

THE PSYCHOLOGICAL REVIEW.

PRELIMINARY REPORT ON IMITATION.¹

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In calling these few notes a Preliminary Report, I have deliberately wished to ask for all the indulgence which the phrase itself can properly invite. I have none but tentative considerations to present. I mean to tell something of the mere plan and programme of a research which I have ventured to begin, but which I cannot hope ever rightly to finish, concerning the processes that enter into the structure and growth of our imitative functions. In making my statement, I shall first be led to speak, perhaps at far too great a length, about the difficult problem of the possible classification and definition of the processes which we can call, with more or less right, imitative. I shall do so because my experimental work, later briefly sketched, has already suggested to me, not only the need, but at least one motive of such a classification. Then I shall very briefly indicate the first beginning of an experimental study of some simple imitative processes which I have been prosecuting only since October 1, at Harvard, under the guidance of my colleague, Prof. Münsterberg. If my little sheaves are, so far, very naturally lean, they may still suggest the fact that in this field the harvest is plenteous, whatever you may think of any of the laborers.

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I.

If we ask ourselves: 'what is the definition of Imitation?' we soon find that any effort to separate imitative motor functions, in ourselves, from those which are not imitative, or imitative conscious processes from those mental processes which are not imitative, is a very difficult thing. Aristotle, who first undertook to define the psychological category of imitative mental processes, and of their correlative expressive functions, was quickly led to extend the term imitation until it came to include the most original productions of that poetic art which he himself called more philosophical than history. No student of the subject can easily avoid a wide extension of the category in question. Prof. Baldwin, in defining imitations (from a general biological point of view), by the very wide characterization which identifies them with 'circular' reactions, or with 'motor processes that tend to reproduce their own stimuli,' has seemed, I suppose, to many of his readers, to have made the concept of imitation far too inclusive for psychological convenience. All acts of sensuous attention are, of course, such circular motor processes. Again, is the insistent brooding of a mourner, as such, an imitative process? Yet it, of course, involves usually many circular reactions. Yet, from another side, there are facts that Prof. Baldwin himself has noted in passing, and will regard as familiar, but that would seem to tend to make even a still wider definition than this one desirable. In the laboratory experiments, later to be mentioned, I ask my subjects to listen to a rhythmic series of taps (made with an electric hammer), and then to reproduce this series by means of an electric key. Now, suppose that a subject persistently guides himself, in this process, as one of my subjects has often done, and as, no doubt, many people would do, by first, more or less deliberately, translating the series of taps to which he listens into a visualized image of pencil strokes arranged at intervals on paper, or of points marked off on a line; and suppose that he hereupon regularly makes his key-imitation by translating back from the visualized space intervals, and perhaps from the muscular feelings

of making the visualized pencil strokes into those muscular movements which reproduce the sound at the key. I suppose we should all agree that here not only is the final reproduction of the original series an imitative process, but the translation into visual and muscular terms, which serves as an intermediate instrument, is itself already an imitation. But, if so, the intermediate stage, which, be it noted, was not, in the subject noted, a spontaneous accidental association, but which was the gradual and habitual outcome of all the motor processes of his careful attention, and which arose as an incident of his deliberate effort to reproduce what he heard,—this intermediate stage is surely not itself the result of a function that reproduces its own stimulus, but of a function that produces, in image form, contents which are not those of the stimulus, but which have relations similar to those presented in the regular stimulus. But that imitations are thus often translations, reproductions which do not even mean to bring back the original stimulation, but which do mean to interpret it, by setting over against it its illumining counterpart in terms of some other set of stimulations, this, at least, on the highest levels of consciousness, is a commonplace. Aristotle already told us of art as intending to imitate life by producing before our eyes something that is in pretty marked contrast to life, e. g., an heroic tragedy. My subjects, at the key, as you will later see, find themselves both voluntarily and involuntarily doing a good deal of this same general sort of thing,—their imitations being often essentially interpretations, just as a translator imitates the original text precisely by meaning to write out, not the words which he gets as a stimulus, but the words of another tongue, which may, as faithfully as possible, serve the same ideal purposes. But in the same way, apart from the special motives of the translator, we all have very deep-set habits of imitating the sensations of one sense by means of deliberately recalled images belonging to another sense, and so, by motor reactions that tend to reproduce the stimuli to which these latter images correspond.

Thus the effort to define imitation, whether by wide or by narrow phrases, is at every point met with pretty decided

difficulties. Ignoring, as far as possible, any but the psychological point of view, I may, however, venture at this stage to suggest some of the more prominent classes of imitative functions, and of functions more or less obviously related to imitation, classes such as I myself have been led to distinguish. Whether any convenient generalization, as to the extent of the word imitation, is possible, we may then briefly consider.

To us all the word imitation first suggests motor functions, such as those of the child that struts about as a soldier, or that runs on all fours as a dog, or that learns to talk. Such functions are very numerous. We observe them in many animals, including birds. Their characteristic is that the imitator is more or less clearly aware of a model, and finds his own body more or less able to repeat certain usually extensive and complex movements of this model. This repetition gives satisfaction to the imitator. Imitation of this sort is to be roughly classified as either more or less critical. Sometimes the imitator is content with the roughest reproduction. Sometimes he is cautious, and is watchfully anxious to do precisely as his model does. A mocking-bird, as I at one period often observed in case of a household pet, appears to study with very great care at least some of the series of notes that he reproduces. Some children far surpass others in an early pedantry about the enunciation and use of their words. In any case, meanwhile, the subjective experiences of the imitator are here, at best, only in part identical with those given him in the stimulus presented to his senses by his model. He hears sounds, and replies by sounds, but of course he feels, more or less, the muscular and other organic disturbances incident to the reproduction. He sees the movements of his model. He both sees and feels his own imitative movements, and in all this he feels the latter as his own. In consequence, the imitator usually takes what is often called a decidedly 'subjective' sort of interest in his power to imitate. His activity has thus two strongly contrasted aspects. He watches his model, so far as he watches it at all, with a highly objective faithfulness. So far, his imitation depends upon a theoretical and very self-

surrendering sort of outward scrutiny. On the other hand, he delights in his own imitative powers as his own, i. e., as corporeally interesting events in his own organism, just as even the mocking-bird very obviously does. On this side the activity is, in the popular sense of the word, as self-centred as is eating or catching prey. That is, it is an activity whose conscious aspect involves an interest in inter-organic experiences. And, on this side too, the imitative process, in our children, is a great meeting place about which all sorts of self-considerate and self-conscious interests gather. Thus one sees how highly inter-organic, or subjective, as well as how highly outward-looking, objective, the imitative consciousness in the present class of cases has to be. Hence the enormous fecundity and various outcome of such imitative interest. Vanity and conscience, ideal devotion and flippant mockery, tame subserviency and the loftiest originality,—all these tendencies alike may, and in fact normally do, take root in this fruitful soil, and any of them may grow into the child's later character, and all because he was, in the first place, disposed to repeat the complex motor processes of his models, and so was forced to set off his consciousness of his own movements against his perception of the movements of others, thus emphasizing both his ideas of himself and his ideas of his models, each set of ideas by contrast with the other set. Imitation may thus become, to use the words again in their purely popular sense, the most self-abnegating or the most self-considerate of tendencies, according as, in the end, one or the other of these opposing drifts of attention gets emphasized, i. e., according as one comes to consider rather his own imitative organism or the outside model.

So much for a first and most familiar class of processes defined as imitative. But we all of us extend the word imitation to include those intelligent functions which tend to the voluntary production of external objects resembling certain other objects called the models of the objects produced. Thus, drawing, painting, modeling, building, mechanical skill of all sorts, are universally named imitative functions. In our own cases such functions, as a class, are obviously almost altogether derived, ~~directly or indirectly,~~ from the

functions of the former class just characterized. We learn, namely, to reproduce things, in whole or in part, by first having learned to imitate people. Mechanical skill may early become self-directing. But it is probably always, at the start, socially guided. Psychological complications are, accordingly, here of much the sort as in the foregoing class of cases. Our imitations of objects involve vast numbers of relatively controllable conscious processes besides our perception of the finished products which resemble the stimulating models. And here, too, in consequence, both our relatively objective, or outward-looking, and our relatively subjective, or inward-looking, interests get a correlative development as we learn to imitate—a development which may have the utmost complexity, and the most momentous psychological consequences. On the whole, however, the imitation of things generally tends, as they say, to send us 'out of ourselves,' i. e., outside of our interest in the processes of our own organisms, still more than does the imitation of the mere acts of people. Our imitative deed is transient; but, when we make something by the deed, its product here remains to calm our more anxious or our vainer interest in our own motor processes as such. Hence it is that musicians are more subjective in mood than are architects; and it is easier to be vain about matters of social etiquette than about one's skill as a carpenter, in case one has any such skill; while, to pass to another case where imitation is complicated with originality, nobody can judge his own book while it is in press as he can after it is in cold print and binding before him.

Now, I have laid stress upon the factors present in these two classes of cases of imitation, because I have meant to use them to illustrate the general nature of imitation itself. In these two classes of cases imitation is not merely, as a psychological process, the reproduction of a series of sense stimulations, or of external perceptions by means of a series of motor processes; but it is something still more complex. It is not only a process by which we reproduce one set of data by means of another set of data like the first, but it is also a process by which we get two sets of data whose inevitable

contrasts are as interesting and as instructive to us as their purposed resemblances. We get an interpretation of the perceived model through the imitation of it. On the other hand, to say that imitation, in these cases, is an act whose main motive is to interpret my perceptions by means of my deeds, is indeed true; but of course, so far, the same might be said of all those acts, such as looking, listening, approaching an object, grasping, touching, handling, exploring, in the perceptive field,—of all acts, in short, which involve intellectually valuable motor processes. What, then, is the characteristic feature of the imitative acts in the mentioned classes of cases? Does it not obviously lie in the fact that my interpretation of what I am usually said to perceive outside of my organism, in the external world, is, in the case of these classes of imitations, conditioned upon my setting over against my perceptions a series of motor processes, or of perceived results of motor processes, which in its wholeness contrasts with the other series in the one principal fact that the motor processes, the imitative deeds or their results, appear to me relatively controllable, plastic, reproducible at will, while otherwise the two series are largely similar. When I learn to grasp an apple, the grasping is indeed, once learned, an easily reproducible and so controllable deed, and on suggestion is remembered as such. But when I learn to say *apple*, upon hearing the word pronounced, the act, once in my power, is felt as controllable, but as to result it resembles its model (namely, the word *apple*, pronounced by my neighbor)—something that concerns not its controllableness, but some of its other characters. Thus, in these cases, imitation is definable, from the psychological side, as an act that interprets an uncontrollable perceptive series by setting over against it a series of experiences that appear to be similar to it in content, but to be also in contrast with it by virtue of their controllableness. Or, again, an imitation is an act that tends to the interpretation of what is beyond my power, or is independent of my movements, by contrasting it with what otherwise resembles it, but is in my power, and is a result of my movements. This feature of imitation, viz., that it accomplishes the aim of throwing light on the

uncontrollable percept by setting the controllable deed beside it, is, I suppose, the principal intellectual function of the higher imitative life. That the light thrown on the processes is throughout relative, that what I perceive outside me helps me to know, by contrast, my own imitative act, as well as the latter helps me to know the former,—this, after what has been said, needs no further illustration. At the outset, of course, we make no clear sundering between what goes on inside our organisms and what we perceive outside them. My point here is, it is our imitation that helps us first to do so by first bringing the mentioned contrast to light.

Now, however, as helping us on to another class of imitative functions, we may note the fact that where I thus use imitative processes to set off or to interpret perceived facts that are outside of my organism, it is not necessary that the similarity between the externally observed and the internally produced processes, between the original and its so-called copy, should have any one established or even desired degree of closeness. I insist, it is often the contrast as much as the agreement between the two that interests us. In every case so far the imitation differs from what it copies by virtue of the associated muscular and affective accompaniments which make the imitation our own, as distinct from what we merely observe without. These accompaniments may involve all the emotions of play. In that case the imitator very frequently wants his imitation to be unlike as well as like its original. One plays in one's own original fashion. Mocking is often more or less consciously untrue to its model. 'This is what you do,' we say to the person whom we mock. But thereupon what we do is only a pretended imitation—an exaggeration, of whose grotesque unreality we then make an ideal. Children surely often do this. The reasons for such action lie deep in the nature of the play motives. The mocking imitation is as imperfect a copy as are often the actions of kittens at play, when compared with the behavior of grown cats that are seriously fighting.

If an imitation thus often sets off our consciousness of the original by virtue of the very contrast that mingles with the similarity, it is plain that we may look to find imitations that

not only by accident, but intentionally, represent one set of sense data in terms of activities that give us data belonging to another sense or to any otherwise contrasted group of experiences. The imitation of a series of sounds by a series of movements involves, of course, as in dancing or in beating time, a vast number of acquired habits of complex nature. Yet the fact remains that such imitations do both fascinate and enlighten us. This principle of the tendency to deliberate idealization of our imitations, to deliberate deviations from the literal, one finds, then, in the most varied forms, in play, in art, in the far-reaching and deep-seated tendency, very complex in its origin, to translate space-relations into time relations and *vice versa*; in every form of fondness for what one may call symbolical motor processes, and so, finally, with very momentous consequences, in all those motor processes that are connected with the growth of our theoretical thinking. That our thoughts are, in this general sense, conscious processes by which we constantly mean to imitate the truth of the things that we experience, is perfectly obvious. Equally obvious is the fact that to think experience is to translate it into terms which are decidedly foreign to its character as it comes to us, apart from such ideal reconstruction, and in its first intention. Now thinking accompanies motor processes, abbreviated and truncated and rendered abstract in all sorts of ways, but very obviously and highly imitative in all the cases where we get them in any relatively unabridged form. The gesture language is a case in point. It gives the gesturer trains of experience of a very complex character, which are in a summary and more or less symbolic fashion similar to the primary trains of experience which by his gestures he undertakes to describe. For gestures we who speak have now learned to substitute trains of words, which we follow with an endless chain of attentive processes shifting from one series of images to another. But the series of attentive processes, as it follows now these, now those images, gives us a total inner experience which we call an account of the experienced reality beyond the thinking process. The value of this account we judge by its resemblance, not in detail, but in its total net-

work of related elements, to those aspects of the relatively external experience which our thinking means to emphasize. And yet, on the other hand, how unlike their originals our abstract ideas mean to be. How far is the thinker's imitation from being a mere inner reproduction of the external experience about which he thinks? It is the very contrast which here enlightens us, when it is accompanied by a consciousness of the sort of agreement which we all the time intend. In symbolic imitation the imitative subject means to neglect all of his model except his own chosen aspect of it; and even this aspect he generally means to reproduce in terms of a sort of inner experience which differs from it as widely as the data of one sense can differ from those of another.

So far I have mentioned ordinary imitations of the doings of our comrades, acquired tendencies to reproduce or picture things, and then the endlessly numerous cases of consciously idealized, playfully falsified or symbolically abbreviated imitations of the interesting aspects of things. Is it not fair to call all these manifestations of the imitative tendency? But some one will say, as people have said of both Tarde's and Prof. Baldwin's uses of the term imitation, that to go on in this fashion is in the end to include pretty much all psychical processes in the field covered by the word. If imitation occurs wherever there are relatively inner or organic experiences—*e. g.*, images or trains of images which, in some aspect, resemble certain relatively external or perceptive experiences—then where can one name an experience involving any images whatever, or any organic adjustment, which will not have something imitative about it? I reply that, if the foregoing classes of cases were all that I had to consider, I myself should be disposed to draw the lines about the class of processes to be called imitative from a purely psychological point of view, in this way: An imitation either is or accompanies a sort of motor adjustment. And, now, what sort? I answer: So far as we have yet gone, an imitation appears as an adjustment that leads to the emphasizing or interpreting of a train of relatively external experiences, by virtue of the fact that the mental accompaniment

of this adjustment is a train of relatively inner experiences (muscular feelings, or images of any sense you please, or affective states), while the similarity of the train of internal experiences to the train of external experiences serves, in the midst of the mutual contrasts of the two trains, to make livelier the consciousness of each series, when viewed side by side with the other. Or, more briefly, an imitation is a more or less conscious motor adjustment that tends to set off a series of given experiences by furnishing from within the conscious counterpart of some one or more of the aspects of the first series—a counterpart which is both like and unlike the original, and whose contrast is therefore often as instructive as its similarity.

Essential to this notion of imitation is so far the fact that the consciousness of the imitator is as truly a consciousness of his adjustment as it is a consciousness of his model. To be sure, at the outset, an infant has no clear idea of himself; but the point is that the ideas of inner and outer thus get clarified. The two must be more or less clearly held apart. How clearly depends upon what grade of consciousness you are considering. Moreover, the model is not a simple sense-fact, like a color, but is always, where we speak of imitation, a complex series of facts. We imitate the complex. We may by mere association reduplicate the elementary, but in that case we have no true instance of imitation. Where association by similarity takes place between a relatively elementary fact of sense and an image, there is no imitation: (1) because one isn't at all conscious of this association as involving what we call his motor adjustment as such; (2) because in many cases the associated elements tend to blend, and not to set each other off; and (3) because by imitation we always mean a consciously complex process of adjustment. Imitation, in the classes of cases heretofore considered, does not mean, therefore, mere similarity of relatively inner and relatively outer experiences, but the similarity of a complex motor series or of its complex result to a complex perceptive series, the conscious interest lying in the antithesis of the two as well as in their mutual support. The two are not merely alike, but each is more or less consciously

referred to the other. The imitation *means* the model, as well as chances to resemble it.

But, if we now proceed one step further, we do indeed seem to meet with functions which an external observer calls imitative, but which apparently do not conform to the foregoing definition. Many of our imitations occur with very little consciousness. We sit when others sit, rise when they rise, yawn when they yawn; follow fashions without any clear intention to do so, and catch by contagion tricks of gesture and facial expressions, as well as states of emotion. Panic-fear, in all gregarious animals, involves functions that seem clearly imitative. Yet here one surely does not mean to observe either the likeness or the contrast between the outer and the inner experiences. In fact, a contagious emotion, such as terror or a violent sympathetic faintness at the sight of another's pain, often seems rather to forbid the appearance of any clear or conscious sympathy with one's fellow as an objectively real person, and one gets lost in one's own feelings even while one is imitative. Yet even here, although the antithesis leaves consciousness, and the relatively subjective series of inter-organic processes and experiences does not help one to interpret the relatively external facts in any deliberate way, it still remains true that we have the one series emphasized by and dependent upon the other; and while the imitator himself does indeed lose sight of any clear relation of himself to his model, the external observer calls this an imitation, and not, like the independent nest-building of two birds of the same species, a mere resemblance in function, because the observer can see what the imitator neglects—the close relation of dependence between the two resembling and contrasting series.

Now I, of course, cannot doubt that, biologically speaking, the tendencies towards a relatively unconscious conformity of an animal's conduct to the conduct of its herd-fellows, lie deeper than the more conscious and intelligent sorts of explicitly discriminating imitation which I have so far defined in this paper. But the question still remains as to what it is about these relatively unconscious sorts of imitation which makes them the basis of so much that is later

important for the higher psychological functions. I venture then still to point out that the unconsciously imitative gregarious animal is still going through motor processes, such as place, side by side with various series of his sensory stimuli, a great number of inter-organic series of processes. These processes, on the one hand, extend far beyond the mere adjustment of his sense organs to the stimulation, while, on the other hand, they tend to emphasize these sense stimulations, not merely by repeating them, but by giving them companions which in various ways resemble them, and which therefore make them more effective in leading to further conduct. When chickens suffer from contagious fright, they all repeat the warning cry of the flock. Of what use is the repetition? Each fowl is in consequence warned, not only by his neighbor but by himself, and the inner warning comes not only to the ear, but also through just those motor sensations and affective inner states which accompany this motor adjustment. No other fowl could warn this one as the bird can warn itself. What is heard without already puts each fowl somewhat on the alert. But the inner resonance of the imitative act makes far more impressive this whole experience of danger. So then, even here, an imitative act appears to me to be not so much an act that, in Prof. Baldwin's phrase, tends to repeat its own stimulus, as an act that tends to reinforce, emphasize, signalize, clarify its complex stimulus by adding thereto other and parallel series of internal or organic stimuli, which by their similarity as a series shall support, while by their differences they shall in general supplement, the stimulus in question. This inter-organic imitation and supplementing of one series of stimuli by a series of inner experiences is, as a fact, very naturally connected in similarly organized beings with a behavior that, externally viewed, appears imitative, even when the creature in question is not interested in this imitative character. Simple attention need not, from my present point of view, be regarded as involving imitation, although simple attention does involve a circular reaction which tends to the repetition of its own stimulation. But if attention is supported by the appearance of a series of experiences,

motor or emotional, which are produced through the motor adjustment, and which taken together, run parallel to a series of stimuli and resemble it, thereby emphasizing and supplementing it, then one has an imitative function.

I conclude, then, so far in general, that imitative functions seem to me to be those which tend to emphasize, to support, or on higher levels to interpret, a complex series of sensory stimulations, by producing, as their accompaniment, another series of inter-organic experiences which resembles as a whole the first series, but which involves in general decidedly different activities of the organism, in addition to those of the organs receiving the stimuli. Lower cases of imitative functions already show us the contrast, in the midst of the similarity, between the imitative process and its sensory stimuli. Higher up this contrast is itself made an object of consciousness. Imitation and model are contrasted series of presentations whose relation keeps them apart. And hence it is that, as I myself suppose, imitation is, psychologically speaking, the one source of our whole series of conscious distinctions between subject and object, thought and truth, deed and ideal, impulse and conscience, inner world and external world—in short, of all those familiar and fundamental rational distinctions which psychology has hitherto found so baffling. The contrast between model and imitation is, to my mind, the first appearance in consciousness of that differentiation which in the end makes internal and external experience not merely qualitatively different—as, of course, they more or less are from the first—but consciously discriminated, as at first they seem not to be.

Biologically speaking, I should fancy that imitation might be, in the end, explicable by something even more fundamental still than Prof. Baldwin's circular reactions, viz., by those generally coöperative tendencies which must lie at the basis of all evolution in organisms consisting of multitudes of cells. These involve amongst their number tendencies to direct functional agreement. What occurs in one part of an organism must in general be repeated with variations elsewhere, in so far as the cells of various regions may be of the same general type, and are meant permanently to

coöperate. Such inter-organic repetitions of disturbance (attended with wide contrasts, which run side by side with the functional agreements) we have in all those recently much studied physiological accompaniments of emotion; and in all those phenomena of functional nervous equivalents which attract one's attention in the history of the varying symptoms of many a complex nervous case. Here what happens to one set of cells may tend sooner or later to be represented by a more or less contrasted functional equivalent in some other set of cells. Now these things are not yet cases of imitation. But they suggest a basis upon which imitative functions may have grown.

I said that my few experiments have already, without as yet proving anything, suggested to me the need of some such analysis as the foregoing. The scope of the experiments themselves is comparatively narrow. Yet some of you will perhaps think it already too wide.

I have desired to get some notion of the inner consciousness and of the outer effectiveness of a person engaged in acquiring skill in some imitative process. This process, as I desired it, should be fairly simple, and yet complex enough to involve the coöperation of a number of different habits, interests and forms of attention in the accomplishment of one end. I decided, by Prof. Münsterberg's advice, to choose the process of imitating rhythmic series of taps which were to be made at controllable intervals by means of an electric hammer, and imitated with an electric key by the subjects. In choosing the particular series of taps, I have followed my own choice and responsibility, and must confess that I have tried several rhythmic series that any more experienced psychological experimenter than myself might have easily regarded as too complex to promise any definite results. Yet so far, despite various inevitable eddies in my little stream of experience, I have not been disappointed at the wealth of suggestions that have come to me. I have regarded the so-called time-sense aspect of my experiments as a necessary, but for my purposes a very subordinate, aspect. The nature of the rhythmic consciousness itself comes in my way, but rhythmic consciousness is here only the instru-

ment, not the end. The chief aim for the first has been to get a pretty careful series of records of the facts, and to wait for experience to indicate the best further procedure. The facts collected have so far been objective records of the imitations and a constant series of subjective records written down at once, after such experiment, by the hands of the subjects concerned.

As for the physical mechanism used, a mechanism which, as I frankly confess, better hands than mine generally guide, it is in summary this: On the axle of a kymograph drum wheels revolve armed with platinum points, arranged at pleasure for each rhythmic series as used, the points successively dipping into mercury contacts at the lowest point in each revolution of their respective wheels. The completed contact gives in each case one stroke of an electric hammer. The moment of each stroke is recorded by an electric pen on the kymograph drum, the record itself being controlled by a tuning-fork tracing. Any one rhythmic series having been heard through by the subject (who sits holding, ready for his response, a metallic key especially prepared for these experiments), the subject, at the word 'ready,' repeats the rhythm that he has heard, by making successive connections between the point of the key and a mercury contact beneath. The key itself is arranged so as to be noiseless, or nearly so, in its own movements. At times it is arranged in the same circuit with the hammer, and then the subject, in making the contacts, tries to repeat the very sounds which he has heard and at the same intervals. At other times this connection is avoided, and then the subject makes his imitative contacts with a 'silent key' depending on the inner light only. Every imitative series of key-contacts is recorded on the same drum with the rhythmic series of hammer strokes which was to be imitated. The routine of each experiment is simply that the kymograph is started; the subject, who cannot see, although he does indeed hear the rotation of the mechanism, hears the word 'ready,' and then the series of hammer taps to be imitated. These taps, of course, cannot under these circumstances be made perfectly uniform, owing to the uncontrolla-

ble variations of the hammer's relation to the magnet; but they have no regular emphasis, and subjects learn to ignore the more ordinary of the caprices of the hammer. The rhythm being completed, there is a very brief pause for re-adjustment, when the subject, at the repeated word 'ready,' proceeds to beat off on the key as exact an imitation as he can of what he has heard. He then at once records dated and numbered notes of his subjective experiences during the experiments, and the records are filed.

So far most, although by no means all, of the records have been taken in work upon two rhythms, both complex enough to make the labor of apperceiving and reproducing them with relative exactitude decidedly noteworthy. They have first been learned, then practised upon daily, or as often as possible, their rates being very widely varied, while keeping the relations of the intervals constant. Separate series of experiments upon the estimation of slight changes of rate, apart from imitation, have also been recorded. And a considerable number of records have been taken of the skill of the subjects in independently giving and varying by minimal steps each rhythm after it had been learned. Of late one of the rhythms has been deliberately distorted by introducing irregularly placed new points into three of its more noteworthy intervals; and the vast change thus suddenly introduced into an already well-established series of conscious data has been studied, both objectively and subjectively.

The subjects include at present four women and four men, all of a fair although decidedly varied amount of introspective preparation. Three have a fair musical training. One of these is especially delicate in rhythmical perception. One of the unmusical subjects, on the other hand, is especially imperfect as to all clearer rhythmical consciousness. Another is a Japanese. Questions have been asked for the subjective records as the state of the experiments seemed to indicate. Above all, I have wanted to know what it means to the subject to try to catch, to hold, to make an ideal for action, of this series of monotonous taps with their varying intervals. I have now about 200 of these subjective notes,

corresponding to about 1000 repetitions of the various rhythms.

Well, so far, I have been especially struck by the fact that the process of holding for imitation involves, according to the records, the most widely varying subjective processes, which do not seem to be constant, even for one subject, in any such way as you would expect. One catches the rhythm and prepares to repeat it by means of what appear in consciousness as the most heterogeneous materials. There is first, of course, the case where one tries, voluntarily or half involuntarily, devices which are either consciously abstract sorts of imitation, such as counting, or else involve the use of voluntary muscular movements, of hand or of foot, made in time to the rhythm while one hears it. But curiously enough, in many cases, and with some of the subjects, devices of this kind are felt as rather hindering than helping the imitation. Interesting also, with some subjects, is the lack of any preference for any particular set of these voluntary or semi-voluntary motor devices. But next, side by side with these voluntary processes, or instead of them, there appear unconsciously selected masses of varying organic feelings, which seem to be quite involuntary in their special origin and which are at least nearly always unexpected. These, when they come, keep some sort of time with the rhythm, and may help to apperceive it. They are described as inner beatings, 'in the head,' 'in the neck,' 'in one temple,' 'in the ball of my thumb,' as tinglings, throbbings, or what not. These vary most remarkably from experiment to experiment, appear to vary quite apart from one's expectation, to come and go as they choose. To these are joined on occasion all sorts of involuntary associations of a more or less symbolic sort—'ideas of urgency,' or of 'deliberation,' or of merriment, or of other such sorts familiar to all who note musical associations. Visual associations join themselves—a dark rhythm has been mentioned in one case. The visualization of the intervals as space intervals is not unknown. All these phenomena show so far a rather baffling variety, which forbids one easily to reduce them to the terms of habit. The whole process, at least in all its

earlier stages, show far less routine than I had expected. The report of definable 'waves of attention,' as such, has been rarer than I should have anticipated. Perhaps further introspection will distinguish these facts better. But, of course, when the rhythm is once well learned, all the foregoing processes may and sometimes do lapse into a mere sense, that 'I know all this.' Then, however, one still has a model general idea or ideal of the one rhythm, 'just like a sentence,' as the subjects are wont to say—a general idea of the one rhythm, which is still variable as to its tempo. By as elaborate devices for variation of the facts as I can devise, I am just now trying to run down what this general ideal of the variable unity of the one rhythm really is. But to speak of this would take me beyond my space. Nor have I as yet any report to make as to the time facts of the rhythm experiments.

I have meant to state a problem, viz., that as to the essential nature of the processes called imitative, and to report the mere fact of a research now under way. You may see how one of these reports suggests why the other is an indication of matters worthy of further study. Herewith my present purpose and your time are alike exhausted.