

Chapter XI

Attention

Strange to say, so patent a fact as the perpetual presence of selective attention has received hardly any notice from psychologists of the English empiricist school. The Germans have explicitly treated of it, either as a faculty or as a resultant, but in the pages of such writers as Locke, Hume, Hartley, the Mills, and Spencer the word hardly occurs, or if it does so, it is parenthetically and as if by inadvertence.¹ The motive of this ignoring of the phenomenon of attention is obvious enough. These writers are bent on showing how the higher faculties of the mind are pure products of 'experience'; and experience is supposed to be of something simply *given*. Attention, implying a degree of reactive spontaneity, would seem to break through the circle of pure receptivity which constitutes 'experience,' and hence must not be spoken of under penalty of interfering with the smoothness of the tale.

But the moment one thinks of the matter, one sees how false a notion of experience that is which would make it tantamount to the mere presence to the senses of an outward order. Millions of items of the outward order are present to my senses which never properly enter into my experience. Why? Because they have no *interest* for me. *My experience is what I agree to attend to.* Only those items

¹ Bain mentions attention in the *Senses and the Intellect*, p. 558, and even gives a theory of it on pp. 370-374 of the *Emotions and the Will*. I shall recur to this theory later on.

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which I *notice* shape my mind—without selective interest, experience is an utter chaos. Interest alone gives accent and emphasis, light and shade, background and foreground—intelligible perspective, in a word. It varies in every creature, but without it the consciousness of every creature would be a gray chaotic indiscriminate-ness, impossible for us even to conceive. Such an empiricist writer as Mr. Spencer, for example, regards the creature as absolutely passive clay, upon which 'experience' rains down. The clay will be impressed most deeply where the drops fall thickest, and so the final shape of the mind is moulded. Give time enough, and all sentient things ought, at this rate, to end by assuming an identical mental constitution—for 'experience,' the sole shaper, is a constant fact, and the order of its items must end by being exactly reflected by the passive mirror which we call the sentient organism. If such an account were true, a race of dogs bred for generations, say in the Vatican, with characters of visual shape, sculptured in marble, presented to their eyes, in every variety of form and combination, ought to discriminate before long the finest shades of these peculiar characters. In a word, they ought to become, if time were given, accomplished *connoisseurs* of sculpture. Anyone may judge of the probability of this consummation. Surely an eternity of experience of the statues would leave the dog as inartistic as he was at first, for the lack of an original interest to knit his discriminations on to. Meanwhile the odors at the bases of the pedestals would have organized themselves in the consciousness of this breed of dogs into a system of 'correspondences' to which the most hereditary caste of *custodi* would never approximate, merely because to them, as human beings, the dog's interest in those smells would for ever be an inscrutable mystery. These writers have, then, utterly ignored the glaring fact that subjective interest may, by laying its weighty index-finger on particular items of experience, so accent them as to give to the least frequent associations far more power to shape our thought than the most frequent ones possess. The interest itself, though its genesis is doubtless perfectly *natural*, makes experience more than it is made by it.

Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization,

concentration, of consciousness are of its essence. It implies withdrawal from some things in order to deal effectively with others, and is a condition which has a real opposite in the confused, dazed, scatterbrained state which in French is called *distraction*, and *Zerstreuung* in German.

We all know this latter state, even in its extreme degree. Most people probably fall several times a day into a fit of something like this: The eyes are fixed on vacancy, the sounds of the world melt into confused unity, the attention is dispersed so that the whole body is felt, as it were, at once, and the foreground of consciousness is filled, if by anything, by a sort of solemn sense of surrender to the empty passing of time. In the dim background of our mind we know meanwhile what we ought to be doing: getting up, dressing ourselves, answering the person who has spoken to us, trying to make the next step in our reasoning. But somehow we cannot *start*; the *pensée de derrière la tête* fails to pierce the shell of lethargy that wraps our state about. Every moment we expect the spell to break, for we know no reason why it should continue. But it does continue, pulse after pulse, and we float with it, until—also without reason that we can discover—an energy is given, something—we know not what—enables us to gather ourselves together, we wink our eyes, we shake our heads, the background-ideas become effective, and the wheels of life go round again.

This curious state of inhibition can for a few moments be produced at will by fixing the eyes on vacancy. Some persons can voluntarily empty their minds and 'think of nothing.' With many, as Professor Exner remarks of himself, this is the most efficacious means of falling asleep. It is difficult not to suppose something like this scattered condition of mind to be the usual state of brutes when not actively engaged in some pursuit. Fatigue, monotonous mechanical occupations that end by being automatically carried on, tend to produce it in men. It is not sleep; and yet when aroused from such a state, a person will often hardly be able to say what he has been thinking about. Subjects of the hypnotic trance seem to lapse into it when left to themselves; asked what they are thinking of, they reply, 'of nothing particular'!²

² "The first and most important, but also the most difficult, task at the outset of an education is to overcome gradually the inattentive dispersion of mind which shows itself wherever the organic life preponderates over the intellectual. The training of animals . . . must be in the first instance based on the awakening of attention (cf.

The abolition of this condition is what we call the awakening of the attention. One principal object comes then into the focus of consciousness, others are temporarily suppressed. The awakening may come about either by reason of a stimulus from without, or in consequence of some unknown inner alteration; and the change it brings with it amounts to a concentration upon one single object with exclusion of aught besides, or to a condition anywhere between this and the completely dispersed state.

TO HOW MANY THINGS CAN WE ATTEND AT ONCE?

The question of the '*span*' of consciousness has often been asked and answered—sometimes *a priori*, sometimes by experiment. This seems the proper place for us to touch upon it; and our answer, according to the principles laid down in Chapter IX, will not be difficult. The number of *things* we may attend to is altogether indefinite, depending on the power of the individual intellect, on the form of the apprehension, and on what the things are. When apprehended conceptually as a connected system, their number may be very large. But however numerous the things, they can only be known in a single pulse of consciousness for which they form one complex 'object' (p. 266 ff.), so that properly speaking there is before the mind at no time a plurality of *ideas*, properly so called.

The 'unity of the soul' has been supposed by many philosophers, who also believed in the distinct atomic nature of 'ideas,' to preclude the presence to it of more than one objective fact, manifested in one idea, at a time. Even Dugald Stewart opines that every *minimum visibile* of a pictured figure

"constitutes just as distinct an object of attention to the mind, as if it were separated by an interval of empty space from the rest. . . . It is impossible for the mind to attend to more than one of these points at once; and as the perception of the figure implies a knowledge of the

Adrien Léonard: *Essai sur l'éducation des animaux*, Lille, 1842); that is to say, we must seek to make them gradually perceive separately things which, if left to themselves, would not be attended to, because they would fuse with a great sum of other sensorial stimuli to a confused total impression of which each separate item only darkens and interferes with the rest. Similarly at first with the human child. The enormous difficulties of deaf-mute- and especially of idiot-instruction is principally due to the slow and painful manner in which we succeed in bringing out from the general confusion of perception single items with sufficient sharpness." (Waitz: *Lehrbuch der Psychologie als Naturwissenschaft*, p. 631.)

relative situation of the different points with respect to each other, we must conclude, that the perception of figure by the eye, is the result of a number of different acts of attention. These acts of attention, however, are performed with such rapidity, that the effect, with respect to us, is the same as if the perception were instantaneous."³

Such glaringly artificial views can only come from fantastic metaphysics or from the ambiguity of the word 'idea,' which, standing sometimes for mental state and sometimes for thing known, leads men to ascribe to the thing, not only the unity which belongs to the mental state, but even the simplicity which is thought to reside in the Soul.

When the things are apprehended by the *senses*, the number of them that can be attended to at once is small, "*Pluribus intentus, minor est ad singula sensus.*"

"By Charles Bonnet the Mind is allowed to have a distinct notion of six objects at once; by Abraham Tucker the number is limited to four; while Destutt de Tracy again amplifies it to six. The opinion of the first and last of these philosophers," [continues Sir William Hamilton] "appears to me correct. You can easily make the experiment for yourselves, but you must beware of grouping the objects into classes. If you throw a handful of marbles on the floor, you will find it difficult to view at once more than six, or seven at most, without confusion; but if you group them into twos, or threes, or fives, you can comprehend as many groups as you can units; because the mind considers these groups only as units,—it views them as wholes, and throws their parts out of consideration."⁴

Professor Jevons, repeating this observation, by counting instantaneously beans thrown into a box, found that the number 6 was guessed correctly 120 times out of 147, 5 correctly 102 times out of 107, and 4 and 3 always right.⁵ It is obvious that such observations decide nothing at all about our attention, properly so called. They rather measure in part the distinctness of our vision—especially of the primary-memory-image⁶—in part the amount of association

³ *Elements of the Philosophy of the Human Mind*, part I, chap. II, *fin.*

⁴ *Lectures on Metaphysics*, lecture XIV.

⁵ *Nature*, vol. III, p. 281 (1871).

⁶ If a lot of dots or strokes on a piece of paper be exhibited for a moment to a person in *normal* condition, with the request that he say how many are there, he will find that they break into groups in his mind's eye, and that whilst he is analyzing and counting one group in his memory the others dissolve. In short, the impression made

in the individual between seen arrangements and the names of numbers.⁷

Each number-name is a way of grasping the beans as one total object. In such a total object, all the parts converge harmoniously to the one resultant concept; no single bean has special discrepant associations of its own; and so, with *practice*, they may grow quite numerous ere we fail to estimate them aright. But where the 'object' before us breaks into parts disconnected with each other, and forming each as it were a separate object or system, not conceivable in union with the rest, it becomes harder to apprehend all these parts at once, and the mind tends to let go of one whilst it attends to another. Still, within limits this can be done. M. Paulhan has experimented carefully on the matter by declaiming one poem aloud whilst he repeated a different one mentally, or by writing one sentence whilst speaking another, or by performing calculations on paper whilst reciting poetry.⁸ He found that

"the most favorable condition for the doubling of the mind was its simultaneous application to two easy and heterogeneous operations.

by the dots changes rapidly into something else. In the *trance-subject*, on the contrary, it seems to *stick*; I find that persons in the hypnotic state easily count the dots in the mind's eye so long as they do not much exceed twenty in number.

⁷ Mr. Cattell made Jevons's experiment in a much more precise way (*Philosophische Studien*, III, 121 ff.). Cards were ruled with short lines, varying in number from four to fifteen, and exposed to the eye for a hundredth of a second. When the number was but four or five, no mistakes as a rule were made. For higher numbers the tendency was to under- rather than to over-estimate. Similar experiments were tried with letters and figures, and gave the same result. When the letters formed familiar words, three times as many of them could be named as when their combination was meaningless. If the words formed a sentence, twice as many of them could be caught as when they had no connection. "The sentence was then apprehended as a whole. If not apprehended thus, almost nothing is apprehended of the several words; but if the sentence as a whole is apprehended, then the words appear very distinct."—Wundt and his pupil Dietze had tried similar experiments on rapidly repeated strokes of sound. Wundt made them follow each other in groups, and found that groups of twelve strokes at most could be recognized and identified when they succeeded each other at the most favorable rate, namely, from three to five tenths of a second (*Physiologische Psychologie*, 2d ed., II, 215). Dietze found that by mentally subdividing the groups into sub-groups as one listened, as many as forty strokes could be identified as a whole. They were then grasped as eight sub-groups of five, or as five of eight strokes each. (*Philosophische Studien*, II, 362.)—Later in Wundt's Laboratory, Bechterew made observations on two *simultaneously* elapsing series of metronome strokes, of which one contained one stroke more than the other. The most favorable rate of succession was 0.3 sec., and he then discriminated a group of 18 from one of 18 + 1, apparently. (*Neurologisches Centralblatt*, 1889, 272.)

⁸ *Revue Scientifique*, vol. 39, p. 684 (May 28, 1887).

Two operations of the same sort, two multiplications, two recitations, or the reciting one poem and writing another, render the process more uncertain and difficult.”

The attention often, but not always, oscillates during these performances; and sometimes a word from one part of the task slips into another. I myself find when I try to simultaneously recite one thing and write another that the beginning of each word or segment of a phrase is what requires the attention. Once started, my pen runs on for a word or two as if by its own momentum. M. Paulhan compared the time occupied by the same two operations done simultaneously or in succession, and found that there was often a considerable gain of time from doing them simultaneously. For instance:

“I write the first four verses of *Athalie*, whilst reciting eleven of Musset. The whole performance occupies 40 seconds. But reciting alone takes 22 and writing alone 31, or 53 altogether, so that there is a difference in favor of the simultaneous operations.”

Or again:

“I multiply 421 312 212 by 2; the operation takes 6 seconds; the recitation of 4 verses also takes 6 seconds. But the two operations done at once only take 6 seconds, so that there is no loss of time from combining them.”

Of course these time-measurements lack precision. With three systems of object (writing with *each* hand whilst reciting) the operation became much more difficult.

If, then, by the original question, how many ideas or things can we attend to at once, be meant how many entirely disconnected systems or processes of conception can go on simultaneously, the answer is, *not easily more than one, unless the processes are very habitual; but then two, or even three*, without very much oscillation of the attention. Where, however, the processes are less automatic, as in the story of Julius Cæsar dictating four letters whilst he writes a fifth,⁹ there must be a rapid oscillation of the mind from one to the next, and no consequent gain of time. Within any one

⁹ Cf. Christian Wolff: *Psychologia Empirica*, § 245. Wolff's account of the phenomena of attention is in general excellent.

of the systems the parts may be numberless, but we attend to them collectively when we conceive the whole which they form.

When the things to be attended to are small sensations, and when the effort is to be exact in noting them, it is found that attention to one interferes a good deal with the perception of the other. A good deal of fine work has been done in this field, of which I must give some account.

It has long been noticed, when expectant attention is concentrated upon one of two sensations, that the other one is apt to be displaced from consciousness for a moment and to appear subsequent; although in reality the two may have been contemporaneous events. Thus, to use the stock example of the books, the surgeon would sometimes see the blood flow from the arm of the patient whom he was bleeding, *before* he saw the instrument penetrate the skin. Similarly the smith may see the sparks fly *before* he sees the hammer smite the iron, etc. There is thus a certain difficulty in perceiving the exact *date* of two impressions when they do not interest our attention equally, and when they are of a disparate sort.

Professor Exner, whose experiments on the *minimal perceptible succession* in time of two sensations we shall have to quote in another chapter, makes some noteworthy remarks about the way in which the attention must be *set* to catch the interval and the right order of the sensations, when the time is exceeding small. The point was to tell whether two signals were simultaneous or successive; and, if successive, which one of them came first.

The first way of attending, which he found himself to fall into, was when the signals did not differ greatly—when, e.g., they were similar sounds heard each by a different ear. Here he lay in wait for the *first* signal, whichever it might be, and identified it the next moment in memory. The second, which could then always be known by default, was often not clearly distinguished in itself. When the time was too short, the first could not be isolated from the second at all.

The second way was to accommodate the attention for a certain *sort* of signal, and the next moment to become aware in memory of whether it came before or after its mate.

“This way brings great uncertainty with it. The impression not prepared for comes to us in the memory more weak than the other, obscure

as it were, badly fixed in time. We tend to take the subjectively stronger stimulus, that which we were intent upon, for the first, just as we are apt to take an objectively stronger stimulus to be the first. Still, it may happen otherwise. In the experiments from touch to sight it often seemed to me as if the impression for which the attention was *not* prepared were there already when the other came."

Exner found himself employing this method oftenest when the impressions differed strongly.¹⁰

In such observations (which must not be confounded with those where the two signals were identical and their successiveness known as mere *doubleness*, without distinction of which came first), it is obvious that each signal must combine stably in our perception with a *different* instant of time. It is the simplest possible case of two discrepant concepts simultaneously occupying the mind. Now the case of the signals being *simultaneous* seems of a *different* sort. We must turn to Wundt for observations fit to cast a nearer light thereon.

The reader will remember the reaction-time experiments of which we treated in Chapter III. It happened occasionally in Wundt's experiments that the reaction-time was reduced to zero or even assumed a negative value, which, being translated into common speech, means that the observer was sometimes so intent upon the signal that his reaction *actually coincided in time with it, or even preceded it*, instead of coming a fraction of a second after it, as in the nature of things it should. More will be said of these results anon. Meanwhile Wundt, in explaining them, says this:

"In general we have a very exact feeling of the simultaneity of two stimuli, if they do not differ much in strength. And in a series of experiments in which a warning precedes, at a fixed interval, the stimulus, we involuntarily try to react, not only as promptly as possible, but also in such wise that our movement may coincide with the stimulus itself. We seek to make our own feelings of touch and innervation [muscular contraction] objectively *contemporaneous with the signal* which we hear; and experience shows that in many cases we approximately succeed. In these cases we have a distinct consciousness of hearing the signal, reacting upon it, and feeling our reaction take place,—all at one and the same moment."¹¹

¹⁰ Pflüger's *Archiv*, XI, 429-31.

¹¹ *Physiologische Psychologie*, 2d ed., II, p. 240.

In another place, Wundt adds:

"The difficulty of these observations and the comparative infrequency with which the reaction-time can be made thus to disappear shows how hard it is, when our attention is intense, to keep it fixed even on *two* different ideas at once. Note besides that when this happens, one always tries to bring the ideas into a certain connection, to grasp them as components of a certain complex representation. Thus in the experiments in question, it has often seemed to me that I produced by my own recording movement the sound which the ball made in dropping on the board."¹²

The 'difficulty,' in the cases of which Wundt speaks, is that of forcing two non-simultaneous events into apparent combination with the same instant of time. There is no difficulty, as he admits, in so dividing our attention between two *really* simultaneous impressions as to feel them to be such. The cases he describes are really cases of anachronistic perception, of subjective time-displacement, to use his own term. Still more curious cases of it have been most carefully studied by him. They carry us a step farther in our research, so I will quote them, using as far as possible his exact words:

"The conditions become more complicated when we receive a series of impressions separated by distinct intervals, into the midst of which a heterogeneous impression is suddenly brought. Then comes the question, with which member of the series do we perceive the additional impression to coincide? with that member with whose presence it really coexists, or is there some aberration? . . . If the additional stimulus belongs to a different sense very considerable aberrations may occur.

"The best way to experiment is with a number of visual impressions (which one can easily get from a moving object) for the series, and with a sound as the disparate impression. Let, e.g., an index-hand move over a circular scale with uniform and sufficiently slow velocity, so that the impressions it gives will not fuse, but permit its position at any instant to be distinctly seen. Let the clockwork which turns it have an arrangement which rings a bell once in every revolution, but at a point which can be varied, so that the observer need never know in advance just when the bell-stroke takes place. In such observations three cases are possible. The bell-stroke can be perceived either exactly at the moment to which the index points when it sounds—in this case there will be no

¹² *Ibid.*, p. 262.

time-displacement; or we can combine it with a later position of the index— . . . *positive time-displacement*, as we shall call it; or finally we can combine it with a position of the index earlier than that at which the sound occurred—and this we will call a *negative displacement*. The most natural displacement would apparently be the positive, since for apperception a certain time is always required. . . . But experience shows that the opposite is the case: it happens most frequently that the sound appears earlier than its real date—far less often coincident with it, or later. It should be observed that in all these experiments it takes some time to get a distinctly perceived combination of the sound with a particular position of the index, and that a single revolution of the latter is never enough for the purpose. The motion must go on long enough for the sounds themselves to form a regular series—the outcome being a simultaneous perception of two distinct series of events, of which either may by changes in its rapidity modify the result. The first thing one remarks is that the sound belongs in a certain region of the scale; only gradually is it perceived to combine with a particular position of the index. But even a result gained by observation of many revolutions may be deficient in certainty, for accidental combinations of attention have a great influence upon it. If we deliberately try to combine the bell-stroke with an arbitrarily chosen position of the index, we succeed without difficulty, provided this position be not too remote from the true one. If, again, we cover the whole scale, except a single division over which we may see the index pass, we have a strong tendency to combine the bell-stroke with this actually seen position; and in so doing may easily overlook more than $\frac{1}{4}$ of a second of time. Results, therefore, to be of any value, must be drawn from long-continued and very numerous observations, in which such irregular oscillations of the attention neutralize each other according to the law of great numbers, and allow the true laws to appear. Although my own experiments extend over many years (with interruptions), they are not even yet numerous enough to exhaust the subject—still, they bring out the principal laws which the attention follows under such conditions.”¹³

Wundt accordingly distinguishes the *direction* from the *amount* of the apparent displacement in time of the bell-stroke. The direction depends on the rapidity of the movement of the index and (consequently) on that of the succession of the bell-strokes. The moment at which the bell struck was estimated by him with the least tendency to error, when the revolutions took place once in a second. Faster than this, *positive* errors began to prevail; slower, *negative*

¹³ *Physiologische Psychologie*, 2d ed., II, 264-6.

ones almost always were present. On the other hand, if the rapidity went *quicken*ing, errors became *negative*; if *slow*ing, *positive*. The amount of error is, in general, the greater the slower the speed and its alterations. Finally, individual differences prevail, as well as differences in the same individual at different times.¹⁴

Wundt's pupil von Tschisch has carried out these experiments on a still more elaborate scale,¹⁵ using, not only the single bell-stroke, but 2, 3, 4, or 5 simultaneous impressions, so that the attention had to note the place of the index at the moment when a whole group of things was happening. The single bell-stroke was always heard too early by von Tschisch—the displacement was invariably 'negative.' As the other simultaneous impressions were added, the dis-

¹⁴ This was the original 'personal equation' observation of Bessel. An observer looked through his equatorial telescope to note the moment at which a star crossed the meridian, the latter being marked in the telescopic field of view by a visible thread, beside which other equidistant threads appear. "Before the star reached the thread he looked at the clock, and then, with eye at telescope, counted the seconds by the beat of the pendulum. Since the star seldom passed the meridian at the exact

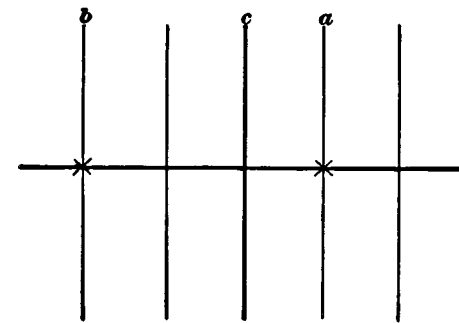


FIG. 35.

moment of a beat, the observer, in order to estimate fractions, had to note its position at the stroke before and at the stroke after the passage, and to divide the time as the meridian-line seemed to divide the space. If, e.g., one had counted 20 seconds, and at the 21st the star seemed removed by *ac* from the meridian-thread *c*, whilst at the 22d it was at the distance *bc*; then, if $ac : bc :: 1 : 2$, the star would have passed at $21\frac{1}{3}$ seconds. The conditions resemble those in our experiment: the star is the index-hand, the threads are the scale; and a time-displacement is to be expected, which with high rapidities may be positive, and negative with low. The astronomic observations do not permit us to measure its absolute amount; but that it exists is made certain by the fact that after all other possible errors are eliminated, there still remains between different observers a personal difference which is often much larger than that between mere reaction-times, amounting . . . sometimes to more than a second." (*Op. cit.*, p. 269.)

¹⁵ *Philosophische Studien*, II, no. 4, 603.

placement first became zero and finally positive, i.e., the impressions were connected with a position of the index that was too late. This retardation was greater when the simultaneous impressions were disparate (electric tactile stimuli on different places, simple touch-stimuli, different sounds) than when they were all of the same sort. The increment of retardation became relatively less with each additional impression, so that it is probable that six impressions would have given almost the same result as five, which was the maximum number used by Herr von T.

Wundt explains all these results by his previous observation that a reaction sometimes antedates the signal (see above, p. 390). The mind, he supposes, is so intent upon the bell-strokes that its 'apperception' keeps ripening periodically after each stroke in anticipation of the next. Its most natural rate of ripening may be faster or slower than the rate at which the strokes come. If faster, then it hears the stroke too early; if slower, it hears it too late. The position of the index on the scale, meanwhile, is noted at the moment, early or late, at which the bell-stroke is subjectively heard. Substituting several impressions for the single bell-stroke makes the ripening of the perception slower, and the index is seen too late. So, at least, do I understand the explanations which Herr Wundt and von Tschisch give.¹⁶

This is all I have to say about the difficulty of having two dis-

¹⁶ *Physiologische Psychologie*, 2d ed., II, 273-4; 3d ed., II, 339; *Philosophische Studien*, II, 621 ff.—I know that I am stupid, but I confess I find these theoretical statements, especially Wundt's, a little hazy. Herr von Tschisch considers it impossible that the perception of the index's position should come in too late, and says it demands no particular attention (p. 622). It seems, however, that this can hardly be the case. Both observers speak of the difficulty of seeing the index at the right moment. The case is quite different from that of distributing the attention impartially over simultaneous momentary sensations. The bell or other signal gives a momentary sensation, the index a continuous one, of motion. To note any one *position* of the latter is to *interrupt* this sensation of motion and to substitute an entirely different percept—one, namely, of position—for it, during a time however brief. This involves a sudden change in the manner of attending to the revolutions of the index; which change *ought* to take place neither sooner nor later than the momentary impression, and *fix* the index as it is then and there visible. Now this is not a case of simply getting two sensations at once and so feeling them—which would be an harmonious act; but of *stopping one* and changing it into another, whilst we simultaneously get a third. Two of these acts are discrepant, and the whole three rather interfere with each other. It becomes hard to 'fix' the index at the very instant that we catch the momentary impression; so we fall into a way of fixing it either at the last possible moment before, or at the first possible moment after, the impression comes.

This at least seems to me the more probable state of affairs. If we fix the index before

crepant concepts together, and about the number of things to which we can simultaneously attend.

THE VARIETIES OF ATTENTION

The things to which we attend are said to *interest* us. Our interest in them is supposed to be the *cause* of our attending. What makes an object interesting we shall see presently; and later inquire in what sense interest may cause attention. Meanwhile

Attention may be divided into kinds in various ways.

It is either to

- a) Objects of sense (sensorial attention); or to
- b) Ideal or represented objects (intellectual attention).

It is either

- c) Immediate; or
- d) Derived: immediate, when the topic or stimulus is interesting in itself, without relation to anything else; derived, when it owes its interest to association with some other immediately interesting thing. What I call derived attention has been named 'apperceptive' attention. Furthermore, Attention may be either

the impression really comes, that means that we perceive it too late. But why do we fix it *before* when the impressions come slow and simple, and *after* when they come rapid and complex? And why under certain conditions is there no displacement at all? The answer which suggests itself is that when there is just enough leisure between the impressions for the attention to adapt itself comfortably both to them and to the index (one second in W.'s experiments) it carries on the two processes at once; when the leisure is excessive, the attention, following its own laws of ripening, and being *ready* to note the index before the other impression comes, notes it *then*, since that is the moment of easiest action, whilst the impression, which comes a moment later, interferes with noting it again; and finally, that when the leisure is insufficient, the momentary impressions, being the more fixed data, are attended to first, and the index is fixed a little later on. The noting of the index at too early a moment would be the noting of a real fact, with its analogue in many other rhythmical experiences. In reaction-time experiments, for example, when, in a regularly recurring series, the stimulus is once in a while omitted, the observer sometimes reacts as if it came. Here, as Wundt somewhere observes, we catch ourselves acting merely because our inward preparation is complete. The 'fixing' of the index is a sort of action; so that my interpretation tallies with facts recognized elsewhere; but Wundt's explanation (if I understand it) of the experiments requires us to believe that an observer like von Tschisch shall steadily and without exception get an hallucination of a bell-stroke before the latter occurs, and *not hear the real bell-stroke afterwards*. I doubt whether this is possible, and I can think of no analogue to it in the rest of our experience. The whole subject deserves to be gone over again. To Wundt is due the highest credit for his patience in working out the facts. His explanation of them in his earlier work (*Vorlesungen über Menschen- und Thierseele*, I, 37-42, 365-371) consisted merely in the appeal to the unity of consciousness, and may be considered quite crude.

- e) Passive, reflex, non-voluntary, effortless; or
- f) Active and voluntary.

Voluntary attention is always derived; we never make an effort to attend to an object except for the sake of some remote interest which the effort will serve. But both sensorial and intellectual attention may be either passive or voluntary.

In *passive immediate sensorial attention* the stimulus is a sense-impression, either very intense, voluminous, or sudden,—in which case it makes no difference what its nature may be, whether sight, sound, smell, blow, or inner pain,—or else it is an *instinctive* stimulus, a perception which, by reason of its nature rather than its mere force, appeals to some one of our normal congenital impulses and has a directly exciting quality. In the chapter on Instinct we shall see how these stimuli differ from one animal to another, and what most of them are in man: strange things, moving things, wild animals, bright things, pretty things, metallic things, words, blows, blood, etc., etc., etc.

Sensitiveness to immediately exciting sensorial stimuli characterizes the attention of childhood and youth. In mature age we have generally selected those stimuli which are connected with one or more so-called permanent interests, and our attention has grown irresponsive to the rest.¹⁷ But childhood is characterized by great active energy, and has few organized interests by which to meet new impressions and decide whether they are worthy of notice or not, and the consequence is that extreme mobility of the attention with which we are all familiar in children, and which makes their first lessons such rough affairs. Any strong sensation whatever produces accommodation of the organs which perceive it, and absolute oblivion, for the time being, of the task in hand. This reflex and passive character of the attention which, as a French writer says, makes the child seem to belong less to himself than to every object which happens to catch his notice, is the first thing which the teacher must overcome. It never is overcome in some people, whose work, to the end of life, gets done in the interstices of their mind-wandering.

The passive sensorial attention is *derived* when the impression, without being either strong or of an instinctively exciting nature, is connected by previous experience and education with things that

¹⁷ Note that the permanent interests are themselves grounded in certain objects and relations in which our interest is immediate and instinctive.

are so. These things may be called the *motives* of the attention. The impression draws an interest from them, or perhaps it even fuses into a single complex object with them; the result is that it is brought into the focus of the mind. A faint tap *per se* is not an interesting sound; it may well escape being discriminated from the general rumor of the world. But when it is a signal, as that of a lover on the window-pane, it will hardly go unperceived. Herbart writes:

“How a bit of bad grammar wounds the ear of the purist! How a false note hurts the musician! or an offence against good manners the man of the world! How rapid is progress in a science when its first principles have been so well impressed upon us that we reproduce them mentally with perfect distinctness and ease! How slow and uncertain, on the other hand, is our learning of the principles themselves, when familiarity with the still more elementary percepts connected with the subject has not given us an adequate predisposition!—Apperceptive attention may be plainly observed in very small children when, hearing the speech of their elders, as yet unintelligible to them, they suddenly catch a single known word here and there, and repeat it to themselves; yes! even in the dog who looks round at us when we speak of him and pronounce his name. Not far removed is the talent which mind-wandering school-boys display during the hours of instruction, of noticing every moment in which the teacher tells a story. I remember classes in which, instruction being uninteresting, and discipline relaxed, a buzzing murmur was always to be heard, which invariably stopped for as long a time as an anecdote lasted. How could the boys, since they seemed to hear nothing, notice when the anecdote began? Doubtless most of them always heard something of the teacher’s talk; but most of it had no connection with their previous knowledge and occupations, and therefore the separate words no sooner entered their consciousness than they fell out of it again; but, on the other hand, no sooner did the words awaken old thoughts, forming strongly-connected series with which the new impression easily combined, than out of new and old together a total interest resulted which drove the vagrant ideas below the threshold of consciousness, and brought for a while settled attention into their place.”¹⁸

Passive intellectual attention is immediate when we follow in thought a train of images exciting or interesting *per se*; derived, when the images are interesting only as means to a remote end, or

¹⁸ Herbart: *Psychologie als Wissenschaft*, § 128.

merely because they are associated with something which makes them dear. Owing to the way in which immense numbers of real things become integrated into single objects of thought for us, there is no clear line to be drawn between immediate and derived attention of an intellectual sort. When absorbed in intellectual attention we may become so inattentive to outer things as to be 'absent-minded,' 'abstracted,' or '*distracts*.' All reverie or concentrated meditation is apt to throw us into this state.

"Archimedes, it is well known, was so absorbed in a geometrical meditation, that he was first aware of the storming of Syracuse by his own death-wound, and his exclamation on the entrance of Roman soldiers was,—*Noli turbare circulos meos*. In like manner, Joseph Scaliger, the most learned of men, when a Protestant student in Paris, was so engrossed in the study of Homer, that he became aware of the massacre of St Bartholomew, and of his own escape, only on the day subsequent to the catastrophe. The philosopher Carneades was habitually liable to fits of meditation so profound, that, to prevent him sinking from inanition, his maid found it necessary to feed him like a child. And it is reported of Newton, that, while engaged in his mathematical researches, he sometimes forgot to dine. Cardan, one of the most illustrious of philosophers and mathematicians, was once, upon a journey, so lost in thought, that he forgot both his way and the object of his journey. To the questions of his driver whither he should proceed, he made no answer; and when he came to himself at nightfall, he was surprised to find the carriage at a stand-still, and directly under a gallows. The mathematician Vieta was sometimes so buried in meditation, that for hours he bore more resemblance to a dead person than to a living, and was then wholly unconscious of everything going on around him. On the day of his marriage, the great Budæus forgot everything in his philological speculations, and he was only awakened to the affairs of the external world by a tardy embassy from the marriage-party, who found him absorbed in the composition of his *Commentarii*." ¹⁹

The absorption may be so deep as not only to banish ordinary sensations, but even the severest pain. Pascal, Wesley, Robert Hall, are said to have had this capacity. Dr. Carpenter says of himself that

"he has frequently begun a lecture, whilst suffering neuralgic pain so severe as to make him apprehend that he would find it impossible to

¹⁹ Sir William Hamilton: *Metaphysics*, lecture xiv.

proceed; yet no sooner has he, by a determined effort, fairly launched himself into the stream of thought, than he has found himself continuously borne along without the least distraction, until the end has come, and the attention has been released; when the pain has recurred with a force that has over-mastered all resistance, making him wonder how he could have ever ceased to feel it." ²⁰

Dr. Carpenter speaks of launching himself by a determined effort. This effort characterizes what we called *active or voluntary attention*. It is a feeling which everyone knows, but which most people would call quite indescribable. We get it in the sensorial sphere whenever we seek to catch an impression of extreme *faintness*, be it of sight, hearing, taste, smell, or touch; we get it whenever we seek to *discriminate* a sensation merged in a mass of others that are similar; we get it whenever we *resist the attractions* of more potent stimuli and keep our mind occupied with some object that is naturally unimpressive. We get it in the intellectual sphere under exactly similar conditions; as when we strive to sharpen and make distinct an idea which we but vaguely seem to have; or painfully discriminate a shade of meaning from its similars; or resolutely hold fast to a thought so discordant with our impulses that, if left unaided, it would quickly yield place to images of an exciting and impassioned kind. All forms of attentive effort would be exercised at once by one whom we might suppose at a dinner-party resolutely to listen to a neighbor giving him insipid and unwelcome advice in a low voice, whilst all around the guests were loudly laughing and talking about exciting and interesting things.

There is no such thing as voluntary attention sustained for more than a few seconds at a time. What is called sustained voluntary attention is a repetition of successive efforts which bring back the topic to the mind.²¹ The topic once brought back, if a congenial one, *develops*; and if its development is interesting it engages the attention passively for a time. Dr. Carpenter, a moment back, described the stream of thought, once entered, as 'bearing him along.' This passive interest may be short or long. As soon as it flags, the

²⁰ *Mental Physiology*, § 124. The oft-cited case of soldiers not perceiving that they are wounded is of an analogous sort.

²¹ Prof. J. M. Cattell made experiments to which we shall refer further on, on the degree to which reaction-times might be shortened by distracting or voluntarily concentrating the attention. He says of the latter series that "the averages show that the attention can be held strained, that is, the centres kept in a state of unstable equilibrium for one second" (*Mind*, xi, 240).

attention is diverted by some irrelevant thing, and then a voluntary effort may bring it back to the topic again; and so on, under favorable conditions, for hours together. During all this time, however, note that it is not an identical *object* in the psychological sense (p. 265), but a succession of mutually related objects forming an identical *topic* only, upon which the attention is fixed. *No one can possibly attend continuously to an object that does not change.*

Now there are always some objects that for the time being *will not develop*. They simply *go out*; and to keep the mind upon anything related to them requires such incessantly renewed effort that the most resolute Will ere long gives out and lets its thoughts follow the more stimulating solicitations after it has withstood them for what length of time it can. There are topics known to every man from which he shies like a frightened horse, and which to get a glimpse of is to shun. Such are his ebbing assets to the spendthrift in full career. But why single out the spendthrift when to every man actuated by passion the thought of interests which negate the passion can hardly for more than a fleeting instant stay before the mind? It is like 'memento mori' in the heyday of the pride of life. Nature rises at such suggestions, and excludes them from the view:—How long, O healthy reader, can you now continue thinking of your tomb?—In milder instances the difficulty is as great, especially when the brain is fagged. One snatches at any and every passing pretext, no matter how trivial or external, to escape from the odiousness of the matter in hand. I know a person, for example, who will poke the fire, set chairs straight, pick dust-specks from the floor, arrange his table, snatch up the newspaper, take down any book which catches his eye, trim his nails, waste the morning *anyhow*, in short, and all without premeditation,—simply because the only thing he *ought* to attend to is the preparation of a noon-day lesson in formal logic which he detests. Anything but *that!*

Once more, the object must change. When it is one of sight, it will actually become invisible; when of hearing, inaudible,—if we attend to it too unmovingly. Helmholtz, who has put his sensorial attention to the severest tests, by using his eyes on objects which in common life are expressly overlooked, makes some interesting remarks on this point in his chapter on retinal rivalry.²² The phenomenon called by that name is this, that if we look with each eye upon a different picture (as in the annexed stereoscopic slide),

²² *Physiologische Optik*, § 32.

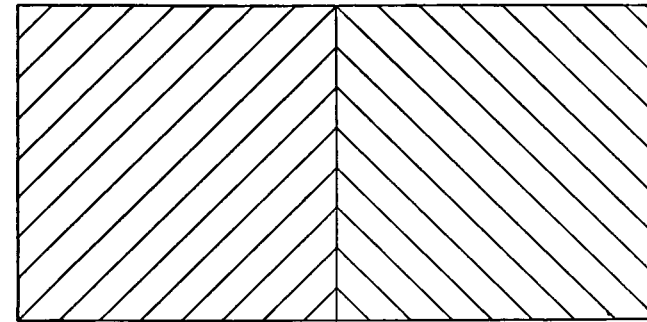


FIG. 36.

sometimes one picture, sometimes the other, or parts of both, will come to consciousness, but hardly ever both combined. Helmholtz now says:

"I find that I am able to attend voluntarily, now to one and now to the other system of lines; and that then this system remains visible alone for a certain time, whilst the other completely vanishes. This happens, for example, whenever I try to count the lines first of one and then of the other system. . . . But it is extremely hard to chain the attention down to one of the systems for long, unless we associate with our looking some distinct purpose which keeps the activity of the attention perpetually renewed. Such a one is counting the lines, comparing their intervals, or the like. An equilibrium of the attention, persistent for any length of time, is under no circumstances attainable. The natural tendency of attention when left to itself is to wander to ever new things; and so soon as the interest of its object is over, so soon as nothing new is to be noticed there, it passes, in spite of our will, to something else. If we wish to keep it upon one and the same object, we must seek constantly to find out something new about the latter, especially if other powerful impressions are attracting us away."

And again criticising an author who had treated of attention as an activity absolutely subject to the conscious will, Helmholtz writes:

"This is only restrictedly true. We move our eyes by our will; but one without training cannot so easily execute the intention of making them converge. At any moment, however, he can execute that of looking at a near object, in which act convergence is involved. Now just as little can we carry out our purpose to keep our attention steadily fixed upon a certain object, when our interest in the object is exhausted,

and the purpose is inwardly formulated in this abstract way. *But we can set ourselves new questions about the object, so that a new interest in it arises, and then the attention will remain riveted.* The relation of attention to will is, then, less one of immediate than of mediate control."

These words of Helmholtz are of fundamental importance. And if true of sensorial attention, how much more true are they of the intellectual variety! The *conditio sine qua non* of sustained attention to a given topic of thought is that we should roll it over and over incessantly and consider different aspects and relations of it in turn. Only in pathological states will a fixed and ever monotonously recurring idea possess the mind.

And now we can see why it is that what is called sustained attention is the easier, the richer in acquisitions and the fresher and more original the mind. In such minds, subjects bud and sprout and grow. At every moment, they please by a new consequence and rivet the attention afresh. But an intellect unfurnished with materials, stagnant, unoriginal, will hardly be likely to consider any subject long. A glance exhausts its possibilities of interest. Geniuses are commonly believed to excel other men in their power of sustained attention.²³ In most of them, it is to be feared, the so-called 'power' is of the passive sort. Their ideas coruscate, every subject branches infinitely before their fertile minds, and so for hours they may be rapt. *But it is their genius making them attentive, not their attention making geniuses of them.* And, when we come down to the root of the matter, we see that they differ from ordinary men less in the character of their attention than in the nature of the objects upon which it is successively bestowed. In the genius, these form a concatenated series, suggesting each other mutually by some rational law. Therefore we call the attention 'sustained' and the topic of meditation for hours 'the same.' In the common man the

²³ " 'Genius,' says Helvetius, 'is nothing but a continued attention,' (*une attention suivie*). 'Genius,' says Buffon, 'is only a protracted patience,' (*une longue patience*). 'In the exact sciences, at least,' says Cuvier, 'it is the patience of a sound intellect, when invincible, which truly constitutes genius.' And Chesterfield has also observed, that 'the power of applying an attention, steady and undissipated, to a single object, is the sure mark of a superior genius.'" (Hamilton: *Lectures on Metaphysics*, lecture xiv.)

series is for the most part incoherent, the objects have no rational bond, and we call the attention wandering and unfixd.

It is probable that genius tends actually to prevent a man from acquiring habits of voluntary attention, and that moderate intellectual endowments are the soil in which we may best expect, here as elsewhere, the virtues of the will, strictly so called, to thrive. But, whether the attention come by grace of genius or by dint of will, the longer one does attend to a topic the more mastery of it one has. And the faculty of voluntarily bringing back a wandering attention, over and over again, is the very root of judgment, character, and will. No one is *compos sui* if he have it not. An education which should improve this faculty would be *the education par excellence*. But it is easier to define this ideal than to give practical directions for bringing it about. The only general pedagogic maxim bearing on attention is that the more interest the child has in advance in the subject, the better he will attend. Induct him therefore in such a way as to knit each new thing on to some acquisition already there; and if possible awaken curiosity, so that the new thing shall seem to come as an answer, or part of an answer, to a question pre-existing in his mind.

At present having described the varieties, let us turn to

THE EFFECTS OF ATTENTION

Its remote effects are too incalculable to be recorded. The practical and theoretical life of whole species, as well as of individual beings, results from the selection which the habitual direction of their attention involves. In Chapters XIV and XV some of these consequences will come to light. Suffice it meanwhile that each of us literally *chooses*, by his ways of attending to things, what sort of a universe he shall appear to himself to inhabit.

The immediate effects of attention are to make us:

- a) perceive—
- b) conceive—
- c) distinguish—
- d) remember—

better than otherwise we could—both more successive things and each thing more clearly. It also

- e) shortens 'reaction-time.'

a and *b*. Most people would say that a sensation attended to becomes stronger than it otherwise would be. This point is, however, not quite plain, and has occasioned some discussion.²⁴ From the strength or intensity of a sensation must be distinguished its clearness; and to increase *this* is, for some psychologists, the utmost that attention can do. When the facts are surveyed, however, it must be admitted that to some extent the relative intensity of two sensations may be changed when one of them is attended to and the other not. Every artist knows how he can make a scene before his eyes appear warmer or colder in color, according to the way he sets his attention. If for warm, he soon begins to *see* the red color start out of everything; if for cold, the blue. Similarly in listening for certain notes in a chord, or overtones in a musical sound, the one we attend to sounds probably a little more loud as well as more emphatic than it did before. When we mentally break a series of monotonous strokes into a rhythm, by accentuating every second or third one, etc., the stroke on which the stress of attention is laid seems to become stronger as well as more emphatic. The increased visibility of optical after-images and of double images, which close attention brings about, can hardly be interpreted otherwise than as a real strengthening of the retinal sensations themselves. And this view is rendered particularly probable by the fact that an imagined visual object may, if attention be concentrated upon it long enough, acquire before the mind's eye almost the brilliancy of reality, and (in the case of certain exceptionally gifted observers) leave a negative after-image of itself when it passes away (see Chapter XVIII). Confident expectation of a certain intensity or quality of impression will often make us sensibly see or hear it in an object which really falls far short of it. In face of such facts it is rash to say that attention cannot make a sense-impression more intense.

But, on the other hand, the intensification which may be brought about seems never to lead the judgment astray. As we rightly perceive and name the same color under various lights, the same sound at various distances; so we seem to make an analogous sort of allowance for the varying amounts of attention with which objects are viewed; and whatever changes of feeling the attention may bring

²⁴ See, e.g., Ulrici: *Leib und Seele*, II, 28; Lotze: *Metaphysic*, § 273; Fechner: *Revision der Hauptpunkte der Psychophysik*, XIX; G. E. Müller: *Zur Theorie der sinnlichen Aufmerksamkeit*, § 1; Stumpf: *Tonpsychologie*, I, 71.

we charge, as it were, to the attention's account, and still perceive and conceive the object as the same.

"A gray paper appears to us no lighter, the pendulum-beat of a clock no louder, no matter how much we increase the strain of our attention upon them. No one, by doing this, can make the gray paper look white, or the stroke of the pendulum sound like the blow of a strong hammer,—everyone, on the contrary, feels the increase as that of his own conscious activity turned upon the thing."²⁵

Were it otherwise, we should not be able to note *intensities* by attending to them. Weak impressions would, as Stumpf says,²⁶ become stronger by the very fact of being observed.

"I should not be able to observe faint sounds at all, but only such as appeared to me of maximal strength, or at least of a strength that increased with the amount of my observation. In reality, however, I can, with steadily increasing attention, follow a diminuendo perfectly well."

The subject is one which would well repay exact experiment, if methods could be devised. Meanwhile there is no question whatever that attention augments the *clearness* of all that we perceive or conceive by its aid. But what is meant by clearness here?

c. Clearness, so far as attention produces it, *means distinction from other things and internal analysis or subdivision*. These are essentially products of intellectual *discrimination*, involving comparison, memory, and perception of various relations. The attention *per se* does not distinguish and analyze and relate. The most we can say is that it is a condition of our doing so. And as these processes are to be described later, the clearness they produce had better not be farther discussed here. The important point to notice here is that it is not attention's *immediate* fruit.²⁷

d. Whatever future conclusion we may reach as to this, we cannot deny that *an object once attended to will remain in the memory*,

²⁵ Fechner: *op. cit.*, p. 271.

²⁶ *Tonpsychologie*, I, p. 71.

²⁷ Compare, on clearness as the essential fruit of attention, Lotze's *Metaphysic*, § 273.

whilst one inattentively allowed to pass will leave no traces behind. Already in Chapter VI (see pp. 165 ff.) we discussed whether certain states of mind were 'unconscious,' or whether they were not rather states to which no attention had been paid, and of whose passage recollection could afterwards find no vestiges. Dugald Stewart says:²⁸ "The connexion between attention and memory has been remarked by many authors." He quotes Quintilian, Locke, and Helvetius; and goes on at great length to explain the phenomena of 'secondary automatism' (see above, p. 119 ff.) by the presence of a mental action grown so inattentive as to preserve no memory of itself. In our chapter on Memory, later on, the point will come up again.

e. Under this head, the *shortening of reaction-time*, there is a good deal to be said of Attention's effects. Since Wundt has probably worked over the subject more thoroughly than any other investigator and made it peculiarly his own, what follows had better, as far as possible, be in his words. The reader will remember the method and results of experimentation on 'reaction-time,' as given in Chapter III.

The facts I proceed to quote may also be taken as a supplement to that chapter. Wundt writes:

"When we wait with strained attention for a stimulus, it will often happen that instead of registering the stimulus, we react upon some entirely different impression,—and this not through confounding the one with the other. On the contrary, we are perfectly well aware at the moment of making the movement that we respond to the wrong stimulus. Sometimes even, though not so often, the latter may be another kind of sensation altogether,—one may, for example, in experimenting with sound, register a flash of light, produced either by accident or design. We cannot well explain these results otherwise than by assuming that the strain of the attention towards the impression we expect coexists with a preparatory innervation of the motor centre for the reaction, which innervation the slightest shock then suffices to turn into an actual discharge. This shock may be given by any chance impression, even by one to which we never intended to respond. When the preparatory innervation has once reached this pitch of intensity, the time that intervenes between the stimulus and the contraction of the muscles which react, may become vanishingly small."²⁹

²⁸ *Elements*, part I, chap. II.

²⁹ *Physiologische Psychologie*, 2d ed., II, 226.

"The perception of an impression is facilitated when the impression is preceded by a warning which announces beforehand that it is about to occur. This case is realized whenever several stimuli follow each other at equal intervals,—when, e.g., we note pendulum movements by the eye, or pendulum-strokes by the ear. Each single stroke forms here the signal for the next, which is thus met by a fully prepared attention. The same thing happens when the stimulus to be perceived is preceded, at a certain interval, by a single warning: the time is always notably shortened. . . . I have made comparative observations on reaction-time with and without a warning signal. The impression to be reacted on was the sound made by the dropping of a ball on the board of the 'drop apparatus.' . . . In a first series no warning preceded the stroke of the ball; in the second, the noise made by the apparatus in liberating the ball served as a signal. . . . Here are the averages of two series of such experiments:

Height of Fall		Average	Mean Error	No. of Expts.
25 cm.	{ No warning	0.253	0.051	13
	{ Warning	0.076	0.060	17
5 cm.	{ No warning	0.266	0.036	14
	{ Warning	0.175	0.035	17

" . . . In a long series of experiments (the interval between warning and stimulus remaining the same), the reaction-time grows less and less, and it is possible occasionally to reduce it to a vanishing quantity (a few thousandths of a second), to zero, or even to a negative value.³⁰ . . . The only ground that we can assign for this phenomenon is *the preparation (vorbereitende Spannung) of the attention*. It is easy to understand that the reaction-time should be shortened by this means; but that it should sometimes sink to zero and even assume negative values, may appear surprising. Nevertheless this latter case is also explained by what happens in the simple reaction-time experiments" just referred to, in which, "when the strain of the attention has reached its climax, the movement we stand ready to execute escapes from the control of our will, and we register a wrong signal. In these other experiments, in which a warning foretells the moment of the stimulus, it is also plain that attention accommodates itself so exactly to the latter's reception that *no sooner is it objectively given than it is fully apperceived, and with the apperception the motor discharge coincides.*"³¹

³⁰ By a negative value of the reaction-time Wundt means the case of the reactive movement occurring *before* the stimulus.

³¹ *Op. cit.*, II, 239.

Usually, when the impression is fully anticipated, attention prepares the motor centres so completely for both stimulus and reaction that the only time lost is that of the physiological conduction downwards. But even this interval may disappear, i.e., the stimulus and reaction may become objectively contemporaneous; or more remarkable still, the reaction may be discharged before the stimulus has actually occurred.³² Wundt, as we saw some pages back (p. 388), explains this by the effort of the mind so to react that we may feel our own movement and the signal which prompts it, both at the same instant. As the execution of the movement must precede our feeling of it, so it must also precede the stimulus, if that and our movement are to be felt at once.

The peculiar theoretic interest of these experiments lies in their showing expectant attention and sensation to be continuous or identical processes, since they may have identical motor effects. Although other exceptional observations show them likewise to be continuous subjectively, Wundt's experiments do not: he seems never, at the moment of reacting prematurely, to have been misled into the belief that the real stimulus was there.

As concentrated attention accelerates perception, so, conversely, perception of a stimulus is retarded by anything which either baffles or distracts the attention with which we await it.

"If, e.g., we make reactions on a sound in such a way that weak and strong stimuli irregularly alternate so that the observer can never expect a determinate strength with any certainty, the reaction-time for all the various signals is increased,—and so is the average error. I append two examples. . . . In Series I a strong and a weak sound alternated regularly, so that the intensity was each time known in advance. In II they came irregularly.

I. Regular Alternation

	Average Time	Average Error	No. of Expts.
Strong sound	0.116"	0.010"	18
Weak sound	0.127"	0.012"	9

II. Irregular Alternation

Strong sound	0.189"	0.038"	9
Weak sound	0.298"	0.076"	15

³² The reader must not suppose this phenomenon to be of frequent occurrence. Experienced observers, like Exner and Cattell, deny having met with it in their personal experience.

"Still greater is the increase of the time when, unexpectedly into a series of strong impressions, a weak one is interpolated, or *vice versa*. In this way I have seen the time of reaction upon a sound so weak as to be barely perceived rise to 0.4" or 0.5", and for a strong sound to 0.25". It is also matter of general experience that a stimulus expected in a general way, but for whose intensity attention cannot be adapted in advance, demands a longer reaction-time. In such cases . . . the reason for the difference can only lie in the fact that wherever a preparation of the attention is impossible, the time of both perception and volition is prolonged. Perhaps also the conspicuously large reaction-times which are got with stimuli so faint as to be just perceptible may be explained by the attention tending always to adapt itself for something more than this minimal amount of stimulus, so that a state ensues similar to that in the case of unexpected stimuli. . . . Still more than by previously unknown stimuli is the reaction-time prolonged by wholly unexpected impressions. This is sometimes accidentally brought about, when the observer's attention, instead of being concentrated on the coming signal, is dispersed. It can be realized purposely by suddenly thrusting into a long series of equidistant stimuli a much shorter interval which the observer does not expect. The mental effect here is like that of being startled;—often the startling is outwardly visible. The time of reaction may then easily be lengthened to one quarter of a second with strong signals, or with weak ones to a half-second. Slighter, but still very noticeable, is the retardation when the experiment is so arranged that the observer, ignorant whether the stimulus is to be an impression of light, sound, or touch, cannot keep his attention turned to any particular sense-organ in advance. One notices then at the same time a peculiar unrest, as the feeling of strain which accompanies the attention keeps vacillating between the several senses.

"Complications of another sort arise when what is registered is an impression anticipated both in point of quality and strength, but accompanied by other stimuli which make the concentration of the attention difficult. The reaction-time is here always more or less prolonged. The simplest case of the sort is where a momentary impression is registered in the midst of another, and continuous, sensorial-stimulation of considerable strength. The continuous stimulus may belong to the same sense as the stimulus to be reacted on, or to another. When it is of the same sense, the retardation it causes may be partly due to the distraction of the attention by it, but partly also to the fact that the stimulus to be reacted on stands out less strongly than if alone, and practically becomes a less intense sensation. But other factors in reality are present; for we find the reaction-time more prolonged by the concomitant stimulation when the stimulus is weak than when it is strong. I made experiments in which the principal impression, or signal for re-

action, was a bell-stroke whose strength could be graduated by a spring against the hammer with a movable counterpoise. Each set of observations comprised two series; in one of which the bell-stroke was registered in the ordinary way, whilst in the other a toothed wheel belonging to the chronometric apparatus made during the entire experiment a steady noise against a metal spring. In one half of the latter series (A) the bell-stroke was only moderately strong, so that the accompanying noise diminished it considerably, without, however, making it indistinguishable. In the other half (B) the bell-sound was so loud as to be heard with perfect distinctness above the noise.

		Mean	Maximum	Minimum	No. of Expts.
A (Bell-stroke moderate)	Without noise	0.189	0.244	0.156	21
	With noise	0.313	0.499	0.183	16
B (Bell-stroke loud)	Without noise	0.158	0.206	0.133	20
	With noise	0.203	0.295	0.140	19

“Since, in these experiments, the sound B even with noise made a considerably stronger impression than the sound A without, we must see in the figures a direct influence of the disturbing noise on the process of reaction. This influence is freed from mixture with other factors when the momentary stimulus and the concomitant disturbance appeal to different senses. I chose, to test this, sight and hearing. The momentary signal was an induction-spark leaping from one platinum point to another against a dark background. The steady stimulation was the noise above described.

Spark	Mean	Maximum	Minimum	No. of Expts.
Without noise	0.222	0.284	0.158	20
With noise	0.300	0.390	0.250	18

“When one reflects that in the experiments with one and the same sense the relative intensity of the signal is always depressed [which by itself is a retarding condition] the amount of retardation in these last observations makes it probable that *the disturbing influence upon attention is greater when the stimuli are disparate than when they belong to the same sense*. One does not, in fact, find it particularly hard to register immediately, when the bell rings in the midst of the noise; but when the spark is the signal one has a feeling of being coerced, as one turns away from the noise towards it. This fact is immediately connected with other properties of our attention. The effort of the latter

is accompanied by various corporeal sensations, according to the sense which is engaged. The innervation which exists during the effort of attention is therefore probably a different one for each sense-organ.”³³

Wundt then, after some theoretical remarks which we need not quote now, gives a table of retardations, as follows:

	Retardation
1. Unexpected strength of impression:	
a) Unexpectedly strong sound	0.073
b) Unexpectedly weak sound	0.171
2. Interference by like stimulus (sound by sound)	0.045 ³⁴
3. Interference by unlike stimulus (light by sound)	0.078

It seems probable, from these results obtained with elementary processes of mind, that all processes, even the higher ones of reminiscence, reasoning, etc., whenever attention is concentrated upon them instead of being diffused and languid, are thereby more rapidly performed.³⁵

Still more interesting reaction-time observations have been made by Münsterberg. The reader will recollect the fact noted in Chapter III (p. 99) that reaction-time is shorter when one concentrates his attention on the expected movement than when one concentrates it on the expected signal. Herr Münsterberg found that this is equally the case when the reaction is no simple reflex, but can take place only after an intellectual operation. In a series of experiments the five fingers were used to react with, and the reactor had to use a different finger according as the signal was of one sort or another. Thus when a word in the nominative case was called out he used

³³ *Op. cit.*, pp. 241-5.

³⁴ It should be added that Mr. J. M. Cattell (*Mind*, xi, 233) found, on repeating Wundt's experiments with a disturbing noise upon two practised observers, that the simple reaction-time either for light or sound was hardly perceptibly increased. Making strong voluntary concentration of attention shortened it by about 0.013 seconds on an average (p. 240). Performing mental additions whilst waiting for the stimulus lengthened it more than anything, apparently. For other, less careful, observations, compare Obersteiner, in *Brain*, i, 439. Cattell's negative results show how far some persons can abstract their attention from stimuli by which others would be disturbed. —A. Bertels (*Versuche über die Ablenkung der Aufmerksamkeit*, Dorpat, 1889) found that a stimulus to one eye sometimes prevented, sometimes improved, the perception of a quickly ensuing very faint stimulus to the other.

³⁵ Cf. Wundt: *Physiologische Psychologie*, 1st ed., p. 794.

the thumb, for the dative he used another finger; similarly adjectives, substantives, pronouns, numerals, etc., or, again, towns, rivers, beasts, plants, elements; or poets, musicians, philosophers, etc., were co-ordinated each with its finger, so that when a word belonging to either of these classes was mentioned, a particular finger and no other had to perform the reaction. In a second series of experiments the reaction consisted in the utterance of a word in answer to a question, such as "name an edible fish," etc.; or "name the first drama of Schiller," etc.; or "which is greater, Hume or Kant?" etc.; or (first naming apples and cherries, and several other fruits) "which do you prefer, apples or cherries?" etc.; or "which is Goethe's finest drama?" etc.; or "which letter comes the later in the alphabet, the letter L or the first letter of the most beautiful tree?" etc.; or "which is less, 15 or 20 minus 8?"³⁶ etc. etc. etc. Even in this series of reactions *the time was much quicker when the reactor turned his attention in advance towards the answer than when he turned it towards the question.* The shorter reaction-time was seldom more than one fifth of a second; the longer, from four to eight times as long.

To understand such results, one must bear in mind that in these experiments the reactor always knew in advance in a general way the *kind* of question which he was to receive, and consequently the *sphere within which* his possible answer lay.³⁷ In turning his attention, therefore, from the outset towards the answer, those brain-processes in him which were connected with this entire 'sphere' were kept sub-excited, and the question could then discharge with a minimum amount of lost time that particular answer out of the 'sphere' which belonged especially to it. When, on the contrary, the attention was kept looking towards the question exclusively and averted from the possible reply, all this preliminary sub-excitement of motor tracts failed to occur, and the entire process of answering had to be gone through with *after* the question was heard. No wonder that the time was prolonged. It is a beautiful example of the summation of stimulations, and of the way in which expectant attention, even when not very strongly focalized, will prepare the motor centres, and shorten the work which a stimulus has to perform on them, in order to produce a given effect when it comes.

³⁶ *Beiträge zur experimentellen Psychologie*, Heft 1, pp. 73-106 (1889).

³⁷ To say the very least, he always brought his articulatory innervation close to the discharging point. Herr M. describes a tightening of the head-muscles as characteristic of the attitude of attention to the reply.

THE INTIMATE NATURE OF THE ATTENTIVE PROCESS

We have now a sufficient number of facts to warrant our considering this more recondite question. And two physiological processes, of which we have got a glimpse, immediately suggest themselves as possibly forming in combination a complete reply. I mean

1. *The accommodation or adjustment of the sensory organs;* and
2. *The anticipatory preparation from within of the ideational centres concerned with the object to which the attention is paid.*

1. The sense-organs and the bodily muscles which favor their exercise are adjusted most energetically in sensorial attention, whether immediate and reflex, or derived. But there are good grounds for believing that even intellectual attention, attention to the *idea* of a sensible object, is also accompanied with some degree of excitement of the sense-organs to which the object appeals. The preparation of the ideational centres exists, on the other hand, wherever our interest in the object—be it sensible or ideal—is *derived* from, or in any way connected with, other interests, or the presence of other objects, in the mind. It exists as well when the attention thus derived is classed as passive as when it is classed as voluntary. So that on the whole we may confidently conclude—since in mature life we never attend to anything without our interest in it being in some degree derived from its connection with other objects—that *the two processes of sensorial adjustment and ideational preparation probably coexist in all our concrete attentive acts.*

The two points must now be proved in more detail. First, as respects the sensorial adjustment.

That it is present when we attend to *sensible* things is obvious. When we look or listen we accommodate our eyes and ears involuntarily, and we turn our head and body as well; when we taste or smell we adjust the tongue, lips, and respiration to the object; in feeling a surface we move the palpatory organ in a suitable way; in all these acts, besides making involuntary muscular contractions of a positive sort, we inhibit others which might interfere with the result—we close the eyes in tasting, suspend the respiration in listening, etc. The result is a more or less massive organic feeling that attention is going on. This organic feeling comes, in the way described on page 289, to be contrasted with that of the objects which it accompanies, and regarded as peculiarly ours, whilst the objects form the not-me. We treat it as a sense of our *own activity*, although it comes in to us from our organs after they are accommo-

dated, just as the feeling of any object does. Any object, if *immediately* exciting, causes a reflex accommodation of the sense-organ, and this has two results—first, the object's increase in clearness; and second, the feeling of activity in question. Both are sensations of an 'afferent' sort.

But in *intellectual* attention, as we have already seen (p. 287), similar feelings of activity occur. Fechner was the first, I believe, to analyze these feelings, and discriminate them from the stronger ones just named. He writes:

"When we transfer the attention from objects of one sense to those of another, we have an indescribable feeling (though at the same time one perfectly determinate, and reproducible at pleasure), of altered *direction* or differently localized tension (*Spannung*). We feel a strain forwards in the eyes, one directed sidewise in the ears, increasing with the degree of our attention, and changing according as we look at an object carefully, or listen to something attentively; and we speak accordingly of *straining the attention*. The difference is most plainly felt when the attention oscillates rapidly between eye and ear; and the feeling localizes itself with most decided difference in regard to the various sense-organs, according as we wish to discriminate a thing delicately by touch, taste, or smell.

"But now I have, when I try to vividly recall a picture of memory or fancy, a feeling perfectly analogous to that which I experience when I seek to apprehend a thing keenly by eye or ear; and this analogous feeling is very differently localized. While in sharpest possible attention to real objects (as well as to after-images) the strain is plainly forwards, and (when the attention changes from one sense to another) only alters its direction between the several external sense-organs, leaving the rest of the head free from strain, the case is different in memory or fancy, for here the feeling withdraws entirely from the external sense-organs, and seems rather to take refuge in that part of the head which the brain fills. If I wish, for example, to recall a place or person it will arise before me with vividness, not according as I strain my attention forwards, but rather in proportion as I, so to speak, retract it backwards."³⁸

In myself the 'backward retraction' which is felt during attention to ideas of memory, etc., seems to be principally constituted by the feeling of an actual rolling outwards and upwards of the eyeballs, such as occurs in sleep, and is the exact opposite of their behavior when we look at a physical thing. I have already spoken of this feel-

³⁸ *Psychophysik*, Bd. II, pp. 475-6.

ing on page 287.³⁹ The reader who doubts the presence of these organic feelings is requested to read the whole of that passage again.

It has been said, however, that we may attend to an object on the periphery of the visual field and yet not accommodate the eye for it. Teachers thus notice the acts of children in the school-room at whom they appear not to be looking. Women in general train their peripheral visual attention more than men. This would be an objection to the *invariable and universal* presence of movements of adjustment as ingredients of the attentive process. Usually, as is well known, no object lying in the marginal portions of the field of vision can catch our attention without at the same time 'catching our eye'—that is, fatally provoking such movements of rotation and accommodation as will focus its image on the fovea, or point of greatest sensibility. Practice, however, enables us, *with effort*, to attend to a marginal object whilst keeping the eyes immovable. The object under these circumstances never becomes perfectly distinct—the place of its image on the retina makes distinctness im-

³⁹ I must say that I am wholly unconscious of the peculiar feelings in the scalp which Fechner goes on to describe. "The feeling of strained attention in the different sense-organs seems to be only a muscular one produced in using these various organs by setting in motion, by a sort of reflex action, the muscles which belong to them. One can ask, then, with what particular muscular contraction the sense of strained attention in the effort to recall something is associated? On this question my own feeling gives me a decided answer; it comes to me distinctly, not as a sensation of tension in the inside of the head, but as a feeling of strain and contraction in the scalp with a pressure from without inwards over the whole cranium, undoubtedly caused by a contraction of the muscles of the scalp. This harmonizes very well with the German popular expression *den Kopf zusammennehmen*, etc., etc. In a former illness, in which I could not endure the slightest effort of continuous thought, and had no theoretical bias on this question, the muscles of the scalp, especially those of the occiput, assumed a fairly morbid degree of sensibility whenever I tried to *think*." (*Ibid.*, pp. 490-491.) In an early writing by Professor Mach, after speaking of the way in which by attention we decompose complex musical sounds into their elements, this investigator continues: "It is more than a figure of speech when one says that we 'search' among the sounds. This hearkening search is very observably a bodily activity, just like attentive looking in the case of the eye. If, obeying the drift of physiology, we understand by attention nothing mystical, but a bodily disposition, it is most natural to seek it in the variable tension of the muscles of the ear. Just so, what common men call attentive looking reduces itself mainly to accommodating and setting of the optic axes. . . . According to this, it seems to me a very plausible view that quite generally Attention has its seat in the mechanism of the body. If nervous work is being done through certain channels, that by itself is a mechanical ground for other channels being closed." (Wien, *Sitzungsberichte*, mathematisch-naturwissenschaftliche Classe, XLVIII, pt. 3, 297, 1863.)

possible—but (as anyone can satisfy himself by trying) we become more vividly conscious of it than we were before the effort was made. Helmholtz states the fact so strikingly that I will quote his observation in full. He was trying to combine in a single solid percept pairs of stereoscopic pictures illuminated instantaneously by the electric spark. The pictures were in a dark box which the spark from time to time lighted up; and, to keep the eyes from wandering between-whiles, a pin-hole was pricked through the middle of each picture, through which the light of the room came, so that each eye had presented to it during the dark intervals a single bright point. With parallel optical axes the points combined into a single image; and the slightest movement of the eyeballs was betrayed by this image at once becoming double. Helmholtz now found that simple linear figures could, when the eyes were thus kept immovable, be perceived as solids at a single flash of the spark. But when the figures were complicated photographs, many successive flashes were required to grasp their totality.

“Now it is interesting,” he says, “to find that, although we keep steadily fixating the pin-holes and never allow their combined image to break into two, we can, nevertheless, before the spark comes, keep our attention voluntarily turned to any particular portion we please of the dark field, so as then, when the spark comes, to receive an impression only from such parts of the picture as lie in this region. In this respect, then, our attention is quite independent of the position and accommodation of the eyes, and of any known alteration in these organs, and free to direct itself by a conscious and voluntary effort upon any selected portion of a dark and undifferentiated field of view. This is one of the most important observations for a future theory of attention.”⁴⁰

Hering, however, adds the following detail:

“Whilst attending to the marginal object we must always,” he says, “attend at the same time to the object directly fixated. If even for a single instant we let the latter slip out of our mind, our eye moves towards the former, as may be easily recognized by the after-images produced, or by the muscular sounds heard. The case is then less properly to be called one of translocation, than one of unusually wide *dispersion*, of the attention, in which dispersion the largest share still falls upon the thing directly looked at.”⁴¹

⁴⁰ *Physiologische Optik*, p. 741.

⁴¹ Hermann's *Handbuch*, III, I, 548.

and consequently directly accommodated for. Accommodation exists here, then, as it does elsewhere, and without it we should lose a part of our sense of attentive activity. In fact, the *strain* of that activity (which is remarkably great in the experiment) is due in part to unusually strong contractions of the muscles needed to keep the eyeballs still, which produce unwonted feelings of pressure in those organs.

2. But if the peripheral part of the picture in this experiment be not physically accommodated for, what is meant by its sharing our attention? What happens when we ‘distribute’ or ‘disperse’ the latter upon a thing for which we remain unwilling to ‘adjust’? This leads us to that second feature in the process, the ‘*ideational preparation*’ of which we spoke. *The effort to attend to the marginal region of the picture consists in nothing more nor less than the effort to form as clear an idea as is possible of what is there portrayed.* The idea is to come to the help of the sensation and make it more distinct. It comes with effort, and such a mode of coming is the remaining part of what we know as our attention’s ‘strain’ under the circumstances. Let us show how universally present in our acts of attention this reinforcing imagination, this inward reproduction, this anticipatory thinking of the thing we attend to, is.

It must as a matter of course be present when the attention is of the intellectual variety, for the thing attended to then *is* nothing but an idea, an inward reproduction or conception. If then we prove ideal construction of the object to be present in *sensorial* attention, it will be present everywhere. When, however, sensorial attention is at its height, it is impossible to tell how much of the percept comes from without and how much from within; but if we find that the *preparation* we make for it always partly consists of the creation of an imaginary duplicate of the object in the mind, which shall stand ready to receive the outward impression as if in a matrix, that will be quite enough to establish the point in dispute.

In Wundt’s and Exner’s experiments quoted above, the lying in wait for the impressions, and the preparation to react, consist of nothing but the anticipatory imagination of what the impressions or the reactions are to be. Where the stimulus is unknown and the reaction undetermined, time is lost, because no stable image can under such circumstances be formed in advance. But where both nature and time of signal and reaction are foretold, so completely does the expectant attention consist in premonitory imagination

that, as we have seen (pp. 392, note, 404-406, 410), it may mimic the intensity of reality, or at any rate produce reality's motor effects. It is impossible to read Wundt's and Exner's pages of description and not to interpret the 'Apperception' and 'Spannung' and other terms as equivalents of *imagination*. With Wundt, in particular, the word *Apperception* (which he sets great store by) is quite interchangeable with both *imagination* and *attention*. All three are names for the excitement from within of ideational brain-centres, for which Mr. Lewes's name of *preperception* seems the best possible designation.

Where the impression to be caught is very weak, the way not to miss it is to sharpen our attention for it by preliminary contact with it in a stronger form.

"If we wish to begin to observe overtones, it is advisable, just before the sound which is to be analyzed, to sound very softly the note of which we are in search The piano and harmonium are well fitted for this use, as both give overtones that are strong. Strike upon the piano first the *g'* [of a certain musical example previously given in the text]; then, when its vibrations have objectively ceased, strike powerfully the note *c*, in whose sound *g'* is the third overtone, and keep your attention steadily bent upon the pitch of the just heard *g'*; you will now hear this tone sounding in the midst of the *c*. . . . If you place the resonator which corresponds to a certain overtone, for example *g'* of the sound *c*, against your ear, and then make the note *c* sound, you will hear *g'* much strengthened by the resonator. . . . This strengthening by the resonator can be used to make the naked ear attentive to the sound which it is to catch. For when the resonator is gradually removed, the *g'* grows weaker; but the attention, once directed to it, holds it now more easily fast, and the observer hears the tone *g'* now in the natural unaltered sound of the note with his unaided ear."⁴²

Wundt, commenting on experiences of this sort, says that

"on carefully observing, one will always find that one tries first to recall the image in memory of the tone to be heard, and that then one hears it in the total sound. The same thing is to be noticed in weak or fugitive visual impressions. Illuminate a drawing by electric sparks separated by considerable intervals, and after the first, and often after the second and third spark, hardly anything will be recognized. But

⁴² Helmholtz: *Tonempfindungen*, 3d ed., 85-9 (English tr., 2d ed., 50, 51; see also pp. 60-1).

the confused image is held fast in memory; each successive illumination completes it; and so at last we attain to a clearer perception. The primary motive to this inward activity proceeds usually from the outer impression itself. We hear a sound in which, from certain associations, we suspect a certain overtone; the next thing is to recall the overtone in memory; and finally we catch it in the sound we hear. Or perhaps we see some mineral substance we have met before; the impression awakens the memory-image, which again more or less completely melts with the impression itself. In this way every idea takes a certain time to penetrate to the focus of consciousness. And during this time we always find in ourselves the peculiar *feeling* of attention. . . . The phenomena show that an *adaptation* of attention to the impression takes place. The surprise which unexpected impressions give us is due essentially to the fact that our attention, at the moment when the impression occurs, is not accommodated for it. The accommodation itself is of the double sort, relating as it does to the intensity as well as to the quality of the stimulus. Different qualities of impression require disparate adaptations. And we remark that our feeling of the *strain* of our inward attentiveness increases with every increase in the strength of the impressions on whose perception we are intent."⁴³

The natural way of conceiving all this is under the symbolic form of a brain-cell played upon from two directions. Whilst the object excites it from without, other brain-cells, or perhaps spiritual forces, arouse it from within. The latter influence is the 'adaptation of the attention.' *The plenary energy of the brain-cell demands the co-operation of both factors*: not when merely present, but when both present and attended to, is the object fully perceived.

A few additional experiences will now be perfectly clear. Helmholtz, for instance, adds this observation to the passage we quoted a while ago concerning the stereoscopic pictures lit by the electric spark.

"These experiments," he says, "are interesting as regards the part which attention plays in the matter of double images. . . . For in pictures so simple that it is relatively difficult for me to see them double, I can succeed in seeing them double, even when the illumination is only instantaneous, the moment I strive to *imagine in a lively way how they ought then to look*. The influence of attention is here pure; for all eye movements are shut out."⁴⁴

⁴³ *Physiologische Psychologie*, 2nd ed., II, 208.

⁴⁴ *Physiologische Optik*, 741.

In another place⁴⁵ the same writer says:

“When I have before my eyes a pair of stereoscopic drawings which are hard to combine, it is difficult to bring the lines and points that correspond, to cover each other, and with every little motion of the eyes they glide apart. *But if I chance to gain a lively mental image (Anschauungsbild) of the represented solid form (a thing that often occurs by lucky chance), I then move my two eyes with perfect certainty over the figure without the picture separating again.*”

Again, writing of retinal rivalry, Helmholtz says:

“It is not a trial of strength between two sensations, but depends upon our fixing or failing to fix the attention. Indeed there is scarcely any phenomenon so well fitted for the study of the causes which are capable of determining the attention. It is not enough to form the conscious intention of seeing first with one eye and then with the other; *we must form as clear a notion as possible of what we expect to see. Then it will actually appear.*”⁴⁶

In figures 37 and 38, where the result is ambiguous, we can make the change from one apparent form to the other by imagining strongly in advance the form we wish to see. Similarly in those puzzles where certain lines in a picture form by their combination an object that has no connection with what the picture ostensibly represents; or indeed in every case where an object is inconspicuous and hard to discern from the background; we may not be able to

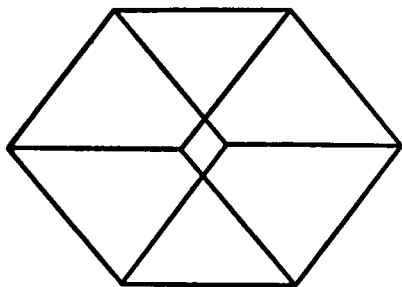


FIG. 37.

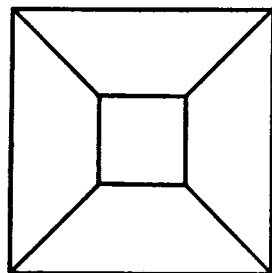


FIG. 38.

see it for a long time; but, having once seen it, we can attend to it again whenever we like, on account of the mental duplicate of it

⁴⁵ P. 728.

⁴⁶ *Popular Lectures on Scientific Subjects*, Eng. Trans., p. 294.

which our imagination now bears. In the meaningless French words ‘*pas de lieu Rhône que nous,*’ who can recognize immediately the English ‘paddle your own canoe’?⁴⁷ But who that has once noticed the identity can fail to have it arrest his attention again? When watching for the distant clock to strike, our mind is so filled with its image that at every moment we think we hear the longed-for or dreaded sound. So of an awaited footstep. Every stir in the wood is for the hunter his game; for the fugitive his pursuers. Every bonnet in the street is momentarily taken by the lover to enshroud the head of his idol. The image in the mind *is* the attention; the *preperception*, as Mr. Lewes calls it, is half of the perception of the looked-for thing.⁴⁸

⁴⁷ Similarly in the verses which someone tried to puzzle me with the other day: “*Gui n’a beau dit, qui sabot dit, nid a beau dit elle?*”

⁴⁸ I cannot refrain from referring in a note to an additional set of facts instanced by Lotze in his *Medicinische Psychologie*, § 431, although I am not satisfied with the explanation, fatigue of the sense-organ, which he gives. “In quietly lying and contemplating a wall-paper pattern, sometimes it is the ground, sometimes the design, which is clearer and consequently comes nearer. . . . Arabesques of monochromic many-convoluted lines now strike us as composed of one, now of another connected linear system, and all without any intention on our part. [This is beautifully seen in Moorish patterns; but a simple diagram like Fig. 39 also shows it well. We see it

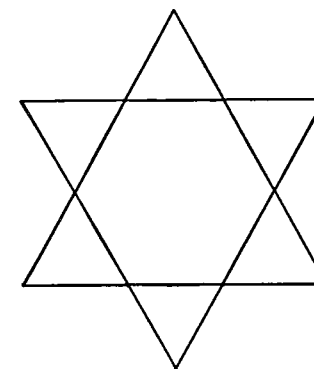


FIG. 39.

sometimes as two large triangles superposed, sometimes as a hexagon with angles spanning its sides, sometimes as six small triangles stuck together at their corners.] . . . Often it happens in reverie that when we stare at a picture, suddenly some one of its features will be lit up with especial clearness, although neither its optical character nor its meaning discloses any motive for such an arousal of the attention. . . . To one in process of becoming drowsy the surroundings alternately fade into darkness and abruptly brighten up. The talk of the bystanders seems now to come from indefinite distances; but at the next moment it startles us by its threatening loudness at our

It is for this reason that men have no eyes but for those aspects of things which they have already been taught to discern. Any one of us can notice a phenomenon after it has once been pointed out, which not one in ten thousand could ever have discovered for himself. Even in poetry and the arts, someone has to come and tell us what aspects we may single out, and what effects we may admire, before our æsthetic nature can 'dilate' to its full extent and never 'with the wrong emotion.' In kindergarten-instruction one of the exercises is to make the children see how many features they can point out in such an object as a flower or a stuffed bird. They readily name the features they know already, such as leaves, tail, bill, feet. But they may look for hours without distinguishing nostrils, claws, scales, etc., until their attention is called to these details; thereafter, however, they see them every time. In short, *the only things which we commonly see are those which we preperceive*, and the only things which we preperceive are those which have been labelled for us, and the labels stamped into our mind. If we lost our stock of labels we should be intellectually lost in the midst of the world.

Organic adjustment, then, and ideational preparation or preperception are concerned in all attentive acts. An interesting theory is defended by no less authorities than Professors Bain⁴⁹ and Ribot,⁵⁰ and still more ably advocated by Mr. N. Lange,⁵¹ who will have it that the ideational preparation itself is a consequence of muscular adjustment, so that the latter may be called the essence of the attentive process throughout. This at least is what the theory of these authors practically amounts to, though the former two do not state it in just these terms. The proof consists in the exhibition of cases of intellectual attention which organic adjustment accompanies, or of objects in thinking which we have to execute a movement. Thus Lange says that when he tries to imagine a certain col-

very ear," etc. These variations, which everyone will have noticed, are, it seems to me, easily explicable by the very unstable equilibrium of our ideational centres, of which constant change is the law. We *conceive* one set of lines as object, the other as background, and forthwith the first set becomes the set we *see*. There need be no *logical* motive for the conceptual change, the irradiations of brain-tracts by each other, according to accidents of nutrition, 'like sparks in burnt-up paper,' suffice. The changes during drowsiness are still more obviously due to this cause.

⁴⁹ *The Emotions and the Will*, 3d ed., p. 370.

⁵⁰ *Psychologie de l'attention* (1889), p. 32 ff.

⁵¹ *Philosophische Studien*, IV, 413 ff.

ored circle, he finds himself first making with his eyes the movement to which the circle corresponds, and *then* imagining the color, etc., as a consequence of the movement.

"Let my reader," he adds, "close his eyes and think of an extended object, for instance a *pencil*. He will easily notice that he first makes a slight movement [of the eyes] corresponding to the straight line, and that he often gets a weak feeling of innervation of the hand as if touching the pencil's surface. So, in thinking of a certain sound, we turn towards its direction or repeat muscularly its rhythm, or articulate an imitation of it."⁵²

But it is one thing to point out the presence of muscular contractions as constant concomitants of our thoughts, and another thing to say, with Herr Lange, that thought is *made possible* by muscular contraction alone. It may well be that where the object of thought consists of two parts, one perceived by movement and another not, the part perceived by movement is habitually called up first and fixed in the mind by the movement's execution, whilst the other part comes secondarily as the movement's mere associate. But even were this the rule with all men (which I doubt⁵³), it would only be a practical habit, not an ultimate necessity. In the chapter on the Will we shall learn that movements themselves are results of images coming before the mind, images sometimes of feelings in the moving part, sometimes of the movement's effects on eye and ear, and sometimes (if the movement be originally reflex or instinctive), of its natural stimulus or exciting cause. It is, in truth, contrary to all wider and deeper analogies to deny that any quality of feeling whatever can directly rise up in the form of an idea, and to assert that only ideas of movement can call other ideas to the mind.

So much for adjustment and preperception. The only third process I can think of as always present is the inhibition of irrele-

⁵² See Lange: *loc. cit.*, p. 417, for another proof of his view, drawn from the phenomenon of retinal rivalry.

⁵³ Many of my students have at my request experimented with imagined letters of the alphabet and syllables, and they tell me that they can see them inwardly as total colored pictures without following their outlines with the eye. I am myself a bad visualizer, and make movements all the while.—M. L. Marillier, in an article of eminent introspective power which appeared after my text was written ("Remarques sur le mécanisme de l'attention," in *Revue Philosophique*, vol. xxvii, p. 566), has contended against Ribot and others for the non-dependence of sensory upon motor images in their relations to attention. I am glad to cite him as an ally.

vant movements and ideas. This seems, however, to be a feature incidental to voluntary attention rather than the essential feature of attention at large,⁵⁴ and need not concern us particularly now. Noting merely the intimate connection which our account so far establishes between attention, on the one hand, and imagination, discrimination, and memory, on the other, let us draw a couple of practical inferences, and then pass to the more speculative problem that remains.

The practical inferences are pedagogic. First, *to strengthen attention in children* who care nothing for the subject they are studying and let their wits go wool-gathering. The interest here must be 'derived' from something that the teacher associates with the task, a reward or a punishment if nothing less external comes to mind. Prof. Ribot says:

"A child refuses to read; he is incapable of keeping his mind fixed on the letters, which have no attraction for him; but he looks with avidity upon the pictures contained in a book. 'What do they mean?' he asks. The father replies: 'When you can read, the book will tell you.' After several colloquies like this, the child resigns himself and falls to work, first slackly, then the habit grows, and finally he shows an ardor which has to be restrained. This is a case of the genesis of voluntary attention. An artificial and indirect desire has to be grafted on a natural and direct one. Reading has no immediate attractiveness, but it has a borrowed one, and that is enough. The child is caught in the wheelwork, the first step is made."

I take another example, from M. B. Perez:⁵⁵

"A child of six years, habitually prone to mind-wandering, sat down one day to the piano of his own accord to repeat an air by which his mother had been charmed. His exercises lasted an hour. The same

⁵⁴ Drs. Ferrier (*Functions of the Brain* (1876), (§§102-3) and Obersteiner (*Brain*, I, 439 ff.) treat it as the essential feature. The author whose treatment of the subject is by far the most thorough and satisfactory is Prof. G. E. Müller, whose little work *Zur Theorie der sinnlichen Aufmerksamkeit*, Inauguraldissertation, Leipzig, Edelmann (1873), is for learning and acuteness a model of what a monograph should be. I should like to have quoted from it, but the Germanism of its composition makes quotation quite impossible. See also G. H. Lewes: *Problems of Life and Mind*, 3d Series, Prob. 2, chap. 10; G. H. Schneider: *Der menschliche Wille*, 294 ff., 309 ff.; C. Stumpf: *Tonpsychologie*, I, 67-75; W. B. Carpenter: *Mental Physiology*, chap. 3; Cappie in *Brain*, July 1886 (hyperæmia-theory); J. Sully in *Brain*, Oct. 1890.

⁵⁵ *L'Enfant de trois à sept ans*, p. 108.

child at the age of seven, seeing his brother busy with tasks in vacation, went and sat at his father's desk. 'What are you doing there?' his nurse said, surprised at so finding him. 'I am,' said the child, 'learning a page of German; it isn't very amusing, but it is for an agreeable surprise to mamma.' "

Here, again, a birth of voluntary attention, grafted this time on a sympathetic instead of a selfish sentiment like that of the first example. The piano, the German, awaken no spontaneous attention; but they arouse and maintain it by borrowing a force from elsewhere.⁵⁶

Then, take that mind-wandering which at a later age may trouble us *whilst reading or listening to a discourse*. If attention be the reproduction of the sensation from within, the habit of reading not merely with the eye, and of listening not merely with the ear, but of articulating to one's self the words seen or heard, ought to deepen one's attention to the latter. Experience shows that this is the case. I can keep my wandering mind a great deal more closely upon a conversation or a lecture if I actively re-echo to myself the words than if I simply hear them; and I find a number of my students who report benefit from voluntarily adopting a similar course.⁵⁷

Second, *a teacher who wishes to engage the attention of his class must knit his novelties on to things of which they already have preperceptions*. The old and familiar is readily attended to by the mind and helps to hold in turn the new, forming, in Herbartian phraseology, an '*Apperceptionsmasse*' for it. Of course it is in every case a very delicate problem to know what '*Apperceptionsmasse*' to use. Psychology can only lay down the general rule.

IS VOLUNTARY ATTENTION A RESULTANT OR A FORCE?

When, a few pages back, I symbolized the 'ideational preparation' element in attention by a brain-cell played upon from within, I added 'by other brain-cells, or by some spiritual force,' without deciding which. The question 'which?' is one of those central psychologic mysteries which part the schools. When we reflect that the turnings of our attention form the nucleus of our inner self; when

⁵⁶ *Psychologie de l'attention*, p. 53.

⁵⁷ Repetition of this sort does not confer *intelligence* of what is said, it only keeps the mind from wandering into other channels. The intelligence sometimes comes in beats, as it were, at the end of sentences, or in the midst of words which were mere words until then. See above, pp. 270-271.

we see (as in the chapter on the Will we shall see) that volition is nothing but attention; when we believe that our autonomy in the midst of nature depends on our not being pure effect, but a cause,—

*Principium quoddam quod fati foedera rumpat,
Ex infinito ne causam causa sequatur—*

we must admit that the question whether attention involve such a principle of spiritual activity or not is metaphysical as well as psychological, and is well worthy of all the pains we can bestow on its solution. It is in fact the pivotal question of metaphysics, the very hinge on which our picture of the world shall swing from materialism, fatalism, monism, towards spiritualism, freedom, pluralism,—or else the other way.

It goes back to the automaton-theory. If feeling is an inert accompaniment, then of course the brain-cell can be played upon only by other brain-cells, and the attention which we give at any time to any subject, whether in the form of sensory adaptation or of 'preperception,' is the fatally predetermined *effect* of exclusively material laws. If, on the other hand, the feeling which coexists with the brain-cells' activity reacts dynamically upon that activity, furthering or checking it, then the attention is in part, at least, a *cause*. It does not necessarily follow, of course, that this reactive feeling should be 'free' in the sense of having its amount and direction undetermined in advance, for it might very well be predetermined in all these particulars. If it were so, our attention would not be *materially* determined, nor yet would it be 'free' in the sense of being spontaneous or unpredictable in advance. The question is of course a purely speculative one, for we have no means of objectively ascertaining whether our feelings react on our nerve-processes or not; and those who answer the question in either way do so in consequence of general analogies and presumptions drawn from other fields. As mere *conceptions*, the effect-theory and the cause-theory of attention are equally clear; and whoever affirms either conception to be true must do so on metaphysical or universal rather than on scientific or particular grounds.

As regards *immediate sensorial attention* hardly anyone is tempted to regard it as anything but an effect.⁵⁸ We are 'evolved'

⁵⁸ The reader will please observe that I am saying all that can *possibly* be said in

so as to respond to special stimuli by special accommodative acts which produce clear perceptions on the one hand in us, and on the other hand such feelings of inner activity as were above described. The accommodation and the resultant feeling *are* the attention. We don't bestow it, the object draws it from us. The object has the initiative, not the mind.

Derived attention, where there is no voluntary effort, seems also most plausibly to be a mere effect. The object again takes the initiative and draws our attention to itself, not by reason of its own intrinsic interest, but because it is connected with some other interesting thing. Its brain-process is connected with another that is either excited, or tending to be excited, and the liability to share the excitement and become aroused is the liability to 'preperception' in which the attention consists. If I have received an insult, I may not be actively thinking of it all the time, yet the thought of it is in such a state of heightened irritability, that the place where I received it or the man who inflicted it cannot be mentioned in my hearing without my attention bounding, as it were, in that direction, as the imagination of the whole transaction revives. Where such a stirring-up occurs, organic adjustment must exist as well, and the ideas must innervate to some degree the muscles. Thus the whole process of involuntary derived attention is accounted for if we grant that there is something interesting enough to arouse and fix the thought of whatever may be connected with it. This fixing *is* the attention;

favor of the effect-theory, since, inclining as I do myself to the cause-theory, I do not want to undervalue the enemy. As a matter of fact, however, one might begin to take one's stand against the effect-theory at the outset, with the phenomenon of immediate sensorial attention. One might say that attention causes the movements of adjustment of the eyes, for example, and is not merely their effect. Hering writes most emphatically to this effect: "The movements from one point of fixation to another are occasioned and regulated by the changes of place of the attention. When an object, seen at first indirectly, draws our attention to itself, the corresponding movement of the eye follows without further ado, as a consequence of the attention's migration and of our effort to make the object distinct. The wandering of the attention entails that of the fixation point. Before its movement begins, its goal is already in consciousness and grasped by the attention, and the location of this spot in the total space seen is what determines the direction and amount of the movement of the eye." (Hermann's *Handbuch*, p. 534.) I do not here insist on this, because it is hard to tell whether the attention or the movement comes first (Hering's reasons, pp. 535-6, also 544-6, seem to me ambiguous), and because, even if the attention to the object does come first, it may be a mere effect of stimulus and association. Mach's theory that the *will to look* is the *space-feeling itself* may be compared with Hering's in this place. See Mach's *Beiträge zur Analyse der Empfindungen* (1886), pp. 55 ff.

and it carries with it a vague sense of activity going on, and of acquiescence, furtherance, and adoption, which makes us feel the activity to be our own.

This reinforcement of ideas and impressions by the pre-existing contents of the mind was what Herbart had in mind when he gave the name of *apperceptive* attention to the variety we describe. We easily see now why the lover's tap should be heard—it finds a nerve-centre half ready in advance to explode. We see how we can attend to a companion's voice in the midst of noises which pass unnoticed though objectively much louder than the words we hear. Each word is *doubly* awakened; once from without by the lips of the talker, but already before that from within by the premonitory processes irradiating from the previous words, and by the dim arousal of all processes that are connected with the 'topic' of the talk. The irrelevant noises, on the other hand, are awakened only once. They form an unconnected train. The boys at school, inattentive to the teacher except when he begins an anecdote, and then all pricking up their ears, are as easily explained. The words of the anecdote shoot into association with exciting objects which react and fix them; the other words do not. Similarly with the grammar heard by the purist and Herbart's other examples quoted on page 395.

Even where the attention is voluntary, it is possible to conceive of it as an effect, and not a cause, a product and not an agent. The things we attend to *come to us* by their own laws. Attention *creates* no idea; an idea must already be there before we can attend to it. Attention only fixes and retains what the ordinary laws of association bring 'before the footlights' of consciousness. But the moment we admit this we see that the attention *per se*, the *feeling* of attending need no more fix and retain the ideas than it need bring them. The associates which bring them also fix them by the interest which they lend. In short, voluntary and involuntary attention may be essentially the same. It is true that where the ideas are intrinsically very unwelcome and the effort to attend to them is great, it seems to us as if the frequent renewal of the effort were the very cause by which they are held fast, and we naturally think of the effort as an original force. In fact it is only to the *effort to attend*, not to the mere *attending*, that we are seriously tempted to ascribe spontaneous power. We think we can make more of it *if we will*; and the amount which we make does not seem a fixed function of the ideas themselves, as it would necessarily have to be if our effort

were an effect and not a spiritual force. But even here it is possible to conceive the facts mechanically and to regard the effort as a mere effect.

Effort is felt only where there is a conflict of interests in the mind. The idea A may be intrinsically exciting to us. The idea Z may derive its interest from association with some remoter good. A may be our sweetheart, Z may be some condition of our soul's salvation. Under these circumstances, if we succeed in attending to Z at all it is always with expenditure of effort. The 'ideational preparation,' the 'preperception' of A keeps going on of its own accord, whilst that of Z needs incessant pulses of voluntary reinforcement—that is, we have the *feeling* of voluntary reinforcement (or effort) at each successive moment in which the thought of Z flares brightly up in our mind. Dynamically, however, that may mean only this: that the associative processes which make Z triumph are really the stronger, and in A's absence would make us give a 'passive' and unimpeded attention to Z; but, so long as A is present, some of their force is used to inhibit the processes concerned with A. Such inhibition is a partial neutralization of the brain-energy which would otherwise be available for fluent thought. But what is lost for thought is converted into feeling, in this case into the peculiar feeling of effort, difficulty, or strain.

The stream of our thought is like a river. On the whole easy simple flowing predominates in it, the drift of things is with the pull of gravity, and effortless attention is the rule. But at intervals an obstruction, a set-back, a log-jam occurs, stops the current, creates an eddy, and makes things temporarily move the other way. If a real river could feel, it would feel these eddies and set-backs as places of effort. "I am here flowing," it would say, "in the direction of greatest resistance, instead of flowing, as usual, in the direction of least. My effort is what enables me to perform this feat." Really, the effort would only be a passive index that the feat was being performed. The agent would all the while be the total downward drift of the rest of the water, forcing *some* of it upwards in this spot; and although, *on the average*, the direction of least resistance is downwards, that would be no reason for its not being upwards now and then. Just so with our voluntary acts of attention. They are momentary arrests, coupled with a peculiar feeling, of portions of the stream. But the arresting force, instead of being this peculiar feeling itself, may be nothing but the processes by which the collision is

produced. The feeling of effort may be 'an accompaniment,' as Mr. Bradley says, 'more or less superfluous,' and no more contribute to the result than the pain in a man's finger, when a hammer falls on it, contributes to the hammer's weight. Thus the notion that our effort in attending is an original faculty, a force additional to the others of which brain and mind are the seat, may be an abject superstition. Attention may have to go, like many a faculty once deemed essential, like many a verbal phantom, like many an idol of the tribe. It may be an excrescence on Psychology. No need of it to drag ideas before consciousness or fix them, when we see how perfectly they drag and fix each other there.

I have stated the effect-theory as persuasively as I can.⁵⁹ It is a clear, strong, well-equipped conception, and like all such, is fitted to carry conviction, where there is no contrary proof. The feeling of effort certainly *may* be an inert accompaniment and not the active element which it seems. No measurements are as yet performed (it is safe to say none ever will be performed) which can show that it contributes energy to the result. We *may* then regard attention as a superfluity, or a 'Luxus,' and dogmatize against its causal function with no feeling in our hearts but one of pride that we are applying Occam's razor to an entity that has multiplied itself 'beyond necessity.'

But Occam's razor, though a very good rule of method, is certainly no law of nature. The laws of stimulation and of association may well be indispensable actors in all attention's performances, and may even be a good enough 'stock-company' to carry on many performances without aid; and yet they *may* at times simply form the background for a 'star-performer,' who is no more their 'inert accompaniment' or their 'incidental product' than Hamlet is Horatio's and Ophelia's. Such a star-performer would be the voluntary effort to attend, if it were an original psychic force. Nature *may*, I say, indulge in these complications; and the conception that she has done so in this case is, I think, just as clear (if not as 'parsimonious' logically) as the conception that she has not. To justify this assertion, *let us ask just what the effort to attend would effect if it were an original force.*

⁵⁹ F. H. Bradley: "Is There Any Special Activity of Attention?" in *Mind*, XI, 305, and Lipps: *Grundtatsachen*, chaps. IV and XXIX, have stated it similarly.

It would deepen and prolong the stay in consciousness of innumerable ideas which else would fade more quickly away. The delay thus gained might not be more than a second in duration—but that second might be *critical*; for in the constant rising and falling of considerations in the mind, where two associated systems of them are nearly in equilibrium it is often a matter of but a second more or less of attention at the outset, whether one system shall gain force to occupy the field and develop itself, and exclude the other, or be excluded itself by the other. When developed, it may make us act; and that act may seal our doom. When we come to the chapter on the Will, we shall see that the whole drama of the voluntary life hinges on the amount of attention, slightly more or slightly less, which rival motor ideas may receive. But the whole feeling of reality, the whole sting and excitement of our voluntary life, depends on our sense that in it things are *really being decided* from one moment to another, and that it is not the dull rattling off of a chain that was forged innumerable ages ago. This appearance, which makes life and history tingle with such a tragic zest, *may* not be an illusion. As we grant to the advocate of the mechanical theory that it may be one, so he must grant to us that it may *not*. And the result is two conceptions of possibility face to face with no facts definitely enough known to stand as arbiter between them.

Under these circumstances, one can leave the question open whilst waiting for light, or one can do what most speculative minds do, that is, look to one's general philosophy to incline the beam. The believers in mechanism do so without hesitation, and they ought not to refuse a similar privilege to the believers in a spiritual force. I count myself among the latter, but as my reasons are ethical they are hardly suited for introduction into a psychological work.⁶⁰ The last word of psychology here is ignorance, for the 'forces' engaged are certainly too delicate and numerous to be followed in detail. Meanwhile, in view of the strange arrogance with which the wildest materialistic speculations persist in calling themselves 'science,' it is well to recall just what the reasoning is, by which the effect-theory of attention is confirmed. It is an argument from analogy, drawn from rivers, reflex actions and other material phenomena where no consciousness *appears* to exist at all, and extended

⁶⁰ More will be said of the matter when we come to the chapter on the Will.

to cases where consciousness seems the phenomenon's essential feature. *The consciousness doesn't count*, these reasoners say; it doesn't exist for science, it is *nil*; you mustn't think about it at all. The intensely reckless character of all this needs no comment. It is making the mechanical theory true *per fas aut nefas*. For the sake of that theory we make inductions from phenomena to others that are startlingly *unlike* them; and we assume that a complication which Nature has introduced (the presence of feeling and of effort, namely) is not worthy of scientific recognition at all. Such conduct may conceivably be *wise*, though I doubt it; but scientific, as contrasted with metaphysical, it cannot seriously be called.⁶¹

INATTENTION

Having spoken fully of attention, let me add a word about *inattention*.

We do not notice the ticking of the clock, the noise of the city streets, or the roaring of the brook near the house; and even the din of a foundry or factory will not mingle with the thoughts of its workers, if they have been there long enough. When we first put on spectacles, especially if they be of certain curvatures, the bright reflections they give of the windows, etc., mixing with the field of view, are very disturbing. In a few days we ignore them altogether. Various entoptic images, *musca volitantes*, etc., although constantly present, are hardly ever known. The pressure of our clothes and shoes, the beating of our hearts and arteries, our breathing, certain steadfast bodily pains, habitual odors, tastes in the mouth, etc., are examples from other senses, of the same lapse into unconsciousness of any too unchanging content—a lapse which Hobbes has expressed in the well-known phrase, "*Semper idem sentire ac non sentire ad idem revertunt.*"

The cause of the unconsciousness is certainly not the mere blunting of the sense-organs. Were the sensation important, we should notice it well enough; and we can at any moment notice it by expressly throwing our attention upon it,⁶² provided it have not be-

⁶¹ See, for a defence of the notion of inward activity, Mr. James Ward's searching articles in *Mind*, XII, 45 and 564.

⁶² It must be admitted that some little time will often elapse before this effort succeeds. As a child, I slept in a nursery with a very loud-ticking clock, and remember my astonishment more than once, on listening for its tick, to find myself unable to

come so inveterate that inattention to it is ingrained in our very constitution, as in the case of the *musca volitantes* the double retinal images, etc. But even in these cases artificial conditions of observation and patience soon give us command of the impression which we seek. The inattentiveness must then be a habit grounded on higher conditions than mere sensorial fatigue.

Helmholtz has formulated a general law of inattention which we shall have to study in the next chapter but one. Helmholtz's law is that we leave all impressions unnoticed which are valueless to us as signs by which to *discriminate things*. At most such impressions fuse with their consorts into an aggregate effect. The upper partial tones which make human voices differ make them differ as wholes only—we cannot dissociate the tones themselves. The odors which form integral parts of the characteristic taste of certain substances, meat, fish, cheese, butter, wine, do not come as odors to our attention. The various muscular and tactile feelings that make up the perception of the attributes 'wet,' 'elastic,' 'doughy,' etc., are not singled out separately for what they are. And all this is due to an inveterate habit we have contracted, of passing from them immediately to their import and letting their substantive nature alone. They have formed connections in the mind which it is now difficult to break; they are constituents of processes which it is hard to arrest, and which differ altogether from what the processes of catching the attention would be. In the cases Helmholtz has in mind, not only we but our ancestors have formed these habits. In the cases we started from, however, of the mill-wheel, the spectacles, the factory, din, the tight shoes, etc., the habits of inattention are more recent, and the manner of their genesis seems susceptible, hypothetically at least, of being traced.

How *can* impressions that are not needed by the intellect be thus shunted off from all relation to the rest of consciousness? Professor G. E. Müller has made a plausible reply to this question, and most of what follows is borrowed from him.⁶³ He begins with the fact that

catch it for what seemed a long space of time; then suddenly it would break into my consciousness with an almost startling loudness.—M. Delboeuf somewhere narrates how, sleeping in the country near a mill-dam, he woke in the night and thought the water had ceased to flow, but on looking out of the open window saw it flowing in the moonlight, and then heard it too.

⁶³ *Zur Theorie der sinnlichen Aufmerksamkeit*, p. 127 foll.

“When we first come out of a mill or factory, in which we have remained long enough to get wonted to the noise, we feel as if something were *lacking*. Our total feeling of existence is different from what it was when we were in the mill. . . . A friend writes to me: ‘I have in my room a little clock which does not run quite twenty-four hours without winding. In consequence of this, it often stops. So soon as this happens, I notice it, whereas I naturally fail to notice it when going. When this first began to happen, there was this modification: I suddenly felt an undefined uneasiness or sort of void, without being able to say what was the matter; and only after some consideration did I find the cause in the stopping of the clock.’ ”

That the stopping of an unfelt stimulus may itself be felt is a well-known fact: the sleeper in church who wakes when the sermon ends; the miller who does the same when his wheel stands still, are stock examples. Now (since every impression falling on the nervous system must propagate itself somewhither), Müller suggests that impressions which come to us when the thought-centres are pre-occupied with other matters may thereby be blocked or inhibited from invading these centres, and may then overflow into lower paths of discharge. And he farther suggests that if this process recur often enough, the side-track thus created will grow so permeable as to be used, no matter what may be going on in the centres above. In the acquired inattention mentioned, the constant stimulus always caused disturbance *at first*; and consciousness of it was extruded successfully only when the brain was *strongly excited* about other things. Gradually the extrusion became easier, and at last automatic.

The side-tracks which thus learn to draft off the stimulations that interfere with thought cannot be assigned with any precision. They probably terminate in organic processes, or insignificant muscular contractions which, when stopped by the cessation of their instigating cause, immediately give us the feeling that something is gone from our existence (as Müller says), or (as his friend puts it) the feeling of a void.⁶⁴

Müller’s suggestion awakens another. It is a well-known fact that persons striving to keep their attention on a difficult subject will resort to movements of various unmeaning kinds, such as pacing

⁶⁴ I have begun to inquire experimentally whether any of the measurable functions of the workmen change after the din of machinery stops at a workshop. So far I have found no constant results as regards either pulse, breathing, or strength of squeeze by the hand. I hope to prosecute the inquiry farther (May, 1890).

the room, drumming with the fingers, playing with keys or watch-chain, scratching head, pulling mustache, vibrating foot, or what not, according to the individual. There is an anecdote of Sir W. Scott, when a boy, rising to the head of his class by cutting off from the jacket of the usual head-boy a button which the latter was in the habit of twirling in his fingers during the lesson.—The button gone, its owner’s power of reciting also departed. Now much of this activity is unquestionably due to the overflow of emotional excitement during anxious and concentrated thought. It drains away nerve-currents which if pent up within the thought-centres would very likely make the confusion there worse confounded. But may it not also be a means of drafting off all the irrelevant sensations of the moment, and so keeping the attention more exclusively concentrated upon its inner task? Each individual usually has his own peculiar habitual movement of this sort. A downward nerve-path is thus kept constantly open during concentrated thought; and as it seems to be a law of frequent (if not of universal) application, that incidental stimuli tend to discharge through paths that are already discharging rather than through others, the whole arrangement might protect the thought-centres from interference from without. Were this the true *rationale* of these peculiar movements, we should have to suppose that the sensations produced by each phase of the movement itself are also drafted off immediately by the next phase and help to keep the circular process agoing. I offer the suggestion for what it is worth; the connection of the movements themselves with the continued effort of attention is certainly a genuine and curious fact.

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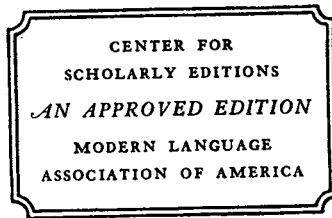
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