

CHAPTER IX

THE LIMITS OF TRAINING IN ANIMALS

Introduction.—Some gifted animals.—(1) Clever Hans.—(2) The horses of Elberfeld.—Claparède's examination; results of the first set of observations.—Later tests by Claparède.—Tests on morning of the 26th of March.—Afternoon of March 26th.—March 28th, morning and afternoon.—Tables of results.—(3) Peter.—(4) Don.—(5) Jasper.—Summary.

Introduction.—From time to time there loom above the level of the behaviorist's horizon reports of individual animals or groups of animals that affirm that at last a prodigy has been found which possesses something special in the way of a behavior equipment. Such animals have never been discovered in the laboratories devoted to the study of animal behavior. That the highly gifted animal should not thus appear in the laboratories is understandable when one considers that investigations have heretofore been rather narrowly concerned with the instincts and the sensory and motor habits which appear in a laboratory environment. The gifted animal has usually been developed by the amateur. Through the animal's contact with its owner and with other animals there arise highly complex modes of response. The training methods are not controlled and no scientific attempts are made to analyze the exact nature of the stimulus to which the animal responds. From an anthropomorphic standpoint the animal apparently is reacting as a human being would act under the same circumstances. In a short time the doings of the animal get noised abroad and it becomes necessary for some trained investigator to step in and reduce the chaos to some semblance of order (interpretation of acts where there is ignorance of training methods is not an easy task). Within recent years several animals have appeared which have caused a certain amount of consternation among

investigators who have gone to examine into the phenomena. The situation is exceedingly like that which appears in the investigation of so-called occult phenomena.¹ Some new medium arises. Some prominent man visits the medium and becomes mystified. A scientific man, usually a physicist, is selected to investigate her. The physicist reports an elaborate series of tests which shows that the medium is not using concealed wires, magnets, mirrors, or other physical equipment. The physicist himself may become "convinced." The mystery grows. Finally the psychologist makes the test and finds some simple trick which will account for the phenomenon. The number of such alleged occult phenomena from telepathy to spiritualistic converse, which have been investigated and found wanting in scientific or philosophical interest, has been so numerous that now it is very difficult to get a psychologist who values his reputation to undertake such an investigation. In the same way, when a wonderful animal appears, zoölogists, botanists, and physiologists are hastened to the scene. A commission is appointed and the mystery deepens. Usually when some man who is familiar with the methods of training animals and with animals' methods of responding is found, the explanation, while not necessarily simple, smacks not at all of the mysterious. This situation in the past, with regard to the animal world, has not been wholly without beneficial effect. In the first place, it has brought the behaviorist face to face with the fact that there may be depths in the animal to which he has not descended and cannot descend except by adopting a part, at least, of the technique of the amateur, viz., that of living a large part of his time with the animal and complicating the methods of training (as is done for the child). That this meritorious effect has been produced is shown by the fact that there are investigators in behavior who are willing to devote a large number of years to the study of a single animal or at most a small group of such animals. The German station on the Canary Isles is a case

¹ Attention is called to President Sanford's "Discussion of Animal Prodigies," *Amer. Jour. Psych.*, 1914, p. 1.

in point. Along with certain biological investigations will go detailed studies on the behavior of the anthropoid apes. It is certain that this tendency to specialize on one or at most a few animals will become more common. Since the higher anthropoids are nearest to man in their equipment and since their tenure of life is long under natural conditions it is to be expected that students will undertake work upon them with greater willingness than upon lower forms. To do such work effectively there is great need of an anthropoid ape station open to American students. The second generally good effect the study of the gifted animals has had upon the behavior work comes from the fact that in making an analysis it is often necessary to undertake a study of the sensitivity of their receptors, field of vision, limen of sensitivity for moving objects, etc.

Some gifted animals.—On account of its bearing upon the limits to which training in animals may be carried, we wish to examine into the behavior of some of the better known gifted animals. We shall discuss in order (1) the horse, Clever Hans, (2) the horses of Elberfeld, (3) the chimpanzee Peter, (4) the talking dog Don, and (5) the dog Jasper. In considering their behavior it seems well to bear in mind that *all behavior, human and animal, is analyzable in terms of stimulus and response*, and that the only difference between man and animal upon this assumption would be in the complexity of behavior. The fundamental difference between man and animal from our point of view lies in the fact that the human being can form habits in the throat (and other bodily language habits),—neglecting his finer sensory-motor equipment. All other habits pale into insignificance when contrasted with these. While this at present is affirmed on the basis purely of theory, we feel that the assumption has a good many points in its favor (p. 322).

Clever Hans.—In 1890 Mr. von Osten, a gentleman of Berlin with some mathematical training, noticed what he considered remarkable behavior in a horse which he then possessed. When that horse died he purchased another (1900) and began training him about a year later. This

horse, Hans II, was destined to arouse an enormous amount of interest both in popular and in scientific circles.

Mr. von Osten's method of instructing the animal was very simple. He began by teaching the horse to respond properly to the different words for spatial localization, such as left, right, above, below, etc. Simple arithmetical problems were next attempted. He would place one, two, three, etc., objects upon a table, kneel down and take the fore-foot of the animal and make him tap once for each object. In a remarkably short time Hans learned to "count" and to perform simple additions and multiplications. But these attainments did not satisfy von Osten. He desired to give Hans a wider medium for the expression of his talents. Accordingly von Osten arranged for him a conventional alphabet. Having mastered this the horse was able to read and to answer simple questions. At the height of his career Hans showed the following scientific accomplishments (summarized from Pfungst): he had mastered the cardinal numbers from 1 to 100 and the ordinals to 10. Upon request he would count objects of all sorts, the persons present, even to distinctions of sex; then hats, umbrellas, and eyeglasses. All forms of simple arithmetical problems involving addition, subtraction, multiplication, and division. He could do fractions, changing them first into decimals. E.g., "How much is $\frac{2}{3} + \frac{1}{2}$?" Answer, $\frac{7}{6}$ (tapping first the numerator and then the denominator). Or again: "I have a number in mind. I subtract 9 and have 3 as a remainder. What is the number?" (12). "What are the factors of 28?" Whereupon Hans taps consecutively 2, 4, 7, 14, 28. He was able to read German readily, whether written or printed. If a series of placards with written words was placed before the horse he would step up and point with his nose to any of the words required of him. With his alphabet he would answer simple questions, e.g.: "What is the woman holding in her hand?" Hans spelled without hesitation "Schirm" (parasol). Furthermore, his memory was excellent. He carried the entire yearly calendar in his head. He could give not only the date of each day without having been previously taught, but also the date of any day one might mention. He could tell the time to the minute. His musical ability was especially well developed. He had absolute pitch memory and a feeling for intervals. He could analyze compound clangs without difficulty, and could inform his experimenters as to what changes should be made in a discordant clang in order to produce consonance.

Naturally Hans' fame spread and different people visited him. These at first were connoisseurs of horses, officers, who—astonished—told about Hans' accomplishments. Soon the public at large became interested and von Osten's court-yard became too small to accommodate the curious. The newspapers discussed it as the "Case of Hans." Violent polemics followed between those who believed in the

animal's intelligence and those who suspected some trick. These latter did not agree among themselves,—some talked of optical signals, others of acoustical signals, which von Osten gave his horse. Others supposed that electrical wires placed under the pavement of the court allowed the master to communicate secretly with his pupil. Still others laid it to telepathy; the N rays (a fad of the moment) and to "suggestion."

A scientific commission was appointed, which delivered its report on the 12th of September, 1904. It was composed of Messrs. Stumpf and Nagel, professors of psychology and physiology respectively at the University of Berlin, of the director of the Zoölogical Garden, a director of the circus, veterinarians, and cavalry officers. The report denied the existence of any tricks used by von Osten, for the very good reason that the experiments had the same results even in his absence. For the rest, the conclusions of the commission were entirely negative. It was said merely what did *not* exist, but the answer to the puzzle was not revealed. The mystery deepened. Haeckel, who had assisted at one of the séances, declared for the authenticity of the mental activity of the horse. A second commission was formed, composed of Stumpf and his students. This time one point was seemingly established. Hans could not read, calculate, or count unless some one present knew the answers. Pfungst established this, indeed, beyond even a doubt by putting a series of questions to the horse, the answers to which were not known to the questioner. A card containing a certain number was picked at random by the experimenter and exhibited to the horse in such a way that no one could see it (the answer being unknown to the experimenter himself). When tested in this way, procedure without knowledge, the horse returned only 8% of correct responses, whereas he responded with an accuracy of 98% in those cases where the questioner knew the answers. Exactly the same state of affairs was found to exist with respect to arithmetical calculations and to reading. It will be recalled that reading was accomplished by first tapping out the number indicating the horizontal

row in which the first letter appeared and next the place in the row. This complicated procedure had to be repeated for each letter in the word. It was found that when the questioner was ignorant as to the letter and row, Hans never responded correctly. Calculation was tested similarly. It was found that if von Osten whispered a number in the horse's ear so that no one present could hear, and then the questioner similarly gave the horse a number and told it to add the two, the answer was wrong 28 times out of 31, whereas in a procedure with knowledge the relation was 29 right and 2 wrong. Hans could not even count on the abacus when the questioner remained in ignorance of the number of balls which were pushed aside. The memory tests and tests on musical ability (all questions of this kind being answered by tapping) all failed to yield correct responses in a procedure without knowledge. Taking all such tests into consideration showed that where the questioner knew the answer 90-100% of the responses were correct. When the experimenter was ignorant of the answer, only 10% at most of the answers were correct. These tests tell us little as to how the experimenter's knowledge aided the horse in giving correct responses. Carrying the analysis one step farther, Pfungst found that vision was necessary for correct response. When the horse was perfectly blinded almost no correct responses could be obtained (only 6% were correct). The final link in unraveling the "mystery" came when Pfungst discovered the signs by means of which the horse responded. These signals were the minimal movements of the questioner's head. "As soon as the experimenter had given a problem to the horse, he involuntarily bent his head and trunk slightly forward and the horse would then put his right foot forward and begin to tap, without, however, returning it to its original position. As soon as the desired number of taps were given, the questioner would make a slight upward jerk of his head. Thereupon the horse would immediately swing his foot in a wide circle, bringing it back to the original position. (This movement which, in the following exposition we shall designate as "the back step," was

never included in the count.) Now after Hans had ceased tapping the questioner would raise his head and trunk to their normal position. This second, far coarser movement, was not the signal for the back step, but always followed it. But whenever this second movement was omitted, Hans, who had already brought back his foot to the original position and had thereby put it out of commission, as it were, would give one more tap with his left foot." These minimal movements turned out to be exceedingly small ($1/5$ mm. and upward). If this analysis of Pfungst's is correct the responses of Hans are exactly similar to those with which we have long been familiar in the laboratory.

The horses of Elberfeld.—Not every one accepted Pfungst's conclusions, yet interest in von Osten and in Hans rapidly abated. Von Osten died in 1909. Hans was entirely forgotten until Karl Krall's book appeared which raised the question of the completeness of Pfungst's explanation. Mr. Krall, a wealthy and highly respected merchant of Elberfeld, having known von Osten and having worked with him during his last years, inherited Hans. He states that Hans works well under circumstances where it is impossible for him to see his master or to distinguish the minimal movements of the questioner. E.g., Krall affirms that Hans replies correctly in complete darkness, or with blinders on that permit him to see only the blackboard or the objects about which he is questioned. Krall determined to render justice to his old friend by proving the truth of von Osten's contentions. He bought two stallions,—Muhamed and Zarif,—and began to train them.

According to Krall their progress was, as in the case of Hans, astonishingly fast. Moreover, the two horses displayed different aptitudes. Muhamed was much quicker at arithmetic. Instruction began with this subject with an hour and a half to two hours of "study" a day for each animal. At the end of three days they could recognize the first numbers, 1, 2, 3 written upon the board, and would touch with the muzzle the one called for. At the end of ten days Muhamed could count up to 4. Several days later the tens were explained to them and they were taught to designate them with the left foot, the right being used for the units. On the 14th

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of November, 1908 (the horses were purchased on November 1st, the first lesson beginning on the 2nd), Muhamed performed correctly such small additions as $1 + 3$, $2 + 5$, etc., and also subtractions such as $9 - 3$. He passed to multiplication and division on November 18th, to fractions and the addition of fractions on the 21st. In December he was taught French and replied equally well to questions asked in French or in German. In the following May Muhamed could extract square roots and cube roots, and could do sums like the following:

$$\frac{(3 \times 4) + \sqrt{36}}{3} \qquad \frac{\sqrt{36} \times \sqrt{64}}{\sqrt{4}}$$

In February, 1909, spelling lessons commenced. Spelling was made possible by means of a conventional alphabet (where each letter or diphthong is represented by a number between 11 and 66, e.g., 11 would represent e, 22, h, etc.) as follows:

	1	2	3	etc.
10	e	n	r	
20	i	h	l	
30	a	d	g	
				etc.

The horse spells by tapping with his foot (the tens are tapped with the left foot, while the units are tapped with the right foot) the number corresponding to the desired letter. By this method Zarif, at the end of four months, could spell, in his own fashion, words spoken to him which he had never seen written. Below are presented some of the different spelling of "Pferd" as spelled by Muhamed and Zarif:

Muhamed: bfert, bfrt, färd, fürt, fert, frt, fäart, faerd, faert, färbr, fferd, frrt. pärd. pfärt. ppervd. pfer, pferd, tfert, fed;
 Zarif: bferd, färed, fferwt, fvert, pfrde, sdfert, pfert, bffet, fdaerp, etc.;

Zucker was spelled zkr, zukr, ztiqr, zuqr. czukr, sucr, szukr, zuäkr, cukr, zucher zuker. zucher, suqker, etc.; Muhamed spelled his name, mäemuaämt, muahmet, muamät, etc.; Zarif spelled his, tsarem,

zarif, sfraci, zuarif, zuruf. Finally Mr. Krall, noticing that the horses tapped "out of lessons," took down their tappings to see if he could make anything out of them. Sure enough! While the discourse was at times as incomprehensible as the first babblings of an infant, nevertheless there were fragments which could be understood. One day Krall told Muhamed that he was going to give him carrots: "fünuf" (i.e., fünf, 5) replied Muhamed spontaneously. At another time he replied: "iohn, hfr, gbn" (iohann hafer geben, John gives oats). Soon he detected genuine conversation between the two pupils. One morning when Zarif had shown himself lazy his companion was asked: "Warum war Zarif nicht lieb?" And Muhamed answered: "weil vaul isd" (because he is lazy). "And why is he lazy?" "Weil r sagt begin wiil niid wisn" (because he said at the beginning that he didn't want to know anything).

Notwithstanding the lesson taught by Hans, Krall's exaggerated report was received favorably by many distinguished men. Haeckel wrote to Krall: "Your careful and critical experiments show in a convincing fashion the existence of reason in the animal, which I have never doubted." On the other hand, Ettliger attacked Krall's experiments with a great deal of vigor. Professor Dexler, in a strongly worded article, declares that "Krall's book is a vile blot on our contemporary literature. Born in the poisoned atmosphere of humbug and of trickery, it is a monument raised to the cult of the beast." Argumentation, however, is not the method to settle behavior questions. Many tests have been made upon the horses but none by thoroughly trained investigators of behavior. The two reports by Claparède are probably the most reliable we have at present. The first was made in August, 1912; the second in April, 1913. The first set of tests is not really scientific in character since Krall himself acted mainly as questioner, and since even when Claparède acted as questioner adequate controls were not introduced. Claparède's second set of tests were undertaken in a much more critical spirit.

CLAPARÈDE'S EXAMINATION: Results of the first set of observations: Zarif was first brought in. Krall showed us (summarized from Claparède's report) that his pupil understood French. He wrote on the board (phonetically without the subtleties of orthography) *fitt sero*, (the horse made the sign of negation with his head, which signified zero in his language), then, *Komptä dis* (the

horse tapped once with his left foot, correct answer). Having written 34 he asked the horse to read the number both ways (reply 34, then 43, right), then to multiply the two figures (3×4) (reply correct), and then to square the larger of the two figures. That time Zarif made an error and replied 15 instead of 16. When asked to correct it he replied 15, then tapped 24. Zwei und zwanzig was written on the board. The horse failed twice to read this number. Then Krall wrote "adire zu elf" (add it to 11). He replied 33. The horse was rewarded for this answer. "Adire zu ein und dreizig" (reply correct). "Zu vängt troa" (phonetic for 23). This time the answer was 44 instead of 45. When told to correct it Zarif gave 54 (which is the reverse of 45) and on a third trial gave 45. Krall wrote on the board "dus" (12). The horse read 22. "Add 12 and 2." Reply 24, then 14. Krall wrote on the board $\sqrt{25} \times \sqrt{49} =$. The horse replied 24. Krall said it was wrong. He repeated 24. Zarif showed signs of embarrassment (at least as interpreted by Krall); he dropped his head like a shamed school boy. Krall told him that several people were present, one of them a professor who was taking notes and putting down all the wrong answers. Then the horse began tapping of his own accord. Krall put down on the board the numbers he tapped: 14, 26, 23, 54, 13, 13, 32. Translated the corresponding word is *schliprrä*. What did it mean? Krall said he could not make it out. We quote Claparède: "But it was not hard for me to discover between these letters and the letters of my name a striking analogy. Krall said it was impossible that Zarif had attempted to spell my name for he did not even know it, but in the afternoon he told me that he remembered having mentioned my name before Zarif while talking to a third person. Was it my name which he voluntarily spelled, wishing to convey the information that he knows that it is I who is taking notes? Cruel enigma!" In order to end this séance which had lasted twenty minutes, Zarif was recalled to his problem (the multiplication of square roots): he gave the correct answer, 35. Then Hänschen was brought in. He resembled an ass, but only externally! Indeed with astonishing quickness, considering the fact that he had been a pupil only a few months, he did a dozen correct additions of numbers of two figures written in a column on a little blackboard before him in an inclined position, for he was too little to use the board fastened on the wall. For the sum of $23 + 12 + 20$ he answered first 65, then 45, then 55, which is correct. Strange to say he corrected himself. He hardly finished one sum before he started another. The problem $2 \times 32 + 12$ brought out a number of wrong answers. The order "zweimal drei und dreizig" (2 times 33) brought first 86, then 66. During Hänschen's exercises, which lasted twenty minutes, Krall stood completely behind the animal. He did not leave his position except to write the problems on the board, which was done in such a manner that no one near by could see it. The groom remained perfectly motionless the entire time. C. was beside him and watched him closely. He did not detect the least sign which could be suspected of being given in correlation with Hänschen's replies, who had his head lowered, with muzzle almost on the board.

At last Muhamed was brought in. He is the genius of the group. He is much more lively, much wider awake than Zarif. Krall wrote upon the board $\sqrt{36} \times \sqrt{49} =$. Muhamed first answered 52, then, when told that that was wrong, 42, which is correct. Krall then substituted the + sign for the \times sign in the problem. The answer was correct, 13. Krall then gave him the following problem:

$$(\sqrt{1296} - \sqrt{81}) \times (\sqrt{144} - \sqrt{49})$$

and went out of the room. Muhamed looked at the problem and immediately answered 115, which is wrong. (The hundreds are tapped with the right foot, but are given after the tens, which are tapped with the left foot. This distinguishes them from the units, which are also tapped with the right foot, but which precede the tens.) Krall then called to him from without to try it again. He tapped 25, then 125 (which is still wrong, the correct answer being 135). When an answer is wrong Krall prefers not to insist on it, and changes the problem, only to return to the original problem in a moment. Claparède was then asked to choose from a large list of squared numbers a number for Muhamed to extract the square root. He chose at random 64516, the root of which is 254, but Muhamed persisted in tapping numbers of only two figures, which made us think that he wanted to say something by means of the conventional alphabet, which contains only numbers of two figures. So these tapings were noted with the following results: *rihgvgdhaig*. It was incomprehensible. He was asked to repeat it. The second attempt was: *rmigdjjg*. This was no clearer. But the similarity between the two series of letters was too striking to be entirely haphazard. But Krall could not unravel it. Muhamed was then asked how many syllables were in the word he wished to spell. He answered three. "Is the word finished?" "No," he replied. "Unfortunately we could get nothing more out of him." Krall then went back to the two problems which he had not solved and which were still written upon the board, and this time, with no difficulty, Muhamed replied 135 to the one and 254 to the other, which are correct. As a reward he was given three carrots: "How many carrots have you eaten?" he was asked. "Three," he replied. To the card $\sqrt{117649} =$ Muhamed answered 4, then 13, then 346, then 347, then 343, which is right. To the card $\sqrt{383161} =$ he answered 58, 317, then, after two "bavures," 619 (right). By "bavures" are meant incomplete wrong answers given by the horse,—incomplete because Krall, seeing that the number of units is wrong, interrupts the horse without letting him go on to the tens and hundreds. Upon this last correct answer, the exhibition ended.

The remaining séances were equally productive of startling results. It is unnecessary to present them in detail. From such a set of tests absolutely nothing can be concluded, and yet Claparède, being much under the influence of his emotions, devotes many pages to speculations concerning the analysis of his observations. The results of the

tests made in April of the next year show that Claparède's attitude has become scientific and critical. We give them in some detail.

LATER TESTS BY CLAPARÈDE: On the 26th, 27th, and 28th of March, 1913, Claparède paid another visit to the horses, accompanied by Dr. J. de Modzelewski and Dr. Weber-Bauler, both of Geneva. Mr. Krall was not at Elberfeld during the first series of tests. We give below a rather careful summary of the tests on the various horses:

TESTS ON MORNING OF THE 26TH OF MARCH.—HÄNSCHEN: During the tests on this horse Claparède, with the two gentlemen named above were present. The horse was led in by the groom, Albert, who remained in the room. The pony was shown two cards designating the number 53. He responded correctly. The digits were next transposed, making the number 35. The response was correct. Every one then left the room except Claparède. Having shuffled a series of cards on which numbers were printed he drew out one at random and placed it under the eyes of the horse without glancing at it himself (procedure "without knowledge"). The horse tapped 42, which was wrong, the correct answer being 45. Twice more this type of test was repeated. The horse tapped 73 for 25; 53 for 84. We have here three wrong answers when the observer tested by the procedure "without knowledge." For the sake of comparison he repeated the test, first glancing at the cards (procedure "with knowledge"). The results were no better: 52 was given for 33. When asked to repeat it he gave 31. The experimenter wrote down 63; the response was 16. He then wrote 43 on the board: the answers were in order, 42, 52, 53, 64. Calculation was next tried: $34 + 25$ was written on the board: the replies in order were, 22, 42, 73, 66. The horse was next tested with $24 + 12$: responses in order were 37, 46, 36, the latter being correct. At this moment the assistant came back. He wrote on the board $34 + 25$. The horse returned 73. After this there followed a long series of tests the answers to which were mainly wrong, although now and then a correct one would be given. Under such conditions it seemed useless to give tests where the experimenter was in ignorance of the answers. The horse having tired, he was removed.

BERTO: The blind stallion Berto was next tested. The animal had double congenital cataract. The horse had learned speedily by the contact method of training employed with blind human beings. It must be remembered that the type of response called for here is much simpler than that demanded by the other horses, at least so far as the "reading" of numbers presented through contact is concerned. At the end of five lessons, the animal, according to his trainers, could add simple numbers, such as $5 + 1$ and $5 + 2$. When the horse was brought in Claparède verified the state of the animal's vision. The horse was completely blind. ("Il ne peut y avoir aucun doute à cet égard: l'animal n'aperçoit pas une carotte que l'on place sous y eux." It is hoped that Claparède does not mean seriously to affirm that such a test is really crucial. The testing of complete blindness in an animal is very difficult. It is

doubtful if any physician can determine this surely except in cases where complete degeneration of the retina is revealed by skioscopic methods.) Berto was quite restless and in order to soothe him the groom held the halter. The groom retired during the reply of the horse. In certain tests the groom was not allowed to hold the halter even while the question was asked. The groom first asked the horse to tap out the following numbers: 2, 14, 42, 33, 40, 2, and to add 2 and 3 and to multiply 5×3 . Only a part of the answers to these questions was right (see appended table). The horse was able to give a number traced upon his rump. In view of the blindness of the horse, procedure "without knowledge" could not easily be undertaken.

MUHAMED: The horse Muhamed was given (by cards) the number 35. The reply was incoherent. Several of them finished with the digit 5, e.g., 15, 25, etc. For 67 he returned 37, then correctly 67: for 48 a series of wrong responses with none correct. An exercise in spelling was next attempted with complete failure. There was incoherence all along the line. Under such conditions it was useless to attempt to make tests under rigorous conditions.

AFTERNOON OF MARCH 26TH:—Simple exercises with numbers were continued but the results were deplorable. Zarif read very nicely the first number Claparède gave him, but after that one correct response nothing further could be obtained in the way of correct responses. Two incidental observations were made on the general behavior of the horses during the period of response. When one insisted that his reply was wrong, once, contrary to his habit, he began to watch the groom while tapping, but the response was wrong all the same. On another occasion the horse, which ordinarily tapped with machine-like precision, hesitated with right foot poised in air before beginning the reply. Muhamed was hardly more brilliant than in the morning. There were several good responses which were interesting in view of the fact that only Claparède and his colleagues were present. The horse read correctly and on the first trial the numbers: 5, 42, 49. To the addition $3 + 4$ given on the card he replied 34. All then left the room except Claparède. Several numbers were then presented (procedure "without knowledge"): all responses were wrong. E.g., 46 was read 44; 43 was read 75; 7 was read 6. To $22 + 15$ the horse replied 37, which was correct. After that response no further correct ones could be obtained regardless of the method of procedure. Berto was then brought in. He gave a pretty series, Claparède doing the questioning. He responded correctly to 2×11 and to 3×11 . When asked to subtract 3 from 7 he tapped 10. Hänschen was next brought in. He did not give a single correct response.

AFTERNOON OF MARCH 27TH: At this session Krall, de Modzelewski, and Claparède were present. They examined successively Muhamed, Zarif, and Hänschen without getting any correct responses. Berto, the blind stallion, alone gave good replies. A recital of these would be without interest. The horses replied wrongly even to Krall.

MARCH 28TH, MORNING AND AFTERNOON: Claparède, de Weimar, and Krall were present. Several fruitless attempts were made to get

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correct responses. Krall advanced as a possible explanation of the poorness of the results the fact that the horses were shedding.*

Tables of results.—From de Modzelewski's note to Claparède's report, we copy the following table showing the number of correct and incorrect responses returned during the several tests:

TOTAL NUMBER OF RIGHT AND WRONG RESPONSES			
<i>March 20</i>	Poor	Right but with help	Good
Hänschen, A.M.	42	5	5
" P.M.	47	6	2
Berto, A.M.	23	5	2
" P.M.	24	10	13
Muhamed, A.M.	9	2	0
" P.M.	46	6	4
Zarif, P.M.	9	2	3
	Total 200	36	29

Of 265 questions, 29 were good, 11%.

RESPONSES TO THE MORE DIFFICULT PROBLEMS (OF THE ABOVE LIST)

	Poor	Right but with help	Good
Hänschen,	31	3	1
Berto,	5	2	6
Zarif,	1	1	1
Muhamed,	12	2	1
	Total 49	8	9

Of 66 responses, 9 were good, 13%.

TOTAL NUMBER OF RIGHT AND WRONG RESPONSES

<i>March 27</i>	Poor	Right but with help	Good
Muhamed,	77	4	2
Zarif,	13	1	5
Berto,	26	8	9
Hänschen,	111	8	4
	Total 227	21	20

Of 268 responses, 20 were good, 7½%.

RESPONSES TO THE MORE DIFFICULT PROBLEMS (OF THE ABOVE LIST)

	Poor	Right but with help	Good
Muhamed,	26	1	1
Zarif,	9	0	3
Berto,	33	4	1
Hänschen,	11	4	4
	Total 79	9	9

Of 97 responses, 9 were good, 9¼%

*Yet another gentleman only a few days later obtained very successful results. Krall then stated that Claparède's failures were due to the fact that he had not gained the confidence of the horses.

As will be seen upon comparison with Pfungst's work on Hans, the percentage of correct responses in Krall's horses is about the same that he obtained by the procedure "without knowledge." How shall we account for the 8-11% of correct responses? Surely chance will account for a certain percentage. It would be impossible to train horses in this way for months to respond to cards and figures upon the board without two things appearing: (1) Training upon special numbers, cards (of square roots, etc.) establishes a set of special simple reactions. It is quite probable that many of the combinations (even those suggested by the outsider) are ones upon which the horse has been specially drilled. (2) If the horses really tap in groups (numbers?) spontaneously, by the theory of probabilities some of the "answers" must be right. What lend color to such a view are the statements of de Modzelewski to the effect (a) that the very simplest problems are answered with no greater percentage of accuracy than the more difficult ones; and (b) that no matter how simple or how difficult the problem is, the horses start mechanically upon the answer; and (c), finally, the horses do not even look at the letters and figures upon the board. Furthermore, it lies well within the bounds of probability that there are certain means of rapport between the horse and his questioner which may serve the horses of Elberfeld as "minimal movements" served Hans. We say this without prejudice and without any intention of intimating that fraudulent means are employed. This would account for the high percentage of accuracy which is sometimes obtained by Krall. (And since in many cases where positive results have been obtained in Krall's absence the grooms have not been excluded, a similar explanation is at hand to account for this fact.) On the whole, it seems not improbable that we are dealing here with responses which do not rise above the level of those given by Hans.

Peter.—The chimpanzee has always been a favorite subject of eulogy. Very few of the highly trained animals have come under observation where experimental conditions could be sufficiently controlled. Several experiments

upon imitation have already been noted on p. 282. Witmer has given a report of some observations made upon Peter in the *Psychological Clinic*. Peter's vaudeville performance, which we have several times witnessed, is most impressive. He skates readily and with accuracy; drinks from bottle or glass; lights and smokes a cigarette (sometimes after a good deal of "help" from the trainer); eats with a fork; and can "ring for the waiter." Furthermore, he has varied motor accomplishments ranging from the riding of a bicycle to the threading of a needle, and from locking and unlocking locks to tying and untying knots in a string.

When Peter entered the clinic Witmer's secretary bent down and he shook hands with her and then kissed the back of her hand. He then began to skate around the room in a lively manner and next examined a camera, attempting to turn the screws and actually manipulating the shutter. The trainer gave him a cork-tipped cigarette and offered him a box of matches. The cigarette was put into the mouth with the cork end first. He next took a match from the box held out to him and struck it on the side of the box. A different kind was offered him wrong end first. He at once reversed it and put the right end (tube) in his mouth. Peter was able to string beads. An incomplete string of beads was held out to him and then a bead was taken from a box and strung before his eyes. This was twice repeated. Then the box and beads were handed to the monkey. He promptly put a bead into his mouth, feeling it with his lips and tongue. He then took it from his mouth and strung it. One bead after another was taken from the box and strung; each was tested with the lips in order to get the hole in the middle in the proper position for stringing. When tested on the pegging board, after being shown how to put the pegs in, he put them in irregularly. The impulse to pull the pegs out was strong but was inhibited upon a word from the trainer. The pegs were given to him one by one. When tested on the lock which he used in his vaudeville performances he locked and unlocked it mechanically. A small padlock with a staple attachment was then given him. The staple had to be pulled entirely off the lock at the end opposite the hole. The key was a small one, difficult to insert and difficult to turn after it had been inserted. It was unlocked for him and the staple attachment taken out. The staple was put back and locked with key withdrawn. Peter reached for the lock, inserted the key, and unlocked it more rapidly than the experimenter. When told to put the staple back and unlock it, he inserted only one prong of the staple. He was told that it was wrong and had his ears boxed by his trainer. The lock was taken from him, the staple slowly pulled out and moved several inches away, then reinserted. This was repeated several times. When tried, he seized the lock, slowly and carefully pulled out the staple, then carefully reinserted it and shoved it

home with a smack of his hand. A small box with a tiny keyhole was next given him. The key was on a ring with a large number of other different sized keys. It was the smallest one on the ring. When handed the ring, he tried first the largest key, then the next largest, and then the third largest, etc. The box was then opened for him and lumps of sugar shown on the inside. The small key was pointed out to him. The box was locked and the bunch of keys shaken up and again handed to him. He was unable to pick out the smallest key. It was picked out and handed to him. He then opened the box with the key and obtained a lump of sugar. He failed again on the second trial. A double-headed hammer and a piece of board on which were some nails and screws were then given to Peter. When the hammer was handed to him he proceeded to drive several nails into the board with the proper head of the hammer. He never mistook a screw for a nail. When given a screw instead of a nail, he stuck it into a hole in the board and at once selected a screwdriver, paying no attention whatever to the hammer lying on the table. The screw was long and wobbled as he turned it. He turned the screw always in the right direction. He used both hands on the handle instead of employing one hand to steady the screw. With the hammer and the nails, he steadied the nail between two fingers of his left hand and used the hammer with his right. Once he pounded his fingers and instantly put them in his mouth. When tested with the form board he showed total inability to place the blocks in their proper compartments. He seemed to be able to articulate the word "mama." Witmer states that he did this with great effort. His response to words was not tested scientifically enough to enable us to pass judgment upon his ability in this direction. When asked certain questions as: "Where is mama?" "Where is daddy?" "Where is Peter?" "I beg pardon!" "Give mama a kiss," "Give daddy a kiss," "Give mama a drink," and so on, he did the correct thing, seemingly in response to the words. No attempt was made by Witmer to substitute different words with the same intonation, etc., and no attempt was made to give the words from behind a screen, etc. (See tests on Don and on Jasper, below.)

The behavior of Peter, while described by Witmer in a grossly anthropomorphic manner, shows us at once that we are dealing with an organism which is far more complicated than any horse at Elberfeld. Witmer states that he ought to be compared rather with the child. Unfortunately neither the behavior of the chimpanzee nor that of the child has been subjected to sufficient analysis to make comparison feasible. At least two general statements may be made of the chimpanzee by way of showing similarity to and difference from man. In the first place his motor development seems capable of being extended to a point where in some instances he can actually compete

with man, and in the second place his lack of language habits puts him forever below the plane of comparison with man.

DON: The analysis of the vocal efforts of Don, "the talking dog," has been undertaken by Pfungst. The analysis is of interest only by way of the light thrown upon the instinctive sounds which can be made by the dog. Don is a German setter about 8 years of age belonging to the royal game warden at Ebers in Gardelegen. His vocabulary is supposed to contain 8 words which may be called out when food is present and the following questions given: "Was heisst du?" "*Don.*" "Was hast du?" "*Hunger.*" "Was willst du?" "*Haben haben.*" "Was ist das?" "*Kuchen.*" "Was bittest du dir aus?" "*Ruhe.*" Don was supposed further to answer questions by *Ja* and *Nein* and to speak the word *Haberland*. On examination it was found that the vocabulary is given always in order beginning with *Don* and ending with *Ruhe*. If the order is varied we find him calling himself *Kuchen* and stating that he desires *Hunger!* The first vocal effort sounding like a word was supposed to have been *haben*. This attracted the attention of the owner and thereupon began a series of lessons in which Don was fed for correct response. Ten repetitions some weeks apart sufficed for completing this response. The word *Ruhe* was supposed to have been uttered first on command of the owner's daughter. It was "fixed" in the same way. It will be seen immediately that there is nothing in the behavior of Don which is different, from the standpoint of interpretation, from what we find in the parrot. Furthermore, close analysis of even the words he speaks shows that they are not true words in the mechanical sense—not all the vowel and consonant sounds being included. Indeed, even the number of syllables is not always constant. The dog makes only one vowel sound lying between *o* and *u*. His one guttural aspirant is like the German *ch* and does duty both for *k* and *h*. There is also a nasal sound lying between *n* and *ng*. When not prolonged it will pass for *d* as in Don. He does not really make the sounds *b*, *d*, *k*, *l*, or *r*. What he really sounds is [(*ch*) *unguo*] in the word which passes for *Hunger*.³

JASPER: The bull terrier owned by Mr. Dixie Taylor is in many ways a remarkable animal, but not nearly so remarkable as his owner believes him to be. Jasper has been several times under the observation of the author. There are many things in his performance which are deserving of a more careful study than we have been able to give him. Jasper's claims to consideration come from his extraordinary ability to do certain acts in response to words. Mr. Taylor thinks the dog can respond properly to several hundred words, including those indicating direction; e.g., up, down, right, left. We have not been able to agree with Mr. Taylor respecting the dog's ability to go in a given direction. In one case in a three-story house we took Jasper to the stair-landing on the second floor. Mr. Taylor remained on the first floor, completely hidden. The author was alone with the dog. The owner then said to the dog, "Go up the stairs, Jasper." Once

³Those of us who have seen Don's performance in this country will surely agree with the above analysis of Pfungst.

he went to the window and looked out (another act he is supposed to do on command), once he tried to go below, but the third time he found the stairs and started up them. Not many tests were made on this point since there were several others which we desired to bring out. The most significant act brought out on command was the following: Jasper was told to "go into the room and turn over the waste-paper basket"; or to "go into the room and bring the waste-paper basket." When the tests were made in the Hopkins Laboratory Mr. Taylor had first gone into the room and touched the articles. We repeated the experiments upon another occasion in which Mr. Taylor had never even seen the articles. The commands were given by the owner from such a position that the dog could not see him. On command the dog would go into the other room and mount the table and look out of the window, or he would close the door. On command, "Go to the next room and bring me a paper lying on the floor," the dog would go and execute the command. Many common objects which are left lying on the floor will be brought in on command. When the situation is complicated by laying several objects in a row near together, e.g., a handkerchief and a one-dollar bill, the dog does not always bring the object designated by the word. Not enough tests have been made to give the percentage of correct responses when two objects are used, nor to tell the decrease in accuracy when three or more objects are placed side by side. Two other tests were made in the open. After reaching the street Mr. Taylor said to Jasper, "Go behind me and put your feet on the bicycle." The bicycle was about 50 feet behind Mr. Taylor. The dog trotted immediately to it and did as he was told. The command to go down the street and put his feet on an automobile (about 100 yards distant) was executed with equal readiness. Many other tests of this character were made, but they were so poorly controlled that no very accurate conclusion can be drawn. For the past 18 months Miss Elizabeth Gilman has been training a cocker spaniel of pure breed (registered) along these same lines. The dog (now about 20 months of age) was purchased a few weeks after birth by the laboratory for this special purpose. He is living in the home of Miss Gilman and is a great pet. So far, although trained every day upon the execution of simple commands, little success has attended Miss Gilman's efforts. This fact has increased our respect for Jasper's accomplishments regardless of the possibility that subsequent analysis may show that his repertoire of responses to spoken command is much more limited than we now believe it to be.⁴

Summary.—Unsatisfactory as this chapter is from the standpoint of the strictly factual material it presents,

⁴Recently the Airedale terrier Rolf, owned by the Moekel family of Mannheim, has come into prominence. This dog is supposed to possess the same mathematical ability and conversational powers as the horses of Krall. No thorough scientific tests have been made upon him. William Mackenzie ("Le Problème du Chien Pensant de Mannheim," *Archives de Psychologie*, 1913, XIII, 312) has given a popular presentation of this dog's accomplishments. Claparède ("À Propos du Chien de Mannheim," J. Languier des Bancels et Ed. Claparède, *Archives de Psychologie*, 1913, XIII, 377) has made a few observations upon Rolf. It seems worth while to mention that Krall "discovered" the dog of Mannheim.

nevertheless it serves to show that the behavior laboratories must be prepared to admit that the sympathetic upbringing of animals in the home where they are thrown into constant contact with human beings does produce in them a certain complex type of behavior for which the laboratory concepts, as they now exist, are inadequate to supply explanation. It is quite obvious that the behaviorist has no right to be content until the newly born chimpanzee and the newly born child are brought up side by side and subjected to the same training. At definite intervals stock should be taken and the lines of divergence and of parallel growth be determined. Such studies can be adequately conducted only in a station where the chimpanzee can be bred.

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