From: William James, *The Principles of Psychology* (1890), pp. 605-610, 619-631

# CHAPTER XV.[1]

## THE PERCEPTION OF TIME.

IN the next two chapters I shall deal with what is sometimes called internal perception, or the perception of *time*, and of events as occupying a date therein, especially when the date is a past one, in which case the perception in question goes by the name of *memory*. To remember a thing as past, it is necessary that the notion of 'past' should be one of our 'ideas.' We shall see in the chapter on Memory that many things come to be thought by us as past, not because of any intrinsic quality of their own, but rather because they are associated with other things which for us signify pastness. But how do these things get *their* pastness? What is the *original* of our experience of pastness, from whence we get the meaning of the term? It is this question which the reader is invited to consider in the present chapter. We shall see that we have a constant feeling *sui generis* of pastness, to which every one of our experiences in turn falls a prey. To think a thing as past is to think it amongst the objects or in the direction of the objects which at the present moment appear affected by this quality. This is the original of our notion of past time, upon which memory and history build their systems. And in this chapter we shall consider this immediate sense of time alone.

If the constitution of consciousness were that of a string of bead-like sensations and images, all separate,

"we never could have any knowledge except that of the present instant. The moment each of our sensations ceased it would be gone for ever; and we should be as if we had never been.... We should be wholly incapable of acquiring experience.... Even if our ideas were associated in trains, but only as they are in imagination, we should still be without the capacity of acquiring knowledge. One idea, upon this supposition, would follow another. But that would be all. Each of our successive states of consciousness, the moment it ceased, would be gone forever. Each of those momentary states would be our whole being."[2]

We might, nevertheless, under these circumstances, *act* in a rational way, provided the mechanism which produced our trains of images produced them in a rational order. We should make appropriate speeches, though unaware of any word except the one just on our lips; we should decide upon the right policy without ever a glimpse of the total grounds of our choice. Our consciousness would be like a glow-worm spark, illuminating the point it immediately covered, but leaving all beyond in total darkness. Whether a very highly developed practical life be possible under such conditions as these is more than doubtful; it is, however, conceivable.

I make the fanciful hypothesis merely to set off our real nature by the contrast. Our feelings are not thus contracted, and our consciousness never shrinks to the dimensions of a glow-worm spark. *The knowledge of some other part of the stream, past or future, near or remote, is always mixed in with our knowledge of the present thing*.

A simple sensation, as we shall hereafter see, is an abstraction, and all our concrete states of mind are representations of objects with some amount of complexity. Part of the complexity is the echo of the objects just past, and, in a less degree, perhaps, the foretaste of those just to arrive. Objects fade out of consciousness slowly. If the present thought is of A B C D E F G, the next one will be of B C D E F G H, and the one after that of C D E F G H I —the lingerings of the past dropping successively away, and the incomings of the future making up the loss. These lingerings of old objects, these incomings of new, are the germs of memory and expectation, the retrospective and the prospective sense of time. They give that continuity to consciousness without which it could not be called a stream.[3]

## THE SENSIBLE PRESENT HAS DURATION.

Let any one try, I will not say to arrest, but to notice or attend to, the *present* moment of time. One of the most baffling experiences occurs. Where is it, this present? It has melted in our grasp, fled ere we could touch it, gone in the instant of becoming. As a poet, quoted by Mr. Hodgson, says,

"Le moment où je parle est déjà loin de moi,"

and it is only as entering into the living and moving organization of a much wider tract of time that the strict present is apprehended at all. It is, in fact, an altogether ideal abstraction, not only never realized in sense, but probably never even conceived of by those unaccustomed to philosophic meditation. Reflection leads us to the conclusion that it *must* exist, but that it *does* exist can never be a fact of our immediate experience. The only fact of our immediate experience is what Mr. E. R. Clay has well called 'the *specious* present.' His words deserve to be quoted in full:[4]

"The relation of experience to time has not been profoundly studied. Its objects

are given as being of the present, but the part of time referred to by the datum is a very different thing from the conterminous of the past and future which philosophy denotes by the name Present. The present to which the datum refers is really a part of the past—a recent past—delusively given as being a time that intervenes between the past and the future. Let it be named the specious present, and let the past, that is given as being the past, be known as the obvious past. All the notes of a bar of a song seem to the listener to be contained in the present. All the changes of place of a meteor seem to the beholder to be contained in the present. At the instant of the termination of such series, no part of the time measured by them seems to be a past. Time, then, considered relatively to human apprehension, consists of four parts, viz., the obvious past, the specious present, the real present, and the future. Omitting the specious present, it consists of three … nonentities—the past, which does not exist, the future, which does not exist, and their conterminous, the present; the faculty from which it proceeds lies to us in the fiction of the specious present."

In short, the practically cognized present is no knife-edge, but a saddle-back, with a certain breadth of its own on which we sit perched, and from which we look in two directions into time. 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.[5] It is only as parts of this *duration-block* that the relation of 610
*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; and to sensible perception its elements are inseparable, although attention looking back may easily decompose the experience, and distinguish its beginning from its end.

When we come to study the perception of Space, we shall find it quite analogous to time in this regard. Date in time corresponds to position in space; and although we now mentally construct large spaces by mentally imagining remoter and remoter positions, just as we now construct great durations by mentally prolonging a series of successive dates, yet the original experience of both space and time is always of something already given as a unit, inside of which attention afterward discriminates parts in relation to each other. Without the parts already given as *in* a time and *in* a space, subsequent discrimination of them could hardly do more than perceive them as *different* from each other; it would have no motive for calling the difference temporal order in this instance and spatial position in that.

And just as in certain experiences we may be conscious of an extensive space full of objects, without locating each of them distinctly therein; so, when many impressions follow in excessively rapid succession in time, although we may be distinctly aware that they occupy some duration, and are not simultaneous, we may be quite at a loss to tell which comes first and which last; or we may even invert their real order in our judgment. In complicated reaction-time experiments, where signals and motions, and clicks of the apparatus come in exceedingly rapid order, one is at first much perplexed in deciding what the order is, yet of the fact of its occupancy of time we are never in doubt.

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### WE HAVE NO SENSE FOR EMPTY TIME.

Although subdividing the time by beats of sensation aids our accurate knowledge of the amount of it that elapses, such subdivision does not seem at the first glance essential to our perception of its flow. Let one sit with closed eyes and, abstracting entirely from the outer world, attend exclusively to the passage of time, like one who wakes, as the poet says, "to hear time flowing in the middle of the night, and all things moving to a day of doom." There seems under such circumstances as these no variety in the material content of our thought, and what we notice appears, if anything, to be the pure series of durations budding, as it were, and growing beneath our indrawn gaze. Is this really so or not? The question is important, for, if the experience be what it roughly seems, we have a sort of special sense for pure time—a sense to which empty duration is an adequate stimulus; while if it be an illusion, it must be that our perception of time's flight, in the experiences quoted, is due to the *filling* of the time, and to our *memory* of a content which it had a moment previous, and which we feel to agree or disagree with its content now.

It takes but a small exertion of introspection to show that the 620
latter alternative is the true one, and that *we can no more intuit a duration than we can intuit an extension, devoid of all sensible content*. Just as with closed eyes we perceive a dark visual field in which a curdling play of obscurest luminosity is always going on; so, be we never so abstracted from distinct outward impressions, we are always inwardly immersed in what Wundt has somewhere called the twilight of our general consciousness. Our heart-beats, our breathing, the pulses of our attention, fragments of words or sentences that pass through our imagination, are what people this

dim habitat. Now, all these processes are rhythmical, and are apprehended by us, as they occur, in their totality; the breathing and pulses of attention, as coherent successions, each with its rise and fall; the heart-beats similarly, only relatively far more brief; the words not separately, but in connected groups. In short, empty our minds as we may, some form of *changing process* remains for us to feel, and cannot be expelled. And along with the sense of the process and its rhythm goes the sense of the length of time it lasts. Awareness of *change* is thus the condition on which our perception of time's flow depends; but there exists no reason to suppose that empty time's own changes are sufficient for the awareness of change to be aroused. The change must be of some concrete sort —an outward or inward sensible series, or a process of attention or volition.[32]

621 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. But a movement is a change, a process; 622 so we see that in the time-world and the space-world alike the first known things are not elements, but combinations, not separate units, but wholes already formed. The condition of *being* of the wholes may be the elements; but the condition of our *knowing* the elements is our having already felt the wholes as wholes.

In the experience of watching empty time flow—'empty' to be taken hereafter in the relative sense just set forth—we tell it off in pulses. We say 'now! now! now!' or we count 'more! more! more!' as we feel it bud. This composition out of units of duration is called the law of time's *discrete flow*. The discreteness is, however, merely due to the fact that our successive acts of *recognition* or *apperception* of *what* it is are discrete. The sensation is as continuous as any sensation can be. All continuous sensations are *named* in beats. We notice that a certain finite 'more' of them is passing or already past. To adopt Hodgson's image, the sensation is the measuring-tape, the perception the dividing-engine which stamps its length. As we listen to a steady sound, we *take it in* in discrete pulses of recognition, calling it successively 'the same! the same! the same!' The case stands no otherwise with time.

After a small number of beats our impression of the amount we have told off becomes quite vague. Our only way of knowing it accurately is by counting, or noticing the clock, or through some other symbolic conception.[33] When the times exceed hours or days, the conception is absolutely symbolic. We think of the amount we mean either solely as a *name*, or by running over a few salient *dates* therein, with no pretence of imagining the full durations that lie between them. No one has anything like a *perception* of the greater length of the time between now and the first century than of that between now and the tenth. To an historian, it 623 is true, the longer interval will suggest a host of additional dates and events, and so appear a more *multitudinous* thing. And for the same reason most people will think they directly perceive the length of the past fortnight to exceed that of the past week. But there is properly no comparative time *intuition* in these cases at all. It is but dates and events, *representing* time; their abundance *symbolizing* its length. I am sure that this is so, even where the times compared are no more than an hour or so in length. It is the same with Spaces of many miles, which we always compare with each other by the numbers which measure them.[34]

From this we pass naturally to speak of certain familiar variations 624 in our estimation of lengths of time. *In general, a time filled with varied and interesting experiences seems short in passing, but long as we look back. On the other hand, a tract of time empty of experiences seems long in passing, but in retrospect short.* A week of travel and sight-seeing may subtend an angle more like three weeks in the memory; and a month of sickness hardly yields more memories than a day. The length in retrospect depends obviously on the multitudinousness of the memories which the time affords. Many objects, events, changes, many subdivisions, immediately widen the view as we look back. Emptiness, monotony, familiarity, make it shrivel up. In Von Holtei's 'Vagabonds' one Anton is described as revisiting his native village.

> "Seven years," he exclaims, "seven years since I ran away! More like seventy it seems, so much has happened. I cannot think of it all without becoming dizzy—at any rate not now. And yet again, when I look at the village, at the church-tower, it seems as if I could hardly have been seven days away."

Prof. Lazarus[35] (from whom I borrow this quotation), thus explains both of these contrasted illusions by our principle of the awakened memories being multitudinous or few:

"The circle of experiences, widely extended, rich in variety, which he had in view on the day of his leaving the village rises now in his mind as its image lies before him. And with it—in rapid succession and violent motion, not in chronologic order, or from chronologic motives, but suggesting each other by all sorts of connections—arise massive images of all his rich vagabondage and roving life. They roll and wave confusedly together, first perhaps one from the first year, then from the sixth, soon from the second, again from the fifth, the first, etc., until it seems as if seventy years must have been there, and he reels with the fulness of his vision.... Then the inner eye turns away from all this past. The outer one turns to the village, especially to the church-tower. The sight of it calls back the old sight of it, so that the consciousness is filled with that alone, or almost alone. The one vision compares itself with the other, and looks so near, so unchanged, that it seems as if only a week of time could have come between."

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*The same space of time seems shorter as we grow older*—that is, the days, the months, and the years do so; whether the hours do so is doubtful, and the minutes and seconds to all appearance remain about the same.

"Whoever counts many lustra in his memory need only question himself to find that the last of these, the past five years, have sped much more quickly than the preceding periods of equal amount. Let any one remember his last eight or ten school years: it is the space of a century. Compare with them the last eight or ten years of life: it is the space of an hour."

So writes Prof. Paul Janet,[36] and gives a solution which can hardly be said to diminish the mystery. There is a law, he says, by which the apparent length of an interval at a given epoch of a man's life is proportional to the total length of the life itself. A child of 10 feels a year as 1/10 of his whole life—a man of 50 as 1/50, the whole life meanwhile apparently preserving a constant length. This formula roughly expresses the phenomena, it is true, but cannot possibly be an elementary psychic law; and it is certain that, in great part at least, the foreshortening of the years as we grow older is due to the monotony of memory's content, and the consequent simplification of the backward-glancing view. In youth we may have an absolutely new experience, subjective or objective, every hour of the day. Apprehension is vivid, retentiveness strong, and our recollections of that time, like those of a time spent in rapid and interesting travel, are of something intricate, multitudinous, and long-drawn-out. But as each passing year converts some of this experience into automatic routine which we hardly note at all, the days and the weeks smooth themselves out in recollection to contentless units, and the years grow hollow and collapse.

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So much for the apparent shortening of tracts of time in *retrospect*. They shorten *in passing* whenever we are so fully occupied with their content as not to note the actual time itself. A day full of excitement, with no pause, is said to pass 'ere we know it.' On the contrary, a day full of waiting, of unsatisfied desire for change, will seem a small eternity. *Tædium*, *ennui*, *Langweile*, *boredom*, are words for which, probably, every language known to man has its equivalent. It comes about whenever, from the relative emptiness of content of a tract of time, we grow attentive to the passage of the time itself. Expecting, and being ready for, a new impression to succeed; when it fails to come, we get an empty time instead of it; and such experiences, ceaselessly renewed, make us most formidably aware of the extent of the mere time itself.[37] Close your eyes and simply wait to hear somebody tell you that a minute has elapsed. The full length of your leisure with it seems incredible. You engulf yourself into its bowels as into those of that interminable first week of an ocean voyage, and find yourself wondering that history can have overcome many such periods in its course. All because you attend so closely to the mere feeling of the time *per se*, and because your attention to that is susceptible of such fine-grained successive subdivision. The *odiousness* of the whole experience comes from its insipidity; for *stimulation* is the indispensable requisite for pleasure in an experience, and the feeling of bare time is the least stimulating experience we can have.[38] The sensation of tædium is a *protest*, says Volkmann, against the entire present.

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Exactly parallel variations occur in our consciousness of space. A road we walk back over, hoping to find at each step an object we have dropped, seems to us longer than when we walked over it the other way. A space we measure by pacing appears longer than one we traverse with no thought of its length. And in general an amount of space attended to in itself leaves with us more impression of spaciousness than one of which we only note the content.[39]

I do not say that *everything* in these fluctuations of estimate can be accounted for by the time's content being crowded and interesting, or simple and tame. Both in the shortening of time by old age and in its lengthening by *ennui* some deeper cause *may* be at work. This cause can only be ascertained, if it exist, by finding out *why we perceive time at all*. To this inquiry let us, though without much hope, proceed.

If asked why we perceive the light of the sun, or the sound of an explosion, we reply, "Because certain outer forces, ether-waves or air-waves, smite upon the brain, awakening therein changes, to which the conscious perceptions, light and sound, respond." But we hasten to add that neither light nor sound *copy* or *mirror* the ether- or air-waves; they represent them only symbolically. The *only* case, says Helmholtz, in which such copying occurs, and in which

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"our perceptions can truly correspond with outer reality, is that of the *time-succession* of phenomena. Simultaneity, succession, and the regular return of simultaneity or succession, can obtain as well in sensations as in outer events. 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."[40]

One experiences an almost instinctive impulse, in pursuing such reflections as these, to follow them to a sort of crude speculative conclusion, and to think that he has at last got the mystery of cognition where, to use a vulgar phrase, 'the wool is short.' What more natural, we say, than that the sequences and durations of things *should* become known? The succession of the outer forces stamps itself as a like succession upon the brain. The brain's successive changes are copied exactly by correspondingly successive pulses of the mental stream. The mental stream, feeling itself, must feel the time-relations of its own states. But as these are copies of the outward time-relations, so must it know them too. That is to say, these latter time-relations arouse their own cognition; or, in other words, the mere existence of time in those changes out of the mind which affect the mind is a sufficient cause why time is perceived by the mind.

This philosophy is unfortunately too crude. Even though we *were* to conceive the outer successions as forces stamping their image on the brain, and the brain's successions as forces stamping their image on the mind,[41] still, between the mind's own changes *being* successive, and *knowing their own succession*, lies as broad a chasm as between the object and subject of any case of cognition in the world. *A succession of feelings, in and of itself, is not a feeling of succession. And since, to our successive feelings, a feeling of their own succession is added, that must be treated as an*

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*additional fact requiring its own special elucidation*, which this talk about outer time-relations stamping copies of themselves within, leaves all untouched.

I have shown, at the outset of the article, that what is past, to be known as past, must be known *with* what is present, and *during* the 'present' spot of time. As the clear understanding of this point has some importance, let me, at the risk of repetition, recur to it again. Volkmann has expressed the matter admirably, as follows:

"One might be tempted to answer the question of the origin of the time-idea by simply pointing to the train of ideas, whose various members, starting from the first, successively attain to full clearness. But against this it must be objected that the successive ideas are not yet the idea of succession, because succession *in* thought is not the thought *of* succession. If idea A follows idea B, consciousness simply exchanges one for another. That B *comes after* A is for our consciousness a non-existent fact; for this *after* is given neither in B nor in A; and no third idea has been supposed. The thinking of the sequence of B upon A is another kind of thinking from that which brought forth A and then brought forth B; and this first kind of thinking is absent so long as merely the thinking of A and the thinking of B are there. In short, when we look at the matter sharply, we come to this antithesis, that if A and B are to be represented *as occurring in succession* they must be simultaneously represented; if we are to think of them as one after the other, we must *think* them both at once."[42]

If we represent the actual time-stream of our thinking by an horizontal line, the thought *of* the stream or of any segment of its length, past, present, or to come, might be figured in a perpendicular raised upon the horizontal at a certain point. The length of this perpendicular stands for a certain object or content, which in this case is the time thought of, and all of which is thought of together at the actual moment of the stream upon which the perpendicular is raised. Mr. James Ward puts the matter very well in his masterly article 'Psychology' in the ninth edition of the Encyclopædia Britannica, page 64. He says:

"We may, if we represent succession as a line, represent simultaneity as a second line at right angles to the first; empty time—or time-length without time-breadth, we may say—is a mere abstraction. Now, it is with the former line that we have to do in treating of time as it is, and with the latter in treating of our intuition of time, where, just as in a perspective representation of distance, we are confined to lines in a plane at right angles to the actual line of depth. In a succession of events, say of sense-impressions, A B C D E … , the presence of B means the absence of A and C, but the presentation of this succession involves the simultaneous presence in some mode or other of two or more of the presentations A B C D. In reality, past, present, and future are differences in time, but in presentation all that corresponds to these differences is in consciousness simultaneously."

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There is thus a sort of *perspective projection* of past objects upon present consciousness, similar to that of wide landscapes upon a camera-screen.

And since we saw a while ago that our maximum distinct *intuition* of duration hardly covers more than a dozen seconds (while our maximum vague intuition is probably not more than that of a minute or so), we must suppose that *this amount of duration is pictured fairly steadily in each passing instant of consciousness* by virtue of some fairly constant feature in the brain-process to which the consciousness is tied. *This feature of the brain-process, whatever it be, must be the cause of our perceiving the fact of time at all*.[43] The duration thus steadily perceived is hardly more than the 'specious present,' as it was called a few pages back. Its *content* is in a constant flux, events dawning into its forward end as fast as they fade out of its rearward one, and each of them changing its time-coefficient from 'not yet,' or 'not quite yet,' to 'just gone' or 'gone,' as it passes by. Meanwhile, the specious present, the intuited duration, stands permanent, like the rainbow on the waterfall, with its own quality unchanged by the events that stream through it. Each of these, as it slips out, retains the power of being reproduced; and when reproduced, is reproduced with the duration and neighbors which it originally had. Please observe, however, that the reproduction of an event, *after* it has once completely dropped out of the rearward end of the specious present, is an entirely different psychic fact from its direct perception in the specious present as a thing immediately past. A creature might be entirely devoid of *reproductive* memory, and yet have the time-sense; but the latter would be limited, in his case, to 631
the few seconds immediately passing by. Time older than that he would never recall. I assume reproduction in the text, because I am speaking of human beings who notoriously possess it. Thus memory gets strewn with *dated* things—dated in the sense of being before or after each other.[44] The date of a thing is a mere relation of *before* or *after* the present thing or some past or future thing. Some things we date simply by mentally tossing them into the past or future *direction*. So in space we think of England as simply to the eastward, of Charleston as lying south. But, again, we may date an event exactly, by fitting it between two terms of a past or future series explicitly conceived, just as we may accurately think of England or Charleston being just so many miles away.[45]

The things and events thus vaguely or exactly dated become thenceforward those signs and symbols of longer time-spaces, of which we previously spoke. According as we think of a multitude of them, or of few, so we imagine the time they represent to be long or short. But *the original paragon and prototype of all conceived times is the specious present, the short duration of which we are immediately and incessantly sensible*.

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FOOTNOTES

[1] This chapter is reprinted almost verbatim from the Journal of Speculative Philosophy, 605
vol. xx. p. 374.

[2] James Mill, Analysis, vol. i. p. 319 (J. S. Mill's Edition). 606

[3] "What I find, when I look at consciousness at all, is, that what I cannot divest myself 607
of, or not have in consciousness, if I have consciousness at all, is a sequence of different feelings.… The simultaneous perception of both sub-feelings, whether as parts of a coexistence or of a sequence, is the total feeling—the minimum of consciousness—and this minimum has duration… Time-duration, however, is inseparable from the minimum, notwithstanding that, in an isolated moment, we could not tell which part of it came first, which last.… We do not require to know that the sub-feelings come in sequence, first one, then the other; nor to know what coming in sequence means. But we have, in any artificially isolated minimum of consciousness, the *rudiments* of the perception of former and latter in time, in the sub-feeling that grows fainter, and the sub-feeling that grows stronger, and the change between them.…

"In the next place, I remark that the rudiments of memory are involved in the minimum of consciousness. The first beginnings of it appear in that minimum, just as the first beginnings of perception do. As each member of the change or difference which goes to compose that minimum is the rudiment of a single perception, so the priority of one member to the other, although both are given to consciousness in one empirical present moment, is the rudiment of memory. The fact that the minimum of consciousness is difference or change in feelings, is the ultimate explanation of memory as well as of single perceptions. A former and a latter are included in the minimum of consciousness; and this is what is meant by saying that all consciousness is in the form of *time*, or that time is the form of feeling, the form of sensibility. Crudely and popularly we divide the course of time into past, present, and future; but, strictly speaking, there is no present; it is composed of past and future divided by an indivisible point or instant. That instant, or time-point, is the strict *present*. What we call, loosely, the present, is an empirical portion of the course of time, containing at least a minimum of consciousness, in which the instant of change is the present time-point.… If we take this as the present time-point, it is clear that the minimum of feeling contains two portions—a sub-feeling that goes and a sub-feeling that comes. One is remembered, the other imagined. The limits of both are indefinite at beginning and end of the minimum, and ready to melt into other minima, proceeding from other stimuli.

"Time and consciousness do not come to us ready marked out into minima; we have to do that by reflection, asking ourselves, What is the least empirical moment of consciousness? That least empirical moment is what we usually call the present moment; and even this is too minute for ordinary use; the present moment is often extended practically to a few seconds, or even minutes, beyond which we specify what length of time we mean, as the present hour, or day, or year, or century.

"But this popular way of thinking imposes itself on great numbers even of philosophically-minded people, and they talk about the *present* as if it was a *datum*—as if time came to us marked into present periods like a measuring-tape." (S. H. Hodgson: Philosophy of Reflection, vol. I. pp. 248-254.) 608

"The representation of time agrees with that of space in that a certain amount of it must be presented together—included between its initial and terminal limit. A continuous ideation, flowing from one point to another, would indeed *occupy* time, but not *represent* it, for it would exchange one element of succession for another instead of grasping the whole succession at once. Both points—the beginning and the end—are equally essential to the conception of time, and must be present with equal clearness together." (Herbart: Psychol. als W., § 115.)

"Assume that … similar pendulum-strokes follow each other at regular intervals in a consciousness otherwise void. When the first one is over, an image of it remains in the fancy until the second succeeds. This, then, reproduces the first by virtue of the law of association by similarity, but at the same time meets with the aforesaid persisting image.… Thus does the simple repetition of the sound provide all the elements of time-perception. The first sound [as it is recalled by association] gives the beginning, the second the end, and the persistent image in the fancy represents the length of the interval. At the moment of the second impression, the entire time-perception exists at once, for then all its elements are presented together, the second sound and the image in the fancy immediately, and the first impression by reproduction. But, in the same act, we are aware of a state in which only the first sound existed, and of another in which only its image existed in the fancy. Such a consciousness as this *is* that of time.… *In it no succession of ideas takes place*." (Wundt: Physiol. Psych., 1st ed. pp. 681-2.) Note here the assumption that the *persistence* and the *reproduction* of an impression are two processes which may go on simultaneously. Also that Wundt's description is merely an *attempt to analyze the 'deliverance'* of a time-perception, and no *explanation of the manner in which it comes about*.

[4] The Alternative, p. 167. 609

[5] Locke, in his dim way, derived the sense of duration from reflection on the succession of our ideas (Essay, book II. chap. XIV. § 3; chap. XV. § 12). Reid justly remarks that if ten successive elements are to make duration, "then one must make duration, otherwise duration must be made up of parts that have no duration, which is impossible.… I conclude, therefore, that there must be duration in every single interval or element of which the whole duration is made up. Nothing, indeed, is more certain than that every elementary part of duration must have duration, as every elementary part of extension must have extension. Now, it must be observed that in these elements of duration, or single intervals of successive ideas, there is no succession of ideas, yet we must conceive them to have duration; whence we may conclude with certainty that *there is a conception of duration where there is no succession of ideas in the mind*." (Intellectual Powers. essay III. chap. V.) "Qu'on ne cherche point," says Royer Collard in the Fragments added to Jouffroy's Translation of Reid, "la durée dans la succession; on ne l'y trouvera jamais; la durée a précédé la succession; in notion de la durée a précédé la notion de la succession. Elle en est donc tout-à fait indépendante, dira-t-on? Oui, elle en est tout-à-fait indépendante." 610

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[32] I leave the text just as it was printed in the Journal of Speculative Philosophy (for 'Oct. 1886') in 1887. Since then Münsterberg in his masterly Beiträge zur experimentellen Psychologie (Heft 2, 1889) seems to have made it clear what the sensible changes are by which we measure the lapse of time. When the time which separates two sensible impressions is less than one third of a second, he thinks it is almost entirely the *amount to which the memory-image of the first impression had faded* when the second one overtakes it, which makes us feel how wide they are apart (p. 29). When the time is longer than this, we rely, he thinks, exclusively upon the feelings of muscular tension and 620 relaxation, which we are constantly receiving although we give to them so little of our direct attention. *These feelings are primarily in the muscles by which we adopt our sense-organs in attending to the signals used*, some of the muscles being in the eye and ear themselves, some of them in the head, neck, etc. We here judge two time-intervals to be equal when between the beginning and end of each we feel exactly similar relaxations and subsequent expectant tensions of these muscles to have occurred. In reproducing intervals 621 ourselves we try to make our feelings of this sort just what they were when we passively heard the interval. These feelings by themselves, however, can only be used when the intervals are very short, for the tension anticipatory of the terminal stimulus naturally reaches its maximum very soon. With longer intervals we *take the feeling of our inspirations and expirations into account*. With our expirations all the other muscular tensions in our body undergo a rhythmical decrease; with our inspirations the reverse takes place. When, therefore, we note a time-interval of several seconds with intent to reproduce it, what we seek is to make the earlier and later interval agree in the number and amount of these respiratory changes combined with sense-organ adjustments with which they are filled. Münsterberg has studied carefully in his own case the variations of the respiratory factor. They are many; but he sums up his experience by saying that whether he measured by inspirations that were divided by momentary pauses into six parts, or by inspirations that were continuous; whether with sensory tension during inspiration and relaxation during expiration, or by tension during both inspiration and expiration, separated by a sudden interpolated relaxation; whether with special notice taken of the cephalic tensions, or of those in the trunk and shoulders, in all cases alike and without exception he involuntarily endeavored, whenever he compared two times or tried to make one the same as the other, to get exactly the same respiratory conditions and conditions of tension, *all* the subjective conditions, in short, *exactly* the same during the second interval as they were during the first. Münsterberg corroborated his subjective observations by experiments. The observer of the time had to reproduce as exactly as possible an interval between two sharp sounds given him by an assistant. The only condition imposed upon him was that he should not modify his breathing for the purposes of measurement. It was then found that when the assistant broke in at random with his signals, the judgment of the observer was vastly less accurate than when the assistant carefully watched the observer's breathing and made both the beginning of the time given him and that of the time which he was to give coincide with identical phases thereof.—Finally, Münsterberg with great plausibility tries to explain the discrepancies between the results of Vierordt, Estel, Mehner, Glass, etc., as due to the fact that they *did not all use the same measure*. Some breathe a little faster, some a little slower. Some break their inspirations into two parts, some do not, etc. The coincidence of the objective times measured with definite natural phases of breathing would very easily give periodical maxima of facility in measuring accurately.

[33] "Any one wishing yet further examples of this mental substitution will find one on 622 observing how habitually he thinks of the spaces on the clock-face instead of the periods they stand for; how, on discovering it to be half an hour later than he supposed, he does not represent the half hour in its duration, but scarcely passes beyond the sign of it marked by the finger." (H. Spencer: Psychology, § 336.)

[34] The only objections to this which I can think of are: (1) The accuracy with which 623 some men judge of the hour of day or night without looking at the clock; (2) the faculty some have of waking at a preappointed hour; (3) the accuracy of time-perception reported to exist in certain trance-subjects. It might seem that in these persons some sort of a subconscious record was kept of the lapse of time *per se*. But this cannot be admitted until it is proved that there are no physiological processes, the feeling of whose course may serve as a *sign* of how much time has sped, and so lead us to infer the hour. That there are such processes it is hardly possible to doubt. An ingenious friend of mine was long puzzled to know why each day of the week had such a characteristic physiognomy to him. That of Sunday was soon noticed to be due to the cessation of the city's rumbling, and the sound

of people's feet shuffling on the sidewalk; of Monday, to come from the clothes drying in the yard and casting a white reflection on the ceiling; of Tuesday, to a cause which I forget; and I think my friend did not get beyond Wednesday. Probably each hour in the day has for most of us some outer or inner sign associated with it as closely as these signs with the days of the week. It must be admitted, after all, however, that the great improvement of the time-perception during sleep and trance is a mystery not as yet cleared up. All my life I have been struck by the accuracy with which I will wake at the same *exact minute* night after night and morning after morning, if only the habit fortuitously begins. The organic registration in me is independent of sleep. After lying in bed a long time awake I suddenly rise without knowing the time, and for days and weeks together will do so at an identical minute by the clock, as if some inward physiological process caused the act by punctually running down.—Idiots are said sometimes to possess the time-measuring faculty in a marked degree. I have an interesting manuscript account of an idiot girl which says: "She was punctual almost to a minute in her demand for food and other regular attentions. Her dinner was generally furnished her at 12.30 P.M., and at that hour she would begin to scream if it were not forthcoming. If on Fast-day or Thanksgiving it were delayed, in accordance with the New England custom, she screamed from her usual dinner-hour until the food was carried to her. On the next day, however, she again made known her wants promptly at 12.30. Any slight attention shown her on one day was demanded on the next at the corresponding hour. If an orange were given her at 4 P.M. on Wednesday, at the same hour on Thursday she made known her expectation, and if the fruit were not given her she continued to call for it at intervals for two or three hours. At four on Friday the process would be repeated but would last less long; and so on for two or three days. If one of her sisters visited her accidentally at a certain hour, the sharp piercing scream was sure to summon her at the same hour the next day," etc., etc.—For these obscure matters consult C. Du Prel: The Philosophy of Mysticism, chap. III. § 1.

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[35] Ideale Fragen (1878). p. 219 (Essay, 'Zeit und Weile').

[36] Revue Philosophique, vol. III. p. 496.

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[37] "Empty time is most strongly perceived when it comes as a *pause* in music or in speech. Suppose a preacher in the pulpit, a professor at his desk, to stick still in the midst of his discourse; or let a composer (as is sometimes purposely done) make all his instruments stop at once; we await every instant the resumption of the performance, and, in this awaiting, perceive, more than in any other possible way, the empty time. To change the example, let, in a piece of polyphonic music—a figure, for instance, in which a tangle of melodies are under way—suddenly a single voice be heard, which sustains a long note, while all else is hushed.... This one note will appear very protracted—why? Because we *expect* to hear accompanying it the notes of the other instruments, but they fail to come." (Herbart: Psychol. als W., §115.)—Compare also Münsterberg, Beiträge, Heft 2, p. 41.

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[38] A night of pain will seem terribly long; we keep looking forward to a moment which never comes—the moment when it shall cease. But the odiousness of this experience is not named *ennui* or *Langweile*, like the odiousness of time that seems long from its emptiness. The more positive odiousness of the pain, rather, is what tinges our memory of the night. What we feel, as Prof. Lazarus says (*op cit*. p. 202), is the long time of the suffering, not the suffering of the long time *per se*.

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[39] On these variations of time-estimate, cf. Romanes, Consciousness of Time. in Mind, vol. III. p. 297; J. Sully, Illusions, pp. 245-261, 302-305; W. Wundt, Physiol. Psych., II. 287, 288; besides the essays quoted from Lazarus and Janet. In German, the successors of Herbart have treated of this subject: compare Volkmann's Lehrbuch d. Psych., § 89, and for references to other authors his note 3 to this section. Lindner (Lbh. d. empir. Psych.), as a parallel effect, instances Alexander the Great's life (thirty-three years), which seems to us as if it must be long, because it was so eventful. Similarly the English Commonwealth, etc.

[40] Physiol Optik, p. 445.

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[41] Succession, time *per se*, *is* no force. Our talk about its devouring tooth, etc., is all elliptical. Its *contents* are what devour. The law of innertia is incompatible with time's being assumed as an efficient cause of anything.

[42] Lehrbuch d. Psych., § 87. Compare also H. Lotze, Metaphysik, § 154.

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[43] The cause of the perceiving, not the object perceived!

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[44] "'No more' and 'not yet' are the proper time-feelings, and we are aware of time in no other way than through these feelings," says Volkmann (Psychol., § 87). This, which is not strictly true of our feeling of *time per se*, as an elementary bit of duration, is true of our feeling of *date* in its events.

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[45] We construct the miles just as we construct the years. Travelling in the cars makes a succession of different fields of view pass before our eyes. When those that have passed from present sight revive in memory, they maintain their mutual order because their contents overlap. We think them as having been before or behind each other; and, from the multitude of the views we can recall behind the one now presented, we compute the total space we have passed through.

It is often said that the perception of time develops later than that of space, because children have so vague an idea of all dates before yesterday and after to-morrow. But no vaguer than they have of extensions that exceed as greatly their unit of space-intuition. Recently I heard my child of four tell a visitor that he had been 'as much as one week' in the country. As he had been there three months, the visitor expressed surprise; whereupon the child corrected himself by saying he had been there 'twelve years.' But the child made exactly the same kind of mistake when he asked if Boston was not one hundred miles from Cambridge, the distance being three miles.

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