of this temporal atomicity, the only present immediacy each of us has direct access to is our own momentary subjectivity. All other events, even those ingredient in our present apprehension, must already be past to be experienced. Thus the subjective/objective distinction becomes a temporal one: the subjective factors of experience refer to one's own present immediacy, while the objective factors refer to those past events ingredient in this immediacy. Since every event was once present, it must have enjoyed its own present immediacy, and the only language at our disposal which can appropriately describe this present immediacy is that used to describe our own subjectivity, suitably purged of all anthropomorphism.

Once the subjective/objective distinction is freed from any necessary correlation with the mental/physical distinction, the latter can take on a new dimension of meaning. Whitehead interprets the physical in terms of repetition of the past, while the mental applies to the origin of novelty. There is much more origination of novelty in the world than just in the animal mind. Living cells, for instance, exemplify it. While all occasions in their own present immediacy are equally subjective, there are degrees of mentality commensurate with their origination of novelty.

Unlike that sort of panpsychism which ascribes degrees of awareness or consciousness to all actualities, Whitehead ascribes consciousness only to those few complex occasions of high mentality capable of sustaining intellectual feelings. There are no degrees of awareness below this threshold, so the scope of consciousness in Whitehead is not much different from that of ordinary theory. Subjectivity, mentality, and consciousness, however, must be sharply distinguished for the later Whitehead, since he is a pansubjectivist.

(3) *Theism*. Whitehead's theism was never merely conventional, for he would never countenance the idea of God as transcendent creator of the world. When first introduced, God is conceived as the

principle of limitation ordering the world; later in *Process and Reality* God is also ascribed a consequent nature. None of this appears in the earlier philosophy of nature. We should not expect it in the earlier books, as outside their purview, but Whitehead's reticence in the metaphysics of the Lowell Lectures is more striking. This metaphysical sketch, taken at face value, constructs a tidy naturalism, although Whitehead does not remark upon that fact. God's existence and nature were not introduced as essential features of his metaphysics until after the shift.³

With these three distinctive features in hand, it becomes possible for us to specify more precisely when the shift between the earlier and the later philosophies of Whitehead took place. Since temporal atomicity is first emphatically espoused in *Science and the Modern World*, many readers have rather naturally supposed the shift to have taken place prior to its composition, perhaps in 1924, the "silent" period during which Whitehead published little. Compositional analysis, however, suggests the shift came *during* the writing of that book, and Whitehead did not go back and revise what he had already written to make it conform to his newly revised outlook.

The eight Lowell Lectures of February 1925 form the core of *Science and the Modern World*. He wrote them after coming to Harvard the previous September, at the rate of one lecture a week. The lectures "with some slight expansion" were "printed as delivered," with the addition of two lectures he had delivered elsewhere and two fresh chapters on "Abstraction" and "God" (SMW viii).

Now it is possible to isolate at least three passages that were added to the Lowell Lectures. In itself this could be unremarkable, but it so happens that both Whitehead's temporal atomicity and his philosophical theism first make their appearance here. Moreover, there are passages in the original Lowell Lectures which stand in considerable tension to these additions. Thus it appears that Whitehead's basic shift took place between the original Lowell Lectures in February and the completion of the book in June 1925.

Had Whitehead confined his later views to the two "metaphysical" chapters on "Abstraction" and "God," it would have been considerably easier for readers to recognize the shift in point of view within *Science and the Modern World*. But we ordinarily expect a book to reflect a coherent perspective, so we do not anticipate such shifts. The shift was made all the more difficult to discern in that these three additions give the earlier material the coloring of the later philosophy.

Thus, let us first detail the four compositional layers of *Science and the Modern World*, as a necessary basis for the analysis of the doctrines of these compositional layers in succeeding chapters. Then we shall conclude this chapter with a study of endurance and vibration, because this particular topic nicely illustrates the differing doctrines of the two main layers of this book.

2. THE FOUR LAYERS OF SCIENCE AND THE MODERN WORLD

(1) The eight Lowell Lectures, delivered in February 1925, form the core of the book. They comprise nine of the chapters: 1, 3, 4, 5, 6, 7, 8, 9, 13. (One lecture, we are told in the preface, was subdivided into two chapters, 7 and 8.) The Lowell Lectures were designed to give a history of modern science to recent times, together with a critique of "scientific materialism." Whitehead also gave a positive alternative in brief sketches included in most lectures. If this was not the "more complete metaphysical study" of the foundations of his philosophy of nature which Whitehead had promised (PNK ix), it was a preliminary study thereto. At any rate, these brief sketches are all that we have of Whitehead's first metaphysical sketch, drafted in fundamental continuity with the earlier philosophy of nature. The adoption of temporal atomism marked a fundamental reorientation in his metaphysical thinking.

(2) Chapters 2 and 12 were occasional lectures delivered elsewhere (SMW viii). They can be classed with the thought of the Lowell Lectures.

Chapter 2, "Mathematics as an Element in the History of Thought," was delivered as a lecture before the Mathematical Society of Brown University. Because its subject-matter is predominantly mathematical, this lecture is difficult to relate to Whitehead's metaphysical views. What slight clues we have point towards the earlier period. Towards the end of this lecture, the paradoxes and perplexities of the quantum theory are introduced (SMW 34f). After sketching his own alternative, Whitehead concludes: "It seems, therefore, that the hypothesis of essentially vibratory existence is the most hopeful way of explaining the paradox of the discontinuous orbit" (SMW 36). To be sure, this might be taken to refer to the atomistic theory of vibration introduced in the final paragraphs which were added to chapter 8 on "The Quantum Theory" (see 3[c] below), but more probably refers to the "general theory of the vibration of primates" (SMW 135) included within the original Lowell Lecture.

One possible addition of six paragraphs may have been made to chapter 2. If so, it was made in conjunction with the chapter on "Abstraction," and will be evaluated with respect to that final layer. In that case Whitehead composed chapter 2 from the standpoint of the Lowell Lectures, revising them later from his newly discovered standpoint by the insertion of this fresh material.

Chapter 12, "Religion and Science," formed an address delivered at the Phillips Brooks House at Harvard. Because it comes immediately after the chapter on "God," we would naturally expect the same theistic perspective to prevail. Then it would be strange that chapter 12 nowhere forthrightly affirms God's existence as in chapter 11. But here Whitehead's philosophical shift must be taken into account. While the later Whitehead is emphatically theistic, the earlier Whitehead is implicitly nontheistic. I say "implicitly," because he was exceedingly reticent about declaring himself in these matters, but the Lowell Lectures are quite consistent with a thorough-going naturalism. Whitehead rejected the notion of a transcendent creator, and did not embrace theism until the concept of God could be disentangled from that notion.

Thus, the issue to be determined is the temporal relationship between "Religion and Science" and the adoption of temporal atomism. According to the *Harvard Crimson* for the next day, this lecture was presented on Sunday, April 5, 1925.⁴ Two days later Whitehead first announced his discovery of temporal atomicity to his classes at Harvard, as something brand new, as something he had not espoused even two weeks before.⁵ It is highly unlikely that he had yet thought through its implications for theism. His particular understanding of God, moreover, is closely connected with his analysis of "Abstraction," and Whitehead first mentions the theme of "Abstraction" in his classroom lectures for May 1925.

For these reasons I conclude that "Religion and Science" belongs with his earlier, nontheistic period. The extremely high estimate of religion in this lecture takes on added poignancy when we realize it was penned by a (possibly reluctant?) nontheist. Consider these words: "It is the one element in human experience which persistently shows an upward trend. It fades and then recurs. But when it renews its force, it recurs with an added richness and purity of content. The fact of the religious vision, and its history of persistent expansion, is our one ground for optimism. Apart from it, human life is a flash of occasional enjoyments lighting up a mass of pain and misery, a bagatelle of transient experience" (SMW 192). To be sure, these words could be interpreted in terms of some nontheistic religious

stance, such as Buddhism. Whitehead, however, defines religion in terms of God in this same address: "Religion is the reaction of human nature to its search for God" (SMW 191). We shall examine this chapter later, along with the chapter on "God," in chapter 5.

(3) The first two layers belong to Whitehead's earlier philosophy, the last two to his later philosophy. The third layer consists of three passages which have been inserted into the texts of the original Lowell Lectures. Together they appear to comprise the "slight expansion" Whitehead mentions in his preface.

(a) The "Triple Envisagement" Addition. This insertion to Whitehead's chapter on "The Nineteenth Century" consists of the three paragraphs overlapping page 105, and beginning with the sentence: "The total temporal duration of such an event bearing an enduring pattern, constitutes its specious present" (SMW 104).

The text of this chapter reads quite smoothly with the omission of these three paragraphs. Thus the paragraph immediately following the intrusion begins: "The atomic material entities which are considered in physical science are merely these individual enduring entities . . ." (SMW 106). What do these material entities refer to? They do not refer to anything in the immediately preceding paragraph in the printed text (SMW 105f), which summarizes his immediate train of thought in terms of a triple envisagement, but refer to four paragraphs earlier, where Whitehead had been considering the extrinsic reality of "an enduring individual entity" (SMW 104). These two paragraphs originally followed one another, and Whitehead inserted a paragraph to explain his newly discovered theory of endurance based upon temporal atomicity, coupled with two paragraphs outlining a triple envisagement which anticipates some of the themes of the later chapters on "Abstraction" and "God." We suspect this passage was written after his introduction of temporal atomicity in the "Relativity" addition (to be considered next), but before he had decided to include his reflections on "Abstraction" and "God" in *Science and the Modern World*.

We shall consider this section, insofar as it pertains to endurance, in the next section, and insofar as it pertains to the triple envisagement, in chapter 5 on "God."

(b) The "Relativity" Addition. This is the most important of Whitehead's additions, for in it he introduces his reasons for temporal atomicity, which serves as the catalyst for the other shifts he introduces into his metaphysics.

We know from his preface that Whitehead subdivided his sixth Lowell Lecture on "Modern Thought" into two separate chapters on

"Relativity" and "The Quantum Theory." Together these two chapters comprise some 32 pages in the second edition, whereas the other Lowell Lectures average 25 or 26 pages, the longest being the first, which runs just 4 lines over 27 pages. Hence we may anticipate that some 5 to 7 pages were added to the sixth lecture. Moreover, if the bulk were added at the end of the section on "Relativity," no awkward transition would be required, since "The Quantum Theory" could form a new chapter.

If we consider chapters 7 and 8 together, then the first paragraph of chapter 8 ("The Quantum Theory") follows quite naturally from the paragraph of chapter 7 beginning: "It only remains to add that Einstein would probably reject the theory of multiple space-time systems which I have been expounding to you" (SMW 122). Whitehead had been discussing the Michelson-Morley experiment and presenting the theory of relativity (in his own terms) as an advance on Newton. In this brief concluding paragraph he alludes to some of the differences of interpretation he has with Einstein, differences articulated in his book, *The Principle of Relativity* (1922), not mentioned here by name. The first paragraph of chapter 8 immediately picks up the theme, and it can be easily read as a transitional paragraph from the earlier discussion of the principles of relativity to the second topic of his Lowell Lecture, the quantum theory.

The last ten paragraphs of the chapter on "Relativity," beginning with "The theory of the relationship between events at which we have now arrived . . ." (SMW 122), thus constitutes this second addition. While the preceding discussion of relativity theory is carried forward in the next chapter, none of the topics of this insertion are alluded to, such as the theory of external and internal relations, the atomicity of temporalization, the inconsistencies of Kant's analysis of extension, and the present validity of Zeno's paradoxes.

Temporal atomicity, however, powerfully crystalizes several lines of argument present in the original Lowell Lectures. For one thing, it enables Whitehead to clarify the relation between an event and an act of prehension. They are identified in the Lowell Lectures, but this is an uneasy identification. Some events are far too long, for the repeated reiteration of pattern within an enduring event suggests that it has several acts of prehensive unification, not just one (SMW 104). Since events as such can be of any length whatsoever, some might be far too brief for a prehensive act.

Also, temporal atomicity allows for the unification of process and prehension. If we conceive of a continuously unfolding nature, each prehensive unity might be thought of as an instantaneous unity of

some slice of nature. Each prehensive unity would be naturally internally related to the whole of nature simultaneous with itself at that instant. If that were the case, there could be no "process" of unification. Such a process must be temporally thick and closed upon itself to make room for the activity of unification.

We shall examine the nature of Whitehead's argument for temporal atomicity in chapter 3. Its ramifications are far-reaching, and will concern us in later chapters as well as in the concluding section of this chapter.

(c) "The Quantum Theory" Addition. Here Whitehead briefly sketches, in an afterthought to this chapter, an alternative solution based on his newly-discovered temporal atomicity. This we take to be the last four or five paragraphs of chapter 8. It is clearly dependent on the "Relativity" addition, as Whitehead explicitly notes. In the preceding paragraphs he had been intent upon giving a theory of the apparently discontinuous character of electrons (generalized as "Primary organisms" or "primates") in terms of vibratory patterns. Then he adds: "The theory of a primate or a vibratory pattern given above, together with the distinction between temporality and extensiveness in [the addition to] the previous chapter, yields exactly this result" (SMW 135). There follows an alternative theory of vibration, couched in terms of successive atomic durations, as required by the theory of temporal atomicity.

The last four paragraphs initiated by the sentence just quoted belong to this addition, but it is less certain whether the immediately preceding paragraph does or does not. We incline to the view that it does, because otherwise it would be the final paragraph of this chapter, unless Whitehead had discarded his original ending. This seems not to have been his usual practice, as we shall see. That paragraph is better understood as a transitional paragraph introducing the new theory than as the final paragraph of the chapter without the addition. On the other hand, *its* predecessor makes a satisfactory terminus to the chapter, and could well have been its original ending.

(4) Finally, after these three additions, we come to the last layer of the book, chapters 10 ("Abstraction") and 11 ("God"). Unlike much of Whitehead's literary production, they were not first delivered as lectures, but written especially for *Science and the Modern World*. They represent his first systematic effort to articulate his revised metaphysics, as modified under the impact of temporal atomicity.

As the "Triple Envisagement" addition adumbrates several key themes in these chapters, Whitehead may have composed that addition before firmly deciding to incorporate "Abstraction" and "God"

within the book. These final chapters not only presuppose the shift, but the three additions as well.

These chapters alone use what becomes Whitehead's standard technical term, "actual occasion." The rest of the book, including the additions, uses "event," although rarely it uses "occasion" in a nontechnical sense, without suggesting its atomicity. Surprisingly enough, "actual occasion" is introduced quite casually, even though it is his standard term throughout these two chapters. This is very much like Plato's casual introduction of the Forms in the *Euthyphro*. In both cases every one is presumed to be already familiar with the terms.

Besides these two chapters (to be considered in detail later), we should examine one possible addition which would belong to this final layer. In his occasional lecture on mathematics (chapter 2), mathematics is described as "a resolute attempt to go the whole way in the direction of complete analysis, so as to separate the elements of mere matter of fact from the purely abstract conditions which they exemplify" (SMW 24). The next six paragraphs may have been added as a meditation in the light of the chapter on "Abstraction" concerning this theme. The predominantly historical thematic of the lecture is picked up seven paragraphs later with the observation that "Pythagoras was the first man who had any grasp of the full sweep of this general principle" (SMW 27). "This general principle" appears to refer to the very sophisticated logical harmony involved in the unity of an occasion, which is the ostensible referent in the immediately preceding paragraph, but it may refer back to the careful description of mathematics enunciated seven paragraphs before. Textual considerations alone are insufficient to determine the matter.

There is reason to believe, however, that these six paragraphs are in fact a reflection, from a mathematical perspective, of the metaphysical enterprise Whitehead undertakes in "Abstraction." He comments at the end of "Abstraction": "The idea [concerning the nature of mathematics], ascribed to Pythagoras, has been amplified, and put forward as the first chapter in metaphysics" (SMW 172). This suggests the following order: first, that definition of the nature of mathematics is directly ascribed to Pythagoras; second, the chapter on "Abstraction" is composed applying that idea to metaphysics; third, a meditation on that definition in the light of "Abstraction" is inserted into the earlier lecture.

Whitehead's use of "occasion" and "occasion of experience" in these six paragraphs is most provocative. As we have noted, he generally uses "event" throughout the Lowell Lectures, while only

the two metaphysical chapters use "actual occasion." Presumably Whitehead has "actual occasion" in mind, but wishes to avoid this particular technical term as inappropriate for a preliminary discussion such as this.

"Mathematics as an Element in the History of Thought" was delivered at Brown in April, 1925.⁶ Substantially the same lecture was given in New York City May 15 or 16, and Whitehead appears to have repeated its salient points to his Harvard class.⁷ William Ernest Hocking's notes do not indicate that those six paragraphs were discussed as part of the lecture. To be sure, any one taking notes omits a lot, or Whitehead could have simply omitted these ideas in his abbreviated presentation. But Whitehead had just been lecturing on the very topics which are to be found in the chapter on "Abstraction" both before and after this isolated lecture on mathematics. If he had composed these six paragraphs as part of his public lecture, or particularly if he had inserted them in his public lecture as an afterthought growing out of his preoccupation just then with the themes of "Abstraction," we could expect him to dwell precisely on that material during his class presentation.

Thus this additional evidence tends to indicate that while the mathematics lecture as a whole is independent of those metaphysical features marking Whitehead's shift, those six paragraphs were added later, probably in conjunction with the chapter on "Abstraction." They form an addition consequent upon that chapter, and not a precondition to the metaphysical chapters. Hence this addition is not classed with the three additions which effected the shift itself.

If the foregoing compositional analysis is correct, all the passages explicitly espousing temporal atomicity and theism were added to the original Lowell Lectures. This alone is not sufficient to demonstrate any shift in Whitehead's outlook, however. It is conceivable that he already had these ideas in mind, yet had no opportunity to develop them. Moreover, much that he writes about "events" in the Lowell Lectures makes as much, if not better, sense when interpreted in terms of the atomic actual occasions Whitehead later explicitly introduces. But as we will show, there are other passages in the Lowell Lectures which cannot be so interpreted, and which are at odds with any theory of temporal atomicity. We shall proceed, therefore, on the assumption that *Science and the Modern World* is composed of various layers best interpreted from diverse perspectives.

A book of this sort calls for a different hermeneutical strategy than most. The strategy is quite different for a systematic account than for a genetic analysis. In a systematic account the interpreter strives

for maximum coherence of argument, utilizing whatever evidence he can find. Disparate materials are assembled to fit one total scheme. For this purpose it is desirable to find the maximum systematic meaning in each passage, one which will be both appropriate for the text and consonant with the elaborated complex meaning of the whole. In a genetic interpretation, however, the levels of allowable meaning are stratified, and a given text is interpreted in terms of the context of meaning for that stratum. We endeavor to find that meaning appropriate to the text consonant with that particular stratum (and with earlier strata insofar as they are still affirmed). No text should be interpreted in terms which exceed that which is explicitly warrantable for that particular stage of the thinker's development.

The genetic principle of interpretation demands considerable discipline on our part, since we customarily approach the text with systematic concerns in mind. Moreover, Whitehead's language is frequently proleptic, leaping ahead of itself. Metaphysical terms, however much stabilized as technicalities, "remain metaphors mutely appealing for an imaginative leap" (PR 4). His language is always straining beyond itself, trying to express the vision Whitehead barely saw and could not fully grasp. His thought has its own entelechy, so that frequently intuitions expressed in earlier works only find their full justification in later ones. The best example of this would be the highly personalistic language about God's care for the world in *Religion in the Making*, which only finally makes full sense in terms of the conceptual tools he devised for the consequent nature of God developed in *Process and Reality*.

We shall attempt, as much as possible, to interpret such language primarily in terms of those concepts at Whitehead's disposal at the time it was articulated. We will not always succeed. Whitehead's reasoning is sometimes elliptical, dependent upon intermediate inferences of which he was not always fully aware. Sometimes these suppressed premises or arguments or distinctions come to light in his later work, but sometimes not, as in the case with many of his statements in the final chapters of *Process and Reality* and *Adventures of Ideas*. Because many of these cryptic assertions become powerfully illuminating when supplied with the necessary intermediate steps, the imaginative systematician is encouraged to hope that the rest will ultimately yield to rational justification. So it may be the case with the earlier works. They may be intelligible only in terms of suppressed considerations, first supplied in the later books. But so far as it will be possible, we shall endeavor to interpret these texts solely in the light of the arguments developed at the time. In this

way contrasting positions can be dramatized, making it possible to trace the stages of Whitehead's development.

3. ENDURANCE AND VIBRATION

Before examining the individual layers separately, we shall examine the question of endurance and vibration in *Science and the Modern World*, because this theme shows quite clearly the tensions and conflicts existing among the layers.

In Whitehead's final theory, actual occasions come into being and perish, but do not change (PR 35). "The fundamental meaning of the notion of 'change' is 'the difference between actual occasions comprised in some determinate event'" (PR 73 and 80). As with change, so endurance. An 'enduring object' is that common element remaining the same for several successive occasions.

Events and occasions are here sharply distinguished. An actual occasion is the atomic unit of temporal realization. An occasion may be divided coordinately, but such parts lack full actuality of the occasion. On the other hand, an event is any spatiotemporal volume, large or small. An event may include many occasions or fragments of several occasions, or simply be part of one occasion. An occasion, in contrast, is a definite ontological unit of becoming, a single concrescence or process of actualization. With respect to actualities, "an actual occasion is the limiting type of an event with only one member" (PR 78).

These distinctions were not explicitly elaborated when the term "actual occasion" was introduced in the final stratum of *Science and the Modern World*, but Whitehead's usage follows these distinctions. Whenever the ontological unit of prehensive unification is referred to, "actual occasion" is used in the chapters on "Abstraction" and "God." In contrast to the rest of the book, "event" is rarely employed. It is either used non-technically, as in "the general course of events" (SMW 161), or in contexts referring both to individual occasions and to groups of occasions forming larger events (SMW 158f, 177).

"Actual occasion" becomes a feature of Whitehead's technical vocabulary when he first finds it necessary to distinguish atomic units of temporal realization from events, which retain their divisibility. Previously, it is true, he had spoken of the "prehensive occasion" (SMW 71), and such an event would be an occasion in which the fullest concreteness would be achieved. Hence it would be appropriately called "actual" (cf. SMW 158). But no such technical

terminology was ever suggested in the Lowell Lectures, let alone stabilized. "Prehensive occasions" are just events like any others.

In one case, in the chapter on "Abstraction," the event in nature is regarded as merely the objective aspect of an actual occasion: "So far I have merely been considering an actual occasion on the side of its full concreteness. It is this side of the occasion in virtue of which it is an event in nature. But a natural event, in this sense of the term, is only an abstraction from a complete actual occasion. A complete occasion includes that which in cognitive experience takes the form of memory, anticipation, imagination, and thought" (SMW 170).

It is the ascription of these inner aspects to spatiotemporal volumes which marks the difference between *Science and the Modern World* and Whitehead's earlier books. In the philosophy of nature, events were described solely in terms of that which was perceived or prehended; here events are described (in the Lowell Lectures) as activities of prehension. "Thus, concrete fact is process. Its primary analysis is into underlying activity of prehension, and into realized prehensive events. Each event is an individual matter of fact issuing from an individualization of the substrate activity" (SMW 70). Viewed internally, "space-time is nothing else than a system of pulling together of assemblages into unities. But the word *event* just means one of these spatiotemporal unities" (SMW 72; cf, 93). For these reasons, and since, for the Lowell Lectures, "the event is the unit of things real" (SMW 152), it is very easy to suppose that the word "event" here is simply an earlier term for "actual occasion," used to signify actual occasions before Whitehead coined the term, simply inherited from his earlier distinction between "events" and "objects" in the philosophy of nature.

Under this supposition, when Whitehead became increasingly aware of the need to distinguish his earlier purely objective approach from his growing concentration upon internal concerns, he would have coined the term "actual occasion." This language could have been suggested by the fact that such an event was the occasion or opportunity for prehensive unity. In the Lowell Lectures he had already spoken of the "prehensive occasion," although as yet nontechnically, and it would only take time before he could adopt "occasion" as his characteristic term.

The difficulty with the supposition is that there are uses of "event" in the Lowell Lectures for an enduring object. The possibility of using "event" in this meaning presupposes notions of continuity and divisibility which directly contravene the atomicity assigned to actual

occasions. Here terms are less important than the absence of temporal atomicity from Whitehead's analysis of endurance.

"Endurance is the retention through time of an achievement of value" (SMW 194). This understanding of endurance is common to all strata of *Science and the Modern World*. What differs is whether the enduring object is characteristic of the event as a whole, simply reiterated in each of its parts (subevents), or whether it is the repetition of the common characteristic in successive occasions. In the early theory endurance is conceived primarily in terms of a single total event: ". . . endurance is not primarily the property of enduring beyond itself, but of enduring within itself. I mean that endurance is the property of finding its pattern reproduced in the temporal parts of the total event. It is in this sense that a total event carries an enduring pattern" (SMW 152).

The enduring characteristic is thus conceived as a continuous property of the event, applicable to all of its sub-divisions. "We can give a precise definition of endurance in this way: Let an event A be pervaded by an enduring structural pattern. Then A can be exhaustively subdivided into a temporal succession of events. Let B be any part of A, which is obtained by picking out any one of the events belonging to a series which thus subdivides A. Then the enduring pattern is a pattern of aspects within the complete pattern prehended into the unity of any temporal slice of A, such as B. For example a molecule is a pattern exhibited in an event of one minute, and of any second of that minute" (SMW 108; cf. 119f). Also any fraction of that second whatsoever, since Whitehead as the inventor of the method of extensive abstraction had a very lively awareness of the unrestricted scope of meaning to be assigned to *any* part. Here there is no suggestion that there is any lowest bound below which the pattern cannot be displayed. This pattern, which is "reproduced in each temporal slice of [the event's] history," is the "enduring object" (SMW 119, cf. 120, 94).

From a traditional standpoint, the enduring object is the primary reality, and the subevents are merely artificial ways of dividing the one event. To be sure, they "reproduce" the common pattern, but merely because it is all-pervasive. Sometimes Whitehead appears to share this perspective, but he is also fascinated by the role these partial events can play in providing the basis for "the property which we may call indifferently *retention, endurance or reiteration*. . . . The reiteration of a particular shape (or formation) of value within an event occurs when the event as a whole repeats some shape which is also exhibited by each one of a succession of its parts. Thus

however you analyze the event according to the flux of its parts through time, there is the same thing-for-its-own-sake standing before you. Thus the event, in its own intrinsic reality, mirrors in itself, as derived from its own parts, aspects of the same patterned value as it realizes in its complete self. It thus realizes itself under the guise of an enduring individual entity, with a life history contained within itself" (SMW 104). Thus it is the total enduring event which realizes itself, not the individual events which then jointly constitute the enduring object.

Yet the passage is ambiguous, for it may mean that the parts are merely arbitrary subdivisions of a total event exhibiting the same enduring pattern, or that the partial events produce this pattern, which is then ascribed to the whole. Whitehead seizes upon this latter meaning in order to insert his "Triple Envisagement" addition. The first paragraph of this addition is inserted to explain endurance now in terms of his new theory of temporal atomism, and it is probably inserted at this point to capitalize upon the ambiguity just noted. Because of it, there could be an apparently smooth transition, but the presuppositions of the bridging paragraphs are quite distinct. In the first, "*however* you analyze the event according to the flux of its parts through time" (SMW 104, italics added), the pattern remains the same and is exhibited in each of the parts. Now, however, Whitehead introduces the notion of the event's specious present, such that it is "within this specious present [that] the event realizes itself as a totality" (SMW 104). It comes into being as a single actuality, in conformity with the later atomistic theory.

To effect the transition, Whitehead has to force the temporal span of what is referred to as the total event into very narrow quarters. In the original lecture he is intent upon explaining endurance, and the event could be of any length. A few pages later, in the same lecture (but after the insertion), he can use the endurance of a molecule throughout a minute as his illustration (SMW 108), and there is no reason why we could not conceive of the endurance of the Egyptian Sphinx since its construction as such an event. Now, however, we are told that "the *total* temporal duration of *such an event* bearing an enduring pattern, constitutes its specious present" (SMW 104, italics added), which is extremely brief. The word "duration," which ordinarily signifies something enduring a while, was technically introduced by Whitehead for a very short temporal expanse approaching instantaneousness, in order to explain simultaneity (CN 56f). In the addition to the chapter on "Relativity," "duration" is regularly used for atomic temporalization. "Time is sheer succession of epochal

durations" (SMW 125). The theory expressed in this first paragraph of the "Triple Envisagement" addition, trying to explain endurance in terms of temporal atomicity, is clearly transitional, because it reflects neither the assumed continuous endurance of the pattern as in the original lecture, nor the later theory in which endurance applies only to the common characteristic of many successive actual occasions. In this first paragraph he is trying to explain what he conceives to be the enduring pattern of a single occasion.

According to the later theory, endurance and prehensive unification are contradictory attributes, since prehensive unification can only apply to individual actual occasions, and endurances to the succession of many occasions. At the time of the Lowell Lectures, however, Whitehead had only the single concept of "event" to cover both cases. Moreover, he believed that no difficulty was involved in conceiving both prehensive unification and the enduring object in similar terms. Thus he could say that "an event is the grasping into unity of a pattern of aspects" and refer to this same pattern as enduring: "If the pattern endures throughout the successive parts of the event, and also exhibits itself in the whole, so that the event is the life history of the pattern, then in virtue of that enduring pattern the event gains in external effectiveness. For its own effectiveness is reinforced by the analogous aspects of all its successive parts" (SMW 119).

This thesis could then be summarized: "Endurance means that a pattern which is exhibited in the prehension of one event is also exhibited in the prehension of those of its parts which are discriminated by a certain rule" (SMW 119f). This sentence can be easily misunderstood if we try to interpret it purely systematically in terms of *Process and Reality*. Then the event becomes a single actual occasion, and the parts various genetic phases with their multiplicity of prehensions. We have to remember, however, that this passage was written before Whitehead anticipated temporal atomicity, let alone thought about genetic division. Also, the term "prehension" has not yet acquired the primary connotation of being the taking account of single datum. That first develops with the differentiation between prehension and concrescence, such that a concrescence is the growing together of many prehensions into one. In *Science and the Modern World*, prehension primarily means prehensive unification, the grasping together of aspects from all events into the unit of the single present event.

The combination of prehension and endurance is not so strange if we bear in mind that the notion of an activity of unification was

not yet very developed. "Prehensive unification" in these lectures appears to mean little more than its synonym "prehensive unity." It has exactly the same force as "synthesis" in Kant's "synthesis of the manifold of intuition." Whitehead conceives of prehension as a state of relatedness between the objective aspects of all other events and the prehending event. Since changes in the environment are negligible with respect to a given enduring object, the prehension or mutual relatedness of the whole can be reflected in the prehension of each part. Thus "that which endures . . . is not self-sufficient. The aspects of all things enter into its very nature. It is only itself as drawing together into its own limitation the larger whole in which it finds itself" (SMW 94).

Despite this, however, there was a subtle tendency upon Whitehead's part to conceive of prehension as more than just synthesis, as involving successive acts of unification. Then the total event becomes exhibited in the successive subevents, and the subevents, as individual acts of unification, have a stronger ontological foundation than the overall event. Yet the single concept of event, signifying any spatiotemporal volume, however large or small, and his predilections for extensive continuity prevent Whitehead from acting on the strength of this tendency. Once temporal atomicity is discovered, however, the picture is immediately clarified: the individual acts of prehensive unification are then understood as atomic occasions, while enduring events refer to groups of contiguous occasions.

The theory of endurance for the Lowell Lectures, as we have presented it, is incomplete. It could be assumed that each pattern reiterates the same pattern throughout the event, just as on the materialist assumption there is undifferentiated sameness throughout the life of an elementary particle. Whitehead recognized that there can be differences among the parts of an event, although at first he was content to describe these in merely spatial terms. "It is not true that any part of the whole event will yield the same pattern as does the whole. For example, consider the total bodily pattern exhibited in the life of a human body during one minute. One of the thumbs during the same minute is part of the whole event. But the pattern of this part is the pattern of the thumb, and is not the pattern of the whole body" (SMW 120).

In the sixth Lowell Lecture, after describing the quantum theory, Whitehead was ready to introduce temporal differences as well: "In the organic theory, a pattern need not endure in undifferentiated sameness through time. The pattern may be essentially one of aes-

thetic contrast. A tune is an example of such a pattern. Thus, the endurance of the pattern now means the reiteration of its succession of contrasts" (SMW 133).

This theory accepts temporal continuity, at least in the sense that any event can be temporally sub-divided into sub-events whose objective characteristics in succession exhibit the character of the whole. Here it is not argued that the parts have no determinate character in themselves, but are only phases in a single process of determination. The determinate parts can be individually objectified, and their succession exhibits the determinate character of the whole.

Whitehead had already accepted, possibly from Bergson, the notion that some events, at least, must have a minimum duration to be themselves. Thus, in his address to the Aristotelian Society in 1919 on "Time, Space, and Material," Whitehead tells us that "a molecule of iron and a tune both require a minimum time in which to express themselves" (IS 67). Such "nonuniform" objects, as he terms them, do not immediately induce him to adopt temporal atomicity. Events and the objects which characterize them are here contrasted, and what atomicity there is is ascribed to the objects. "The continuity of nature arises purely from the extensional properties of events. . . . The atomic properties of nature arise entirely from objects" (IS 67).

Whitehead foresees the importance which vibration will play in quantum theory, but does not suggest that temporalization is itself atomized. "Whenever nonuniform objects emerge, then time-minima become important in physics (i.e. *quanta* of time, in the modern nomenclature). The atomic property of objects and the nonuniformity of some types of objects are obviously the basis of the quantum properties of nature which are assuming such an important position in modern physics" (IS 68). Such vibrations are expressed in terms of a succession of several atomic objects characterizing some of the subdivisions of the continuously divisible total event.

The addition to the chapter on "The Quantum Theory," which we have previously isolated as not part of the original Lowell Lecture, introduces a drastic restructuring of this theory. Here Whitehead distinguishes between (atomic) temporality and (continuous) extensiveness. "The continuity of the complex of events arises from the relationships of extensiveness; whereas the temporality arises from the realization in a subject-event of a pattern which requires for its display that the whole of a duration be spatialized (i.e., arrested), as given by its aspects in the event. Thus, realization proceeds *via* a succession of epochal durations; and the continuous transition, i.e., the organic deformation, is within the duration which is already

given. The vibratory organic deformation is in fact the reiteration of the pattern" (SMW 135f). The reiteration of the pattern in terms of successive determinate parts is retained for the event's objective display, but the event itself is conceived as an atomic unit of actualization. "One complete period defines the duration required for the complete pattern. Thus, the primate [roughly, the elementary particle] is realized atomically in a succession of durations, each duration to be measured from one maximum to another" (SMW 136).

This same theory of vibration underlies the initial paragraph of the "Triple Envisagement" addition discussed above. "One and the same pattern is realized in the total event, and is exhibited by each of these various parts through an aspect of each part grasped into the togetherness of the total event" (SMW 105). The successive parts now display the total pattern of this vibration, but they are all unified in a single prehensive unification, i.e. in a single occasion.

The theory of vibration expressed here and in the addition to the chapter on "The Quantum Theory" is not Whitehead's final one. Each vibration, measured from one maximum to another, constitutes here a single atomic event, while later Whitehead analyzed it in terms of two successive patterns, alternating with one another (PR 277-79). In part he wants to show how novelty (each occasion is different from its immediate predecessor and successor) and stability (each occasion is the same as every other one in this series) can be wedded together to achieve a modicum of intensity, but in part he was following the implications of his theory of change. Change is "the difference between actual occasions comprised in some determinate event" (PR 72). Since even a single vibration involves some change, this must be displayed in the difference between at least two occasions. At first Whitehead was willing to see the change involved within a vibratory event to apply to a single atomic occasion, but not later.

This discussion of endurance and vibration, together with the compositional analysis earlier in the chapter, indicates the shift that took place in Whitehead's metaphysics during the composition of *Science and the Modern World*. In order to gauge the extent of that shift, we need to know the character of his metaphysics beforehand, as it can be ascertained from the Lowell Lectures. That is the task of the next chapter.

NOTES

1. *Whitehead's Philosophical Development: A Critical History of the Background of Process and Reality* (Berkeley: University of California Press, 1956). In apparent independence from Lawrence (whom he never cites), Georges H elal comes to strikingly similar conclusions in *La philosophie comme panphysique: La philosophie des sciences de A. N. Whitehead*. (Montreal: Bellarmin, 1979).

2. "Whitehead's Philosophy" (a critical examination of Lawrence's book), *Review of Metaphysics* 11 (1957-58), 68-93.

3. Many of his early English admirers, such as L. Susan Stebbing, were shocked by this turn of events, for they had supposed him to be a "tough-minded" empiricist who was done with religious views.

4. I am indebted to Professor John E. Skinner of the Episcopal Divinity School, Cambridge, Massachusetts, for this information.

5. See chapter 3, and Appendix 1, for details.

6. Victor Lowe, "Whitehead's Gifford Lectures," *The Southern Journal of Philosophy* 7/4 (1969-70), 331.

7. See Appendix 1 for the notes of Whitehead's Harvard Lectures of May 19, 1925.