

**AN ANALYSIS OF THE  
ACTION  
CONSCIOUSNESS, BASED  
ON THE SIMPLE REACTION**

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An analysis of the action consciousness, based on the simple reaction by Joseph Herschel Coffin

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THESIS PRESENTED TO THE  
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OF DOCTOR OF PHILOSOPHY

JOSEPH HERSCHEL COFFIN

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## AN ANALYSIS OF THE ACTION CONSCIOUSNESS BASED ON THE SIMPLE REACTION

### INTRODUCTION.<sup>1</sup>

The author began the experiments upon which this paper is based, in the fall of 1904, with the view of ultimately formulating some sort of definition of voluntary action, and of outlining, as accurately as might be, the psychology of it. The impulse which prompted this bit of research seems to have been one in common with a general impulse toward a more complete and satisfactory explanation of the problem which action sets to psychology. For, within the last year (1906), a number of articles and books have appeared,—notably Ach's *Willensthatigkeit und das Denken*, and the Garmann *Festschrift*,—all of which attack the problem of will, and of voluntary action.

Generally speaking, it is safe to say that the phenomena of voluntary action have been, and are, the least understood of any group of psychical phenomena. In the course of the development of psychology, the chapter on 'will' has invariably presented great difficulty to the various psychologists, no matter to what school they may have belonged. It has probably provoked more sheer speculation than any other set of mental phenomena, and also lies at the bottom of a greater number of errors and misconceptions than anything else. Moreover, a great amount of the confusion which has arisen within the science of psychology itself, both with regard to its relation to the other sciences and to philosophy, can doubtless be traced to the different interpretations which have been given to attention, will and voluntary action. Historically, at least, the so-called psychological discussions of will have, in many instances, been purely metaphysical; and where not so, the explanations have led to many and various logical difficulties.

So it is not surprising that Experimental Psychology, with its more advanced methods, and keener insight, should approach the problem of voluntary action, together with other higher, more intimate and more purely psychical processes, with hope and some degree of confidence; and neither is it

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<sup>1</sup> See Appendix F.

surprising that the movement should be a general one. The history of science reveals the fact that advancement has usually been effected by independent, but simultaneous discoveries by different individuals. Hence, in relation to the above-mentioned books and articles, this article may appear to be a timely one.

The Reaction Experiment has had a long and varied life, and has been put to many uses. As a psychological experiment, it was in its infancy from 1820, when Bessel began to investigate the difference in observation times in astronomy, and discovered what he called the 'personal equation,' to 1850, when the need was felt for a more accurate method of observation, and the Registration Method (chronoscope) was introduced. During this period it meant little more than a possible means of standardizing individual differences, in the matter of correct transit observations. In 1856, Mitchell undertook to get the absolute 'personal equation,' by the introduction of the Reaction Experiment proper. He called it the 'personality of the eye,' however, thinking it a defect of that organ. And in this connection, Hartmann discovered in 1858 that expectation and surprise greatly affect the personal equation: in all of which we have the glimmering of its psychological importance.

Thus the Reaction Experiment was finding its way into psychology from astronomy. But 30 years after the personal equation had been discovered Helmholtz (1850) conceived the idea of using the Reaction Experiment to measure the rapidity of neural excitation and transmission; so physiology became interested in it also, at a very early date. It was about this time that Donders worked out his set of experiments on the rapidity of thought, which he believed would be represented by the difference between the reaction time and the physiological time, which he thought he already knew. He therefore combined the physiological and psychological aspects of the experiment and made explicit its psychological value. His classic A, B, and C methods are familiar to every one who is familiar with the Reaction Experiment. And it was upon this as a basis that Wundt began experimenting on the Reaction in 1861.<sup>1</sup>

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<sup>1</sup>For a History of the Reaction, see Sanford, A. J., 2, pp. 1-38.

Cf. Titchener, "The Leipsig School," *Mind*, 1892, pp. 206-534; and *Manual of Psychology*, Vol. 2, Pt. II, p. 356 f.

Also note that Titchener paralleled his exposition of action with the Reaction Experiment in his *Primer of Psychology* (1898), and in his *Outlines of Psychology* (1895).

During the 70's there were many reaction experiments performed. Exner (Hermann's Handbuch, Vol. II, Pt. I, pp. 262 ff.) found ten different researches, one of the important ones of which was that carried on in Helmholtz's laboratory by von Kries and Aurbach (Arch. f. Anatomie u., Physiologie, 1877, 297 ff.), the object of which was to find out how sensations are worked up into ideas.

Thus far, then, we have noted four uses to which the Reaction Experiment has been put; (1) in astronomy,—the personal equation; (2) in physiology,—measurement of the rapidity of nerve currents; (3) method of finding rapidity of thought; and (4) a way of studying consciousness. The last two have significance for psychology, and it is plain that Astronomy and Physiology have offered Psychology a most fruitful method for the study of mental processes.

But throughout the history of the Reaction Experiment, as used by psychologists, until comparatively recently, the main interest has always been the temporal measurement of conscious processes. Great tables of reaction times have been made; the effects of practice, fatigue, warning signals, strength of stimulus, etc., were worked out at great length, and their effects on the reaction times noted. Great elaboration in technique was made, but small advance in introspective data, as to the constituents of the action consciousness itself. Introspection was used mainly as a check upon the experiment,—telling the direction and degree of attention, etc.

Without doubt, the most consistent and systematic account of the Reaction Experiment for psychology, historically considered, has been Wundt's treatment of it in the various editions of his *Grundzüge*. Here, as elsewhere, in the early treatment of the experiment, the emphasis is placed on the temporal relation of the ideas, as they run their course; and it is the chronoscopic results as to the actual time duration of the various processes that are of interest to him. A statement of Wundt's position with regard to the Reaction will probably best illustrate the general attitude toward the experiment, as represented in the literature of the 70's and 80's. This attitude would best be gleaned, however, from the first four editions of the *Grundzüge*, for in the fifth edition, his own position is slightly shifted with regard to the matter.

The fourth division of the first edition of the *Grundzüge* (1874), Wundt devotes to a consideration of "Consciousness and the Course of Ideas." The first chapter of this division takes up consciousness and attention. Omitting, for the present discussion, his analysis and characterization of attention as such, and his exposition of perception and apper-



ception, the important point in connection with what is to follow, is, that attention is regarded as the first condition of all clear ideation. The second chapter of this division is entitled, "The Course and Association of Ideas." And here it is that the discussion of the Reaction Experiment occurs. According to this account, then, there are two ways open to the psychologist by which the course of ideas may be studied. One may either seize upon and analyze the course of memory images which constitutes so large a part of our mental life, or one may investigate the changes of ideas dependent upon sensation,—*i. e.*, those that are originated from without. The former of these is the method which has been employed heretofore. But at the basis of this method there lies a fundamental fallacy: *viz.*, it has been supposed that the course of the ideas repeats, without essential change, the temporal course of the original sensations; which supposition need not be true. The second method, then, is the one which must be adopted. And the first task, accordingly, is to investigate the general laws governing the temporal course of ideas as based upon experimental investigation of the relation of their formation and succession, to the original outer stimulus. Now the simplest case of this kind is given when a simple sensation is perceived as a stimulus, in response to which a simple movement is to be made, when the impression has been apperceived: *i. e.*, attended to. To supplement this, it is necessary to have some sort of time measuring apparatus,—some way of determining the time elapsing between the giving of the stimulus and the muscular response which follows. The whole situation is a succession of very simple mental processes, given under uniform conditions, and capable of being investigated. It is a device for the study of the course of ideas; for it is necessary that an idea of the impression shall be formed, that the movement shall be determined upon, and that it be executed. The procedure may, therefore, be factored into the five following steps: (1) The transmission of the nervous impulse toward the centre, (2) the perception of the stimulus, *i. e.*, the entrance of the sensation into the field of consciousness, (3) apperception, or the entrance of the sensation into the focus of attention, (4) the will-impulse, the willing of the action, and (5) the transmission of the nervous excitation toward the periphery. Of these, the first and last are purely physiological, while the second, third and fourth are psychological processes. And of the psychological group, the middle one, apperception, is most important. As a matter of fact, however, the three stand in very close relation, for in the first place, perception may be said to be little more than a pre-

liminary; it is the beginning of what, in its completion is the clear, distinct apperception. This process is not only the most important intrinsically, but also probably consumes more time than the others. In the second place, the will-impulse is more or less automatic in its action,—the movement having already been determined upon. In many cases, to be sure, the will-impulse seems to be a separate act, and to be so recognized in introspection, but in general one has no knowledge of this separateness, but rather feels the two things joined; and the will-impulse seems to be merely a fruition of the potential nature of the apperception. And, in short, we can do no better than to group all five processes together and call the resultant complex, the 'reaction time.' Of this, we have every reason to believe that the greater part is consumed by the psychical, not the physiological part of the process.

Next in the exposition, Wundt gives the norms for the various sense departments, under conditions of constant quality and intensity of stimulus;<sup>1</sup> nothing, however, being said of the various types of reaction, depending upon the direction of attention. Moreover, by making the various stimuli liminal, he finds that the reaction times very markedly approach each other, as to length. He therefore concludes that the apperception time in all cases is the same; and that, where variations occur, they are due to differences in the sense departments that mediate the stimulus. After this, he inquires into the effect of intensity upon the reaction time. Here, he finds that in general, increased intensity shortens the time, in cases where attention has been constant.<sup>2</sup> He also worked with known and unknown stimuli,<sup>3</sup> in which experiments he found that reaction to a known stimulus is of shorter duration than that to an unknown one. Further, he gives results concerning expectation and distracting influences.<sup>4</sup> Entirely unexpected stimuli greatly increase the time, and the presence of disturbing noises likewise lengthens reaction times. In these and other complications mentioned, the thing to be noted is, that the new or changed element has its effect upon the apperception part of the psychical process. Therefore, the thing to be emphasized is, that the nature, and temporal course, of the ideas in that given moment of time are altered. Their kind, number and duration, and their relation to each other in the complex

<sup>1</sup> Grundzüge (1874), p. 730 ff.

<sup>2</sup> Grundzüge (1874), pp. 733 ff.

<sup>3</sup> Grundzüge (1874), pp. 741 ff.

<sup>4</sup> Grundzüge (1874), pp. 743 ff.

changes with the variations of the conditions. This can be measured in part, at least, by the chronoscope. No other significance seems, then, to be here attached to the Reaction Experiment, than that it is a means of exercising some objective control over the mental processes concerned in a simple flow of ideas, during attention, aroused by a simple external situation. No inkling is here given that the Reaction Experiment furnishes a possible means of studying a cross-section of a simple action,—a use to which it has later been put.

In the second edition (1880) Wundt first uses the term 'simple reaction.' And, following the first edition, the exposition of it is found in the chapter entitled "Apperception and the Course of Ideas,"—the heading of the first paragraph of which is, "Simple Reaction to Sense Impression." The problem is stated here in almost the same words as used in the previous edition; the gist of which is, that it is our task to investigate the course of ideas in a simple case in which a simple train of ideas is aroused by an external impression. And as a method, the simple reaction will serve better than anything else. Here, the reaction is factored as in the previous treatment, and the figures used in regard to the norms of various sense departments are here repeated, no mention being made as yet of the types of reaction.<sup>1</sup> In short, the problems taken up in the two editions are the same, with this exception: in the second edition, he has discovered a further means of studying apperception. It consists in the complication reaction.<sup>2</sup> Here, he introduces the discrimination and choice reaction, and by manipulating the results, is able to obtain temporal values for the interpolated processes. The impression gained from a comparison of the two editions is that, if any difference, Wundt uses the Reaction Experiment more consciously and more systematically to illuminate the course of ideas in the second than in the first edition. On the other hand, he has a deeper interest in the Reaction Experiment for its own sake; he is inclined to develop all its possibilities, as far as he sees them, and to make the systematic application later. But here, as before, the emphasis is entirely upon the course of the ideas during the reaction time.

Again, in the third edition (1887) the discussion of the Simple Reaction occurs in the chapter entitled "Apperception and the Course of Ideas." The problem here, as formerly, is "the investigation of the general laws of the course of

<sup>1</sup> Grundzüge (1880), pp. 219 ff.

<sup>2</sup> Grundzüge (1880), pp. 247 ff.