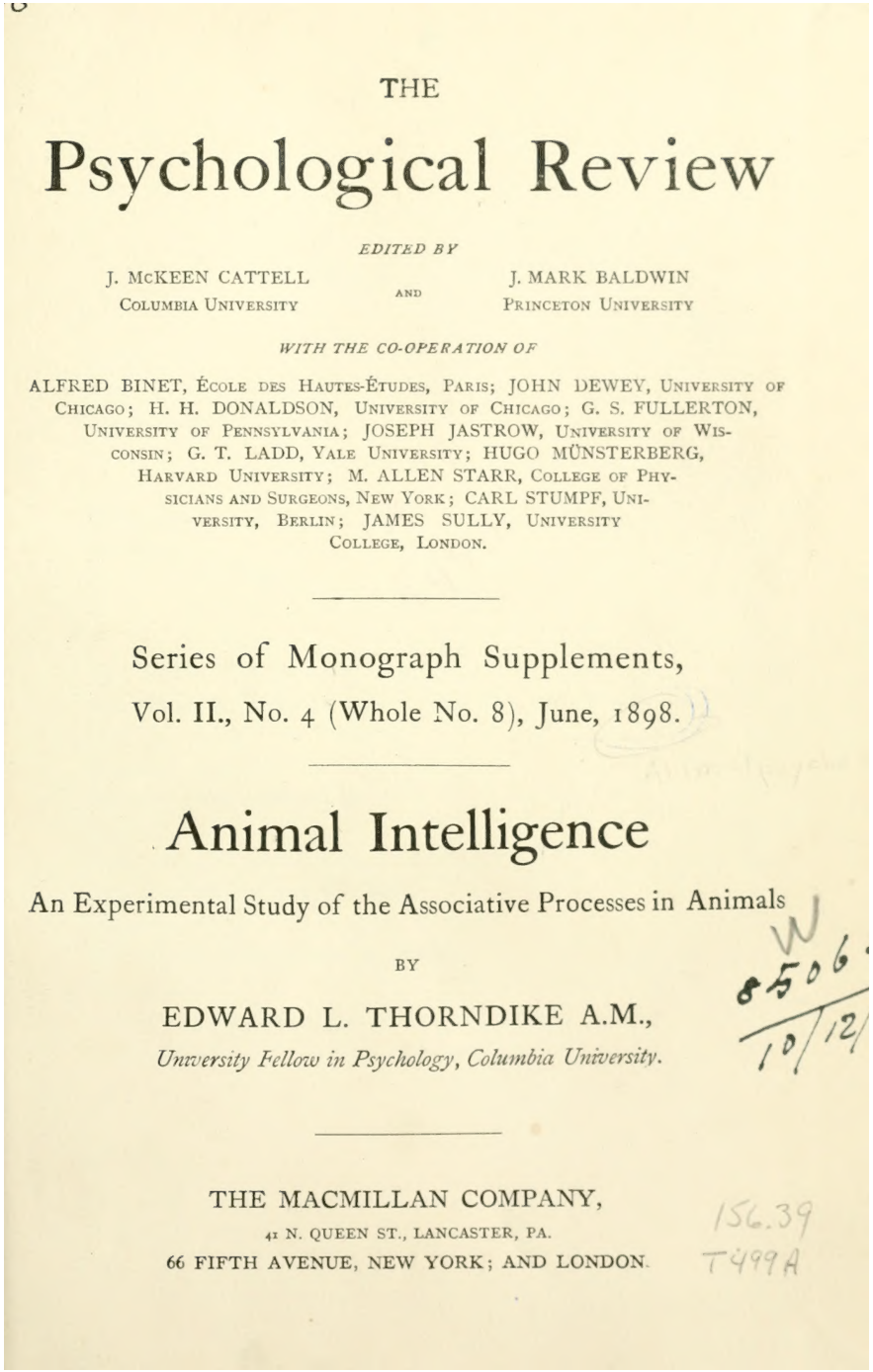


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An Experimental Study of the Associative Processes in Animals

BY

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动物智慧

动物联结过程的实验研究

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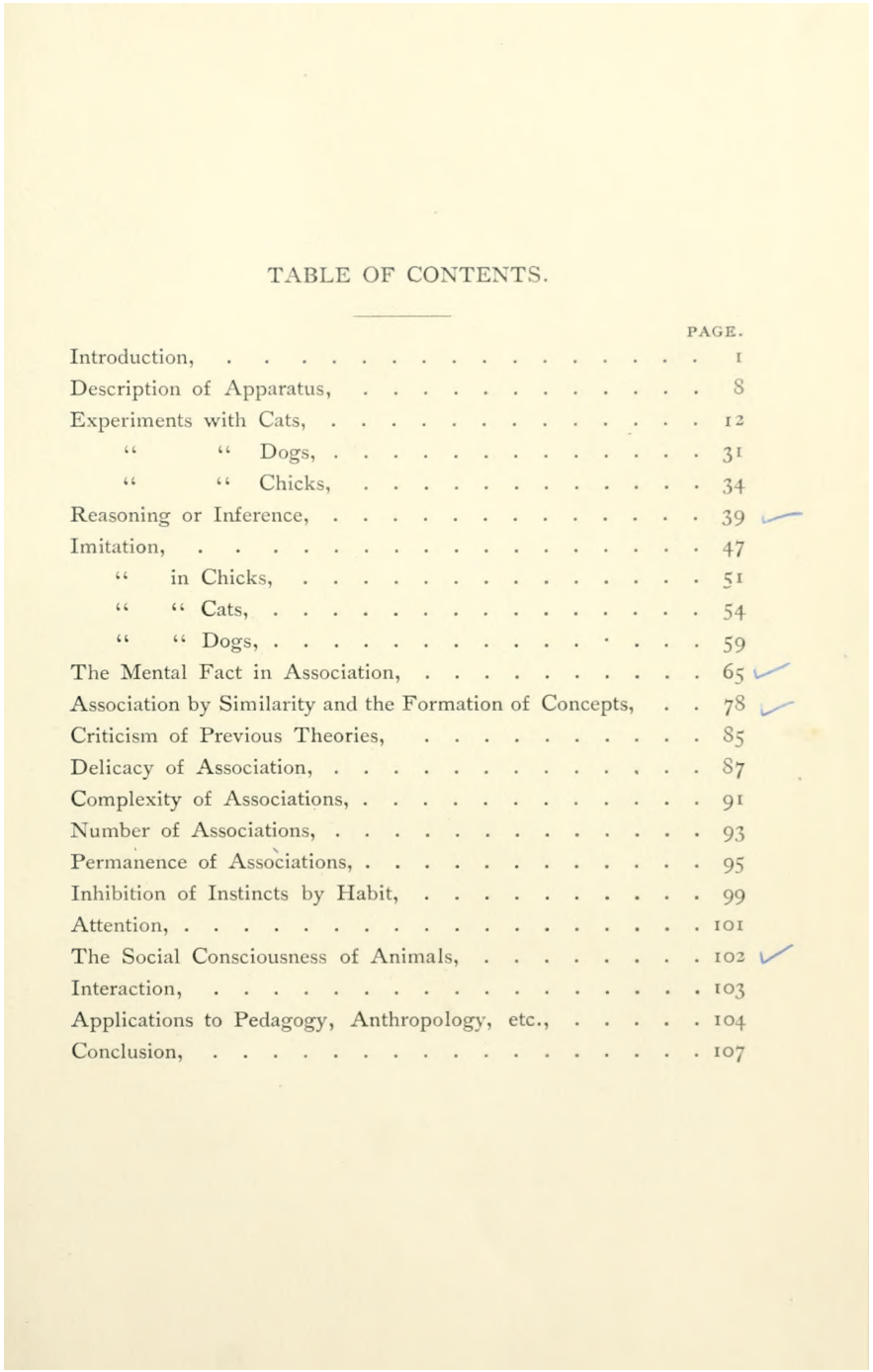


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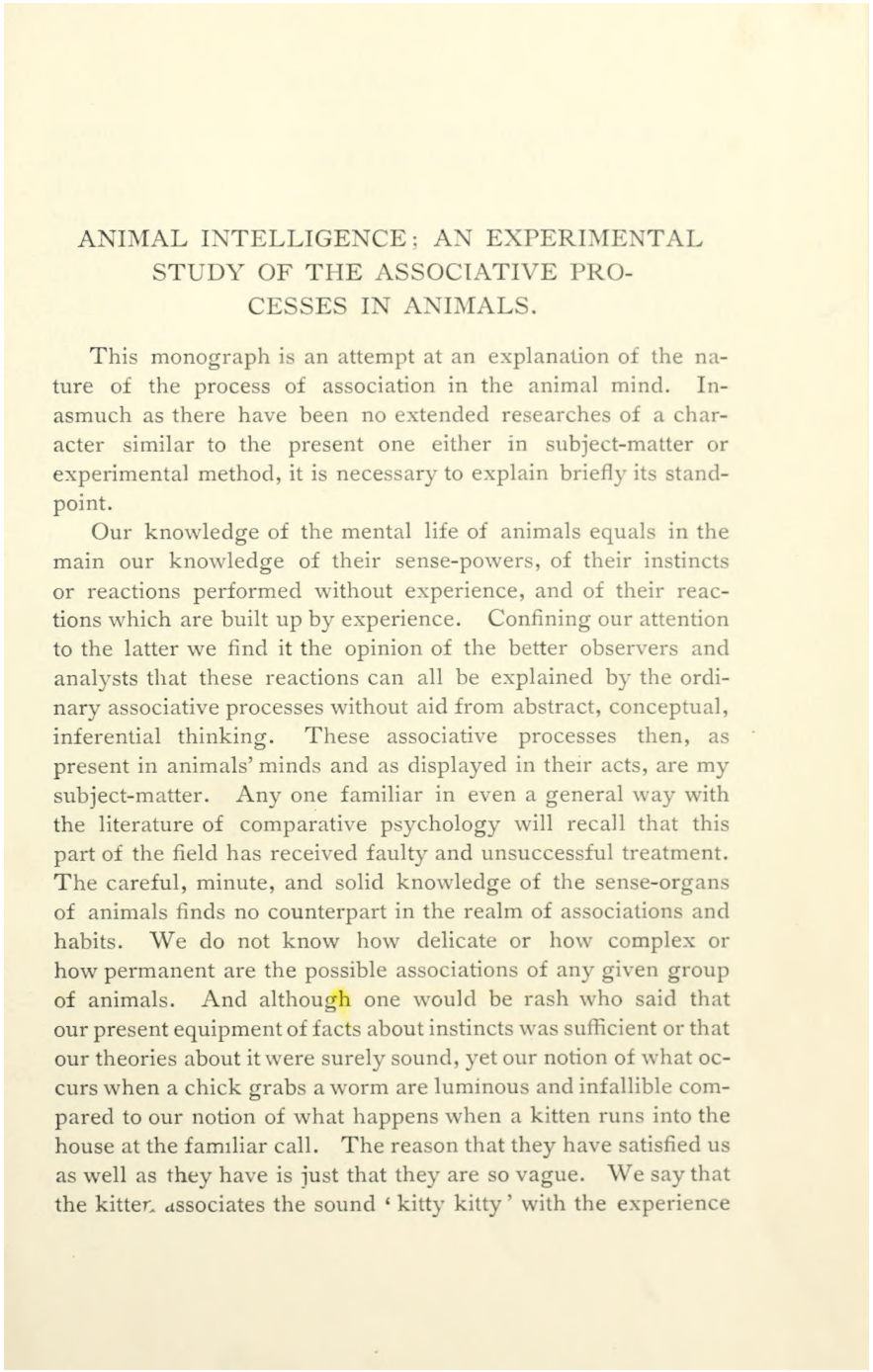
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ANIMAL INTELLIGENCE: AN EXPERIMENTAL STUDY OF THE ASSOCIATIVE PROCESSES IN ANIMALS.

This monograph is an attempt at an explanation of the nature of the process of association in the animal mind. Inasmuch as there have been no extended researches of a character similar to the present one either in subject-matter or experimental method, it is necessary to explain briefly its standpoint.

Our knowledge of the mental life of animals equals in the main our knowledge of their sense-powers, of their instincts or reactions performed without experience, and of their reactions which are built up by experience. Confining our attention to the latter we find it the opinion of the better observers and analysts that these reactions can all be explained by the ordinary associative processes without aid from abstract, conceptual, inferential thinking. These associative processes then, as present in animals' minds and as displayed in their acts, are my subject-matter. Any one familiar in even a general way with the literature of comparative psychology will recall that this part of the field has received faulty and unsuccessful treatment. The careful, minute, and solid knowledge of the sense-organs of animals finds no counterpart in the realm of associations and habits. We do not know how delicate or how complex or how permanent are the possible associations of any given group of animals. And although one would be rash who said that our present equipment of facts about instincts was sufficient or that our theories about it were surely sound, yet our notion of what occurs when a chick grabs a worm are luminous and infallible compared to our notion of what happens when a kitten runs into the house at the familiar call. The reason that they have satisfied us as well as they have is just that they are so vague. We say that the kitten associates the sound 'kitty kitty' with the experience

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导论

本专著试图解释动物心理中联结过程的性质。此前，无论在研究内容还是实验方法上，都没有与本研究相似的广泛研究，因此有必要简要说明本研究的立场。

我们关于动物心理生活的知识，主要就是关于感觉能力、本能或无需经验便会出现的反应，以及通过经验形成的反应的知识。把注意力集中在最后一类反应上，我们就会发现，较出色的观察者和分析者认为：这些反应都可以用普通的联结过程来解释，无须借助抽象、概念或推论思维。存在于动物心理之中、并在其行动中表现出来的这些联结过程，就是我的研究对象。任何对比较心理学文献稍有了解的人，都会知道这一领域的这部分研究存在缺陷，未能取得满意成果。对于动物的感觉器官，我们已有细致、精确而扎实的知识；但在联结和习惯方面，没有相应的知识。对于任何动物群体，我们都不知道它们可能形成的联结有多精细、多复杂，或者能保持多久。倘若有人声称，我们掌握的有关本能的事实已经足够充分，或关于本能的理论肯定正确，未免过于武断。然而，与我们对“小猫听到熟悉呼唤便跑进屋里”的理解相比，我们对“小鸡抓住一条虫子”时发生了什么的理解，简直清楚明白、确凿无误。这些解释能让我们如此满意，恰恰因为它们太含糊了。我们说，小猫把“咪咪，咪咪”的声音同某种经验联系起来--即喝到美味牛奶的经验。

of nice milk to drink, which does very well for a common-sense answer. It also suffices as a rebuke to those who would have the kitten ratiocinate about the matter, but it fails to tell what real mental content is present. Does the kitten feel "*sound of call, memory-image of milk in a saucer in the kitchen, thought of running into the house, a feeling, finally, of 'I will run in'?*" Does he perhaps feel only the sound of the bell and an impulse to run in, similar in quality to the impulses which make a tennis player run to and fro when playing? The word association may cover a multitude of essentially different processes, and when a writer attributes anything that an animal may do to association his statement has only the negative value of eliminating reasoning on the one hand and instinct on the other. His position is like that of a zoölogist who should to-day class an animal among the 'worms.' To give to the word a positive value and several definite possibilities of meaning is one aim of this investigation.

The importance to comparative psychology in general of a more scientific account of the association-process in animals is evident. Apart from the desirability of knowing all the facts we can, of whatever sort, there is the especial consideration that these associations and consequent habits have an immediate import for biological science. In the higher animals the bodily life and preservative acts are largely directed by these associations. They, and not instinct, make the animal use the best feeding grounds, sleep in the same lair, avoid new dangers and profit by new changes in nature. Their higher development in mammals is a chief factor in the supremacy of that group. This, however, is a minor consideration. The main purpose of the study of the animal mind is to learn the development of mental life down through the phylum, to trace in particular the origin of human faculty. In relation to this chief purpose of comparative psychology the associative processes assume a rôle predominant over that of sense-powers or instinct, for in a study of the associative processes lies the solution of the problem. Sense-powers and instincts have changed by addition and supersedence, but the cognitive side of consciousness has changed not only in quantity but also in quality. Somehow

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作为常识性的回答，这很合适，也足以反驳那些认为小猫会为这件事进行逻辑推理的人；但它没有告诉我们，小猫当时究竟有什么心理内容。它体验的是“呼唤声、厨房里碟中牛奶的记忆表象、跑进屋里的念头，最后还有‘我要跑进去’的感觉”吗？或许，它体验的只是铃声和跑进去的冲动，性质上类似网球运动员打球时来回奔跑的冲动？“联结”可能涵盖许多本质不同的过程。作者把动物的某种行为归因于联结时，这种说法只有排除性的价值：一方面排除了推理，另一方面排除了本能。他的立场，就像动物学家今天仍把某种动物归入“蠕虫”一类。本研究的目标之一，就是赋予“联结”实质性的解释价值，并明确它可能具有的几种具体含义。

更科学地说明动物的联结过程，对于整个比较心理学的重要性显而易见。我们固然希望尽可能了解一切事实，但还应特别考虑，这些联结及由此形成的习惯，对生物科学有直接意义。高等动物的身体生活和维持生存的行动，大多受这些联结支配。使动物利用最佳觅食地点、睡在同一巢穴、躲避新危险、从自然环境的新变化中获益的，是这些联结而不是本能。联结在哺乳动物中发展得更完善，是这一群体占据优势的重要因素。不过，这还只是次要考虑。研究动物心理的主要目的，是沿动物演化谱系向下追踪心理生活的发展，尤其追溯人类心理能力的起源。就这一目的而言，联结过程比感觉能力和本能发挥更主要的作用，因为研究联结过程才有望解决问题。感觉能力和本能通过新增和替代而变化；意识的认知方面则不仅有量的变化，也有质的变化。以某种方式--

out of these associative processes have arisen human consciousnesses with their sciences and arts and religions. The association of ideas proper, imagination, memory, abstraction, generalization, judgment, inference, have here their source. And in the metamorphosis the instincts, impulses, emotions and sense-impressions have been transformed out of their old natures. For the origin and development of human faculty we must look to these processes of association in lower animals. Not only then does this department need treatment more, but promises to repay the worker better.

Although no work done in this field is enough like the present investigation to require an account of its results, the *method* hitherto in use invites comparison by its contrast and, as I believe, by its faults. In the first place, most of the books do not give us a psychology, but rather a *eulogy*, of animals. They have all been about animal *intelligence*, never about animal *stupidity*. Though a writer derides the notion that animals have reason, he hastens to add that they have marvellous capacity of forming associations, and is likely to refer to the fact that human beings only rarely reason anything out, that their trains of ideas are ruled mostly by association, as if, in this latter, animals were on a par with them. The history of books on animals' minds thus furnishes an illustration of the well-nigh universal tendency in human nature to find the marvelous wherever it can. We wonder that the stars are so big and so far apart, that the microbes are so small and so thick together, and for much the same reason wonder at the things animals do. They used to be wonderful because of the mysterious, God-given faculty of instinct, which could almost remove mountains. More lately they have been wondered at because of their marvellous mental powers in profiting by experience. Now imagine an astronomer tremendously eager to prove the stars as big as possible, or a bacteriologist whose great scientific desire is to demonstrate the microbes to be very, very little! Yet there has been a similar eagerness on the part of many recent writers on animal psychology to praise the abilities of animals. It cannot help leading to partiality in deductions from facts and more especially in the choice of facts

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--人类意识及其科学、艺术和宗教，便从这些联结过程中产生了。严格意义上的观念联想、想象、记忆、抽象、概括、判断和推论，皆以此为源头。在这一转变中，本能、冲动、情绪和感觉印象，也改变了原有性质。要了解人类心理能力的起源和发展，我们必须考察较低等动物中的联结过程。因此，这一领域不仅更需要研究，也更有望给研究者带来丰硕成果。

本领域尚没有与本研究足够相似、因而需要介绍其结果的工作；但以往的方法，既因与本研究形成对照，也因我认为它们存在缺陷，值得比较。首先，多数著作提供的与其说是动物心理学，不如说是对动物的赞颂。它们谈的都是动物的聪明，从不谈动物的愚笨。即使作者嘲笑动物具有理性的说法，也会赶紧补充，动物具有惊人的联结形成能力；还可能说，人类很少真正推理，我们的观念序列主要由联想支配，仿佛在这一点上动物与人处于同一水平。动物心理著作史，正说明人性中一种几乎普遍的倾向：只要可能，就想发现令人惊奇的事物。我们惊叹恒星巨大、相距遥远，也惊叹微生物微小、分布密集；我们对动物行为惊奇，原因也大致相同。过去，动物因神秘的、上帝赋予的、仿佛可以移山的本能而显得神奇；近来，人们又赞叹它们从经验中获益的心理能力。不妨想象，一个天文学家急于证明恒星越大越好，或一个细菌学家最大的科学愿望就是证明微生物非常、非常小！然而，许多近来的动物心理学作者，确实怀着类似热情，急于赞扬动物能力。这势必使他们根据事实推论时带有偏向，尤其影响其选择哪些事实--

for investigation. How can scientists who write like lawyers, defending animals against the charge of having no power of rationality, be at the same time impartial judges on the bench? Unfortunately the real work in this field has been done in this spirit. The level-headed thinkers who might have won valuable results have contented themselves with arguing against the theories of the eulogists. They have not made investigations of their own.

In the second place the facts have generally been derived from anecdotes. Now quite apart from such pedantry as insists that a man's word about a scientific fact is worthless unless he is a trained scientist, there are really in this field special objections to the acceptance of the testimony about animals' intelligent acts which one gets from anecdotes. Such testimony is by no means on a par with testimony about the size of a fish or the migration of birds, etc. For here one has to deal not merely with ignorant or inaccurate testimony, but also with prejudiced testimony. Human folk are as a matter of fact eager to find intelligence in animals. They like to. And when the animal observed is a pet belonging to them or their friends, or when the story is one that has been told as a story to entertain, further complications are introduced. Nor is this all. Besides commonly misstating what fact sthey report, they report only such facts as show the animal at his best. Dogs get lost hundreds of times and no one ever notices it or sends an account of it to a scientific magazine. But let one find his way from Brooklyn to Yonkers and the fact immediately becomes a circulating anecdote. Thousands of cats on thousands of occasions sit helplessly yowling, and no one takes thought of it or writes to his friend, the professor; but let one cat claw at the knob of a door supposedly as a signal to be let out, and straightway this cat becomes the representative of the cat-mind in all the books. The unconscious distortion of the facts is almost harmless compared to the unconscious neglect of an animal's mental life until it verges on the unusual and marvelous. It is as if some denizen of a planet where communication was by thought-transference, who was surveying humankind and reporting their psychology, should be oblivious to all our

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--进行研究。科学家若像律师一样为动物辩护，反驳它们没有理性能力的指控，又怎能同时充当公正的法官？不幸的是，实际研究正是在这种精神下开展的。那些头脑清醒、可能取得有价值成果的思想者，却满足于反驳赞颂者的理论，没有开展自己的研究。

其次，事实材料通常来自轶事。无须坚持那种迂腐的观点，认为只有受过训练的科学家，对科学事实的陈述才有价值；但在这个领域，接受轶事中有关动物聪明行为的证词，确实有特殊问题。这类证词不能与关于鱼的大小、鸟类迁徙等事实的证词等量齐观。我们面对的不只是缺乏知识或不准确的证词，还有带偏见的证词。人们确实想在动物身上发现智慧，并乐于这样做。如果动物是自己或朋友的宠物，或者故事原是为了消遣而讲述的，情况更复杂。问题还不止于此。人们不仅常把事实说错，而且只报告最能显示动物本领的事实。狗迷路几百次，没人留意，也没人写信告诉科学杂志；可只要一条狗从布鲁克林找到了通往扬克斯的路，立刻就成了四处流传的轶事。成千上万只猫，在成千上万个场合里无助地号叫，没人当回事，也没人告诉自己的教授朋友；可只要一只猫抓门把手，被认为是在示意让它出去，这只猫就在所有书中成了猫心理的代表。人们只在动物表现得异乎寻常、令人惊叹时，才关注它们的心理活动，对平常的表现却视而不见，而且自己并未意识到这种偏向。与这种偏向相比，不自觉地歪曲事实，几乎还算无害。就像某个通过思想传递交流的星球上的居民来考察人类、报告人类心理，却忽视人类所有交流方式，只注意心灵研究学会记录的现象。

inter-communication save such as the psychical-research society has noted. If he should further misinterpret the cases of mere coincidence of thoughts as facts comparable to telepathic communication, he would not be more wrong than some of the animal psychologists. In short, the anecdotes give really the *abnormal* or *super-normal* psychology of animals.

Further, it must be confessed that these vices have been only ameliorated, not obliterated, when the observation is first-hand, is made by the psychologist himself. For as men of the utmost scientific skill have failed to prove good observers in the field of spiritualistic phenomena,[1] so biologists and psychologists before the pet terrier or hunted fox often become like Samson shorn. They, too, have looked for the intelligent and unusual and neglected the stupid and normal.

Finally, in all cases, whether of direct observation or report by good observers or bad, there have been three other defects. Only a single case is studied, and so the results are not necessarily true of the type; the observation is not repeated, nor are the conditions perfectly regulated; the previous history of the animal in question is not known. Such observations may tell us, if the observer is perfectly reliable, that a certain thing takes place, but they cannot assure us that it will take place universally among the animals of that species, or universally with the same animal. Nor can the influence of previous experience be estimated. All this refers to means of getting knowledge about what animals *do*. The next question is, "What do they *feel?*" Previous work has not furnished an answer or the material for an answer to this more important question. Nothing but carefully designed, crucial experiments can. In abandoning the old method one ought to seek above all to replace it by one which will not only tell more accurately *what they do*, and give the much-needed information *how they do it*, but also inform us *what they feel* while they act.

To remedy these defects experiment must be substituted for

[1] I do not mean that scientists have been too credulous with regard to spiritualism, but am referring to the cases where ten or twenty scientists have been sent to observe some trick-performance by a spiritualistic 'medium,' and have all been absolutely confident that they understood the secret of its performance, *each of them giving a totally different explanation.*

如果他进一步把思想巧合，误解成可与心灵感应交流相比的事实，也不会比某些动物心理学家错得更严重。
简言之，轶事真正呈现的是动物的异常心理或所谓超常心理。

必须承认，即使由心理学家亲自进行第一手观察，这些弊病也只是减轻，并未消失。正如科学能力极高的人，在通灵现象研究中也未能成为好观察者［原注］，生物学家和心理学家面对宠物梗犬或被追猎的狐狸，也常像被剪去头发的参孙一样失去力量。他们同样寻找聪明、异常的表现，而忽视愚笨、正常的表现。

最后，无论直接观察还是优秀或欠佳观察者的报告，都还有三个缺点：只研究一个案例，结果未必适用于整个类型；观察没有重复，条件没有充分控制；不了解动物此前的经历。可靠观察或许能告诉我们某件事发生过，却不能保证它会普遍发生在同种动物中，或总发生在同一只动物身上；此前经验的影响也无法估计。以上关乎如何知道动物做了什么。下一问题是："它们体验到了什么？"对这个更重要的问题，以往研究既无答案，也无足以回答它的材料。只有精心设计、具有关键判别作用的实验才能做到。放弃旧方法时，尤其应以一种方法取代它：既更准确地告诉我们动物做了什么，提供急需的"如何做到"的知识，也告诉我们它们行动时体验到了什么。

要克服这些缺点，就必须用实验取代观察和轶事收集。

原注：我不是说科学家对通灵现象太轻信。我指十位或二十位科学家被派去观察某位"灵媒"的戏法表演，每个人都完全确信自己理解了秘密，却各自给出完全不同的解释。

observation and the collection of anecdotes. Thus you immediately get rid of several of them. You can repeat the conditions at will, so as to see whether or not the animal's behavior is due to mere coincidence. A number of animals can be subjected to the same test, so as to attain typical results. The animal may be put in situations where its conduct is especially instructive. After considerable preliminary observation of animals' behavior under various conditions, I chose for my general method one which, simple as it is, possesses several other marked advantages besides those which accompany experiment of any sort. It was merely to put animals when hungry in enclosures from which they could escape by some simple act, such as pulling at a loop of cord, pressing a lever, or stepping on a platform. (A detailed description of these boxes and pens will be given later.) The animal was put in the enclosure, food was left outside in sight, and his actions observed. Besides recording his general behavior, special notice was taken of how he succeeded in doing the necessary act (in case he did succeed), and a record was kept of the time that he was in the box before performing the successful pull, or clawing, or bite. This was repeated until the animal had formed a perfect association between the sense-impression of the interior of that box and the impulse leading to the successful movement. When the association was thus perfect, the time taken to escape was, of course, practically constant and very short.

If, on the other hand, after a certain time the animal did not succeed, he was taken out, but *not fed*. If, after a sufficient number of trials, he failed to get out, the case was recorded as one of complete failure. Enough different sorts of methods of escape were tried to make it fairly sure that association in general, not association of a particular sort of impulse, was being studied. Enough animals were taken with each box or pen to make it sure that the results were not due to individual peculiarities. None of the animals used had any previous acquaintance with any of the mechanical contrivances by which the doors were opened. So far as possible the animals were kept in a uniform state of hunger, which was practically utter hunger. That is, no cat or dog was experimented on when the experi-

这样便能摆脱若干问题：随意重复条件，判断行为是否偶然；让多只动物接受同一测试，取得有代表性的结果；把动物放入特别有助于揭示问题的情境。在对各种条件下的动物行为作了相当多初步观察后，我选择一种一般方法。它虽简单，却在实验共有的优点之外另有明显优势：把饥饿动物放进围闭装置，使其通过简单动作逃出，如拉绳圈、压杠杆、踏平台。箱子和围栏将于后文详述。把动物放进去，将食物置于外面看得见处，观察其行动。除一般行为外，特别注意它怎样成功完成必要动作，并记录它在箱中待多久，才成功拉动、抓挠或啃咬。反复进行，直到箱内环境的感觉印象，与引向成功动作的冲动之间形成完善联结。这时逃出时间便很短，而且实际上相当稳定。

若一定时间内未成功，则把动物取出，但不喂食。若经足够多次尝试仍无法逃出，就记录为完全失败。设置足够多种逃出方法，使我们有相当把握研究的是一般的联结，而非某种特定冲动的联结。每种箱子或围栏，都让足够多只动物参加，保证结果不是个体特殊性所致。动物此前都不熟悉这些开门机械。我尽可能使它们维持一致的饥饿状态，实际上就是十分饥饿。因此，当实验涉及重要事实或理论问题时只有确认猫或狗的动机达到统一强度，才进行实验。

ment involved any important question of fact or theory, unless I was sure that his motive was of the standard strength. With chicks this is not practicable, on account of their delicacy. But with them dislike of loneliness acts as a uniform motive to get back to the other chicks. Cats (or rather kittens), dogs and chicks were the subjects of the experiments. All were apparently in excellent health, save an occasional chick.

By this method of experimentation the animals are put in situations which call into activity their mental functions and permit them to be carefully observed. One may, by following it, observe personally more intelligent acts than are included in any anecdotal collection. And this actual vision of animals in the act of using their minds is far more fruitful than any amount of histories of what animals have done without the history of how they did it. But besides affording this opportunity for purposeful and systematic observation, our method is valuable because it frees the animal from any influence of the observer. The animal's behavior is quite independent of any factors save its own hunger, the mechanism of the box it is in, the food outside, and such general matters as fatigue, indisposition, etc. Therefore the work done by one investigator may be repeated and verified or modified by another. No personal factor is present save in the observation and interpretation. Again, our method gives some very important results which are quite uninfluenced by *any* personal factor in any way. The curves showing the progress of the formation of associations, which are obtained from the records of the times taken by the animal in successive trials, are facts which may be obtained by any observer who can tell time. They are absolute, and whatever can be deduced from them is sure. So also the question of whether an animal does or does not form a certain association requires for an answer no higher qualification in the observer than a pair of eyes. The literature of animal psychology shows so uniformly and often so sadly the influence of the personal equation that any method which can partially eliminate it deserves a trial.

Furthermore, although the associations formed are such as could not have been previously experienced or provided for by heredity, they are still not too remote from the animal's ordinary

小鸡身体较为脆弱，不适合像猫和狗那样，通过控制饥饿程度来保证实验中的动机强度。不过，小鸡不愿独自待着，想回到同伴身边的愿望，也能为实验提供强度较为一致的动机。

实验使用的动物是猫（准确地说，是小猫）、狗和小鸡。除个别小鸡外，所有动物看起来都非常健康。

这种方法把动物置于唤起心理功能、又允许仔细观察这些功能的情境。亲眼看到的聪明行为，可能比任何轶事集所收录的还多。亲眼观察动物正在运用心理能力，比读到无论多少仅叙述它们做过什么、却不说明如何做到的故事，更有收获。方法除允许有目的、系统的观察，还使动物摆脱观察者的影响。行为仅受饥饿、箱中装置、箱外食物、疲劳、身体不适等一般因素影响。因此一位研究者的工作，可由另一位重复、验证或修正。个人因素只存在于观察、解释环节。此外，方法能提供完全不受个人因素影响的重要结果：连续试验中记录的逃出时间，构成联结形成进程的曲线，任何会计时的观察者都能获得这些事实。它们是确切事实，从中能够推导的结论也可靠。判断动物是否形成某种联结，观察者也只须有一双眼睛。动物心理学文献普遍而令人遗憾地显示出观察者个人因素的影响，任何可部分消除它的方法，都值得一试。

另外，动物所形成的这些联结，虽然动物们此前未曾经验过，也不可能由遗传预先安排，却并未远离它们通常的生活过程。

course of life. They mean simply the connection of a certain act with a certain situation and resultant pleasure, and this general type of association is found throughout the animal's life normally. The muscular movements required are all such as might often be required of the animal. And yet it will be noted that the acts required are nearly enough like the acts of the anecdotes to enable one to compare the results of experiment by this method with the work of the anecdote school. Finally, it may be noticed that the method lends itself readily to experiments on imitation.

We may now start in with the description of the apparatus and of the behavior of the animals.[1]

Description of Apparatus.

The shape and general apparatus of the boxes which were used for the cats is shown by the accompaning drawing of box K. Unless special figures are given, it should be understood

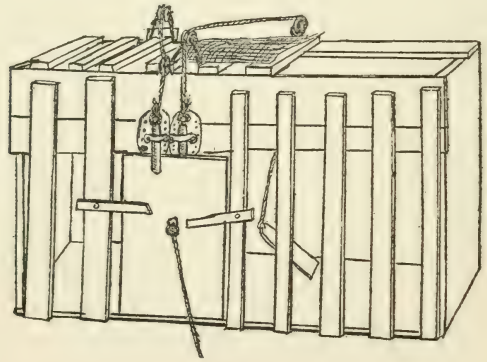


Fig. 1.

that each box is approximately 20 inches long by 15 broad by 12 high. Except where mention is made to the contrary, the door was pulled open by a weight attached to a string which ran over a pulley and was fastened to the door, just as soon as the

[1] The experiments now to be described were for the most part made in the Psychological Laboratory of Columbia University during the year '97–'98, but a few of them were made in connection with a general preliminary investigation of animal psychology undertaken at Harvard University in the previous year.

它们只是将某个动作同某种情境及随之而来的愉快体验联系起来；这种一般类型的联结，正常地贯穿于动物生活。要求的肌肉动作，也都是动物经常可能需要作出的动作。这些动作又与轶事中的动作足够相似，允许把实验结果同轶事研究者的工作比较。最后，这种方法也很容易用于模仿实验。

现在开始介绍实验装置和动物行为［原注］。

仪器说明

供猫使用的箱子的外形及一般装置，见图1中的K箱。除特殊说明，每箱约长20英寸、宽15英寸、高12英寸。除另有说明，箱门系有一根跨过滑轮的绳子，另一端悬着重物；只要动物松开固定门的闩或横挡重物就拉开门。

图1：K箱的实验装置。三个不同动作须全部完成，方可逃出。

原注：以下实验大多于1897-1898年在哥伦比亚大学心理学实验室进行；少数于前一年在哈佛大学开展的动物心理学一般性初步研究中进行。

animal loosened the bolt or bar which held it. Especial care was taken not to have the widest openings between the bars at all near the lever, or wire-loop, or what not, which governed the bolt on the door. For the animal instinctively attacks the large openings first, and if the mechanism which governs the opening of the door is situated near one of them the animal's task is rendered easier. You do not then get the association process so free from the helping hand of instinct as you do if you make the box without reference to the position of the mechanism to be set up within it. These various mechanisms are so simple that a verbal description will suffice in most cases. The facts which the reader should note are the nature of the movement which the cat had to make, the nature of the object at which the movement was directed, and the position of the object in the box. In some special cases attention will also be called to the force required. In general, however, that was very slight (20 to 100 grams if applied directly). The various boxes will be designated by capital letters.

A. A string attached to the bolt which held the door ran up over a pulley on the front edge of the box, and was tied to a wire loop (2½ inches diameter) hanging 6 inches above the floor in front center of box. Clawing or biting it, or rubbing against it even, if in a certain way, opened the door. We may call this box A '*O at front*.'

B. A string attached to the bolt ran up over a pulley on the front edge of the door, then across the box to another pulley screwed into the inside of the back of the box 1¼ inches below the top, and passing over it ended in a wire loop (3 inches in diameter) 6 inches above the floor in back center of box. Force applied to the loop or *to the string* as it ran across the top of the box between two bars would open the door. We may call B '*O at back*.'

B1. In B1 the string ran outside the box, coming down through a hole at the back, and was therefore inaccessible and invisible from within. Only by pulling the loop could the door be opened. B1 may be called '*O at back 2nd*.'

C. A door of the usual position and size (as in Fig. 1) was kept closed by a wooden button 3½ inches long, ⅞ inch wide,

我特别注意，不把控制门闩的杠杆、金属圈等放在栏条间最宽的空隙旁。动物本能地先攻击大空隙；若开门机关在其附近，任务就更容易。这时所观察的联结过程，比随机安排箱内机关时更多受到本能帮助。各机关很简单，多数可用文字说明。读者应注意猫要作什么动作、动作针对什么物体、物体在箱中何处；某些特殊情况还须注意用力大小。一般所需力很小，直接施力时约20-100克。各箱以大写字母表示。

A：系于门闩的绳子，经箱前上缘滑轮，接到箱前中央、距地6英寸的金属圈，圈直径2½英寸。以某种方式抓、咬，甚至摩擦圈，都能开门。称“前圈”。

B：门闩上的绳经前缘滑轮，再横穿箱顶，绕过固定在后内壁、距顶1¼英寸的另一滑轮，末端接直径3英寸的金属圈，悬于箱后中央、距地6英寸处。对圈施力，或对箱顶两栏条间横穿的绳施力，都能开门。称“后圈”。

B1：绳在箱外走，经后壁孔垂下；箱内看不到、碰不到绳。只能拉圈开门。称“后圈第二式”。

C：门位置、大小与图1相同，用木制旋钮挡住。旋钮长3½英寸，宽7/8英寸，

¼ inch thick. This turned on a nail driven into the box ½ inch above the middle of the top edge of the door. The door would fall inward as soon as the button was turned from its vertical to a horizontal position. A pull of 125 grams would do this if applied sideways at the lowest point of the button 2¼ inches below its pivot. The cats usually clawed the button round by downward pressure on its top edge, which was 1¼ inches above the nail. Then, of course, more force was necessary. C may be called '*Button*.'

D. The door was in the extreme right of the front. A string fastened to the bolt which held it ran up over a pulley on the top edge and back to the top edge of the back side of the box (3 inches in from the right side) and was there firmly fastened. The top of the box was of wire screening and arched over the string ¾ inch above it along its entire length. A slight pull on the string anywhere opened the door. This box was 20 × 16, but a space 7 × 16 was partitioned off at the left by a wire screen. D may be called '*String*.'

D1 was the same box as B, but had the string fastened firmly at the back instead of running over a pulley and ending in a wire loop. We may call it '*String 2nd*.'

E. A string ran from the bolt holding the door up over a pulley and down to the floor outside the box, where it was fastened 2 inches in front of the box and 1½ inches to the left of the door (looking from the inside). By poking a paw out between the bars and pulling this string inward the door would be opened. We may call E '*String outside*.'

In F the string was not fastened to the floor but ended in a loop 2½ inches in diameter which could be clawed down so as to open the door. Unless the pull was in just the right direction, the string was likely to catch on the pulley. This loop hung 3 inches above the floor, and 1¾ inches in front of the box. We may call F '*String outside unfastened*.'

G was a box 29×20½×22½, with a door 29×12 hinged on the left side of the box (looking from within), and kept closed by an ordinary thumb-latch placed 15 inches from the floor. The remainder of the front of the box was closed in by wooden bars. The door was a wooden frame covered with screening.

厚¼英寸，以钉子为轴；钉钉在门上缘中央以上½英寸处。旋钮从竖直转为水平，门便向内倒下。如果在轴下2¼英寸的最低点横向施力，125克拉力便足够。猫通常向下压轴上1¼英寸的上缘，把旋钮抓转，这当然需要更大力。C称“旋钮”。

D：门位于前壁最右端。门闩的绳经上缘滑轮，伸向箱后上缘、距右侧3英寸处并固定。箱顶是金属网，沿整根绳上方¾英寸拱起。在任何地方轻拉绳便开门。箱底20×16英寸，左边7×16英寸区域以网隔开。称“绳”。

D1：与B同箱，但绳固定于后壁，不绕滑轮、不接金属圈。称“绳第二式”。

E：门闩的绳绕滑轮，垂至箱外地面，固定于箱前2英寸、门左1½英寸处，左右以箱内视角为准。爪伸出栏间，将绳向内拉便开门。称“外绳”。

F：绳不固定于地面，末端为直径2½英寸的圈，向下抓拉可开门。若拉力方向不恰当，绳易卡住滑轮。圈距地3英寸、距箱前1¾英寸。称“未固定外绳”。

G：箱体29×20½×22½英寸；门29×12英寸，铰接于箱左侧，从内看，用距地15英寸的普通拇指门闩固定。前壁余部为木栏条；门为覆网木框。

It was *not* arranged so as to open as soon as the latch was lifted, but required a force of 400 grams, even when applied to the best advantage. The bar of the thumb-latch, moreover, would fall back into place again unless the door were pushed out at least a little. The top of this box was not of bars or screening, but solid. We may call G '*Thumb-latch*.'

H was, except for the opening where the door was situated, a perfectly solid and dark box. In the front was cut an opening about 9 × 7 inches. A wooden frame covered with wire netting hung in front of this. It was fastened to the box only by a screw through the middle of the frame's top piece, and could therefore be pushed to either side so as to permit escape from the box if it were prevented from swinging back into place.

I was a box 12 × 14 × 23. The door was 8 inches wide, 4 high, and hinged at the left side. It was held closed by a wooden bar which moved easily on a pivot and which could be pushed up by another bar which projected 5 inches into the box. This second bar was pivoted so that downward pressure on it pushed the first bar up and let the door swing open. The second bar entered the box at a point 4 inches above the floor and 2½ inches in from the right side of the box. In its normal position its inner end was 5½ inches above the floor. A depression of 2 inches at that end was necessary to open the door. Of course, nearer the pivot a shorter depression would do. The front of the box was closed by bars, but the rest by solid boards. We may call I '*Lever*.'

J was the same as B except that the door was not opened by a weight as soon as the bolt was pulled up. On the contrary, the door was held closed by a small piece of board (4 × 3½ × ¾ thick) placed against it outside. After pulling the loop at the back the cat had to knock down this support and push the door open. We may call J '*Double*.'

K was a box arranged so that three separate acts were required to open the door, which was held by two bolts at the top and two bars outside. One of the bolts was connected with a platform in the back center of the box so that depressing the platform raised the bolt. The other was raised by a string

中文译文

门并非抬闩便自动打开，即使在最有利处施力，仍需400克。门若不略向外推，门闩横杆还会落回原位。箱顶为实板，不是栏条或网。G称“拇指门闩”。

H：除门口外，箱体完全实闭、黑暗。前壁开口约9×7英寸，外悬覆金属网的木框，仅用框顶中央的螺钉固定；可向任一侧推开，只要不让它摆回，便可逃出。

I：箱体12×14×23英寸。门宽8英寸、高4英寸，铰接于左侧。门由易绕轴转动的木杆挡住；另一根伸入箱内5英寸的杆，可把它抬起。压下第二杆，第一杆即升起，门便打开。第二杆在距地4英寸、距箱右侧2½英寸处进入；正常位置，其内端距地5½英寸。内端须下降2英寸才能开门；越靠近轴，所需下降量越小。前壁为栏条，其余为实板。称“杠杆”。

J：与B相同，但拉起门闩后门不由重物自动打开，而被箱外一块4×3½英寸、厚¾英寸的小木板撑住。猫拉后圈后，还须推倒撑板并推门。称“双重”。

K：须三个独立动作才能打开门。门由顶部两个门闩及外侧两个挡杆固定。一个闩连接箱后中央的平台，压平台便抬闩；另一个闩由绳抬起绳先绕前方滑轮，在箱顶栏条上方1英寸处横穿，再绕近箱角的滑轮，垂至地板并固定。

which ran up over a pulley in the front, across the box 1 inch above the bars, over a pulley near the corner of the box, and down to the floor, where it was fastened. Pulling on this string, either by clawing at it where it was running vertically from the last pulley to the floor, or by putting the paw out between the bars which covered the top of the box, and clawing the string downwards, would raise the bolt. If both bolts were raised and *either* bar was pushed up or down far enough to be out of the way, the cat could escape. K, or 'Triple,' as it may be called, is the box reproduced in Figure 1.

L was a box that also required three acts to open the door. It was a combination of A (O at front), D (string), I (lever). The lever or bar to be depressed was 2 inches to the right of the door, which was in the front center. The string to be clawed or bitten ran from front center to back center 1 inch below the top of the box.

Z was a box with back and sides entirely closed, with front and top closed by bars and screening, with a small opening in the left front corner. A box was held in front of this and drawn away when the cats happened to lick themselves. Thus escape and food followed always upon the impulse to lick themselves, and they soon would immediately start doing so as soon as pushed into the box. The same box was used with the impulse changed to that for scratching themselves. The size of this box was 15×10×16.

Experiments with Cats.

In these various boxes were put cats from among the following. I give approximately their ages while under experiment.

No. 1. 8–10 months.
No. 2. 5–7 months.
No. 3. 5–11 months.
No. 4. 5–8 months.
No. 5. 5–7 months.
No. 6. 3–5 months.
No. 7. 3–5 months.
No. 8. 6–6½ months.
No. 10. 4–8 months.

抓拉末段竖绳，或把爪伸出顶栏向下抓绳，均能抬起此闩。两闩都抬起，并把任一外挡杆向上或向下推开，猫才可逃出。K称“三重”，即图1所绘装置。

L：也须三个动作开门，是A前圈、D绳、I杠杆的组合。门在前壁中央，须压的杠杆在门右2英寸处。须抓咬的绳从前中央通到后中央，位于顶下1英寸。

Z：后壁、侧壁实闭，前壁和顶为栏条、网；前左角留小口。另有箱子挡于小口前，一旦猫舔自己就撤走。因此逃出和食物始终紧随舔自身的冲动。猫很快一被放入就立刻舔自己。也用同一箱，改为猫搔自己时给予逃出机会。箱尺寸15×10×16英寸。

猫的实验

参与上述实验的猫及实验期间约略月龄如下：1号8-10个月；2号5-7；3号5-11；4号5-8；5号5-7；6号3-5；7号3-5；8号6-6½；10号4-8个月。名单续下页。

No. 11. 7–8 months.
No. 12. 4–6 months.
No. 13. 18–19 months.

The behavior of all but 11 and 13 was practically the same. When put into the box the cat would show evident signs of discomfort and of an impulse to escape from confinement. It tries to squeeze through any opening; it claws and bites at the bars or wire; it thrusts its paws out through any opening and claws at everything it reaches; it continues its efforts when it strikes anything loose and shaky; it may claw at things within the box. It does not pay very much attention to the food outside, but seems simply to strive instinctively to escape from confinement. The vigor with which it struggles is extraordinary. For eight or ten minutes it will claw and bite and squeeze incessantly. With 13, an old cat, and 11, an uncommonly sluggish cat, the behavior was different. They did not struggle vigorously or continually. On some occasions they did not even struggle at all. It was therefore necessary to let them out of some box a few times, feeding them each time. After they thus associate climbing out of the box with getting food, they will try to get out whenever put in. They do not, even then, struggle so vigorously or get so excited as the rest. In either case, whether the impulse to struggle be due to an instinctive reaction to confinement or to an association, it is likely to succeed in letting the cat out of the box. The cat that is clawing all over the box in her impulsive struggle will probably claw the string or loop or button so as to open the door. And gradually all the other non-successful impulses will be stamped out and the particular impulse leading to the successful act will be stamped in by the resulting pleasure, until, after many trials, the cat will, when put in the box, immediately claw the button or loop in a definite way.

The starting point for the formation of any association in these cases, then, is the set of instinctive activities which are aroused when a cat feels discomfort in the box either because of confinement or a desire for food. This discomfort, plus the sense-impression of a surrounding, confining wall, expresses itself prior to any experience, in squeezings, clawings, bitings,

中文译文

11号7-8个月；12号4-6个月；13号18-19个月。

除11、13号外，行为几乎相同。放进箱子便显出不适和逃离禁闭的冲动：试图挤过任何开口，抓咬栏条、网，把爪伸出并抓一切够得着的东西；遇到松动、摇晃的东西便继续用力，也会抓箱内物体。它不太注意箱外食物，似乎只是本能地力图逃出，挣扎猛烈得惊人，能连续八至十分钟抓、咬、挤。成年13号和异常迟钝的11号不同，不猛烈或持续挣扎，有时完全不挣扎。因此须先让它们从某箱逃出几次，每次喂食。把出箱与食物联结后，它们才每次被放入都设法逃出；即使如此，仍不如其他猫激动、猛烈。

无论挣扎来自禁闭引出的本能反应，还是已有联结，它都可能使猫成功逃出。冲动挣扎中四处抓挠的猫，可能抓到绳、圈或旋钮而开门。其他无效冲动逐渐被消除；成功动作的特定冲动，由结果带来的愉快而被巩固。经过许多尝试，猫一入箱便以确定方式抓旋钮或圈。

因此，这些联结形成的起点，是猫因禁闭或饥饿而不适时所唤起的一组本能活动。即使没有经验，这种不适连同围闭箱壁的感觉印象，也使得猫展现出挤、抓、咬等行为。

etc. From among these movements one is selected by success. But this is the starting point only in the case of the first box experienced. After that the cat has associated with the feeling of confinement certain impulses which have led to success more than others and are thereby strengthened. A cat that has learned to escape from A by clawing has when put into C or G a greater tendency to claw at things than it instinctively had at the start, and a less tendency to squeeze through holes. A very pleasant form of this decrease in instinctive impulses was noticed in the gradual cessation of howling and mewing. However, the useless instinctive impulses die out slowly, and often play an important part even after the cat has had experience with six or eight boxes. And what is important in our previous statement, namely, that the activity of an animal when first put into a new box is not directed by any appreciation of *that* box's character, but by certain general impulses to acts, is not affected by this modification. Most of this activity is determined by heredity; some of it, by previous experience.

My use of the words *instinctive* and *impulse* may cause some misunderstanding unless explained here. Let us, throughout this book, understand by instinct any reaction which an animal makes to a situation *without experience*. It thus includes unconscious as well as conscious acts. Any reaction, then, to totally new phenomena, when first experienced, will be called instinctive. Any impulse then felt will be called an instinctive impulse. Instincts include whatever the nervous system of an animal, as far as inherited, is capable of. My use of the word will, I hope, everywhere make clear what fact I mean. If the reader gets the fact meant in mind it does not in the least matter whether he would himself call such a fact instinct or not. Any one who objects to the word may substitute 'hocus-pocus' for it wherever it occurs. The definition here made will not be used to prove or disprove any theory, but simply as a signal for the reader to imagine a certain sort of fact.

The word *impulse* is used against the writer's will, but there is no better. Its meaning will probably become clear as the reader finds it in actual use, but to avoid misconception at any time I will state now that *impulse* means the consciousness ac-

其中一个动作因成功而被选择。但这只适用于首次接触的箱子。此后，猫已把禁闭的感觉，同一些比别的冲动更常成功、因此得到强化的冲动联系起来。学会抓挠逃出A的猫，再进C或G时，比最初更倾向抓东西、更少企图挤过孔隙。此类本能冲动减弱，有个令人愉快的表现：号叫逐渐停止。不过，无用本能冲动消退得慢，接触六至八个箱子后仍常起重要作用。这不影响先前论点：动物初进新箱的活动，并非由理解此箱性质所引导，而由某些一般动作冲动引导。多数活动由遗传决定，一部分由经验决定。

“本能”和“冲动”的用法，须解释以免误解。本书中，本能指动物无需经验就对某情境作出的任何反应，既包括无意识动作，也包括有意识动作。初次面对全新现象的反应称本能反应；当时体验的冲动称本能冲动。本能包括动物神经系统凭遗传所具备的一切能力。我希望上下文清楚表明所指事实。读者若把握事实，是否也称之为本能毫不重要。不喜欢这个词的人，大可处处换成“戏法”。此定义不用来证成或推翻任何理论，只是提示读者想象某类事实。

“冲动”也并非我愿意使用的词，但没有更好的。实际使用会使意义逐渐清楚；为避免误解，先声明，它指伴随肌肉神经支配而有的意识有别于看见自己运动、感觉身体位置改变等产生的动作感。

companying a muscular innervation *apart* from *that feeling of the act which comes from seeing oneself move, from feeling one's body in a different position, etc.* It is the *direct feeling of the doing* as distinguished from the *idea of the act done* gained through eye, etc. For this reason I say 'impulse *and* act' instead of simply 'act.' Above all, it must be borne in mind that by impulse I never mean the *motive* to the act. In popular speech you may say that hunger is the impulse which makes the cat claw. That will never be the use here. The word *motive* will always denote that sort of consciousness. Any one who thinks that the act ought not to be thus subdivided into impulse and deed may feel free to use the word *act* for *impulse* or *impulse and act* throughout, if he will remember that the act in this aspect of being felt as to be done or as doing is in animals the important thing, is the thing which gets associated, while the act as done, as viewed from outside, is a secondary affair. I prefer to have a separate word, impulse, for the former, and keep the word act for the latter, which it commonly means.

Starting, then, with its store of instinctive impulses, the cat hits upon the successful movement, and gradually associates it with the sense-impression of the interior of the box until the connection is perfect, so that it performs the act as soon as confronted with the sense-impression. The formation of each association may be represented graphically by a time-curve. In these curves lengths of one millimeter along the abscissa represent successive experiences in the box, and heights of one millimeter above it each represent ten seconds of time. The curve is formed by joining the tops of perpendiculars erected along the abscissa 1 mm. apart (the first perpendicular coinciding with the y line), each perpendicular representing the time the cat was in the box before escaping. Thus, in Fig. 2 on page 18 the curve marked 12 in A shows that, in 24 experiences or trials in box A, cat 12 took the following times to perform the act, 160 sec., 30 sec., 90 sec., 60, 15, 28, 20, 30, 22, 11, 15, 20, 12, 10, 14, 10, 8, 8, 5, 10, 8, 6, 6, 7. A short vertical line below the abscissa denotes that an interval of approximately 24 hours elapsed before the next trial. Where the interval was longer it is designated by a figure 2 for two days, 3 for three

它是做动作时直接的体验，区别于经眼睛等获得的、关于已完成动作的观念。因此我说“冲动与动作”，而非单说“动作”。尤其须记住，冲动绝不是动作的动机。日常可说饥饿是使猫抓挠的冲动，本书不会这样用；那类意识始终称“动机”。不愿把行动分为冲动和外在动作的读者，可把本书的“冲动”或“冲动与动作”统称“动作”，但须记住：动物体验为将做、正在做的那一面，才是重要而被联结的东西；已完成、从外部观察的动作，是次要的。我愿用“冲动”专指前者，用通常的“动作”指后者。

猫以储备的本能冲动为起点，偶然碰到成功动作，再逐步把它与箱内的感觉印象联结，直至完善，遇到该印象就行动。每个联结的形成，可用时间曲线表示：横轴每1毫米表示连续一次入箱经历，纵轴每1毫米表示10秒；在横轴相隔1毫米处画垂线，首条在纵轴上，高度为逃出前在箱中所用时间，再连接各垂线顶端。例如第18页图2的“12号在A中”，24次试验时间依次为160、30、90、60、15、28、20、30、22、11、15、20、12、10、14、10、8、8、5、10、8、6、6、7秒。横轴下短竖线表示距下次约24小时；更长间隔以2表示两天、3表示三天依此类推。

days, etc. If the interval was shorter the number of hours is specified by 1 hr., 2 hrs., etc. In many cases the animal failed in some trial to perform the act in ten or fifteen minutes and was then taken out by me. Such failures are denoted by a break in the curve either at its start or along its course. In some cases there are short curves after the main ones. These, as shown by the figures beneath, represent the animal's mastery of the association after a very long interval of time, and may be called memory curves. A discussion of them will come in the last part of the book.

The time-curve is obviously a fair representation of the progress of the formation of the association, for the two essential factors in the latter are the disappearance of all activity save the particular sort which brings success with it, and perfection of that particular sort of act so that it is done precisely and at will. Of these the second is, on deeper analysis, found to be a part of the first; any clawing at a loop except the particular claw which depresses it is theoretically a useless activity. If we stick to the looser phraseology, however, no harm will be done. The combination of these two factors is inversely proportional to the time taken, provided the animal surely wants to get out at once. This was rendered almost certain by the degree of hunger. Theoretically a perfect association is formed when both factors are perfect,—when the animal, for example, does nothing but claw at the loop, and claws at it in the most useful way for the purpose. In some cases (*c. g.*, 2 in K on page 26) neither factor ever gets perfected in a great many trials. In some cases the first factor does but the second does not, and the cat goes at the thing not always in the desirable way. In all cases there is a fraction of the time which represents getting oneself together after being dropped in the box, and realizing where one is. But for our purpose all these matters count little, and we may take the general slope of the curve as representing very fairly the progress of the association. The slope of any particular part of it may be due to accident. Thus, very often the second experience may have a higher time-point than the first, because the first few successes may all be entirely due to accidentally hitting the loop, or whatever it is, and whether the

较短间隔标明“1小时”“2小时”等。动物有时十至十五分钟仍未完成动作，便由我取出；曲线开头或途中断开处表示这种失败。主曲线后有时附短曲线，下方数字表示隔了很长时间后动物重新掌握联结的情况，称“记忆曲线”，书末将讨论。

时间曲线能公正表示联结形成的进程，因为联结形成有两个关键因素：除成功活动外，其他活动消失；成功动作得到完善，能准确、随意作出。深入分析，后者其实属于前者：对圈的抓挠若未以恰当方式压下圈，理论上也是无用活动。暂用较宽松的说法，无妨。只要动物确实想立刻逃出，两因素综合完善程度就与所用时间成反比；饥饿程度使这一前提几乎确定。理论上，两因素都完善时，联结便完善：例如猫只抓圈，并以最有效方式抓。在一些例子中，如第26页“2号在K中”，试验许多次，两因素仍未完善；另一些，第一因素完善，第二未完善，猫并非总以理想方式作用于机关。所有记录都包含入箱后恢复动作、意识到所在位置所花的时间；对本研究影响不大，总体曲线斜率仍可相当公正地表示联结进展。局部斜率可能偶然。例如第二次常比第一次慢，因为最初几次成功可能完全靠偶然碰到圈或其他机关，而这一偶然在哪次更早发生，本是机遇问题。

accident will happen sooner in one trial than another is then a matter of chance. Considering the general slope, it is, of course, apparent that a gradual descent—say, from initial time of 300 sec. to a constant time of 6 or 8 sec. in the course of 20 to 30 trials—represents a difficult association, while an abrupt descent, say in 5 trials, from a similar initial height, represents a very easy association. Thus, 2 in Z, on page 23, is a hard, and 1 in I, on page 22, an easy association.

In boxes A, C, D, E, I, 100 % of the cats given a chance to do so hit upon the movement and formed the association. The following table shows the results where some cats failed.

	No. cats tried.	*No. cats failed.*
F	5	4
G	8	5
H	9	2
J	5	2
K	5	2

The time-curves follow. By referring to the description of apparatus they will be easily understood. Each mm. along the abscissa represents one trial. Each mm. above it represents 10 seconds.

These time-curves show, in the first place, what associations are easy for an animal to form, and what are hard. The act must be one which the animal will perform in the course of the activity which its inherited equipment incites or its previous experience has connected with the sense-impression of a box's interior. The oftener the act naturally occurs in the course of such activity, the sooner it will be performed in the first trial or so, and this is one condition, sometimes, of the ease of forming the association. For if the first few successes are five minutes apart the influence of one may nearly wear off before the next, while if they are forty seconds apart the influences may get summated. But this is not the only or the main condition of the celerity with which an association may be formed. It depends also on the amount of attention given to the act. An act of

总体看，20-30次试验中从最初300秒缓降到稳定6或8秒，表示较难的联结；从相似初值在约5次中陡降，则表示很容易。故第23页“2号在Z中”困难，第22页“1号在I中”容易。

A、C、D、E、I中，所有获得机会的猫都碰到了成功动作并形成联结。其他箱的结果为：F，试验5只、失败4只；G，8只、失败3只；H，9只、失败2只；J，5只、失败2只；K，5只、失败2只。

时间曲线如下，对照装置说明便易理解。横轴每毫米为一次试验，纵轴每毫米为10秒。

这些曲线首先表明，哪些联结容易、哪些困难。动作必须能出现在动物的活动中；这些活动来自遗传禀赋所唤起的冲动，或先前经验与箱内感觉印象建立的联系。某动作在这种活动中越常自然出现，就越可能在早期作出，有时也越容易形成联结。最初几次成功若间隔五分钟，前次影响可能几乎消退，才有下次；若仅隔40秒，影响便可能累积。但这不是形成速度的唯一或主要条件；它还取决于对动作投入多少注意。一个容易受到充分注意的动作，会学得更快。

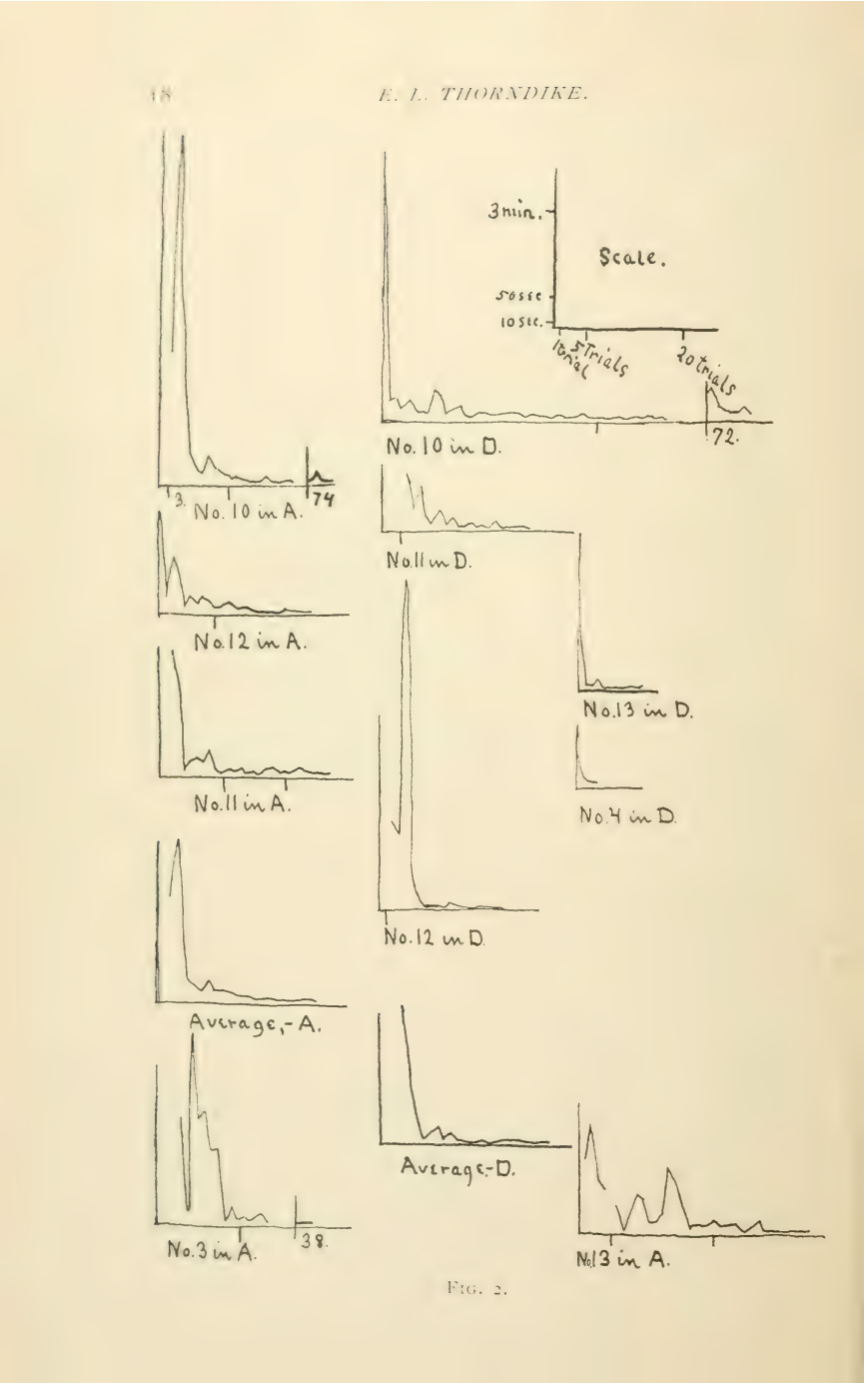


FIG. 2.

图2：猫在A箱和D箱中的时间曲线。

图中文字译法：No.10 in A＝10号猫在A箱中，其他编号同理；Average-A＝A箱平均曲线；Average-D＝D箱平均曲线；Scale＝比例尺；3 min.＝3分钟；30 sec.＝30秒；10 sec.＝10秒；10 trials＝10次试验；20 trials＝20次试验。

横轴每1毫米表示一次试验，纵轴每1毫米表示10秒。横轴下短竖线表示距下次试验约24小时；标注数字或“h.”表示特殊间隔。主曲线后的短曲线为长间隔后复测，详见正文第15-16页。

本页为图版，正文第17页末句接第27页。

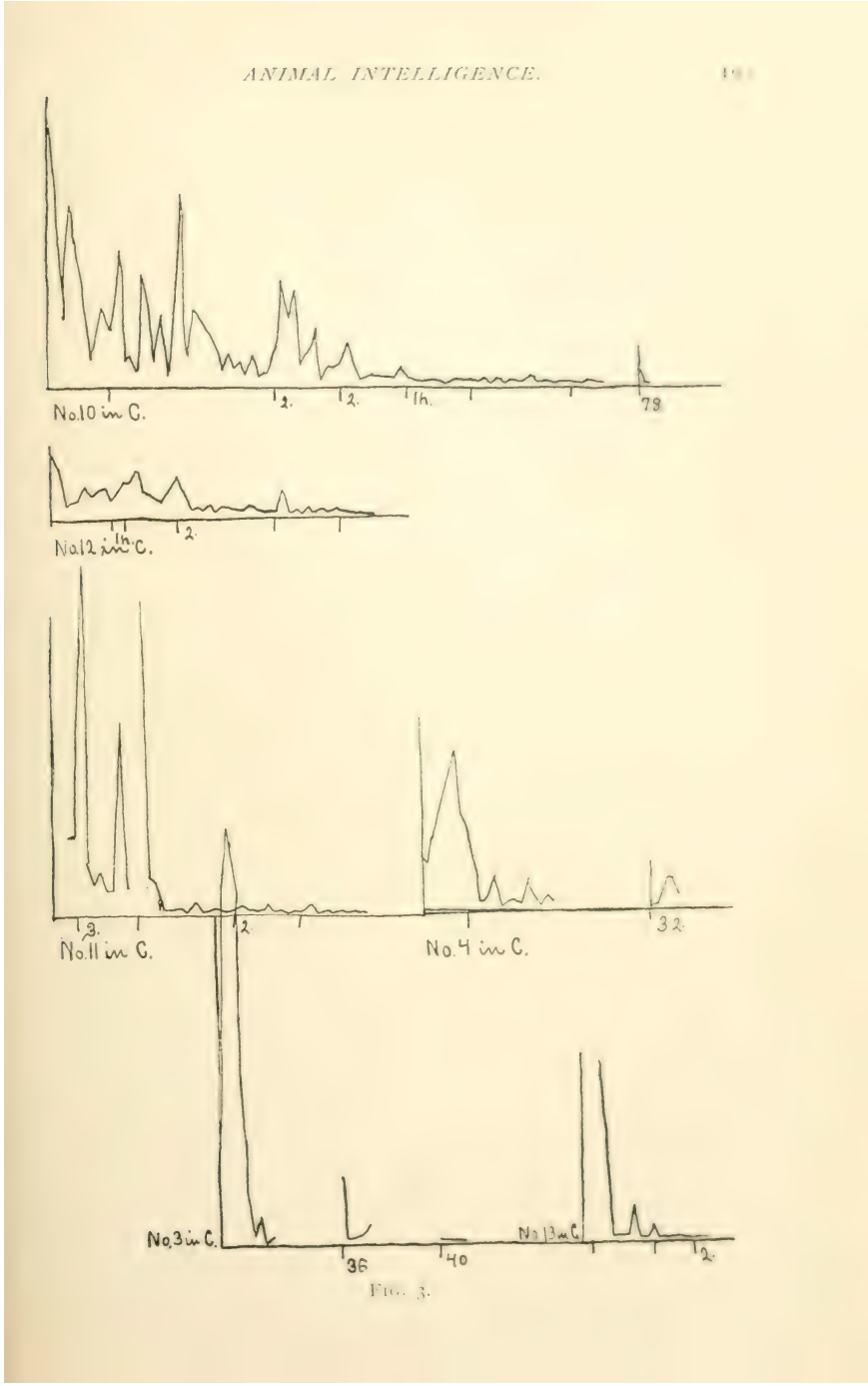


图3：猫在C箱中的时间曲线。

各曲线分别表示10、12、11、4、3、13号猫在C箱中的表现。“No.”为动物编号，“in C”为“在C箱中”。轴的比例及间隔标记，与图2相同；完整曲线和数字保留在左侧原图。

本页为图版，正文第17页末句接第27页。

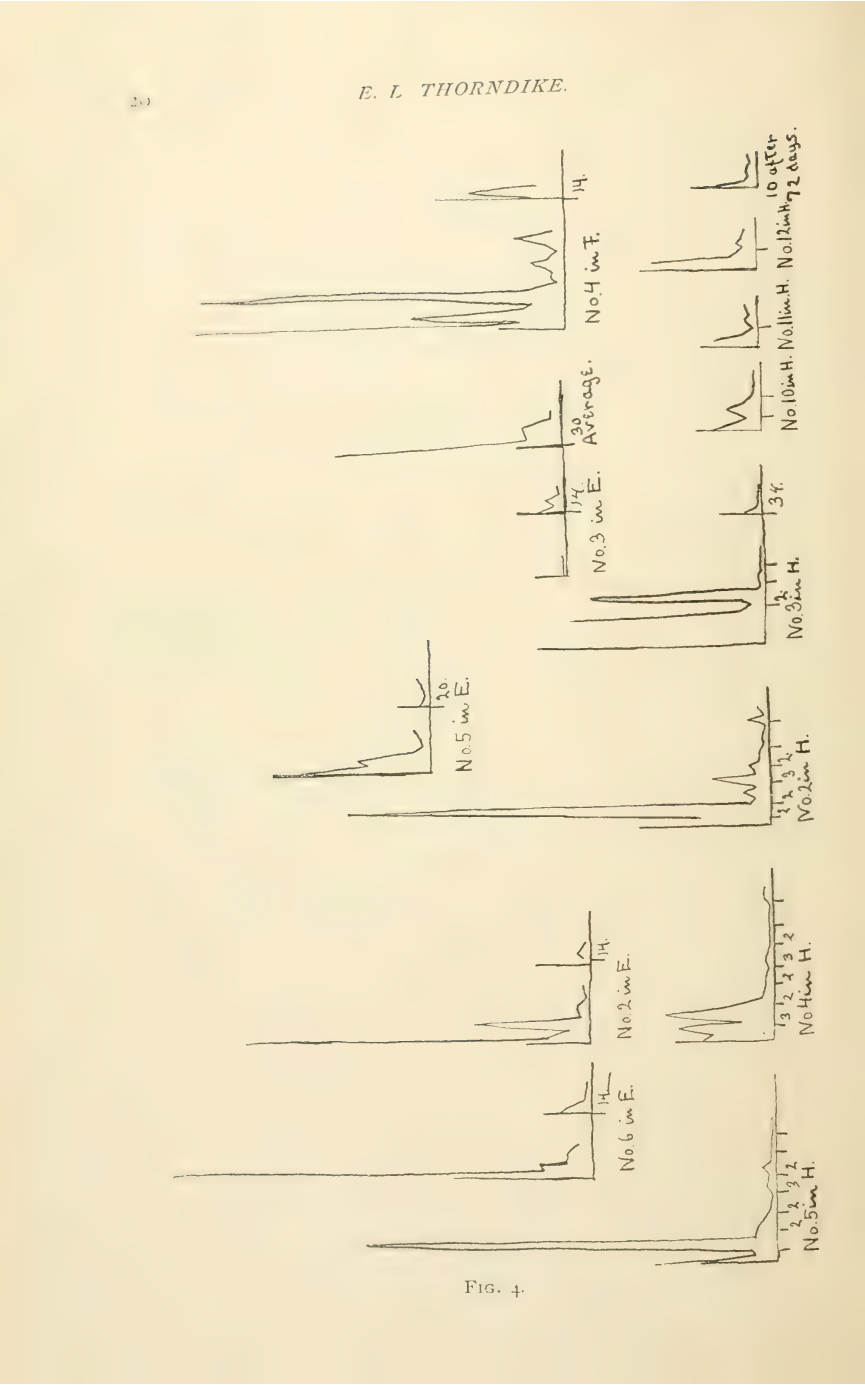


Fig. 4.

图4：猫在E、F和H箱中的时间曲线。

图中“Average”译为“平均”，“No.× in E/F/H”译为“×号猫在E/F/H箱中”；“h.”为小时，“days”为天。比例同前。原图部分曲线横置，数值、间隔和编号依原图保留。

本页为图版，正文第17页末句接第27页。

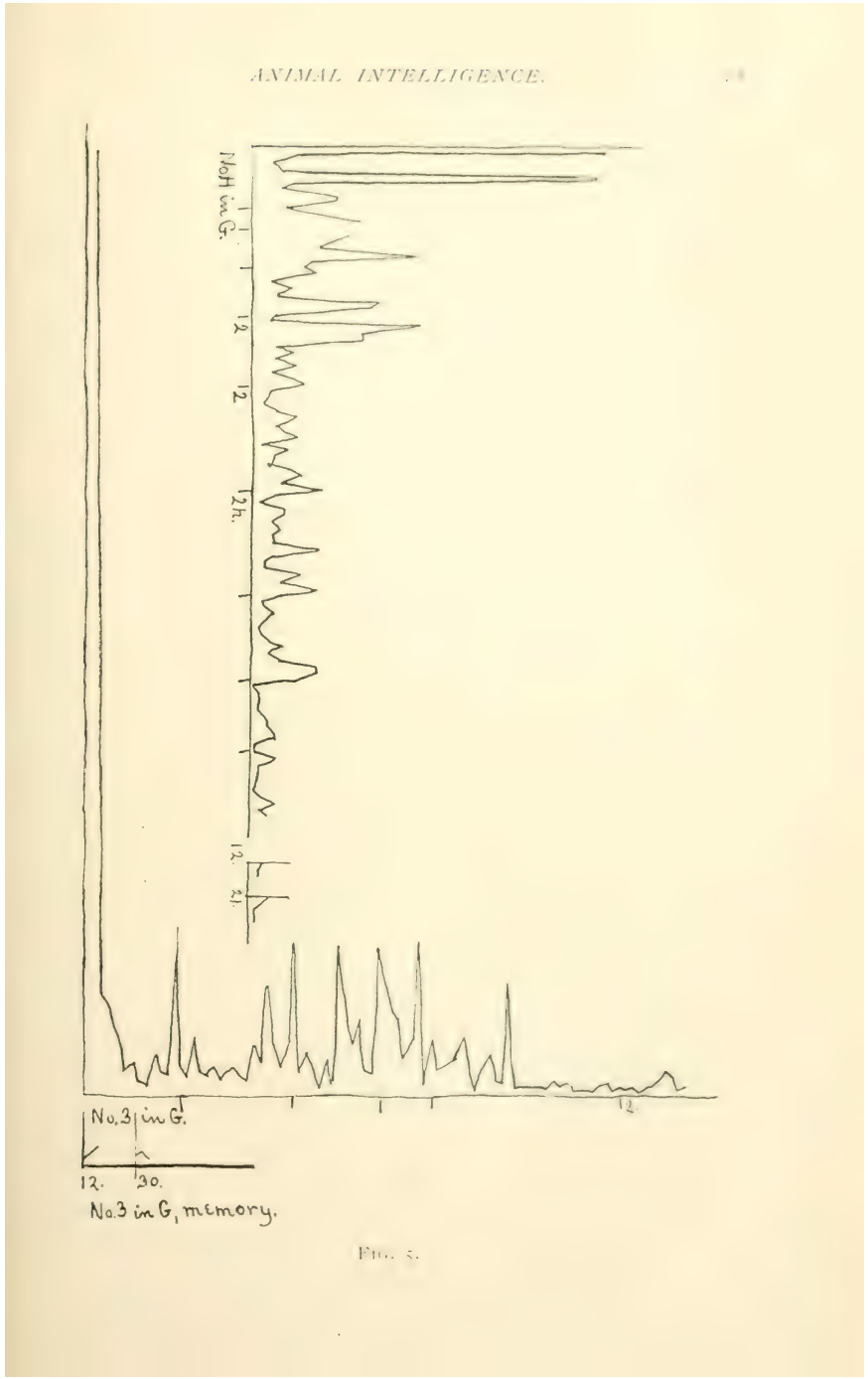


FIG. 5.

图5：猫在G箱中的时间曲线。

图示4号、3号猫在G箱中的表现；“No.3 in G, memory”译为“3号猫在G箱中的记忆曲线”，即间隔后复测结果。比例及间隔标记同前。

本页为图版，正文第17页末句接第27页。

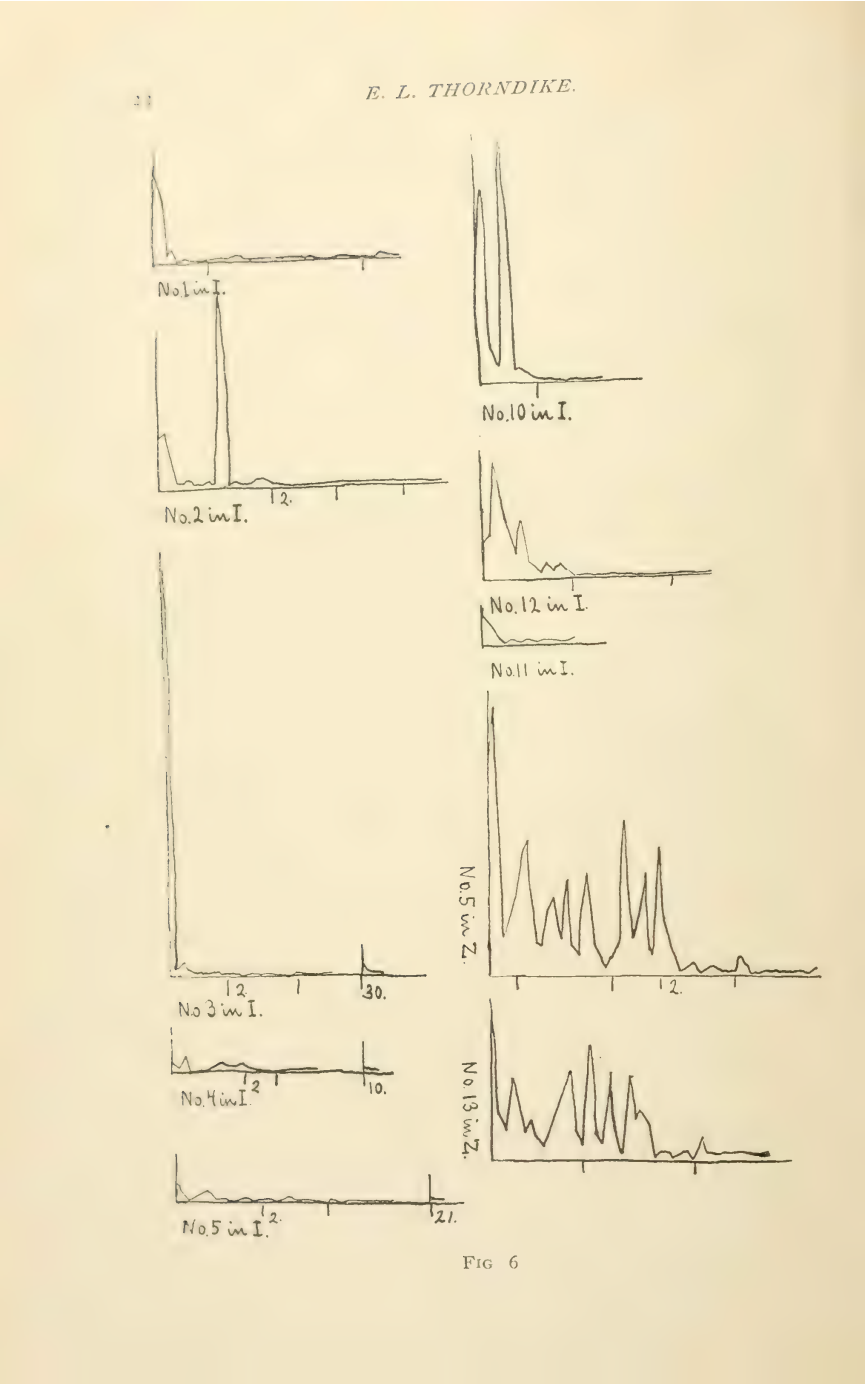


Fig 6

图6：猫在I箱和Z箱中的时间曲线。

左侧及右上图为猫在I箱中的表现；右下图为5号、13号猫在Z箱中的表现。“No.× in I/Z”译为“×号猫在I/Z箱中”。I要求压杠杆；Z以舔或搔自身后获准逃出建立联结。各曲线编号、轴和间隔标记依原图保留。

本页为图版，正文第17页末句接第27页。

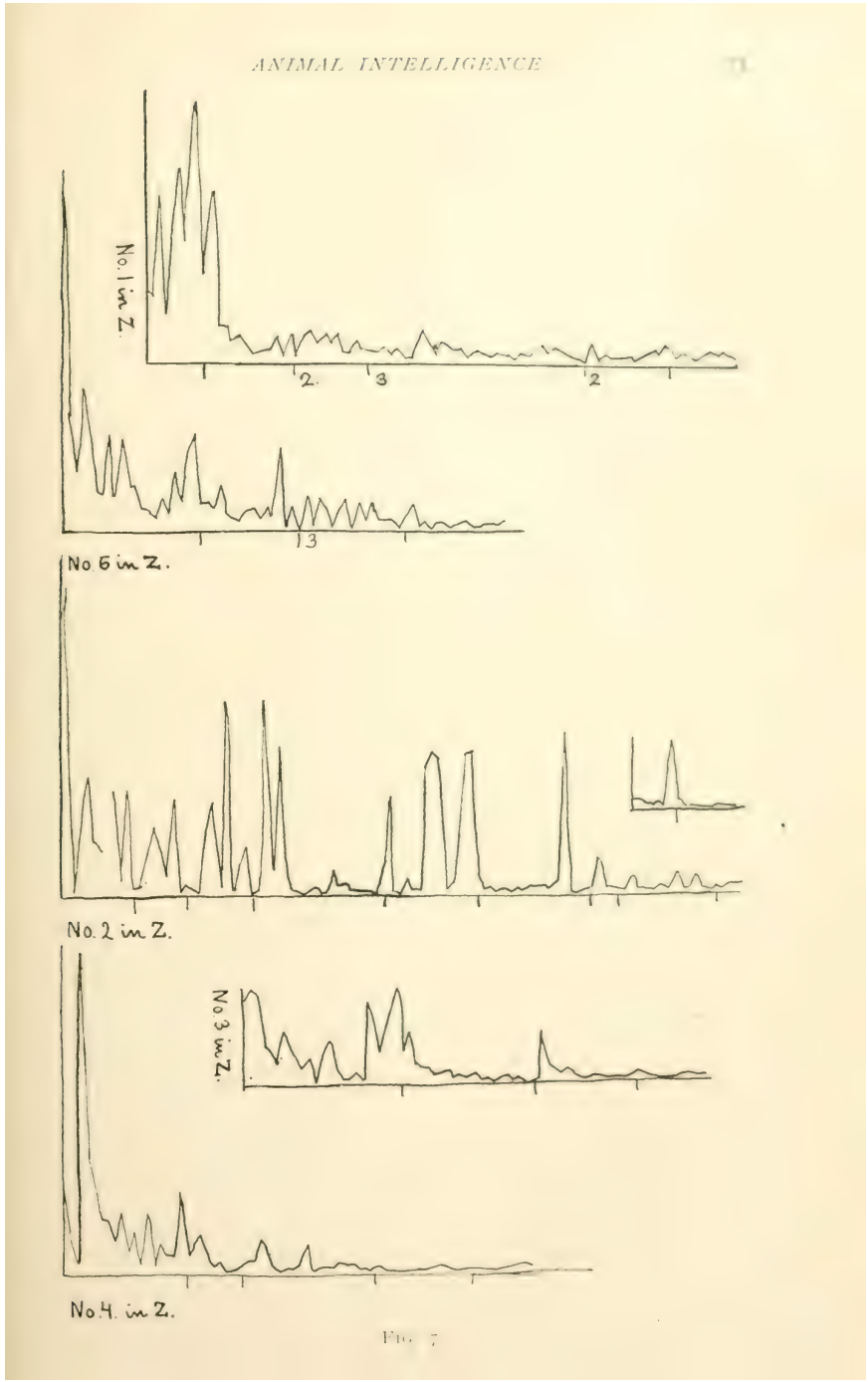


Fig. 7

图7：猫在Z箱中的时间曲线。

图示1、6、2、3、4号猫在Z箱中的表现。“No.× in Z”译为“×号猫在Z箱中”。图中保留全部原始曲线和间隔标记；舔自身、搔自身两类联结的对应关系见第27页正文。

本页为图版，正文第17页末句接第27页。

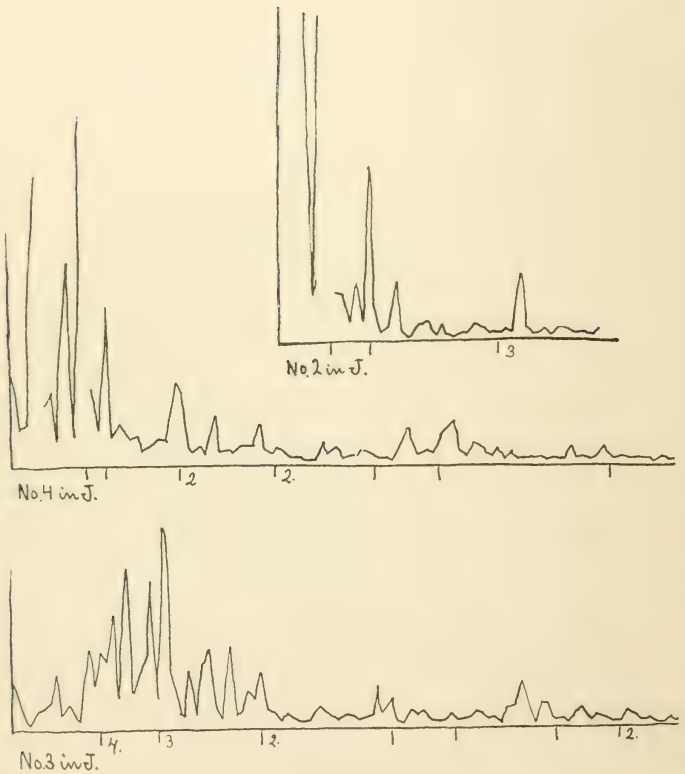


FIG. 8.

图8：猫在J箱中的时间曲线。

图示4号、2号、3号猫在J箱中的表现。“No.× in J”译为“×号猫在J箱中”。J是须先拉圈、再移开撑板并推门的“双重”装置。比例及间隔标记同前。

本页为图版，正文第17页末句接第27页。

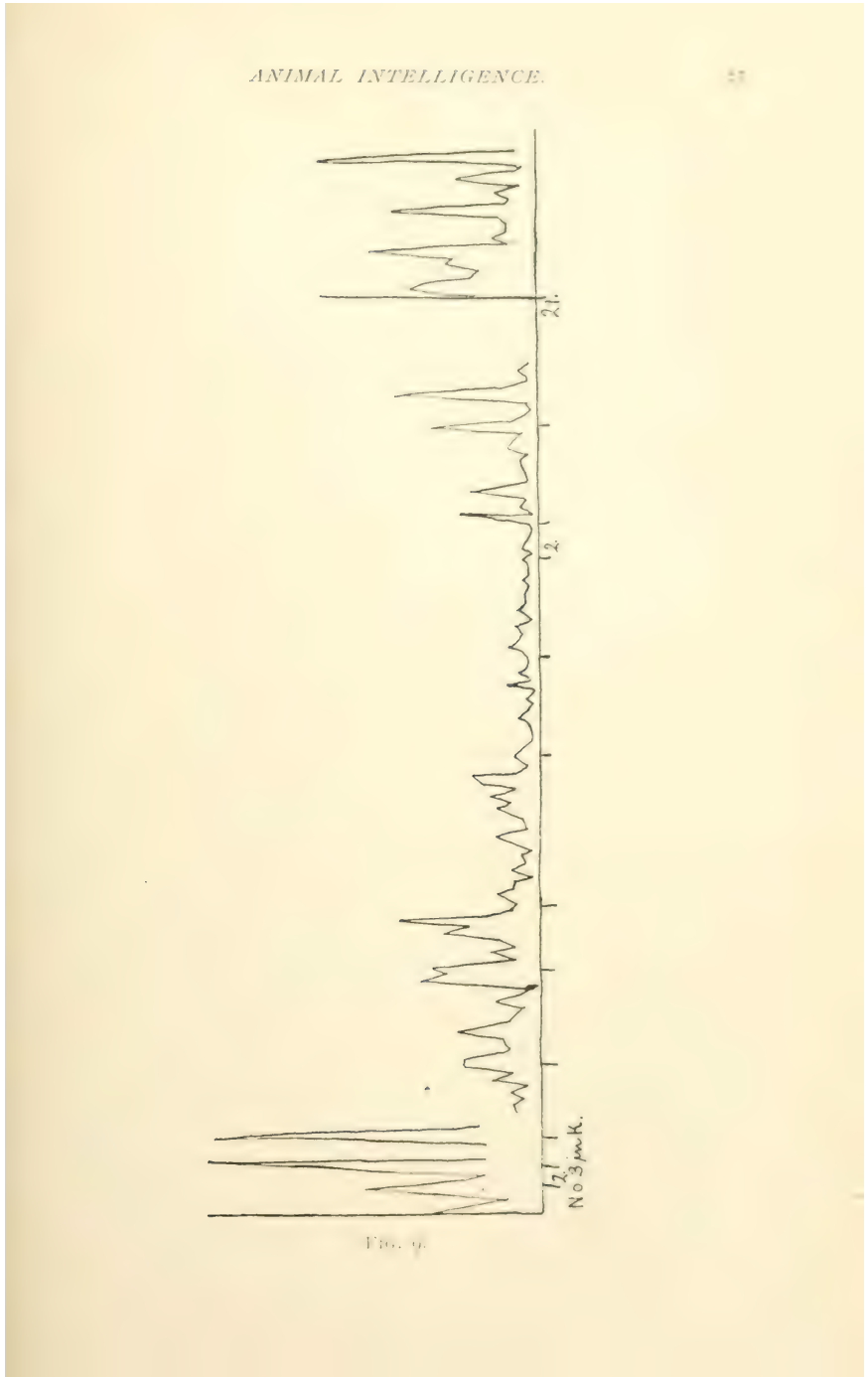


图9：3号猫在K箱中的时间曲线。

“No.3 in K”译为“3号猫在K箱中”。K是需完成三种独立动作的“三重”装置。原图横置，全部曲线与间隔标记保留。

本页为图版，正文第17页末句接第27页。

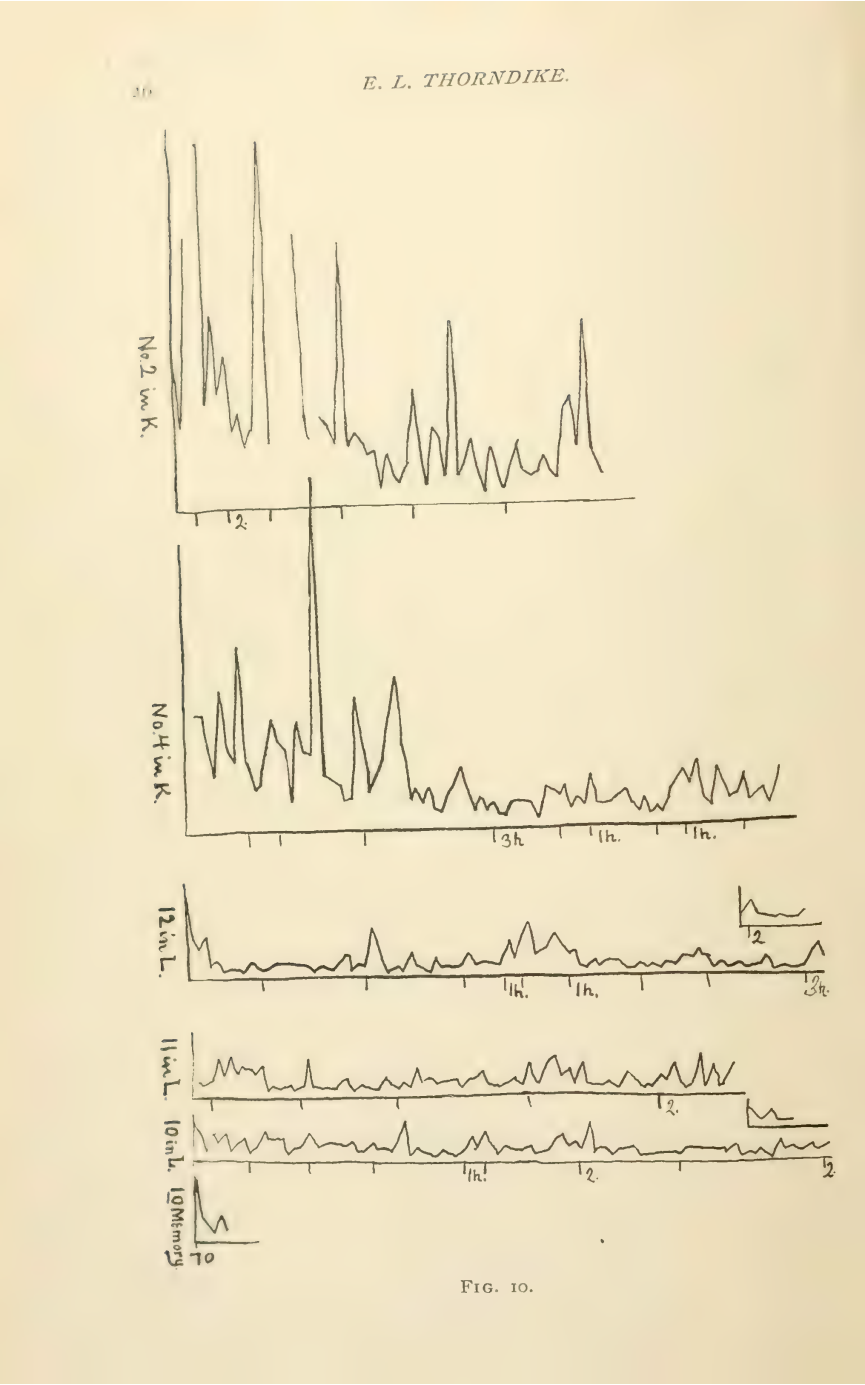


FIG. 10.

图10：猫在K箱和L箱中的时间曲线。

图示2号、4号猫在K箱，以及12号、11号、10号猫在L箱中的表现。“No.× in K/L”译为“×号猫在K/L箱中”；“memory”译为“记忆曲线”；“h.”译为小时。K、L均须三种动作。全部曲线、编号和复测间隔依原图保留。

本页为图版，正文第17页末句接第27页。

the sort likely to be well attended to will be learned more quickly. Here, too, accident may play a part, for a cat may merely happen to be attending to its paw when it claws. The kinds of acts which insure attention are those where the movement which works the mechanism is one which the cat makes definitely to get out. Thus A (O at front) is easier to learn than C (button), because the cat does A in trying to claw down the front of the box and so is attending to what it does, whereas it does C generally in a vague scrabble along the front or while trying to claw outside with the other paw, and so does not attend to the little unimportant part of its act which turns the button round. Above all, *simplicity* and *definiteness* in the act make the association easy. G (thumb-latch), J (double) and K and L (triples) are hard, because complex. E is easy, because directly in the line of the instinctive impulse to try to pull oneself out of the box by clawing at anything outside. It is thus very closely attended to. The extreme of ease is reached when a single experience stamps the association in so completely that ever after the act is done at once. This is approached in I and E. In these experiments the sense-impressions offered no difficulty one more than the other.

Vigor, abundance of movements, was observed to make differences between individuals in the same association. It works by shortening the first times, the times when the cat still does the act largely by accident. Nos. 3 and 4 show this throughout. Attention, often correlated with lack of vigor, makes a cat form an association quicker after he gets started. No. 13 shows this somewhat. The absence of a fury of activity let him be more conscious of what he did do.

The curves on pages 22 and 23 showing the history of cats 1, 5, 13 and 3, which were let out of the box Z when they licked themselves, and of cats 6, 2, and 4, which were let out when they scratched themselves, are interesting because they show associations where there is no congruity (no more to a cat than to a man) between the act and the result. One chick, too, was thus freed whenever he pecked at his feathers to dress them. He formed the association, and would whirl his head round and poke it into the feathers as soon as dropped in the box. There

中文译文

偶然也起作用：猫抓挠时可能恰巧注意爪。能保证注意的，是猫明确为逃出而作的、直接触动机关的动作。因此A前圈比C旋钮容易学：猫在A中试图抓开前壁，注意自己所做的；在C中却常在前壁乱抓，或另一爪伸向外面时碰转旋钮，不注意这小而无关紧要的一部分。尤其是动作简单、明确，联结就容易。G拇指门闩、J双重、K和L三重，都因复杂而难；E与抓外物、把自己拉出箱的本能冲动直接一致，注意高度集中，因此容易。一次经验能在行动完后立刻巩固联结是最简单的情形；I、E接近于此。各实验的感觉印象本身，并无相对难易之分。

活动旺盛、动作多，造成同一联结中的个体差异，主要缩短最初仍靠偶然成功时的时间。3、4号一贯如此。注意常与不猛烈活动相关，却使猫在开始学习后更快形成联结；13号多少如此。没那么猛烈的活动，让它更清楚自己实际所做的。

第22、23页中，1、5、13、3号舔自身后被放出Z箱，6、2、4号搔自身后被放出；这些曲线有趣，因为动作和结果，无论对猫还是人，都没有相称关系。一只小鸡也在啄羽整理时被释放；它形成联结，入箱便转头啄羽。在这些例子中都明显倾向于缩减动作，最终只剩舔或搔的痕迹，原因我不知道。

is in all these cases a noticeable tendency, of the cause of which I am ignorant, to diminish the act until it becomes a mere vestige of a lick or scratch. After the cat gets so that it performs the act soon after being put in, it begins to do it less and less vigorously. The licking degenerates into a mere quick turn of the head with one or two motions up and down with tongue extended. Instead of a hearty scratch, the cat waves its paw up and down rapidly for an instant. Moreover, if sometimes you do not let the cat out after this feeble reaction, it does not at once repeat the movement, as it would do if it depressed a thumb-piece, for instance, without success in getting the door open. Of the reason for this difference I am again ignorant.

Previous experience makes a difference in the quickness with which the cat forms the associations. After getting out of six or eight boxes by different sorts of acts the cat's general tendency to claw at loose objects within the box is strengthened and its tendency to squeeze through holes and bite bars is weakened; accordingly it will learn associations along the general line of the old more quickly. Further, its tendency to pay attention to what it is doing gets strengthened, and this is something which may properly be called a change in degree of intelligence. A test was made of the influence of experience in this latter way by putting two groups of cats through I (lever), one group (1, 2, 3, 4, 5) after considerable experience, the other (10, 11, 12) after experience with only one box. As the act in I was not along the line of the acts in previous boxes, and as a decrease in the squeezings and bitings would be of little use in the box as arranged, the influence of experience in the former way was of little account. The curves of all are shown on page 22.

If the whole set of curves are examined in connection with the following table, which gives the general order in which each animal took up the different associations which he eventually formed, many suggestions of the influence of experience will be met with. The results are not exhaustive enough to justify more than the general conclusion that there is such an influence. By taking more individuals and thus eliminating all other factors besides experience, one can easily show just how and how far experience facilitates association.

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猫已能入箱很快行动后，动作就越来越轻：舔变成快速转头、伸舌上下动一两次；有力的搔变成短暂快速摆爪。若有时不在这种微弱反应后放出，它不会立刻重做；这不同于按门闩却未开门时的重复。原因我同样不知道。

先前经验影响联结形成速度。通过不同动作逃出六至八箱后，抓箱内松动物体的倾向加强，挤孔、咬栏的倾向减弱；于是与旧动作同方向的新联结学得更快。此外，注意自己正在做什么的倾向增强，这可恰当地称为智慧程度的变化。我用两组猫在I杠杆箱中检验后一影响：1-5号已有丰富经验，10-12号只接触过一个箱。I的动作不同于旧箱动作，减少挤、咬在此箱也少有帮助，因此前一影响不大。全部曲线见第22页。

把整组曲线同下页表格结合考察--该表列各猫最终形成的联结的大致学习次序--会发现经验影响的许多迹象。结果尚不够全面，只足以得出经验确有影响的一般结论。采用更多个体，排除经验以外的因素，便能显示经验究竟如何、在多大程度上促进联结。

When in this table the letters designating the boxes are in italics it means that, though the cat formed the association, it was in connection with other experiments and so is not recorded in the curves.

Cat 1	*A B C* D_1 *D Z* I
" 2	*C* D_1 *D* E Z H J I K
" 3	A C E G H J Z I K
" 4	C F G D Z H J I K
" 5	*C* E Z H I
" 6	*A C* E Z
" 7	*A C*
" 10	C I A H D L
" 11	C I A H D L
" 12	C I A H D L
" 13	A C D G Z

The advantage due to experience in our experiments is not, however, the same as ordinarily in the case of trained animals. With them the associations are with the acts or voice of man or with sense impressions to which they naturally do not attend (*e. g.*, figures on a blackboard, ringing of a bell, some act of another animal). Here the advantage of experience is mainly due to the fact that by such experience the animals gain the habit of attending to the master's face and voice and acts and to sense impressions in general.

I made no attempt to find the differences in ability to acquire associations due to age or sex or fatigue or circumstances of any sort. By simply finding the average slope in the different cases to be compared, one can easily demonstrate any such differences that exist. So far as this discovery is profitable, investigation along this line ought now to go on without delay, the method being made clear. Of differences due to difference in the species, genus, etc. Of the animals I will speak after reviewing the time-curves of dogs and chicks.

In the present state of animal psychology there is another

表中表示箱子的字母若用斜体，意为猫确实形成联结，但发生在其他实验中，故不记入本书曲线。表格列各编号猫学习各箱的顺序；动物编号、装置字母及其排列完整保留在左页，字母对应第8-12页装置说明。

本实验中经验的优势，不同于通常训练动物的优势。后者建立的是与人的动作、声音，或自然不注意的感觉印象之间的联结，例如黑板数字、铃声、其他动物的动作。经验的优势主要在于动物由此养成注意主人面孔、声音、动作以及一般感觉印象的习惯。

我没有研究年龄、性别、疲劳或各种情境造成的联结学习差异。比较各组曲线平均斜率，便容易证明存在的这类差异。只要值得研究，方法既已明确，就应立即沿此方向继续。物种、属等不同造成的差异，将在介绍狗和小鸡的曲线之后讨论。

就动物心理学目前的状况而言，这些结果还有另一种价值，正是我开始就特别想获得的：定量估计普通猫能做什么。

value to these results which was especially aimed at by the investigator from the start. They furnish a quantitative estimate of what the average cat can do, so that if any one has an animal which he thinks has shown superior intelligence or perhaps reasoning power, he may test his observations and opinion by taking the time-curves of the animal in such boxes as I have described.[1]

If his animal in a number of cases forms the associations very much more quickly, or deals with the situation in a more intelligent fashion than my cats did, then he may have ground for claiming in his individual a variation toward greater intelligence and possibly intelligence of a different order. On the other hand, if the animal fails to rise above the type in his dealings with the boxes, the observer should confess that his opinion of the animal's intelligence may have been at fault and should look for a correction of it.

We have in these time-curves a fairly adequate measure of what the ordinary cat can do, and how it does it, and in similar curves soon to be presented a less adequate measure of what a dog may do. If other investigators, if especially all amateurs who are interested in animal intelligence, will take other cats and dogs, especially those supposed by owners to be extraordinarily intelligent, and experiment with them in this way, we shall soon get a notion of how much variation there is among animals in the direction of more or superior intelligence. The beginning here made is meager but solid. The knowledge it gives needs to be much extended. The variations found in individuals should be correlated not merely with supposed superiority in intelligence, a factor too vague to be very serviceable, but with observed differences in vigor, attention, memory and muscular skill. No phenomena are more capable of exact and thorough investigation by experiment than the associations of animal consciousness. Never will you get a better psychological subject than a hungry cat. When the crude beginnings of this research have been improved and replaced by more ingen-

[1] To any such person who may chance to read this monograph I may say that I will gladly furnish him photographs of the boxes, so that he may work with exact duplicates of them.

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若有人认为某动物显出更高智慧或推理能力，就可让它接受我所描述的箱子实验，记录时间曲线，检验自己的观察和判断［原注］。若该动物在许多例子中明显更快形成联结，或处理情境比我的猫更聪明，便可能有理由主张它具有朝更高智慧的变异，甚至不同层次的智慧。反之，若它处理箱子的表现不超过普通类型，观察者就该承认原判断可能有错，并寻求修正。

这些曲线相当充分地测量普通猫能做什么、怎样做；即将介绍的类似曲线，对狗能做什么的测量还不够充分。其他研究者，尤其所有关心动物智慧的业余爱好者，若把其他猫狗、特别是主人认为异常聪明的个体，按此方法实验，我们很快便能了解动物在更高、优越智慧方向的变异幅度。这一起步虽微薄，却扎实，知识仍须大幅扩展。个体变异不应只同模糊而不实用的“智慧优越”联系，而应同观察到的活力、注意、记忆、肌肉技巧差异联系。没有什么现象比动物意识中的联结更适合精确、充分的实验研究；也难找到比饥饿的猫更好的心理学被试。当本研究粗糙的开端，被更巧妙、更熟练的实验者改进、取代，结果应很有价值。

原注：读到本专著而有意这样做的人，我很乐意提供箱子的照片，供制作完全相同的装置。

ious and adroit experimenters, the results ought to be very valuable.

Surely every one must agree that no man now has a right to advance theories about what is in animals' minds or to deny previous theories unless he supports his thesis by systematic and extended experiments. My own theories, soon to be proclaimed, will doubtless be opposed by many. I sincerely hope they will, provided the denial is accompanied by actual experimental work. In fact I shall be tempted again and again in the course of this book to defend some theory, dubious enough to my own mind, in the hope of thereby inducing some one to oppose me and in opposing me to make the experiments I have myself had no opportunity to make yet. Probably there will be enough opposition if I confine myself to the theories I feel sure of.

Experiments with Dogs.

The boxes used were as follows:

AA was similar to A (O at front), except that the loop was of stiff cord ⅜ inch in diameter and was larger (3½ inches diameter); also it was hung a foot from the floor and 8 inches to the right of the door. The box itself was 41 × 20 × 23.

BB was similar to B, the loop being the same as in AA, and being hung a foot from the floor. The box was of the same size and shape as AA.

BB1 was like BB, but the loop was hung 18 inches from the floor.

CC was similar to C (Button), but the button was 6 inches long, and the box was 36½ × 22 × 23.

II was similar to I, but the box was 30 × 20 × 25 inches: the door (11 inches wide, 6 high) was in the left front corner, and the lever was 6 inches long and entered the box at a point 2 inches to the right of the door and 4 inches above the floor.

In M the same box as in II was used, but instead of a lever projecting inside the box, a lever running outside parallel to the plane of the front of the box and 18 inches long was used. This lay close against the bars composing the front of the box, and could be pawed down by sticking the paw out an inch or

任何人若不能以系统、广泛的实验支持主张，都无权提出关于动物心理内容的理论，或否定以往理论。我接下来要阐述的理论，无疑会遭到不少人的反对。只要反对者愿意开展实际的实验研究，我就衷心希望有人来反对我。
事实上，在本书的论述中，我可能会不止一次地想为某些连自己都还存疑的理论辩护，希望借此引来他人的反驳，促使他们在反驳我的过程中，去做那些我自己尚无机会开展的实验。不过，即使我只提出那些自己有把握的理论，恐怕也已经会招来足够多的反对了。

狗的实验

AA：类似A前圈，但圈以3/8英寸粗的硬绳制成，圈直径3½英寸，距地1英尺、门右8英寸；箱体41×20×23英寸。

BB：类似B，圈与AA相同，距地1英尺；箱形、大小同AA。BB1：同BB，但圈距地18英寸。

CC：类似C旋钮，但旋钮长6英寸，箱体36½×22×23英寸。

II：类似I，箱体30×20×25英寸；门宽11、高6英寸，在前左角。杠杆长6英寸，从门右2英寸、距地4英寸处进入。

M：与II同箱，但杠杆不向箱内伸，改用在箱外平行前壁的18英寸长杆，紧贴前壁栏条；把爪伸出栏间约1英寸在距地约15英寸、距前壁右缘6英寸处，就可把杆抓下。M称“外杠杆”。

so between two bars, at a point about 15 inches high and 6 inches in from the right edge of the front. We may call M '*Lever outside*.'

N was a pen 5×3 feet made of wire netting 46 inches high. The door, 31×20, was in the right half of the front. A string from the bolt passed up over a pulley and back to the back center, where it was fastened 33 inches above the floor. Biting or pawing this string opened the door.

O was like K, except that there was only one bar, that the string ran inside the box, so that it was easily accessible, and that the bolt raised in K by depression of the platform could be raised in O (and was by the dog experimented on) by sticking the muzzle out between two bars just above the bolt and by biting the string, at the same time jerking it upward. O was 30×20×25 in size.

The box G was used for both dogs and cats, without any variation save that for dogs the resistance of the door to pressure outwards was doubled.

In these boxes were put in the course of the experiments dog 1 (about 8 months old), and dogs 2 and 3, adults, all of small size.

A dog who, when hungry, is shut up in one of these boxes is not nearly so vigorous in his struggles to get out as is the young cat. And even after he has experienced the pleasure of eating on escape many times he does not try to get out so hard as a cat, young or old. He does try to a certain extent. He paws or bites the bars or screening, and tries to squeeze out in a tame sort of way. He gives up his attempts sooner than the cat, if they prove unsuccessful. Furthermore his attention is taken by the food, not the confinement. He wants to get *to* the food, not *out of* the box. So, unlike the cat, he confines his efforts to the front of the box. It was also a practical necessity that the dogs should be kept from howling in the evening, and for this reason I could not use as a motive the utter hunger which the cats were made to suffer. In the morning, when the experiments were made, the dogs were surely hungry, and no experiment is recorded in which the dog was not in a state to be willing to make a great effort for a bit of

N：金属网围栏，5×3英尺，网高46英寸；门31×20英寸，位于前壁右半。门闩的绳经滑轮至后中央，固定在距地33英寸处，咬或抓绳便开门。

O：类似K，但仅一个外挡杆；绳走箱内，易够到；K中由压平台抬起的门闩，在O中受试狗可把嘴巴伸到闩上两栏之间，咬绳同时向上猛拉而抬起。尺寸30×20×25英寸。

G同时用于狗、猫；唯一改变是狗实验中把向外推门的阻力加倍。

参加实验的狗有1号，约8个月，2号和3号已成年，体形都小。

饥饿的狗关入箱中，挣扎远不如幼猫猛烈；即使多次逃出后尝到食物的愉快，仍不如猫，无论幼猫还是成年猫。它也抓咬栏条、网，温和地挤出口，失败后较早放弃。它注意的是食物而非禁闭，想的是接近食物而非离开箱子。因此不同于猫，它把努力限制在前壁。又因实际需要，必须避免狗夜间嚎叫，所以不能像猫那样以极度饥饿作为动机。早晨实验时，狗确实饥饿；所有记入的实验，狗都愿为一块肉作很大努力，但动机可能不像猫那样始终稳定、相等。

meat, but the motive may not have been even and equal throughout, as it was with the cats.

The curves which follow are to be interpreted in the same way as those for the cats, and are on the same scale. The order in which No. 1 took up the various associations was AA, BB, BB1, G, N, CC, II, O.

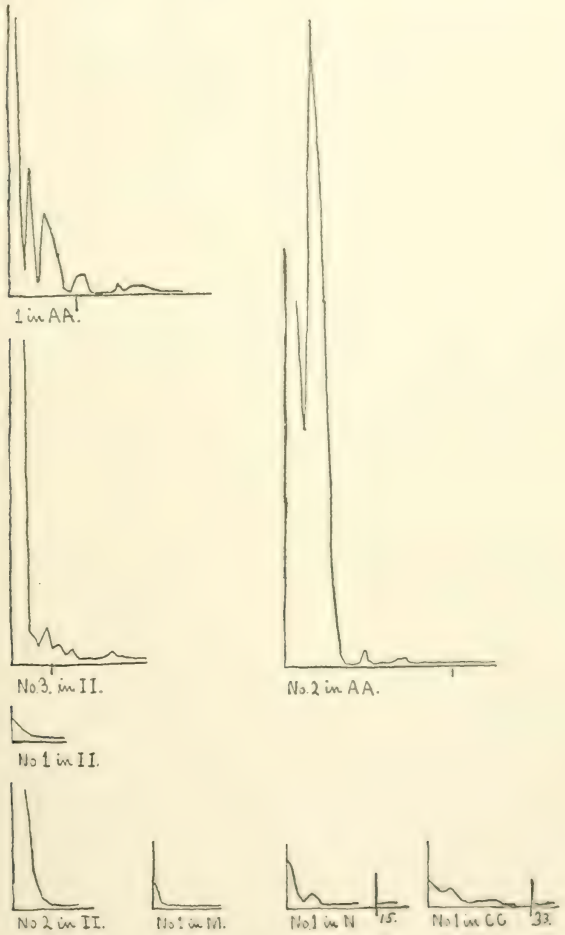


FIG. 11.

以下曲线的解释及比例与猫相同。1号学习各联结的顺序为AA、BB、BB1、G、N、CC、II、O。

图11：狗的时间曲线。图中动物编号、箱子代号、原始曲线和复测间隔完整保留。“No.× in AA/II/M/N/CC”译为“×号狗在相应箱中”；横轴为连续试验，纵轴每毫米10秒。

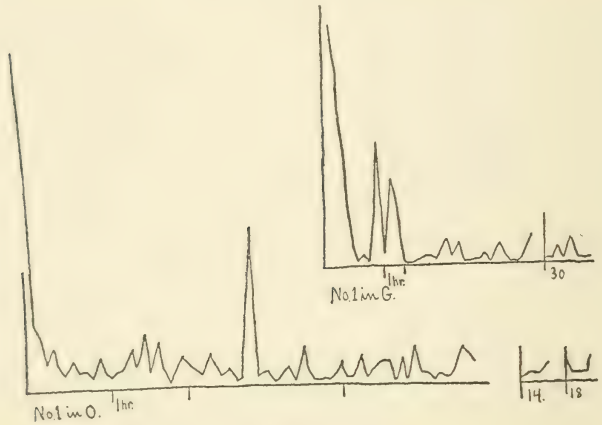


FIG. 12.

The percentage of dogs succeeding in the various boxes is given below, but is of no consequence, because so few were tried, and because the motive, hunger, was not perhaps strong enough, or equal in all cases.

In AA 3 out of 3.
" BB 0 " " 2 (that is, without previous experience of AA).
In CC 1 out of 2.
" II 3 " " 3.
" M 1 " " 2.
" N 1 " " 3.
" G 1 " " 3.

EXPERIMENTS WITH CHICKS.

The apparatus was as follows:

P was simply a small pen arranged with two exits, one leading to the enclosure where were the other chicks and food, one leading to another pen with no exit. The drawing (Fig. 13 on page 35) explains itself. A chick was placed at A and left to find its way out. The walls were made of books stuck up on end.

Q was a similar pen arranged so that the real exit was harder to find. (See Fig. 14.)

图12：1号狗在G箱和O箱中的时间曲线。“No.1 in G/O”译为“1号狗在G/O箱中”；“hr.”为小时。

各箱成功比例列于下，但意义不大，因为狗数太少，饥饿动机可能不够强，各次也未必相等：AA为3只中3只；BB为2只中0只，指先前没有AA经验；CC为2只中1只；II为3只中3只；M为2只中1只；N为3只中1只；G为3只中1只。

小鸡的实验

装置如下。P为两出口的小围栏，一个通往有其他小鸡、食物的围栏，另一个通往无出口的围栏。第35页图13足以说明。小鸡置于A，任其寻找出口；围墙用竖立的书搭成。

Q类似，但真正出口更难找到，见图14。

R was still another pen similarly constructed, with four possible avenues to be taken. (See Fig. 15.)



Fig. 13.

Fig. 14.

Fig. 15.

S was a pen with walls 11 inches high. On the right side an inclined plane of wire screening led from the floor of the pen to the top of its front wall. Thence the chick could jump down to where its fellows and the food and drink were. S was 17 × 14 in size.

T was a pen of the same size as S, with a block of wood 3 inches by 3 and 2 inches high in the right back corner. From this an inclined plane led to the top of the front wall (on the right side of the box). But a partition was placed along the left edge of this plane, so that a chick could reach it only via the wooden block, not by a direct jump.

U was a pen 16 × 14 × 10 inches. Along the back toward the right corner were placed a series of steps 1½ inches wide, the first 1, the second 2, and the third 3 inches high. In the corner was a platform 4 × 4, and 4 high, from which access to the top of the front wall of the pen could be gained by scrambling up inside a stovepipe 11 inches long, inclined upward at an angle of about 30°. From the edge of the wall the chick could of course jump down to food and society. The top of the pen was covered so that the chick could not from the platform jump onto the edge of the stovepipe or the top of the pen wall. The only means of exit was to go up the steps to the platform, up through the stovepipe to the front wall, and then jump down.

The time-curves for chicks 90, 91, 92, 93, 94 and 95, all 2–8 days old when experimented on, follow on page 37. The scale is the same as that in the curves of the cats and dogs.

R也是类似围栏，有四条可能选择的路径，见图15。

图13、14、15分别为P、Q、R的布局；A为小鸡放入位置。

S的墙高11英寸；右侧金属网斜面，从地面通到前墙顶，小鸡再跳到同伴及食物、饮水所在处。底面17×14英寸。

T大小同S，后右角有长宽各3英寸、高2英寸木块，斜面由此通至前墙顶，沿箱右侧。斜面左缘有隔板，令小鸡只能经木块进入，不能直接跳上。

U尺寸16×14×10英寸。沿后壁向右角设置一列宽1½英寸的台阶；三阶分别高1、2、3英寸。角上为4×4英寸、高4英寸的平台。从平台可爬进11英寸长、向上约30°倾斜的炉管，通到前墙顶，再跳至食物和同伴处。围栏顶部有盖，不能从平台直接跳到管缘或墙顶；唯一出口，是上阶到平台、爬管到前墙，再跳下。

第37页列90-95号小鸡的曲线，实验时均2-8日龄；比例与猫狗相同。

Besides these simple acts, which any average chick will accidentally hit upon and associate, there are, in the records of my preliminary study of animal intelligence, a multitude of all sorts of associations which some chicks have happened to form. Chicks have escaped from confinement by stepping on a little platform in the back of the box, by jumping up and pulling a string like that in D, by pecking at a door, by climbing up a spiral staircase and out through a hole in the wall, by doing this and then in addition walking across a ladder for a foot to another wall from which they could jump down, etc., etc. Not every chick will happen upon the right way in these cases, but the chicks who did happen upon it all formed the associations perfectly after enough trials.

The behavior of the chicks shows the same general character as that of the cat, conditioned, of course, by the different nature of the instinctive impulses. Take a chick put in T (inclined plane) for an example. When taken from the food and other chicks and dropped into the pen he shows evident signs of discomfort; he runs back and forth, peeping loudly, trying to squeeze through any openings there may be, jumping up to get over the wall, and pecking at the bars or screen, if such separate him from the other chicks. Finally, in his general running around he goes up the inclined plane a way. He may come down again, or he may go on up far enough to see over the top of the wall. If he does, he will probably go running up the rest of the way and jump down. With further trials he gains more and more of an impulse to walk up an inclined plane when he sees it, while the vain running and pecking, etc., are stamped out by the absence of any sequent pleasure. Finally, the chick goes up the plane as soon as put in. In scientific terms this history means that the chick, when confronted by loneliness and confining walls, responds by those acts which in similar conditions in nature would be likely to free him. Some one of these acts leads him to the successful act, and the resulting pleasure stamps it in. Absence of pleasure stamps all others out. The case is just the same as with dogs and cats. The time-curves are shown in Fig. 16.

Coming now to the question of differences in intelligence

除普通小鸡都能偶然碰到并建立联结的这些简单动作外，初步研究记录还包括许多小鸡偶然形成的其他联结：踩箱后小平台、跳起拉类似D箱的绳、啄门、爬螺旋阶梯从墙孔逃出，或再走过一英尺长的梯子到另一墙边跳下，等等。不是每只都会找到正确方式；但找到者经足够试验，都完善地形成联结。

小鸡行为总体与猫相同，当然受本能冲动不同所制约。以放入T斜面箱为例：离开食物、同伴后显出不适，来回跑、大声叫、挤孔、跳墙；若栏条或网与同伴相隔，就啄它们。最终乱跑时上了斜面一点，可能退下，也可能继续至看见墙外；若看见，多半会走完余路跳下。反复试验中，看见斜面便走上的冲动增强，徒劳跑、啄等因无愉快结果而被消除；最终入箱立即上斜面。

科学地说，孤独和围闭墙壁引出的，是在自然中类似条件下可能令小鸡脱困的动作；某一动作引向成功，结果的愉快将它巩固，无愉快将其他动作消除。这同猫狗完全一样。时间曲线见图16。

现在讨论不同动物的智慧差异。显然，这类差异难准确估计。

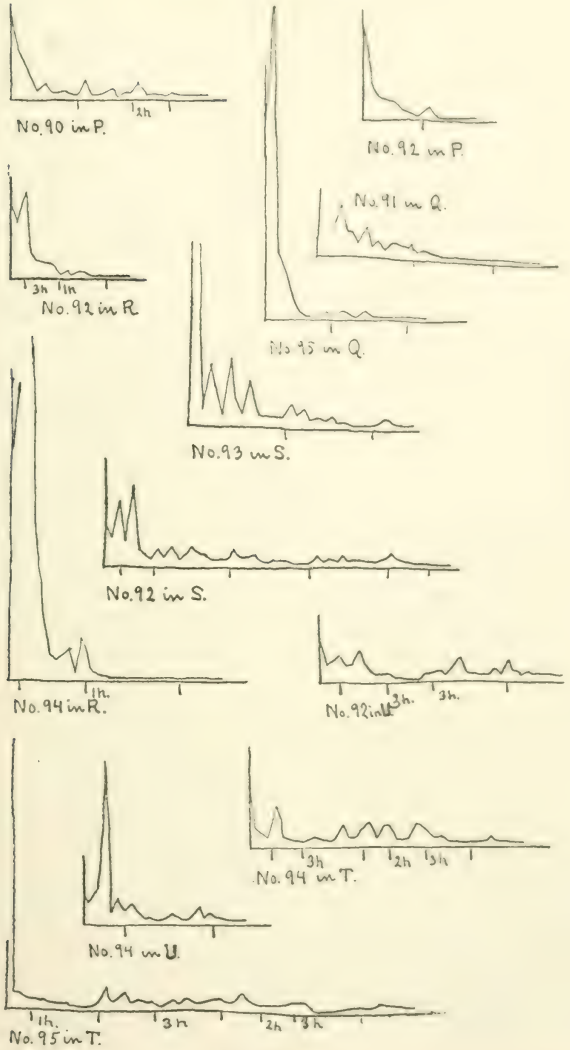


FIG. 16.

between the different animals, it is clear that such differences are hard to estimate accurately. The chicks are surely very

中文译文

图16：小鸡的时间曲线。图示各编号小鸡在P、Q、R、S、T、U围栏中的学习及复测结果。“No.× in P/Q/R/S/T/U”译为“×号小鸡在相应围栏中”；“h.”为小时。动物编号、时间间隔和全部曲线依左页原图保留。横轴为试验，纵轴每毫米10秒。

-

much slower in forming associations and less able to tackle hard ones, but the biggest part of the difference between what they do and what the dogs and cats do is not referable so much to any difference in intelligence as to a difference in their bodily organs and instinctive impulses. As between dogs and cats, the influence of the difference in quantity of activity, in the direction of the instinctive impulses, in the versatility of the fore-limb, is hard to separate from the influence of intelligence proper. The best practical tests to judge such differences in general would be differences in memory, which are very easily got at, differences in the delicacy and complexity attainable, and of course differences in the slope of the curves for the same association. If all these tests agreed, we should have a right to rank one animal above the other in a scale of intelligence. But this whole question of grading is, after all, not so important for comparative psychology as its popularity would lead one to think. Comparative psychology wants first of all to trace human intellection back through the phylum to its origin, and in this aim is helped little by knowing that dogs are brighter than cats, or whales than seals, or horses than cows. Further, the whole question of 'intelligence' should be resolved into particular inquiries into the development of attention, activity, memory, etc.

So far as concerns dogs and cats, I should decide that the former were more generally intelligent. The main reason, however, why dogs seem to us so intelligent is not a good reason for the belief. It is because, more than any other domestic animal, they direct their attention to *us*, to what we do, and so form associations connected with acts of ours.

Having finished our attempt to give a true description of the facts of association, so far as observed from the outside, we may now progress to discuss its inner nature. A little preface about certain verbal usages is necessary before doing so. Throughout I shall use the word 'animal' or 'animals,' and the reader might fancy that I took it for granted that the associative processes were the same in all animals as in these cats and dogs of mine. Really, I claim for my animal psychology only that it is the psychology of just these particular animals. What this

小鸡无疑非常缓慢地形成联结，也较不能处理困难联结；但其行为与猫狗的多数差异，不如说来自器官和本能冲动差异，而非智慧差异。猫狗之间，活动量、本能冲动方向、前肢灵活性的影响，也难同智慧本身的影响分开。实际比较最好的指标，是容易检验的记忆差异、联结能达到的精细和复杂程度，以及同一联结的曲线斜率。若所有检验一致，才能把一种动物列在另一种之上。但智慧分级并不像受欢迎程度所暗示的那样重要。比较心理学首要任务，是沿演化谱系追溯人类思维的起源；知道狗比猫、鲸比海豹、马比牛聪明，对此帮助很小。整个“智慧”问题，应分解为注意、活动、记忆等发展的具体研究。

猫狗相比，我倾向判狗具有更广泛的智慧；但我们觉得狗聪明的主要理由，并不足以支持此判断：狗比其他家畜更注意我们及我们的行动，因而更常形成与我们行为有关的联结。

已从外部观察角度努力如实描述联结事实，现在讨论内在性质。先须说明用语：我一直说“动物”，读者可能以为我认定所有动物的联结过程，都与这些猫狗相同。实际上，我只主张这套动物心理学是这些特定动物的心理学。

warrants about animals in general may be left largely to the discretion of the reader. As I shall later say, it is probable that in regard to imitation and the power of forming associations from a lot of free ideas, the anthropoid primates are essentially different from the cats and dogs.

The reasons why I say 'animals' instead of 'dogs and cats of certain ages' are two. I do think that the probability that the other mammals, barring the primates, offer no objections to the theories here advanced about dogs and cats, is a very strong probability, strong enough to force the burden of proof upon any one who should, for instance, say that horse-goat psychology was not like cat-dog psychology in these general matters. I should claim that, till the contrary was shown in any case, my statements should stand for the mammalian mind in general, barring the primates. My second reason is that I hate to burden the reader with the disgusting rhetoric which would result if I had to insert particularizations and reservations at every step. The word 'animal' is too useful, rhetorically, to be sacrificed. Finally, inasmuch as most of my theorizing will be in the line of denying certain relatively high functions to animals, the evidence from cats and dogs is sufficient, for they are from among the most intelligent animals, and functions of the kind to be discussed, if absent in their case, are probably absent from the others.

Reasoning or Inference.

The first great question is whether or not animals are ever led to do any of their acts by reasoning. Do they ever conclude from inference that a certain act will produce a certain desired result, and so do it? The best opinion has been that they do not. The best interpretation of even the most extraordinary performances of animals has been that they were the result of accident and association or imitation. But it has after all been only opinion and interpretation, and the opposite theory persistently reappears in the literature of the subject. So, although it is in a way superfluous to give the *coup de grace* to the despised theory that animals reason, I think it is worth while to settle this question once for all.

它对一般动物能支持哪些结论，主要留给读者判断。后文将说，在模仿及凭一组自由观念形成联结的能力上，类人灵长类很可能与猫狗有本质区别。

我用“动物”而不说“某些年龄的猫狗”，有两个原因。其一，我认为灵长类以外的其他哺乳动物，极可能不与本书关于猫狗的理论相冲突。可能性够大，以至声称马羊在这些一般问题上不同于猫狗者，理应承担举证责任。在出现反例前，我的陈述应代表除灵长类外的一般哺乳动物心理。其二，若每步都插入限定、保留，文字会令人厌烦；“动物”一词在修辞上太有用，不能舍弃。此外，我的理论主要否定某些较高级功能，猫狗证据足够，因为它们本属于最聪明的动物；若它们缺少这些功能，其他动物大概也缺少。

推理或推论

首要问题是：动物是否有时凭推理行动？是否推断某动作将产生某种所欲结果，因而去做？最好的意见认为不会。即使最不寻常的动物行为，也最好解释为偶然、联结或模仿。但毕竟仍只是意见和解释，相反理论持续重现于文献。因此，虽然对受鄙弃的“动物会推理”理论补上致命一击多少多余，我仍认为值得把问题彻底解决。

The great support of those who do claim for animals the ability to infer has been their wonderful performances which resemble our own. These could not, they claim, have happened by accident. No animal could learn to open a latched gate by accident. The whole substance of the argument vanishes if, as a matter of fact, animals do learn those things by accident. *They certainly do.* In this investigation choice was made of the intelligent performances described by Romanes in the following passages. I shall quote at some length because these passages give an admirable illustration of an attitude of investigation which this research will, I hope, render impossible for any scientist in the future. Speaking of the general intelligence of cats, Romanes says:

"Thus, for instance, while I have only heard of one solitary case * * * of a dog which, without tuition, divined the use of a thumb-latch so as to open a closed door by jumping on the handle and depressing the thumb-piece, I have received some half-dozen instances of this display of intelligence on the part of cats. These instances are all such precise repetitions of one another that I conclude the fact to be one of tolerably ordinary occurrence among cats, while it is certainly very rare among dogs. I may add that my own coachman once had a cat which, certainly without tuition, learnt thus to open a door that led into the stables from a yard into which looked some of the windows of the house. Standing at these windows when the cat did not see me, I have many times witnessed her *modus operandi*. Walking up to the door with a most matter-of-course kind of air, she used to spring at the half hoop handle just below the thumb-latch. Holding on to the bottom of this half-hoop with one fore paw, she then raised the other to the thumb-piece, and while depressing the latter finally with her hind legs scratched and pushed the door-posts so as to open the door * * *.

"Of course in all such cases the cats must have previously observed that the doors are opened by persons placing their hands upon the handles and, having observed this, the animals act by what may be strictly termed rational imitation. But it should be observed that the process as a whole is something more than imitative. For not only would observation alone be scarcely enough (within any limits of thoughtful reflection that it would be reasonable to ascribe to an animal) to enable a cat upon the ground to distinguish that the essential part of the process consists not in grasping the handle, but in

主张动物能推论者，最有力的依据，是动物做出与人相似的惊人行为。他们认为这些不可能偶然发生，动物不可能偶然学会开启有闩的门。但只要事实表明动物确实偶然学会，整个论证便消失。而它们确实如此。本研究选择了罗曼尼斯以下文字所描述的聪明行为。引文较长，因为它们极好地展示一种研究态度，我希望本研究会使科学家今后无法再采取它。论猫的一般智慧，罗曼尼斯说：

“例如，一只狗未经教导，自己领悟拇指门闩的用法，跳到把手上、压下拇指片而打开门，这样的例子我只听到一个……；猫显出这种智慧的例子，我却收到约半打。它们如此精确地重复同一过程，我认为这在猫中相当常见，在狗中却极罕见。我自己的车夫也曾有一只猫，肯定未经教导，却学会打开院子通马厩的门；房屋一些窗子正对院子。我站在窗边、猫看不见我时，多次看到它的做法。它若无其事地走到门前，跃向拇指门闩下的半环把手。一只前爪抓住环底，另一只抬至拇指片并压下，同时后腿抓推门框，使门打开……。

“当然，这些猫必定先观察过人把手放在把手上开门；观察之后，动物采取严格说可称为‘理性模仿’的行动。但整个过程不只是模仿。单凭观察，在合理归于动物的思考范围内，恐怕不足以让地上的猫分辨，关键不是抓把手，而是压门闩；

depressing the latch; but the cat certainly never saw any one, after having depressed the latch, pushing the door-posts with his legs; and that this pushing action is due to an originally deliberate intention of opening the door, and not to having accidentally found this action to assist the process, is shown by one of the cases communicated to me; for in this case, my correspondent says, 'the door was not a loose-fitting one, by any means, and I was surprised that by the force of one hind leg she should have been able to push it open after unlatching it.' Hence we can only conclude that the cats in such cases have a very definite idea as to the mechanical properties of a door: they know that to make it open, even when unlatched, it requires to be *pushed*—a very different thing from trying to imitate any particular action which they may see to be performed for the same purpose by man. The whole psychological process, therefore, implied by the fact of a cat opening a door in this way is really most complex. First the animal must have observed that the door is opened by the hand grasping the handle and moving the latch. Next she must reason, by 'the logic of feelings'—'If a hand can do it, why not a paw?' Then strongly moved by this idea she makes the first trial. The steps which follow have not been observed, so we cannot certainly say whether she learns by a succession of trials that depression of the thumb-piece constitutes the essential part of the process, or, perhaps more probably, that her initial observations supplied her with the idea of clicking the thumb-piece. But, however this may be, it is certain that the pushing with the hind feet after depressing the latch must be due to adaptive reasoning unassisted by observation; and only by the concerted action of all her limbs in the performance of a highly complex and most unnatural movement is her final purpose attained." (Animal Intelligence, pp. 420–422.)

A page or two later we find a less ponderous account of a cat's success in turning aside a button and so opening a window:

"At Parara, the residence of Parker Bowman, Esq., a full-grown cat was one day accidentally locked up in a room without any other outlet than a small window, moving on hinges, and kept shut by means of a swivel. Not long afterwards the window was found open and the cat gone. This having happened several times, it was at last found that the cat jumped upon the window-sill, placed her fore-paws as high as she could reach against the side, deliberately reached with one over to the swivel, moved it from its horizontal to a vertical position, and then, leaning with her whole weight against

而且猫肯定不曾看到人压闩后用腿推门框。一位通信者的案例说明，这种推是原先就有意开门，并非偶然发现有帮助；他说：‘门绝不松动，我惊讶它解闩后竟用一条后腿的力量推开。’因此只能得出结论：这种猫对门的机械性质有非常明确的观念；它们知道，即使解除门闩，也必须推才能开。这与照着人为同一目的所做的某个动作模仿，大不相同。

“故猫这样开门所包含的心理过程非常复杂。首先观察，手抓把手、移动门闩便开门；继而用‘感觉的逻辑’推理：‘手能做到，为什么爪不能？’受此观念强烈驱动，进行第一次尝试。后续步骤无人观察，不能确定它是反复尝试学会压拇指片为关键，还是更可能在最初观察中已有拨动拇指片的观念。但无论如何，压闩后用后脚推，必定是无观察帮助的适应性推理；只有四肢协同进行高度复杂、极不自然的动作，才能达到最终目的。”（《动物智慧》，第420-422页。）

稍后，关于猫拨旋钮、开窗成功，有一段不那么繁重的描述：

“在Parker Bowman先生位于Parara的住所，一只成年猫偶然被锁在房中。唯一出口是铰链安装、旋钮锁住的小窗。不久发现窗开、猫走了。反复几次后终于看到：猫跳上窗台，把前爪尽可能高地撑在侧面，有意把一爪伸向旋钮，将它从水平转至竖直，再把全身重量压在窗上，推开逃走。”（《动物智慧》，第425页。）

the window, swung it open and escaped." (Animal Intelligence, p. 425.)

A description has already been given on page 9 of the small box (C), whose door fell open when that button was turned, and also of a large box (CC) for the dogs,with a similar door. The thumb-latch experiment was carried on with the same box (G) for both cats and dogs, but the door was arranged so that a greater force (1.3 kilograms) was required in the case of the dogs. It will be remembered that the latch was so fixed that if the thumb-piece were pressed down, without contemporaneous outward pressure of the door, the latch bar would merely drop back into its catch as soon as the paw was taken off the door. If, however, the door were pushed outward the latch bar, being pressed closely against the outer edge of its catch, would, if lifted, be likely to fall outside it and so permit the door to open if then or later sufficient pressure were exerted. Eight cats (Nos. 1, 2, 3, 4, 5, 6, 7 and 13) were, one at a time, left in this thumb-latch box. All exhibited the customary instinctive clawings and squeezings and bitings. Out of the eight all succeeded in the course of their vigorous struggles in pressing down the thumb-piece, so that if the door had been free to swing open they could have escaped. Six succeeded in pushing both thumb-piece down and door out, so that the bar did not fall back into its place. Of these five succeeded in also later pushing the door open, so that they escaped and got the fish outside. Of these, three, after repeated trials, associated the complicated movements required with the sight of the interior of the box so firmly that they attacked the thumb-latch the moment they were put in. The history of the formation of the association in the case of 3 and of 4 is shown in the curves on page 21. In the case of 13 the exact times were not taken. The combination of accidents required was enough to make it take No. 1 and No. 6 a long time to get out. Consequently, weariness and failure inhibited their impulses to claw, climb, etc., more than the rare pleasure from getting out strengthened them, and they failed to form the association. Like the cats who utterly failed to get out, they finally ceased to try when put in. The history of their efforts is as follows: The figures in the columns represent

第9页已说明旋钮转动即开门的C小箱，以及供狗使用的类似CC大箱。拇指门闩实验对猫狗都用G，但狗开门需较大力量，为1.3千克。记得若压拇指片时没有同时向外推门，爪移开后门闩横杆会重新落入卡座；若门正向外推，横杆紧贴卡座外缘，抬起后更可能落在卡座外，只要同时或随后用够力，门便打开。

8只猫，1、2、3、4、5、6、7、13号，分别放入此箱，都惯常抓、挤、咬。8只在猛烈挣扎中都压下过拇指片，若门可自由打开，便能逃出。6只同时压片、推门，使横杆未落回；其中5只后来推开门，得到外面的鱼。又有3只经重复试验，把复杂动作与箱内景象联系得很牢，入箱即攻击门闩。3、4号的形成过程见第21页曲线；13号未精确计时。

所需偶然的组合，使1、6号很久才逃出。疲劳和失败对抓、爬等冲动的抑制，超过偶尔逃出的愉快对其强化，故未形成联结。同完全失败的猫一样，它们最终入箱也不再尝试。下页记录其努力，列中数字表示逃出前，

the time (in minutes and seconds) the animal was in the box before escaping or before being taken out if he failed to escape. Cases of failure are designated by an F after the figures. Double lines represent an interval of twenty-four hours.

No. 1.	No. 6.
13.00 F	17.50
9.30	3.30
1.40	9.00
.50	2.10
15.00	1.45
6.00 F	1.55
14.00	13.00
20.00 F	5.00
4.30	2.30
20.00 F	15.00
20.00 F	10.00 F
15.00 F	5.00
60.00 F	15.00 F
	10.00 F
	10.00 F

It should be noted that, although cats 3 and 4 had had some experience in getting out of boxes by clawing at loops and turning buttons, they had never had anything at all like a thumb-latch to claw at, nor had they ever seen the door opened by its use, nor did they even have any experience of the fact that the part of the box where the thumb-piece was was the door. And we may insert here, what will be stated more fully later, that there was displayed no observation of the surroundings or deliberation upon them. It was just a mad scramble to get out.

Three dogs (1, 2 and 3) were given a chance to liberate themselves from this same box. 2 and 3, who were rather inactive, failed to even push the thumb-piece down. No. 1, who was very active, did push it down at the same time that she hap-

或失败后被取出前，动物在箱中的时间，单位为分和秒。数字后F表示失败；双横线表示相隔24小时。左页原表完整保留1号、6号猫每次用时、失败标记及日间分隔。

应注意，3、4号虽有抓圈、转旋钮逃出的经验，但从未抓过任何类似拇指门闩的东西，从未看见以它开门，甚至不曾知道拇指片所在处就是门。此处先提出、后文详论的一点是：没有表现出对周围环境的观察或思量，只有疯狂地争相逃出。

3只狗，1、2、3号，也有机会从同一箱脱困。较不活跃的2、3号甚至未压下拇指片。活跃的1号压下时，恰巧也在推门。

pened to be pushing against the door. She repeated this and formed the association as shown in the curve on page 34. She had had experience only of escaping by pulling a loop of string.

Out of 6 cats who were put in the box whose door opened by a button, not one failed, in the course of its impulsive activity, to push the button around. Sometimes it was clawed one side from below; sometimes vigorous pressure on the top turned it around; sometimes it was pushed up by the nose. No cat who was given repeated trials failed to form a perfect association between the sight of the interior of that box and the proper movements. Some of these cats had been in other boxes where pulling a loop of string liberated them, 3 and 4 had had considerable experience with the boxes and probably had acquired a general tendency to claw at loose objects. 10, 11 and 12 had never been in *any box* before. The curves are on page 19.

Of two dogs, one, when placed in a similar but larger box, succeeded in hitting the button in such a way as to let the door open, and formed a permanent association, as shown by the curves on page 33. No one who had seen the behavior of these animals when trying to escape could doubt that their actions were directed by instinctive impulses, not by rational observation. It is then absolutely sure that a dog or cat *can* open a door closed by a thumb-latch or button, merely by the accidental success of its natural impulses. If *all* cats, when hungry and in a *small* box, will accidentally push the button that holds the door, an *occasional* cat in a *large* room may very well do the same. If three cats out of eight will accidentally press down a thumb-piece and push open a small door, three cats out of a thousand may very well open doors or gates in the same way.

But besides thus depriving of their value the facts which these theorizers offer as evidence, we may, by a careful examination of the method of formation of these associations as it is shown in the time-curves, gain positive evidence that no power of inference was present in the subjects of the experiments. Surely if 1 and 6 had possessed any power of inference they would not have failed to get out after having done so several times. Yet they did (see p. 43). If they had once even, much less if they

它重复此动作，形成联结，见第34页曲线；此前只学过拉绳圈逃出。

6只猫进入旋钮开门箱，在冲动活动中，没有一只未把旋钮拨转；有的从下往旁抓，有的猛压上缘，有的用鼻子顶。凡反复试验者，都在箱内景象与恰当动作间形成完善联结。其中一些只学过拉圈；3、4号接触过许多箱，或许已有抓松动物的倾向；10、11、12号此前从未进过任何箱。曲线见第19页。

两狗之一，置于类似大箱时，碰转旋钮而开门，并形成持久联结，见第33页。亲眼看过动物逃出行为的人，不会怀疑其动作受本能冲动、而非理性观察引导。因此，猫狗能仅靠自然冲动偶然成功，打开拇指门闩或旋钮锁住的门，是绝对确定的。所有饥猫在小箱里都会偶然拨旋钮，大房间里偶尔一只这样做，当然可能；8猫中3猫偶然压片、推小门，1000猫中3猫以同样方式开门或大门，也完全可能。

除了剥除理论家所举事实的证据价值，仔细检查曲线显示的联结形成方式，还可取得被试没有推论能力的正面证据。若1、6号有推论能力，几次逃出后不该再失败；它们却失败了，见第43页。假使仅一次，更不用说六次或八次，推断出该做什么，第七或第九次也该推断。

had six or eight times, inferred what was to be done, they should have made the inference the seventh or ninth time. And if there were in these animals any power of inference, however rudimentary, however sporadic, however dim, there should have appeared among the multitude some cases where an animal, seeing through the situation, knows the proper act, does it, and from then on does it immediately upon being confronted with the situation. There ought, that is, to be a sudden vertical descent in the time-curve. Of course, where the act resulting from the impulse is very simple, very obvious, and very clearly defined, a simple experience may make the association perfect, and we may have an abrupt descent in the time-curve without needing to suppose inference. But if in a complex act, a series of acts or an ill-defined act, one found such a sudden consummation in the associative process, one might very well claim that reason was at work. Now, the scores of cases recorded show no such phenomena. The cat does not look over the situation, much less *think* it over, and then decide what to do. It bursts out at once into the activities which instinct and experience have settled on as suitable reactions to the situation '*confinement when hungry with food outside*.' It does not ever in the course of its successes realize that such an act brings food and therefore decide to do it and thenceforth do it immediately from *decision* instead of from impulse. The one impulse, out of many accidental ones, which leads to pleasure, becomes strengthened and stamped in thereby, and more and more firmly associated with the sense-impression of that box's interior. Accordingly it is sooner and sooner fulfilled. Futile impulses are gradually stamped out. The gradual slope of the time-curve, then, shows the absence of reasoning. They represent the wearing smooth of a path in the brain, not the decisions of a rational consciousness.

In a later discussion of imitation further evidence that animals do not reason will appear. For the present, suffice it to say, that a dog, or cat, or chick, who does not in his own impulsive activity learn to escape from a box by pulling the proper loop, or stepping on a platform, or pecking at a door, will not learn it from seeing his fellows do so. They are incapable of

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若动物有任何推论能力，无论多原始、多偶发、多模糊，在大量例子中应有动物看透情境，知道、完成恰当动作，此后每次面对情境立刻行动；时间曲线应突然垂直下降。动作若很简单、明显、明确，一次经验也能完善联结，陡降无须假定推论。但复杂动作、动作序列或不明确动作，若突然完善联结，便可能主张理性起作用。记录的几十例却无此现象。

猫不先察看、更不先思考，再决定。它立即爆发出本能和经验为“饥饿、被关、外面有食物”这一情境确定的活动。在成功过程中，它从不领悟某动作带来食物，因而决定去做，并从此靠决定而非冲动立即行动。许多偶然冲动中，带来愉快的一种得到强化、巩固，更牢地同箱内感觉印象联系，因而越来越早出现；无效冲动逐渐消除。故曲线缓降显示推理缺席，代表脑中路径逐步磨顺，不是理性意识的决定。

后文模仿讨论还会给出动物不推理的证据。此处先说：不能靠自身冲动活动学会拉正确圈、踩平台、啄门逃出的狗猫小鸡，也不能因观看同伴而学会。它们甚至不能作出“能让别人得到食物的，也能让我得到”这样的推论，

even the inference (if the process may be dignified by that name) that what gives another food will give it to them also. So, also, it will be later seen that an animal cannot learn an act by being put through it. For instance, a cat who fails to push down a thumb-piece and push out the door cannot be taught by having one take its paw and press the thumb-piece down with it. This *could* be learned by a certain type of associative process without inference. *Were there inference it surely would be learned.*

Finally, attention may be called to the curves which show the way that the animal mind deals with a series of acts (*e. g.*, curves for G, J, K, L and O, found on pages 21 to 26 and 34). Were there any reasoning the animals ought early to master the method of escape in these cases (see descriptions on pages 10 to 12 and 32) so as to do the several acts in order, and not to repeat one after doing it once, or else ought utterly to fail to master the thing. But, in all these experiments, where there was every motive for the use of any reasoning faculty, if such existed, where the animals literally lived by their intellectual powers, one finds no sign of abstraction, or inference, or judgment.

So far I have only given facts which are quite uninflenced by any possible incompetence or prejudice of the observer. These alone seem to disprove the existence of any rational faculty in the subjects experimented on. I may add that my observations of all the conduct of all these animals during the months spent with them, failed to find any act that even *seemed* due to reasoning. I should claim that this quarrel ought now to be dropped for good and all, that investigation ought to be directed along more sensible and profitable lines. I should claim that the psychologist who studies dogs and cats in order to defend this 'reason' theory is on a level with a zoölogist who should study fishes with a view to supporting the thesis that they possessed clawed digits. The rest of this account will deal with more promising problems, of which the first, and not the least important, concerns the facts and theories of *imitation*.

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若此过程配称推论。后文还会看到，动物也不能被带着做动作而学会。例如不会压拇指片、推门的猫，不能由人握爪压片教会。某类无推论的联结过程，本来也可能学会这一点；若有推论，则肯定会学会。

还应注意处理动作序列的曲线，如第21-26、34页的G、J、K、L、O。若有推理，动物应早早掌握逃出方法，依序行动，不重复已完成步骤，或者完全不能掌握。但是，这些实验有一切理由促使动物使用假如存在的推理功能，它们简直靠智力维生，却无抽象、推论、判断迹象。

此前只给出完全不受观察者可能无能或偏见影响的事实；单凭它们，似乎已否定被试存在理性功能。还可补充，数月观察所有动物的全部行为，也没发现一个看起来来自推理的动作。我主张应彻底结束争论，转向更合理、更有成效的方向。研究猫狗以捍卫“理性”理论的心理学家，犹如研究鱼以证明鱼有带爪手指的动物学家。余下讨论处理更有希望的问题，首先且十分重要的，是模仿的事实与理论。

Imitation.

To the question, 'Do animals imitate?' science has uniformly answered, 'Yes.' But so long as the question is left in this general form, no correct answer to it is possible. It will be seen, from the results of numerous experiments soon to be described, that imitation of a certain sort is not possible for animals, and before entering upon that description it will be helpful to differentiate this matter of imitation into several varieties or aspects. The presence of some sorts of imitation does not imply that of other sorts.

There are, to begin with, the well-known phenomena presented by the imitative birds. The power is extended widely, ranging from the parrot who knows a hundred or more articulate sounds to the sparrow whom a patient shoemaker taught to get through a tune. Now, if a bird really gets a sound in his mind from hearing it and sets out forthwith to imitate it, as mocking-birds are said at times to do, it is a mystery and deserves closest study. If a bird, out of a lot of random noises that it makes, chooses those for repetition which are like sounds that he has heard, it is again a mystery *why*, though not as in the previous case a mystery *how*, he does it. The important fact for our purpose is that, though the imitation of sounds is so habitual, there does not appear to be any marked general imitative tendency in these birds. There is no proof that parrots do muscular acts from having seen other parrots do them. But this should be studied. At any rate, until we know what sort of sounds birds imitate, what circumstances or emotional attitudes these are connected with, how they learn them and, above all, whether there is in birds which repeat sounds any tendency to imitate in other lines, we cannot, it seems to me, connect these phenomena with anything found in the mammals or use them to advantage in a discussion of animal imitation as the forerunner of human. In what follows they will be left out of account, will be regarded as a specialization removed from the general course of mental development, just as the feathers or right aortic arch of birds are particular specializations of no consequence for the physical development of mammals. For

模仿

科学一向对“动物会模仿吗？”回答“会”。但问题若保持如此笼统，便不能正确回答。即将介绍的许多实验表明，某类模仿对动物不可能；须先区分若干类型或方面。一类模仿存在，不意味着另一类也存在。

首先，模仿鸟类的现象众所周知，从懂百余种清晰语音的鹦鹉，到耐心鞋匠教会唱曲的麻雀，范围很广。若鸟听到声音，真把声音存入心理，立刻着手模仿，如据说反舌鸟有时这样做，那是值得密切研究的谜。若鸟从许多随机叫声中挑与听过声音相似者重复，谜便是它为何这样做，而非如何做。关键在于，声音模仿虽习惯性存在，这些鸟并未显出明显的一般模仿倾向；无证据表明鹦鹉看到别的鹦鹉作肌肉动作，就跟着作。此事仍须研究。

在知道鸟模仿哪些声音、与什么情境或情绪相联、怎样学会，尤其会重复声音的鸟是否也在其他方面模仿之前，我认为不能把它们同哺乳动物现象相联系，也不能用来讨论动物模仿作为人类模仿的前身。以下将它们视为远离心理发展一般路线的特殊化而不计，就像鸟羽或右主动脉弓，属对哺乳动物身体发展无关的特殊化。此后“模仿”指扣除模仿鸟类现象后的模仿。

us, henceforth, imitation will mean imitation minus the phenomena of imitative birds.

There are also certain pseudo-imitative or semi-imitative phenomena which ought to be considered by themselves. For example, the rapid loss of the fear of railroad trains or telegraph wires among birds, the rapid acquisition of arboreal habits among Australian rodents, the use of proper feeding grounds, etc., may be held to be due to imitation. The young animal stays with or follows its mother from a specific instinct to keep near that particular object, to wit, its mother. It may thus learn to stay near trains, or scrabble up trees, or feed at certain places and on certain plants. Actions due to following pure and simple may thus simulate imitation. Other groups of acts which now seem truly imitative may be indirect fruits of some one instinct. This must be kept in mind when one estimates the supposed imitation of parents by young. Further, it is certain that in the case of the chick, where early animal life has been carefully observed, instinct and individual experience between them rob imitation of practically all its supposed influence. Chicks get along without a mother very well. Yet no mother takes more care of her children than the hen. Care in other cases, then, need not mean instruction through imitation.

These considerations may prevent an unreserved acceptance of the common view that young animals get a great number of their useful habits from imitation, but I do not expect or desire them to lead to its summary rejection. I should not now myself reject it, though I think it quite possible that more investigation and experiment may finally reduce all the phenomena of so-called imitation of parents by young to the level of indirect results of instinctive acts.

Another special department of imitation may be at least vaguely marked off: namely, apparent imitation of certain limited sorts of acts which are somewhat frequent in the animal's life. An example will do better than further definition.

Some sheep were being driven on board ship one at a time. In the course of their progress they had to jump over a hurdle. On this being removed before all had passed it, the next sheep was seen to jump as if to get over a hurdle, and so on for five

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还有某些伪模仿或半模仿现象，应单独考察。如鸟很快不再害怕火车、电报线，澳大利亚啮齿动物迅速获得树栖习惯，利用恰当觅食地等，可能被归于模仿。幼兽因靠近母亲这一特定对象的特殊本能，与母亲同处或跟随；由此可能学会留在火车附近、爬树、在特定地点吃特定植物。单纯跟随可制造模仿的外观。另一些看似真正模仿的行为，也可能是某本能的间接结果。估计幼兽所谓模仿父母时，须记住这一点。

已被仔细观察的小鸡早期生活表明，本能和个体经验几乎夺走模仿所有被假定的影响。没有母鸡，小鸡也活得很好；而没有哪种母亲比母鸡更照顾子女。故别种照护也未必意味着模仿教学。这些考虑可阻止毫无保留接受“幼兽从模仿得到许多有用习惯”的常见观点，但我不希望据此草率否定它。我现在也不否定，虽然进一步研究可能把这些所谓模仿，全归为本能行为的间接结果。

另可大致区分：对动物生活中较常出现的某些有限动作的表面模仿。例如羊依次被赶上船，途中须跳障碍。障碍在尚未全通过时移走，接着五六只仍仿佛越障碍般跳起，看似每只模仿前羊的确证。

or six, apparently sure evidence that they imitated the action, each of the one in front. Now, it is again possible that among gregarious animals there may be elaborate connections in the nervous system which allow the sight of certain particular acts in another animal to arouse the innervation leading to those acts, but that these connections are *limited*. The reactions on this view are specific responses to definite signals, comparable to any other instinctive or associational reaction. The sheep jumps when he sees the other sheep jump, not because of a general ability to do what he sees done, but because he is furnished with the instinct to jump at such a sight, or because his experience of following the flock over boulders and brooks and walls has got him into the habit of jumping at the spot where he sees one ahead of him jump; and so he jumps even though no obstacle be in his way. If due to instinct the only peculiarity of such a reaction would be that the sense-impression calling forth the act would be the same act as done by another. If due to experience there would be an exact correspondence to the frequent acts called forth *originally* by several elements in a sense-impression, one of which is essential, and done *afterwards* when only the *non-essentials* are present. These two possibilities have not been sufficiently realized, yet they may contain the truth. On the other hand, these limited acts may be the primitive, sporadic beginnings of the general imitative faculty which we find in man. To this general faculty we may now turn, having cleared away some of the more doubtful phenomena which have shared its name.

It should be kept in mind that an imitative act may be performed quite unthinkingly, as when a man in the mob shouts what the others shout or claps when the others clap; may be done from an inference that since A by doing X makes pleasure for himself, I by doing X may get pleasure for myself; may, lastly, be done from what may be called a transferred association. This process is the one of interest in connection with our general topic, and most of my experiments on imitation were directed to the investigation of it. Its nature is simple. One sees the following sequence: 'A turning a faucet, A getting a drink.' If one can free this association from its narrow con-

但群居动物的神经系统，可能存在复杂却有限的连接，使看见同类某些特定动作，引起做那些动作的神经支配。依此，反应只是明确信号引出的特定反应，与其他本能或联结反应可比。羊见前羊跳便跳，可能并非有“照做所见动作”的一般能力，而是天生对这种景象跳，或跟羊群跨巨石、溪流、墙的经验，养成见前羊在哪跳便在哪跳的习惯，所以无障碍也跳。

若属本能，特殊之处只是：引出动作的感觉印象，恰好也是别的动物所作的同一动作。若属经验，则正类似常见行为：最初由感觉印象的几个要素共同唤起，某要素必要；后来只有非必要要素时也会出现。人们未充分认识这两种可能，而它们也许是真相。另一方面，这些有限动作，也可能是人类一般模仿功能原始、零星的开端。澄清几种共用名称的可疑现象后，转向这种一般功能。

模仿可以不假思索，如人群中别人喊便喊、别人拍手便拍；也可来自推论：“A做X获愉快，我做X也可能获愉快”；最后，可来自“迁移过来的联结”。这才与一般主题相关，多数实验针对它。过程很简单：看到“A转龙头，A喝到水”。若能把联结从仅限于A的范围中解放出来，

finement to A, so as to get from it the association, 'impulse to turn faucet, *me* getting a drink,' one will surely, if thirsty, turn the faucet, though he had never done so before. If one can from an act witnessed learn to do the act, he in some way makes use of the sequence seen, transfers the process to himself; in the common human sense of the word, he *imitates*. This kind of imitation is surely common in human life. It may be apparent in ontogeny before any power of inference is shown. After that power does appear, it still retains a wide scope, and teaches us a majority, perhaps, of the ordinary accomplishments of our practical life.

Now, as the writers of books about animal intelligence have not differentiated this meaning from the other possible ones, it is impossible to say surely that they have uniformly credited it to animals, and it is profitless to catalogue here their vague statements. Many opposers of the 'reason' theory have presupposed such a process and used it to replace reason as the cause of some intelligent performances. The upholders of the reason theory have customarily recognized such a process and claimed to have discounted it in their explanations of the various anecdotes. So we found Mr. Romanes, in the passage quoted, discussing the possibility that such an imitative process, without reason, could account for the facts. In his chapter on Imitation in 'Habit and Instinct,' Principal C. Lloyd Morgan, the sanest writer on comparative psychology, seems to accept imitation of this sort as a fact, though he could, if attacked, explain most of his illustrations by the simple forms. The fact is, as was said before, that no one has analyzed or systematized the phenomena, and so one cannot find clear, decisive statements to quote.

At any rate, whether previous authorities have agreed that such a process is present or not, it is worth while to tackle the question; and the formation of associations by imitation, if it occurs, is an important division of the formation of associations in general. The experiments and their results may now be described.

形成“转龙头的冲动，我喝到水”的联结，那么口渴时肯定会转，即使从未这样做过。由观看学会动作，就是以某方式利用所见顺序，把过程迁移给自己；按人类通常意义，他在模仿。这类模仿在人类生活中确实常见，可能在个体发展中早于推论能力出现；推论出现后，它仍发挥广泛作用，甚至教会我们大多数日常实际技能。

动物智慧著作没有把这一含义同其他含义区分，故不能确定它们是否一致把此能力归于动物；罗列其模糊说法也无用。许多反对理性理论者，预设此过程，用它解释聪明行为以取代理性；理性理论支持者也惯常承认，并声称解释轶事时已排除。前引罗曼尼斯，就讨论过无需理性、单凭模仿能否解释事实。比较心理学最清醒的作者C. Lloyd Morgan，在《习惯与本能》的模仿章中似乎也把它当事实；不过若受质疑，大部分例子也能用简单形式解释。无人分析、系统化现象，因此找不到可引用的清楚、决定性陈述。

不论前人是否一致承认这种过程，问题都值得研究；如果能由模仿形成联结，它就是一般联结形成的重要分支。以下介绍实验及结果。

IMITATION IN CHICKS.

No. 64 learned to get out of a certain pen (16 × 10 inches) by crawling under the wire screening at a certain spot. There was also a chance to get out by walking up an inclined plane and then jumping down. No. 66 was put in with 64. After 9 minutes, 20 seconds, 66 went out by the inclined plane, although 64 had in the mean time crawled out under the screen 9 times. (As soon as he got out and ate a little he was put back.) It was impossible to judge how many of these times 66 really saw 64 do this. He was looking in that direction 5 of the times. So also, in three more trials, 66 used the inclined plane, though 64 crawled under each time. 67 was then tried. In 4 minutes, 10 seconds, he crawled under, 64 having done so twice. Being then put in *alone*, he, without the chance to imitate, still crawled under. So probably he went under *when with 64* not by imitation but by accident, just as 64 had learned the thing himself.

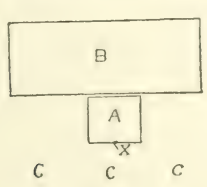


FIG. 17.

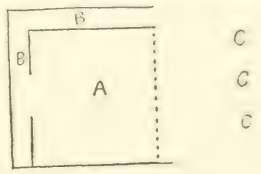


FIG. 18.

The accompanying figure (17) shows the apparatus used in the next experiment. A represents the top of a box (5 × 4 inches), 13 inches above the level of the floor, C. On the floor C were the chicks and food. B is the top of a box 10 inches high. Around the edges of A except the one next B a wire screen was placed, and 65 was repeatedly put upon A until he learned to go quickly back to C *via* B. Then the screen was bent outward at X so that a chick could barely squeeze through and down (A to C). Eleven chicks were then one at a time placed on A with 65. In every case but one they went A–C. In the case of the chick (75) who went A–B–C, there could have been no imitation, for he went down *before* 65 did. One other went through the hole before 65 went to B. The remain-

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小鸡的模仿

64号学会从16×10英寸围栏，在特定处钻过网底逃出，也可上斜面再跳下。66号与64号同放，9分20秒后走斜面出去；期间64号钻网9次，每次出去吃一点就放回。难判断66真正看见几次；5次正朝那方向看。再试3次，66仍用斜面，64每次钻网。67号在4分10秒钻出，其间64已作两次；然后单放，无模仿机会仍钻出。所以它与64同处时大概也靠偶然，与64原先学法一样。

图17为下一实验装置：A是5×4英寸箱顶，距地面C高13英寸；C有小鸡和食物；B是10英寸高箱顶。A边缘除邻B一侧都设网。反复把65放A，直到它能经B迅速回C；再在X把网向外弯，使小鸡勉强可挤过，直接A到C。11只小鸡分别与65同放A，除一只外都走A-C。唯一走A-B-C的75号，比65先下，故不可能模仿。另有一只也在65至B前钻孔；其余9只都有模仿65、避免挤孔不适的机会。

图17、18：模仿实验的两种装置。A、B、C、X为位置标记；各路径由正文说明。

ing nine all had a chance to imitate 65 and to save the uncomfortable struggle to get through the hole, 65 going A–B–C 8 times before 68 went A–C, 2 times when with 66 and 76, once in the case of each of the others.

In still another experiment the apparatus was (as shown in figure 18) a pen 14 inches square, 10 inches high, with a wire screen in front and a hole 3½ inches square in the back. This hole opened into a passage-way (B) leading around to C, where were the other chicks and food. Chicks who had failed, when put in alone, to find the way out, were put in with other chicks who had learned the way, to see if by seeing them go out they would learn the way. Chick 70 was given 4 trials alone, being left in the box 76 minutes all told. He was then given 9 trials (165 minutes) with another chick who went out *via* B 36 times. 70 failed to follow him on any occasion. The trials were all given in the course of two days. Chick 73 failed in 1 trial (12 minutes) to get out of himself, and was then given 4 trials (94 minutes) with another chick who went out *via* B 33 times. In this experiment, as in all others reported, sure evidence that the animals wanted to get out, was afforded by their persistent peckings and jumpings at the screen or bars that stood between them and C. Chick 72, after 8 unsuccessful trials alone (41 minutes), was given 8 trials with a chance to imitate. After the other chick had gone out 44 times, 72 *did go out*. He did not follow the other but went 20 seconds later. It depends upon one's general opinion whether one shall attribute this one case out of three to accident or imitation.

I also took two chicks, one of whom learned to escape from A (in figure 17) by going to B and jumping down the side to the *right* of A, the other of whom learned to jump down the side to the *left*, and placed them together upon A. Each took his own course uninfluenced by the other in 10 trials.

Chicks were also tried in several pens where there was only one possible way of escape to see if they would learn it *more quickly* when another chick did the thing several times before their eyes. The method was to give some chicks their first trial with an imitation possibility and their second without, while others were given their first trial without and their second with.

68号走A-C前，65走A-B-C共8次；与66、76同处时各2次；与其他各1次。

另一实验用图18装置：围栏长宽14英寸、高10英寸，前为网，后有边长3½英寸方孔，通入绕至C的过道B；C有小鸡、食物。单独放入而找不到出口者，与已学会者同放，看能否观看学会。70号先单试4次，总76分钟；再与同伴试9次、165分钟，同伴经B逃出36次，70一次未跟。所有试验在两日内。73号单试一次12分钟失败，再同伴试4次94分钟，观看33次逃出。在本实验及所有记录中，持续啄、跳挡在它们与C之间的网或栏，确证它们想出去。72号单试8次、41分钟失败，再获8次模仿机会。同伴出去44次后，72确实出去，但不是跟随，而是20秒后。三个案例中的这一例，归于偶然还是模仿，取决于总体判断。

又取两只小鸡，一只学会A经B从A右侧跳下，另一只从左侧跳下；同置A，10次中各走原路，不受对方影响。

还用只有唯一出口的围栏，检验同伴在眼前反复示范能否加快学习。一组初试有模仿机会、第二次没有；另一组初试没有、第二次有。

If the ratio of the average time of the first trial to the average time of the second is smaller in the first class than it is in the second class, we may find evidence of this sort of influence by imitation. Though imitation may not be able to make an animal *do* what he would otherwise *not do*, it may make him do *quicker* a thing he would have done sooner or later any way. As a fact the ratio is *much larger*. This is due to the fact that a chick, when in a pen with another chick, is not afflicted by the discomfort of loneliness, and so does not try so hard to get out. So the other chick, who is continually being put in with him to teach him the way out, really prolongs his stay in. This factor destroys the value of these quantitative experiments, and I do not insist upon them as evidence against imitation, though they certainly offer none for it. I do not give descriptions of the apparatus used in these experiments or a detailed enumeration of the results, because in this discussion we are not dealing primarily with imitation as a slight general factor in forming experience, but as a definite associational process in the mind. The utter absence of imitation in this limited sense is apparently demonstrated by the results of the following experiments.

V was a box 16 × 12 × 8½, with the front made of wire screening and at the left end a little door held by a bolt but in such a way that a sharp peck at the top of the door would force it open.

W was a box of similar size, with a door in the same place fixed so that it was opened by raising a bolt. To this bolt was tied a string which went up over the top of the edge of the box and back across the box, as in D. By jumping up and coming down with the head over this thread, the bolt would be pulled up. The thread was 8½ inches above the floor.

X was a box of similar size, with door, bolt and string likewise. But here the string continued round a pulley at the back down to a platform in the corner of the box. By stepping on the platform the door was opened.

Y was a box 12 × 8 × 8½, with a door in the middle of the front, which I myself opened when a chick pecked at a tack which hung against the front of the box 1½ inches above the top of the door.

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若第一组“首次平均时间／第二次平均时间”之比，小于第二组，可作为模仿影响的证据。模仿即使不能使动物做原本不会做的事，仍可能让它更快做迟早会做的事。但实际比值大得多：与同伴同关的小鸡不受孤独不适，较少努力逃出，反复放入教它的同伴，反而延长禁闭。这一因素毁掉定量实验的价值；我不把它们强当作反模仿证据，尽管它们绝不支持模仿。这里主要讨论作为明确心理联结过程的模仿，而非经验形成中轻微的一般因素，故不详述这些装置及结果。以下实验似乎证明此限定意义的模仿完全缺席。

V：箱体16×12×8½英寸，前为网，左端小门用闩固定，但猛啄门顶即可推开。

W：尺寸相似，门在同处，抬闩才开；闩上绳经箱上缘横穿，类似D。小鸡跳起，落下时头越过绳，便把闩拉起。绳距地8½英寸。

X：尺寸、门、闩、绳相似，但绳再绕后方滑轮，连接箱角平台。踩平台便开门。

Y：箱体12×8×8½英寸，门在前中央。小鸡啄悬于前壁、门上缘以上1½英寸的小钉时，由我开门。

These different acts, pecking at a door, jumping up and with the neck pulling down a string, stepping on a platform, and pecking at a tack, were the ones which various chicks were given a chance to imitate. The chicks used were from 16 to 30 days old. The method of experiment was to put a chick in, leave him 60 to 80 seconds, then put in another who knew the act, and on his performing it, to let both escape. No cases were counted unless the imitator apparently saw the other do the thing. After about every ten such chances to learn the act, the imitator was left in alone for ten minutes. The following table gives the results. The imitators of course had previously failed to form the association of themselves. F denotes failure to perform the act:

Chick.	Act.	No. Times Saw.	Times in Which Failed.	Final Time.
84	V	38	45.00 F	15.00 F
85	V	30	30.00 F	10.00 F
86	V	44	55.00 F	15.00 F
87	V	26	35.00 F	15.00 F
80	W	54	60.00 F	15.00 F
81	W	40	45.00 F	15.00 F
87	W	27	30.00 F	10.00 F
81	X	18	20.00 F	10.00 F
82	X	21	20.00 F	8.40 *Did*
83	X	33	35.00 F	15.00 F
84	X	46	55.00 F	15.00 F
84	Y	45	55.00 F	15.00 F
83	Y	29	35.00 F	15.00 F

Thus out of all these cases only one did the act in spite of the ample chance for imitation. I have no hesitation in declaring 82's act in stepping on the platform the result of mere accident, and am sure that any one who had watched the experiments would agree.

Imitation in Cats.

By reference to the previous descriptions of apparatus, it will be seen that box D was arranged with two compartments, separated by a wire screen. The larger of these had a front of wooden bars with a door which fell open when a string stretched across the top was bitten or clawed down. The smaller was closed by boards on three sides and by the wire

啄门、跳起用颈拉绳、踩平台、啄钉，是让小鸡有机会模仿的动作。小鸡16-30日龄。先单放60-80秒，再放入知道动作的同伴；同伴完成，便让两者逃出。只有模仿者显然看见动作才计入；每约10次学习机会，再单留10分钟。模仿者此前都不能自行形成联结。

表列结果，中文列名依次为：小鸡编号、动作或装置代号、观看次数、此前未成功的试验用时、最后一次用时。时间以分、秒表示；F＝未完成动作；Did＝完成动作。数字和全部记录保留在左页。V、W、X、Y的对应动作见第53页。

全部例子中，尽管模仿机会充足，仅一只完成。我毫不犹豫认定82号踩平台纯属偶然，相信亲眼观察者都会同意。

猫的模仿

此前装置说明表明，D箱有金属网隔开的两室。大室前壁木栏，门在横穿箱顶的绳被咬或抓下时打开；小室三侧为板，第四侧为网。

screen on the fourth. Through the screen a cat within could see the one to be imitated pull the string, go out through the door thus opened and eat the fish outside. When put in this compartment, the top being covered by a large box, a cat soon gave up efforts to claw through the screen, quieted down and watched more or less the proceedings going on in the other compartment. Thus this apparatus could be used to test the power of imitation. A cat who had no experience with the means of escape from the large compartment was put in the closed one; another cat, who would do it readily, was allowed to go through the performance of pulling the string, going out, and eating the fish. Record was made of the number of times he did so and of the number of times the imitator had his eyes clearly fixed on him. These were called 'times seen.' Cases where the imitator was looking in the general direction of the 'imitatee' and might very well have seen him and probably did, were marked 'doubtful.' In the remaining cases the cat did not see what was done by his instructor. After the imitatee had done the thing a number of times, the other was put in the big compartment alone, and the time it took him before pulling the string was noted and his general behavior closely observed. If he failed in 5 or 10 or 15 minutes to do so, he was released and not fed. This entire experiment was repeated a number of times. From the times taken by the imitator to escape and from observation of the way that he did it, we can decide whether imitation played any part. The history of several cases are given in the following tables. In the first column are given the lengths of time that the imitator was shut up in the box watching the imitatee. In the second column is the number of times that the latter did the trick. In the third and fourth are the times that the imitator surely and possibly saw it done, while in the last is given the time that, when tried alone, the imitator took to pull the string, or if he failed, the time he was in the box trying to get out. Times are in minutes and seconds, failures denoted by F:

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小室猫能透网看到被模仿者拉绳、出门、吃箱外鱼。小室顶以大箱盖住，猫很快不再企图抓网，安静下来，多多少少观看另一室，于是可测试模仿。未有大室逃出经验的猫放小室；熟练猫反复拉绳、出箱、吃鱼。记录示范次数，以及模仿者目光明确固定其身上的次数，称“确定看见”；只朝大致方向看、可能也大概看见者，称“可疑”；其余未看见。

示范若干次后，单把另一猫放大室，记录拉绳前时间，仔细观察一般行为。若5、10或15分钟失败，便释放，不喂食。整个实验反复。由独自逃出时间及做法，可判断模仿是否起作用。

下表记录若干案例。第一列为模仿者观看时被关的时间；第二列为示范者完成次数；第三、第四为确定、可能看见次数；末列为单试时拉绳前用时，或失败时努力逃出所待时间。单位分、秒；F为失败。

No. 7 Imitating No. 2.

	Time Watching.	No. of times 2 did.	No. of times 7 saw.	No. of times Doubtful.	Time of 7 when alone.
	10.00	11	3	5	
After 48 Hours	11.00	10	4	2	
	12.00	20	4	13	10.00 F
					1.00[1]
After 24 Hours	8.00	20	6	11	3.30
					10.00 F
	13.00	25	8	12	20.00 F
After 24 Hours	9.00	20	4	11	10.00 F
After 24 Hours	12.00	35	5	21	30.00 F
After 2 Hours	10.00	25	3	8	25.00 F
After 24 Hours	15.00	35	6	21	20.00 F
After 24 Hours	6.00	20	0	7	10.00 F
Total times surely and possibly seen, -			43	111	

No. 5 Imitating No. 2.

	Time Watching.	No. of times 2 did.	No. of times 5 saw.	No. of times Doubtful.	Time of 5 when alone.
	12.00	15	3	8	5.00 F
After 2 Hours	10.00	8	4	4	
After 24 Hours	5.00	5	0	3	
After 1 Hour	14.00	10	5	3	10.00 F
After 1 Hour	13.00	22	7	11	10.00 F
After 24 Hours	7.00	15	3	8	5.00 F
After 48 Hours	18.00	20	2	9	20.00 F
After 24 Hours	14.00	20	2	10	30.00 F
After 24 Hours	10.00	20	7	12	20.00 F
Total times surely and possibly seen, -			33	68	

No. 6 Imitating No. 2.

	Time Watching.	No. of times 2 did.	No. of times 6 saw.	No. of times Doubtful.	Time of 6 when alone.
	12.00	30	0	19	1.10[2]
After 48 Hours	11.00	30	0	11	9.30
After 72 Hours	10.00	30	0	15	3.00
After 72 Hours	6.00	20	3	7	1.50
After 24 Hours	9.00	30	1	13	10.00 F
After 24 Hours	10.00	30	6	9	10.00 F
After 24 Hours	10.00	30	1	8	9.40
Total times surely and possibly seen, -			11	82	

[1] No. 7 hit the string in his general struggling, apparently utterly without design. He did not realize that the door was open till, two seconds after it had fallen, he happened to look that way.

[2] No. 6, in trying to crawl out at the top of the box, put its paw in above the string. It fell down and thus pulled the string. It did not claw *at* it, and it was 16 seconds before it noticed that the door was open. In all the other times that it escaped the movement was made in the course of promiscuous scrabbling, never in anything like the same way that No. 2 made it.

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本页三表分别为：7号猫模仿2号，5号猫模仿2号，6号猫模仿2号。

各列译法：Time Watching＝观看时间；No. of times 2 did＝2号完成次数；No. of times 7/5/6 saw＝相应猫确定看见次数；No. of times Doubtful＝可能看见次数；Time of 7/5/6 when alone＝相应猫单独受试的用时。After 1/2/24/48/72 Hours＝相隔1/2/24/48/72小时。Total times surely and possibly seen＝确定与可能看见次数的总计。F为失败，时间单位为分、秒。

确定／可能看见总计：7号43／111；5号33／68；6号11／82。各次数据、时间及分隔线完整保留在左侧原表。

原注一：7号在一般挣扎中碰到绳，显然全无意图。门落下两秒后，它恰好朝那边看，才发现已经打开。

原注二：6号企图从箱顶爬出，把爪伸到绳上方，爪落下而拉了绳；并非有意抓绳。16秒后才注意门开。在其他逃出的试验中，也都是胡乱抓挠时作出动作，从未像2号那样做。

		No. 3 Imitating No. 2.			
	S.00	30	2	19	3.30[1]
					3.30
After 48 Hours	10.00	30	2	14	.20
					.20
After 72 Hours	10.00	30	2	8	.18
					.08
Total time surely and possibly seen,		- 6		41	

Before entering upon a discussion of the facts shown by these tables, we must describe the behavior of the imitators, when, after seeing 2 pull the string, they were put in alone. In the opinion of the present observer there was not the slightest difference between their behavior and that of cats 4, 10, 11, 12 and 13, who were put into the same position without ever having seen 2 escape from it. 6, 7, 5 and 3 paid no more attention to the string than they did, but struggled in just the same way. No one, I am sure, who had seen them, would have claimed that their conduct was at all influenced by what they had seen. When they did hit the string the act looked just like the accidental success of the ordinary association experiment. But, besides these personal observations, we have in the impersonal time-records sufficient proofs of the absence of imitation. If the animals pulled the string from having seen 2 do so, they ought to pull it in each individual case at an approximately regular length of time after they were put in, and presumably pretty soon thereafter. That is, if an association between the sight of that string in that total situation and a certain impulse and consequent freedom and food had been formed in their minds by the observation of the acts of 2, they ought to pull it *on seeing it*, and if any disturbing factor required that a certain time should elapse before the imitative faculty got in working order, that time ought to be somewhere near constant. The times were, as a fact, long and irregular in the extreme. Furthermore, if the successful cases were even in part due to imitation, the times ought to decrease the more they saw 2 do the thing. Except with 3, they *increase* or give place to failures. Whereas 6 and 7, if they had been put in again immediately after their first successful trial and

[1]No. 3 did not go out until 12 seconds had elapsed after it had pulled the string.

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本页表为3号猫模仿2号。列名、时间和符号同第55-56页；确定／可能看见总计为6／41。相隔48、72小时及每次数据完整保留在左页。

讨论表中事实前，须说明猫看过2号拉绳、再单独受试时的行为。依我观察，它们与未看过2号逃出、直接放同箱的4、10、11、12、13号，毫无差异。6、7、5、3号没有更注意绳，挣扎完全相同。亲眼看者不会主张行为受所见影响；碰到绳时也像普通联结实验的偶然成功。

除个人观察，客观时间记录也足以证明没有模仿。若因看过2号而拉绳，入箱后每次应约在相同时间、且大概很快行动。若观察已在绳的整体情境、某冲动及随之自由食物之间形成联结，看见绳便应拉；若干扰使模仿功能须待一阵才生效，等待时间也应近乎恒定。实际时间却长而极不规则。若成功哪怕部分来自模仿，示范看得越多，时间应越短。除3号，时间却增加或转为失败。6、7号若第一次成功后立即再次入箱并此后反复试验，毫无疑问会形成联结；

原注：3号拉绳后12秒，才出箱。

from then on repeatedly, would have unquestionably formed the association, they did not, when put in after a further chance to increase their knowledge by imitation, do the thing as soon as before. The case of 3 is not here comparable to the rest because he *was* given three trials in immediate succession. He was a more active cat and quicker to learn, as may be seen by comparing his time curves with those of 7, 6 and 5. That the mere speed with which he mastered this association is no sign that imitation was present may be seen by reference to the time curves of 4 and 13 (on page 18).

Some cats were also experimented with in the following manner. They were put into a box [No. 7 into box A (o at front), No. 5 into B (o at back)] and left for from 45 to 75 seconds. Then a cat who knew the way to get out was put in, and, of course, pulled at the loop and opened the door. *Both cats then went out and both were fed.* After the cat had been given a number of such chances to learn by imitation, he was put in and left until he did the thing, or until 5 or 10 minutes elapsed. As in the preceding experiments, no change in their behavior which might signify imitation was observed. No. 7 acted exactly like 3, or 10, or 11, when put in the box, apparently forming the association by accident in just the same way. Good evidence that he did not imitate is the fact that, whereas 1 (whom he saw) pulled the loop with his teeth, 7 pulled it with his paw. 5 failed to form the association, though he saw 3 do it 8 times and probably saw him 18 times more. He did get out twice by clawing the *string* in the *front* of the box, not the *loop* in the *back*, as 3 did. These successes took place early in the experiment. After that he failed when left alone to get out at all.

Another experiment was made by a still different method. My cats were kept in a large box about 4 ft. high, the front of which was covered with poultry-yard netting. Its top was a board which could be removed. To save opening the door and letting them all loose, I was in the habit of taking them out by the top when I wanted to experiment with them. Of course the one who happened to climb up (perhaps attracted by the smell of fish on my fingers) was most likely to be taken out and experi-

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但给予更多观看、增长模仿知识的机会后，它们并未同先前一样快行动。3号不可比，因为曾立即连续试三次，且更活跃、学得更快，对照7、6、5号曲线便知。单凭掌握快不能证明模仿，参见第18页4、13号曲线。

另一些猫用不同方法：7号入A前圈箱，5号入B后圈箱，先留45-75秒，再放懂逃出的猫；它拉圈开门，两猫一起出去喂食。给若干次机会后，单放至动作完成或5、10分钟。仍无表示模仿的行为变化。7号与3、10、11号一样，显然偶然形成联结；更好证据是示范的1号用牙拉圈，7号用爪。5号确定看3号8次，可能又看18次，仍未形成联结。它两次逃出，是抓前方绳而非像3号拉后圈；发生在早期，之后单试再也未逃出。

还有另一方法：猫养在约4英尺高、前覆禽网的大箱，顶板可移。为免开门全放走，我从顶端取受试猫。恰好往上爬的猫，或被指间鱼气味吸引，最容易被取出、试验并喂食。

mented with and fed. Thus they formed the habit of climbing up the front of the box whenever I approached. Of three cats which I obtained at the same time, one did not after 8 or 10 days acquire this habit. Even though I held out a piece of fish through the netting, he would not climb after it. It was reasonable to suppose that imitation might overcome this sluggishness, if there were any imitation. I therefore put two cats with him and had them climb up 80 times before his eyes and get fish. He never followed or tried to follow them.

4 and 3 had been subjected to the following experiment. I would make a certain sound and after 10 seconds would go up to the cage and hold the fish out to them through the netting at the top. They would then, of course, climb up and eat it. After a while, they began to climb up upon hearing the signal (4) or before the 10 seconds were up. I then took 12 and 10, who were accustomed to going up when they saw me approach, but who had no knowledge of the fact that the signal meant anything, and gave them each a chance to imitate 3. That is one of them would be left in the box with 3, the signal would be given, and after from 5 to 10 seconds 3 would climb up. At 10 seconds I would come up with food, and then of course 12 would climb up. This was repeated again and again. The question was whether imitation would lead them to form the association more quickly than they would have done alone. It did not. That when at last they did climb up before 10 seconds was past, that is before I approached with food, it was not due to imitation, is shown by the fact that on about half of such occasions they climbed up *before 3 did*. That is they reacted to the *signal* by *association*, not to his *movements* by *imitation*.

Imitation in Dogs.

Here the method was not to see if imitation could arouse more quickly an act which accident was fairly likely to bring forth sooner or later, but to see if, where accident failed, imitation would succeed.

3 was found to be unable of himself to escape from box BB1, and was then given a chance to learn from watching 1. The

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因此猫养成我一接近便爬前网的习惯。同日得到的3猫中，一只过8-10天仍无此习惯；鱼伸过网也不跟着爬。若有模仿，理应克服迟钝。我放两猫与它同住，让它们在其眼前爬80次、获鱼，它一次也不跟或试图跟。

3、4号还做如下实验：我发特定声音，10秒后走到箱边，在顶网处给鱼，它们爬上吃。后来4号一听信号就爬，或在10秒结束前爬。10、12号已习惯见我接近便爬，但不知道信号意义；分别同3号关箱，发信号后3号在5-10秒爬，10秒时我持食接近，另一猫再爬。反复试验，检验模仿能否比单独更快建立联结，并未能。后来它们在我接近前、10秒内上爬，也不是模仿；因为约半数这样的时候，比3号更早爬。它们凭联结响应信号，而非模仿3号动作。

狗的模仿

这里不是检验模仿是否加速原本迟早会偶然出现的动作，而是检验偶然失败时模仿能否成功。3号不能自行逃出BB，便让它观看1号学习。拆掉BB1后板，换金属网；

back of box BB1 was torn off and wire netting substituted for it. Another box with open front was placed directly behind and against box BB1. No. 3, who was put in this second box, could thus see whatever took place in and in front of box BB1 (o at back, high). The record follows:

	Dog 3 Imitating Dog 1.			
	Times 1 did.	Times 3 saw.	Times probably saw.	Times in alone.
	30	7	14	3.00 F
After 1 Hour - -	35	9	14	3.00 F
After 1 Hour - -	10	3	3	5.00 F
After 24 Hours - -	20	6	8	
	30	8	13	6.00 F
After 48 Hours - -	25	8	11	8.00 F
	25	6	12	6.00 F
	25	9	7	10.00 F
After 24 Hours - -	30	10	11	40.00 F
Total times surely and possibly seen, -		66	93	

A similar failure to imitate was observed in the case of another simple act. No. 1, as may be seen on page 33, had learned to escape from a pen about 8 by 5 feet by jumping up and biting a cord which ran from one end of the pen to the other and at the front end was tied to the bolt which held the door. Dogs 2 and 3 had failed in their accidental jumping and pawing to hit this cord, and were then given a chance to learn by seeing 1 do so, escape, and of course be fed. 1 always jumped in the same way, biting the cord at the same place, namely where a loose end from a knot in it hung down 4 or 5 inches. 2 and 3 would either be tied up in the pen or left in a pen at one side. They had a perfect chance to see 1 perform his successful act. After every twenty or thirty performances by 1, 2 and 3 would be put in alone. It should be remembered that here, as also in the previous experiment and all others, the imitators certainly *wanted* to get out when thus left in alone. They struggled and jumped and pawed and bit, but they never jumped *at the cord*. Their records follow.

另一个前开口箱紧贴其后。3号置后箱，可看BB1高后圈箱内及前方发生的一切。

表题“3号狗模仿1号”。列名：1号完成次数、3号确定看见次数、可能看见次数、3号单独在箱内的用时；After 1/24/48 Hours＝相隔1/24/48小时；F＝失败。确定／可能观看总计66／93；全部逐次记录保留左页。

另一简单动作也未出现模仿。1号已学会从约8×5英尺围栏跳起、咬横贯绳逃出；绳前端接门闩，见第33页。2、3号随机跳、抓未碰绳，便给予观看1号、逃出、喂食的机会。1号每次跳法相同，咬绳同一位置，即绳结有4-5英寸松端垂下处。2、3号或拴围栏中、或留在旁边围栏，观看机会充分。每20-30次示范后，单放它们。必须记住，同先前及所有其他实验一样，单放时它们肯定想逃出：挣扎、跳、抓、咬，却从不朝绳跳。记录见下页。

Dog 2 Imitating Dog 1.

	Times 1 did.	Times 2 saw.	Times Doubtful.	Time 2 was in alone
	30	9	11	10.00 F
After 1 Hour, - -	30	10	9	10.00 F
After 48 Hours, - -	25	8	8	
After 1 Hour, - -	10	3	4	9.00 F [1]
After 24 Hours, - -	30	8	12	15.00 F
After 1 Hour, - -	30	9	12	15.00 F
After 48 Hours, - -	20	7	6	10.00 F
	20	8	7	
After 48 Hours, - -	30	6	8	15.00 F
After 24 Hours, - -	15	2	4	10.00 F
Total times surely and possibly seen, -	70		81	

Dog 3 Imitating Dog 1.

	Time 1 did.	Times 3 saw.	Times Doubtful.	Time 3 was in alone
	30	10	10	10.00 F
After 1 Hour, - -	30	9	10	10.00 F
After 1 Hour, - -	15	6	4	
After 24 Hours, - -	30	9	11	15.00 F
After 24 Hours, - -	30	10	12	15.00 F
After 1 Hour, - -	30	8	9	10.00 F
After 48 Hours, - -	20	6	7	40.00 F
After 1 Hour, - -	20	6	5	
After 48 Hours, - -	30	8	9	15.00 F
After 24 Hours, - -	15	3	4	20.00 F
Total times surely and possibly seen, -	75		81	

Another corroborative, though not very valuable, experiment was the following: Dog 3 had been taught for the purpose of another experiment to jump up on a box and beg when I held a piece of meat above the box. I then caused him to do this 110 times (within two days) in the presence of 1. Although 1 saw him at least 20 % of the times (3 was always fed each time he jumped on the box), he never tried to imitate him.

It seems sure from these experiments that the animals were unable to form an association leading to an act from having seen the other animal, or animals, perform the act in a certain

[1] The back of the pen adjoined the elevator shaft, being separated from it by a partition 33 inches high. No. 2 heard the elevator coming up and put his paws up on the top of this partition so as to look over. In so doing he knocked the fastening of the cord at that end and opened the door. He did not turn to come out, and I shut the door again.

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两表分别为“2号狗模仿1号”“3号狗模仿1号”。列名：1号完成次数、模仿者确定观看次数、可能观看次数、单独受试用时；小时为试验间隔，F为失败。确定／可能观看总计，2号70／81，3号75／81。全部数字、间隔及记录保留左页。

另一支持性但价值不大的实验：为别的实验，已教会3号在我把肉举于箱上时跳上箱乞食。两天内让它在1号面前作110次，每次跳上喂食。1号至少看到20%的次数，却从不试模仿。

这些实验似乎确定表明：动物不能仅因看见同类在某一情境下行动，而形成引向该行动的联结。

原注：围栏后紧邻电梯井，隔板高33英寸。2号听见电梯上行，把爪搭隔板顶想往外看，碰开此端绳的固定处而开门。它没转身出来，我重新关门。

situation. Thus we have further restricted the association process. Not only do animals not have associations accompanied, more or less permeated and altered, by inference and judgment; they do not have associations of the sort which may be acquired from other animals by imitation. What this implies concerning the actual mental content accompanying their acts will be seen later on. It also seems sure that we should give up imitation as an *a priori* explanation of any novel intelligent performance. To say that a dog who opens a gate, for instance, need not have reasoned it out *if he had seen another dog do the same thing*, is to offer instead of one false explanation another equally false. Imitation in any form is too doubtful a factor to be presupposed without evidence. And if a general imitative faculty is not sufficiently developed to succeed with such simple acts as those of the experiments quoted, it must be confessed that the faculty is in these higher mammals still rudimentary and capable of influencing to only the most simple and habitual acts, or else that for some reason its sphere of influence is limited to a certain class of acts, possessed of some *qualitative difference*, other than mere simplicity, which renders them imitable. The latter view seems a hard one to reconcile with a sound psychology of imitation or association at present, without resorting to instinct. Unless a certain class of acts are by the innate mental make-up especially tender to the influence of imitation, the theory fails to find good psychological ground to stand on. The former view may very well be true. But in any case the burden of proof would now seem to rest upon the adherents to imitation; the promising attitude would seem to be one which went without imitation as long as it could, and that is, of course, until it surely found it present.

Returning to imitation considered in its human aspect, to imitation as a transferred association in particular, we find that here our analytical study of the animal mind promises important contributions to general comparative psychology. If it is true, and there has been no disagreement about it, that the primates do imitate acts of such novelty and complexity that only this out-and-out kind of imitation can explain the fact, we have located one great advance in mental development. Till the primates

因此又限制了联结过程：不仅没有伴随、渗透或受推论判断改变的联结，也没有可从别的动物经模仿取得的联结。对行为所伴心理内容的意义，后文再说。

我们也应放弃用模仿先验地解释任何新奇聪明行为。说开门狗若见别狗这样做，就不必自己推理，只是以同样错误的解释替代另一个。任何形式的模仿，都太可疑，不能无证据预设。若一般模仿能力连实验这些简单动作也不能学，它在高等哺乳动物中就仍属原始，只能影响最简单、最习惯的动作；或者其影响限定于某类有质的差异、而非仅更简单的动作。后一观点若不求助本能，难与目前合理的模仿或联结心理学协调；除非先天心理构造令某类动作特别易受模仿，理论缺少根据。前一观点很可能真。但无论如何，举证责任现在应在主张模仿者；有前途的态度，是尽可能不用模仿，直到确实发现它。

回到人类方面，尤其作为迁移联结的模仿，这种动物心理分析可对一般比较心理学作重要贡献。如果确实如无人异议的那样，灵长类会模仿新颖、复杂到只能由完全意义的模仿解释的动作，那么便找到心理发展的一个重大进步。在灵长类以前几乎只有本能，以及通过冲动性试错获得的个体经验。

we get practically nothing but instincts and individual acquirement through impulsive trial and error. Among the primates we get also acquisition by imitation, one form of the increase of mental equipment by tradition. The child may learn from the parent quickly without the tiresome process of seeing for himself. The less active and less curious may share the progress of their superiors. The brain whose impulses hitherto could only be dislodged by specific sense-impressions may now have any impulse set agoing by the sight of the movement to which it corresponds.

All this on the common supposition that the primates *do* imitate, that a monkey in the place of these cats and dogs *would* have pulled the string. My apology for leaving the matter in this way without experiments of my own is that the monkey which I procured for just this purpose failed in two months to become tame enough to be thus experimented on. Accurate information about the nature and extent of imitation among the primates should be the first aim of further work in comparative psychology, and will be sought by the present writer as soon as he can get subjects fit for experiments.

In a questionnaire which was sent to fifteen animal-trainers, the following questions were asked:

1. "If one dog was in the habit of 'begging' to get food and another dog saw him do it ten or twenty times, would the second dog then beg himself?"

2. "In general is it easier for you to teach a cat or dog a trick if he has seen another do it?"

3. "In general do cats imitate each other? Do dogs? Do monkeys?"

4. "Give reasons for your opinion, and please write all the reasons you have."

Five gentlemen (Messrs. R. C. Carlisle, C. L. Edwards, V. P. Wormwood, H. S. Maguire and W. E. Burke) courteously responded to my questionnaire. All are trainers of acknowledged reputation. To these questions on imitation four replied.

To the first question we find the following answers: (*a*) "Most dogs would." (*b*) "Yes; he will very likely do it. He will try and imitate the other dog *generally*." (*c*) "If a young dog with the mother, it would be very apt to . . . With older dogs, it would depend very much upon circumstances." (*d*) "He would not."

To 2 the answers were: (*a*) "Very much easier." (*b*) "It is always easier if they see another one do it often." (*c*) "This would also depend on certain conditions. In teaching to jump out of a box and in again, seeing another might help, but in teaching something very difficult, I do not think it would be the case." (*d*) "It is not."

中文译文

灵长类还通过模仿获得，是凭传统增添心理禀赋的一种形式。子女可从父母快速学习，不必费力亲自摸索；较不活跃、少好奇者也可分享更优秀者的进步。以往冲动只能由特定感觉印象激发的脑，现在看见对应动作便可激发该冲动。

这全以“灵长类确实模仿、猴若替代这些猫狗便会拉绳”的通常假定为前提。我未自行实验的原因，是专为此取得的猴，两个月后仍未温驯到可实验。准确了解灵长类模仿的性质、范围，应是后续比较心理学的首要目标；一有合适被试，我即研究。

向15位驯兽师寄问卷，问：1.“若一狗习惯乞食，另一狗看十或二十次，第二狗会自己乞食吗？”2.“猫狗看过同类表演后，通常更容易教会技能吗？”3.“猫通常互相模仿吗？狗呢？猴呢？”4.“请说明判断理由，并写出全部理由。”

5位公认著名驯兽师R. C. Carlisle、C. L. Edwards、V. P. Wormwood、H. S. Maguire、W. E. Burke礼貌回复，其中4位回答模仿问题。第一问答：a“大多数会”；b“会，很可能，一般会试着模仿”；c“幼狗与母亲同处很可能；成年狗很依情况”；d“不会”。第二问答：a“容易得多”；b“经常看别只做，总更容易”；c“依条件；学进出箱可能有帮助，非常困难的事大概不会”；d“不更容易”。

To 3 the answers were: (*a*) "Yes. Some. More than either dogs or cats." (*b*) "Yes. Yes. Yes." (*c*) "In certain things, yes; mostly in those things which are in compliance to the laws of their own nature." (*d*) "No. No. Yes, they are born imitators."

The only definite answer to question 4 was: "Take a dog or cat and close them up in a room and go in and out several times, and you will find that they will go to the door and stand up on their hind legs with front paws on the door knob and try to open the door to get out. I could also give you a hundred more such reasons." This was given by (*b*).

The replies to a test question, however, go to show that these opinions regarding imitation may be mistaken. Question 8 was: "If you wanted to teach a cat to get out of a cage by opening an ordinary thumb-latch and then pushing the door, would you take the cat's paw and push down the thumb-piece with it and then push the door open with the paw, or would you just leave the cat inside until it learned the trick itself?" The second is certainly the better way, as will be seen in a later part of this paper, and pushing the latch with the cat's paw has absolutely no beneficial influence on the formation of the association, yet (*a*) and (*b*) both chose the first way, and (*c*) answered ambiguously. Further, the only reason given is, of course, no reason at all. It proves too much, for if there were such imitation as that, my cats and dogs would surely have done the far simpler things required of them. I cannot find that trainers make any practical use of imitation in teaching animals tricks, and on the whole I think these replies leave the matter just where it was before. They are mere opinions—not records of observed facts. It seems arrogant and may seem to some unjustifiable thus to discard testimony, to stick to a theory based on one's own experiments in the face of these opinions. If I had wished to gain applause and avoid adverse criticism, I would have abstained from upholding the radical view of the preceding pages. At times it seems incredible to me that the results of my experiments should embody the truth of the matter, that there should be no imitation. The theory based on them seems, even to me, too radical, too novel. It seems highly improbable that I should be right and all the others wrong. But I cannot avoid the responsibility of giving what seems to my judgment the most probable explanation of the results of the experiments; and that is the radical explanation already given.

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第三问答：a“猫会，狗有些会，猴比两者更多”；b“会、会、会”；c“某些事会，主要符合自身自然规律的事”；d“猫不，狗不，猴会，它们天生模仿”。第四问唯一明确理由来自b：“把猫狗关房间，自己进出几次，它们便会到门边、后腿站立、前爪搭门把手，尝试开门出去；我还能给一百个理由。”

但检验性问题显示这些模仿意见可能错误。第8问是：“若教猫开普通拇指门闩、再推门逃出，会握它的爪压片、再用爪推门，还是只让它留在箱里直到自行学会？”后文将表明，后者肯定更好，握爪压闩对联结形成绝无帮助；然而a、b都选前者，c模糊回答。所给唯一理由也不算理由，证明得过头：若有这种模仿，我的猫狗肯定会做远简单得多的要求动作。我没发现驯兽师教技能时实际利用模仿；总体上，这些回答仍让问题停留原处，只是意见而非观察事实记录。

这样摒弃证词、面对他人意见坚持自己的实验理论，显得傲慢，有人也许认为不正当。若求赞赏、免批评，我便不会支持上述激进观点。有时我自己也难相信实验结果真揭示事实、竟没有模仿；理论对我也太激进、太新。我对而所有人错，似乎极不可能。但我不能逃避责任，必须提出自己判断中最可能的实验解释；就是已经给出的激进解释。

THE MENTAL FACT IN ASSOCIATION.

It is now time to put the question as to just what is in an animal's mind when, having profited by numerous experiences, he has formed the association and does the proper act when put in a certain box. The commonly accepted view of the mental fact then present is that the sight of the inside of the box reminds the animal of his *previous pleasant experience after escape* and *of the movements* which he made which were immediately followed by and so associated with that escape. It has been taken for granted that *if the animal remembered the pleasant experience and remembered the movement, he would make the movement*. It has been assumed that the association was *an association of ideas:* that when one of the ideas was of a movement the animal was capable of making the movement. So, for example, Morgan says, in the 'Introduction to Comparative Psychology': "If a chick takes a lady-bird in its beak forty times and each time finds it nasty, this is of no practical value to the bird unless the sight of the bird suggests *the nasty taste*," p. 90.

Again, on page 92, Morgan says, "*A race after the ball* had been suggested through the channel of olfactory sensations." Also on page 86 "* * * the visual impression suggested the idea or representation of unpleasant gustatory experience." The attitude is brought out more completely in a longer passage on page 118: "On one of our first ascents one of them put up a young coney, and they both gave chase. Subsequently they always hurried on to this spot, and, though they never saw another coney there, reiterated disappointment did not efface *the memory of that first chase*, or so it seemed." That is, according to Morgan, the dogs thought of the chase and its pleasure, on nearing the spot where it had occurred, and so hurried on. On page 148 of 'Habit and Instinct,' we read, "Ducklings so thoroughly associated water with the sight of their tin that they tried to drink from it and wash in it when it was empty, nor did they desist for some minutes," and this with other similar phenomena is attributed to the 'association by contiguity' of human psychology.

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联结中的心理事实

动物从多次经验获益，形成联结，入某箱便恰当行动时，其心理究竟有什么？通常观点是，箱内景象使它想起先前逃出后的愉快经验，及紧接着带来逃出、因而与逃出相联的动作。人们理所当然地假定，只要记得愉快经验和动作，动物就会作动作。联结被假定为观念联想：一个观念关于动作，动物便能作该动作。

例如摩根在《比较心理学导论》第90页说："小鸡把瓢虫叼进嘴40次，每次都觉难吃，除非看见瓢虫会唤起难吃的味道，否则毫无实际价值。"第92页又说："嗅觉感觉通过其通道唤起追球。"第86页："……视觉印象唤起不愉快味觉经验的观念或表象。"第118页更完整："我们最初一次登山时，其中一狗惊起幼兔，两狗都追。此后总赶到该处，虽再未见兔，反复失望似乎未抹去第一次追逐的记忆。"即按摩根说法，狗接近原地点，想起追逐及愉快，所以赶去。

《习惯与本能》第148页："小鸭把水同铁罐景象联系得如此牢，即使空罐也试着喝、洗，好几分钟不停止。"这和类似现象，被归于人类心理学的"接近联想"。

From these quotations it seems fairly sure that if we should ask Mr. Morgan, who is our best comparative psychologist, what took place in the mind of one of these cats of our experiments during the performance of one of the 'tricks,' he would reply: "The cat performs the act because of the association of ideas. He is reminded by the sight of the box and loop of his experience of pulling that loop and of eating fish outside. So he goes and pulls it again." This view has stood unchallenged, but its implication is false. It implies that an animal, whenever it thinks of an act, can supply an *impulse to do* the act. It takes for granted that the performance of a cat who gets out of a box is mentally like that of a man who thinks of going down street or of writing a letter and then does it. The mental process is not alike in the two cases, for animals can *not* provide the impulse to *do* whatever act they think *of*. *No cat can form an association leading to an act unless there is included in the association an impulse of its own which leads to the act.* There is no general storehouse from which the impulse may be supplied after the association is formed.

Before describing the experiments which justify these statements, it will be worth while to recall the somewhat obvious facts about the composition of one of these associations. There might be in an association, such as is formed after experience with one of our boxes, the following elements:

1. Sense-impression of the interior of the box, etc.
2. (*a*) Discomfort and (*b*) desire to get out.
3. Representation of oneself pulling the loop.
4. Fiat comparable to the human "I'll do it."
5. The impulse which actually does it.
6. Sense-impression of oneself pulling the loop, seeing one's paw in a certain place, feeling one's body in a certain way, etc.
7. Sense impression of going outside.
8. Sense-impression of eating, and the included pleasure.

Also between 1 and 4 we may have 9, representations of one's experience in going out, 10, of the taste of the food, etc.

6, 7 and 8 come after the act and do not influence it, of course, except in so far as they are the basis of the future 3's, 9's and 10's. About 2 we are not at present disputing. Our

这些引文表明，若问最好的比较心理学家摩根，猫完成实验技能时心理发生什么，他多半答："猫因观念联想而行动。箱子、圈使它想起拉圈、到外面吃鱼的经验，于是再次拉。"此观点未受挑战，却包含错误含义：动物想到某动作，就能提供做它的冲动；默认猫逃箱在心理上如人想上街、写信后行动。两者并不相同，动物不能随意提供所想到动作的冲动。猫的联结若不包含它自身引向动作的冲动，便不能引向行动；没有在联结形成后可随意提供冲动的一般储库。

说明实验依据前，先分析联结可能包含的要素：

1.箱内等的感觉印象。

2.a不适，b想出去。

3.自己拉圈的表象。

4.类似人类"我要做"的意志命令。

5.真正完成动作的冲动。

6.自己正在拉圈、看见爪的位置、感觉身体状态等的感觉印象。

7.走到外面的感觉印象。

8.进食的感觉印象及愉快。

在1与4之间，还可能有9，出箱经验的表象，和10，食物味道的表象等。6、7、8在动作后，不影响当下动作，当然会作为未来3、9、10的基础。我们不争论2；问题是3还是5为关键。

question is as to whether 3 or 5 is the essential thing. In human associations 3 certainly often is, and the animals have been credited with the same kind. Whatever he *thinks*, Professor Morgan surely *talks* as if 1 aroused 9 and 10 and 3 and leaves 5 to be supplied at will. We have affirmed that 5 is the essential thing, that no association without a specific 5 belonging to it and acquired by it can lead to an act. Let us look at the reasons.

A cat has been made to go into a box through the door, which is then closed. She pulls a loop and comes out and gets fish. She is made to go in by the door again, and again lets herself out. After this has happened enough times, the cat will of her own accord go into the box after eating the fish. It will be hard to keep her out. The old explanation of this would be that the cat associated the memory of being in the box with the subsequent pleasure, and therefore performed the equivalent of saying to herself, "Go to! I will go in." The thought of *being in*, they say, makes her *go in*. *The thought of being in will not make her go in*. For if, instead of pushing the cat toward the doorway or holding it there, and thus allowing it to itself give the impulse, to innervate the muscles, to walk in, you shut the door first and drop the cat in through a hole in the top of the box, she will, after escaping as many times as in the previous case, *not* go into the box of her own accord. She has had exactly the same opportunity of connecting the idea of being in the box with the subsequent pleasure. Either a cat cannot connect ideas, representations, at all, or she has not the power of progressing from the thought of being in to the act of going in. The only difference between the first cat and the second cat is that the first cat, in the course of the experience, has the impulse to crawl through that door, while the second has not the impulse to crawl through the door or to drop through that hole. So, though you put the second cat on the box beside the hole, she doesn't try to get into the box through it. The impulse is the *sine qua non* of the association. The second cat has everything else, but cannot supply that. These phenomena were observed in six cats, three of which were tried by the first method, three by the second. Of

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人类联结往往以3为关键，人们也把同类过程归于动物。不论摩根怎么想，其语言确实仿佛是1引出9、10、3，而5可随意提供。我们主张5才关键：没有特定且通过该联结获得的5，任何联结都不能引向行动。理由如下。

猫从门进入箱，门关，拉圈出去吃鱼；再令它走门进去、自行出来。重复足够多次后，吃完鱼它会主动进箱，甚至难阻止。旧解释是，猫把在箱中的记忆与后来的愉快联结，相当于对自己说“好，我进去”；在箱中的念头令它进去。

在箱中的念头不会使它进去。若不是把猫推向门、停门边，使它自己产生走入的冲动、支配肌肉，而先关门、从顶孔放入，那么即使同样多次逃出，它也不主动进箱。它同样有机会把在箱中的观念与随后愉快相联。或者猫根本不能联结观念、表象，或者不能从“在里面”的念头转到“走进去”的动作。

两猫唯一差异，是第一猫曾有爬过门的冲动，第二猫没有过门或从孔下落的冲动。把第二猫置顶孔旁，它也不想进去。冲动是联结不可缺少的条件；其余全具备，它却不能另行补给冲动。6猫分别两方法试，三只走门组中，

the first three, one went in himself on the 26th time and frequently thereafter, one on the 18th and the other on the 37th; the two last as well as the first did that frequently in later trials. The other three all failed to go in themselves after 50, 60 and 75 trials, respectively.

The case of No. 7 was especially instructive, though not among these six. No. 7 had had some trials in which it was put in through the door, but ordinarily in this particular experiment was dropped in. After about 80 trials it would frequently exhibit the following phenomena: It would, after eating the fish, go up to the doorway and, rushing from it, search for fish. The kitten was very small and would go up into the doorway, whirl round and dash out, all in one quick movement. The best description of its behavior is the paradoxical one that it went out without going in. The association evidently concerned what it had *done*, what it had an impulse for, namely, *coming out through that door* to get fish, not what it remembered, had a representation of.

Still more noteworthy evidence is found in the behavior of cats and dogs who were put in these boxes, left one or two minutes, and then put through the proper movement. For example, a cat would be put in B (o at back) and left two minutes. I would then put my hand in through the top of the box, take the cat's paw and with it pull down the loop. The cat would then go out and eat the fish. This would be done over and over again, and after every ten or fifteen such trials the cat would be left in alone. If in ten or twenty minutes he did not escape, he would be taken out through the top and not fed. In one series of experiments animals were taken and thus treated in boxes from which their own impulsive activity had failed to liberate them. The results, given in the table below, show that no animal who fails to perform an act in the course of his own impulsive activity will learn it by being put through it.

In these experiments some of the cats and all of the dogs but No. 1 showed no agitation or displeasure at my handling from the very start. Nor was there any in Dog 1 or the other cats after a few trials. It may also be remarked that in the trials alone which took place during and at the end of the ex-

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一只第26次、另两只第18和37次主动进去，以后都常如此。另三只分别50、60、75次后仍未自行进去。

不在这6只内的7号尤其有启发。它偶尔经门放入，本实验通常从顶放。约80次后，吃鱼后常走到门口，又冲离门口找鱼。它很小，走入门槛、转身、冲出，连成一个快动作；最好的描述反而是悖论："未进去就出来。"联结显然关乎它做过、有冲动做的动作--从门出来获鱼--而非记忆表象。

更有力证据来自放箱一两分钟、再由人带着完成正确动作的猫狗。如猫入B后圈箱两分钟，我从顶伸手、握爪拉圈，猫出去吃鱼，反复；每10或15次后，单留猫，10或20分钟未逃出便从顶取出，不喂食。一组实验取自身冲动活动不能使它们逃出的动物。下表表明：不能在自身冲动活动中完成动作者，也不能因被带着做而学会。

开始时，一些猫及除1号外的狗，对操作没有不安或不悦；1号狗和其他猫几次后也不再有。实验中及最终的单独试验毫无例外表明，失败不是因不想逃出。

periment the animals without exception showed that they did not fail to perform the act from lack of a desire to get out. They all tried hard enough to get out and would surely have used the association if they had formed it.

Individual.	Apparatus.	Time in which impulsive activity failed to lead to the act	Number of times the animal was put through the movement	Time in which this experience failed to lead to the act.	Time of final trial
Cat 1	F (String outside unfastened)	55.00	77	120.00	20.00
Cat 5	G (Thumb-latch) - -	57.00	59	55.00	10.00
Cat 7	G (Thumb-latch) - -	50.00	30	35.00	10.00
Cat 2	G (Thumb-latch) - -	54.00	141	110.00	20.00
Dog 2	BB1 (o at back, high) -	45.00	30	80.00	05.00
Dog 3	BB1 (o at back, high) -	20.00	85	55.00	10.00
Dog 2	M (Lever outside) - -	15.00	95	140.00	30.00
Dog 1	FF[1] - - - - -	30.00	110	135.00	60.00
Chick 89	X (See page 53).	20.00	30	60.00	30.00
Cat 13	KKK[2, 3] - - - -	40.00	65	60.00	10.00

Now, the only difference between the experiences of the animals in these experiments and their experiences in those where they let themselves out, is that here they only saw and felt themselves making the movement, whereas in the other case they also felt the impulse, gave the innervation. That, then, is the essential. It may be objected that the animals failed because they did not *attend* to the process of being put through the movement, that, had they attended to it, they would later themselves have made the movement. It is, however, improbable that out of fifty times an animal should not have attended to what was going on at least two or three times. But if seeing himself do it was on a par with feeling an impulse to and so doing it, even two or three times would suffice to start the habit. And it is even more im-

[1] FF was a box 40×21×24 inches, the door of which could be opened by putting the paw out between the bars to its right and pulling a loop which hung 16 inches above the floor, 4 inches out from the box and six inches to the right of the door.

[2] KKK was box K with both bolts removed. All that had to be done was to poke the paw out at one side of the door and press down a little bar of wood.

[3] The cats and chick were left in for two minutes at each trial, the dogs for from one to one and a half minutes.

所有动物都足够努力，若已形成联结，肯定会用。

表列中文列名依次为：个体、装置、自行冲动活动未引出该动作的用时、被带着完成动作的次数、单独受试仍未完成动作的用时、最后一次试验用时。纯数字及各动物的全套记录保留左页。F＝未固定外绳；G＝拇指门闩；BB1＝高后圈；M＝外杠杆；FF、KKK见原注；X见第53页。

这些经验与动物自己逃出的经验，唯一不同是：这里仅看见、感觉自己在运动，另一种还体验自身冲动、主动发出神经支配。所以后者才是关键。可能有人反对，失败因为没注意被带着动作；若注意，以后就会自做。但50次中连两三次也没注意，极不可能。若看见自己做，真等同于体验冲动、主动做，两三次就该启动习惯。更难相信一种经验50次后都紧接强烈愉快，

原注一：FF箱40×21×24英寸；爪从门右栏间伸出，拉距地16英寸、箱外4英寸、门右6英寸处悬着的圈，即可开门。

原注二：KKK是去掉两门闩的K；只须把爪从门一侧伸出，压一小木杆。

原注三：猫、小鸡每次先单留两分钟；狗先留一至一分半。

probable that an experience should be followed by keen pleasure fifty times and not be attended to with might and main, unless animals attend *only* to their own impulses and the excitements thereof. But if the latter be true, it simply affirms our view from a more fundamental standpoint.

In another set of experiments animals were put in boxes with whose mechanism they had had no experience, and from which they might or might not be able to escape by their own impulsive acts. The object was to see whether the time taken to form the association could be altered by my instruction. The results turned out to give a better proof of the inability to form an association by being put through the act than any failure to change the time-curve. For it happened in all but one of the cases that the movement which the animal made to open the door was different from the movement which I had put him through. Thus, several cats were put through (in Box C [Button]) the following movement: I took the right paw and, putting it against the lower right-hand side of the button, pushed it round to a horizontal position. The cats' ways were as follows: No. 1 turned it by clawing vigorously at its top; No. 6, by pushing it round with his nose; No. 7, in the course of an indiscriminate scrabble at first, in later trials either by pushing with his nose or clawing at the top, settling down finally to the last method. Nos. 2 and 5 did it as No. 1 did. Cat 2 was tried in B (0 at back). I took his paw and pressed the loop with it, but he formed the habit of clawing and biting the string at the top of the box near the front. No. 1 was tried in A. I pressed the loop with his paw, but he formed the habit of biting at it.

In every case I kept on putting the animal through the act every time, if at the end of two minutes (one in several cases) it had not done it, even after it had shown, by using a different way, that my instruction had no influence. I never succeeded in getting the animal to change its way for mine. Moreover, if any one should fancy that the animal really profited by my instruction so as to learn what result to attain, namely, the turning of a certain button, but chose a way of his own to turn it, he would be deluding himself. The time taken to learn the act with instruction was no shorter than without.

却没有受到充分注意，除非动物仅注意自身冲动及其激动。若后者为真，只是从更根本角度肯定我们的观点。

另一组取对箱中机关完全无经验、可能或不可能自行逃出的动物，检验我的指导能否改变学习时间。结果比“时间曲线不改变”更有力地证明不能经被动带做建立联结：除一例外，动物自行开门的动作都不同于我带它做的动作。例如C旋钮箱，握右爪顶旋钮右下侧，推至水平。1号却猛抓顶部；6号用鼻子转；7号最初乱抓，后来鼻推或抓顶部，最后固定抓顶部；2、5号同1号。2号在B中，我握爪压圈，它却学会抓咬箱顶近前部的绳；1号在A中，我握爪压圈，它却学会咬圈。

每次两分钟后，有些一分后，未自做便继续带做，即使它已用另一方式证明指导无影响；从未使动物改用我的方式。若以为指导教会的是应达到“转动某旋钮”这一结果，只是动物自选做法，那也错：有指导的学习时间，并不短于无指导。

If, then, an animal happens to learn an act by being put through it, it is just happening, nothing more. Of course, you may *direct* the animal's efforts so that he will perform the act himself the sooner. For instance, you may hold him so that his accidental pawing will be sure to hit the vital point of the contrivance. But the animal can not form an association leading to an act unless the particular impulse to that act is present as an element of the association; he cannot supply it from a general stock. The groundwork of animal associations is not the association of *ideas*, but the association of idea or sense-impression with *impulse*.

In the questionnaire mentioned elsewhere, some questions were asked with a view to obtaining corroboration or refutation of this theory that an impulse or innervation is a necessary element in every association formed if that association leads to an act. The questions and answers were:

Question 1: "If you wanted to teach a horse to tap seven times with his hoof when you asked him, "How many days are there in a week?," would you teach him by taking his leg and making him go through the motions?"

A answered, "Yes! at first."

B answered, "No! I would not."

C answered, "At first, yes!"

D answered, "No!"

Question 2: "Do you think you *could* teach him that way, even if naturally you would take some other way?"

A answered, "In time, yes!"

B answered, "I think it would be a very hard way."

C answered, "Certainly I do."

D answered, "I do not think I could."

E answered, "Yes."

Question 3: "How would you teach him?"

A answered, "I should tap his foot with a whip, so that he would raise it, and reward him each time."

B answered, "I should teach him by the motion of the whip."

C answered, "First teach him by pricking his leg the number of times you wanted his foot lifted."

动物若在被带做后碰巧学会，仅是碰巧。当然可以引导它的努力，使其更早自做；如握住身体，使偶然爪动必碰机关关键处。但联结若不包含该动作的特定冲动，就不能引向动作，动物不能从一般储备补给它。动物联结的基础不是观念与观念，而是观念或感觉印象同冲动的联结。

前述问卷也问几项，试图支持或反驳“凡引向行动的联结都须包含冲动或神经支配”这一理论。

问题1：“若让马在问‘一星期几天？’时蹄敲七下，会握腿带它做动作来教吗？”A：“最初会。”B：“不会。”C：“最初会。”D：“不会。”

问题2：“即使通常另用方法，你认为这样能教会吗？”A：“久了能。”B：“我想这非常难。”C：“当然能。”D：“我不认为能。”E：“能。”

问题3：“你会怎样教？”A：“用鞭轻碰蹄，让它抬脚，每次奖赏。”B：“借鞭的动作教。”C：“最初刺触腿，次数就是要它抬蹄的次数。”

D answered, "You put figure 2 on blackboard and touch him on leg twice with cane, and so on."

E answered ambiguously.

It is noteworthy that even those who think they *could* teach an animal by putting him through the trick do not use that method, except at first. And what they really do then is probably to stimulate the animal to the reflex act of raising his hoof. The hand simply replaces the cane or whip as the means of stimulus. The answers are especially instructive, because the numerous counting tricks done by trained horses seem, at first, to be incomprehensible, unless the trainer can teach the horse by putting it through the movement the proper number of times. The counting tricks performed by Mascot, Professor Maguire's horse, were quoted to me by a friend as incomprehensible on my theory. The answers given above show how simple the thing really is. All the counting-tricks of all the intelligent horses depend on the fact that a horse raises his hoof when a certain stimulus is given. One simple reaction gives the basis for a multitude of tricks. In the same way other tricks, which at first sight seem to require that the animal should learn by being put through the movement, may depend on some simple reflex or natural impulse.

Another question was, "How would you teach a cat to get out of a box, the door of which was closed with a thumb-latch?"

A answered, "I should use a puff-ball as a plaything for the cat to claw at." This means, I suppose, that he would get the cat to claw at the puff-ball and thus direct its clawings to the vicinity of the thumb-piece.

B answered, "I would put the cat in and get it good and hungry and then open the door by lifting the latch with my finger. Then put some food that the cat likes outside, and she will soon try to imitate you and so learn the trick."

C answered, "I would first adjust all things in connection with the surroundings of the cat so they would be applicable to the laws of its nature, and then proceed to teach the trick."

I suppose this last means that he would fix the box so that some of the cat's instinctive acts would lead it to perform the trick. The answer given by *B* means apparently that he would

D回答："黑板写2，用杖碰腿两次，依此类推。"E回答不明确。

值得注意，认为带做能教会者，也只在最初用此法；实际上大概是在刺激抬蹄的反射。手只是代替杖、鞭作为刺激。回答很有启发，因为训练马许多数数技能，乍看若不由人带它作恰当次数，似乎难理解。朋友曾举Maguire教授的马Mascot数数，说我的理论解释不了；上述回答表明其实简单。聪明马的全部数数技能，都依赖某刺激引起抬蹄。一种简单反应可成为许多技能的基础。其他看似必须由带做学会的技能，也可能依赖简单反射或自然冲动。

另一问："怎么教猫打开拇指门闩逃箱？"A："用绒球让它玩、抓。"我想就是诱抓绒球，引导爪到拇指片附近。B："放箱，令很饿，用手指抬闩开门，外放喜爱食物；它很快模仿而学会。"C："先把周围一切调整得适合其自然规律，再教。"最后一答大概是调整箱子，让某些本能动作引向技能。B则显然是只把事情交给偶然，因为他假定的模仿不可能。

simply leave the thing to accident, for any such imitation as he supposes is out of the question. At all events, none of these would naturally start to teach the trick by putting the animal through the motions, which, were it a possible way, would probably be a traditional one among trainers. On the whole, I see in these data no reason for modifying our dogma that animals cannot learn acts without the impulse.

Presumably the reader has already seen budding out of this dogma a new possibility, a further simplification of our theories about animal consciousness. The possibility is that animals may have *no images or memories at all, no ideas to associate*. Perhaps the entire fact of association in animals is the presence of sense-impressions with which are associated, by resultant pleasure, certain impulses, and that therefore, and therefore only, a certain situation brings forth a certain act. Returning to our analysis of the association, this theory would say that there was no (9) or (10) or (3) or (4), that the sense-impression gave rise, when accompanied by the feeling of discomfort, to the impulse (5) directly, without the intervention of any representations of the taste of the food, or the experience of being outside, or the sight of oneself doing the act. This theory might be modified so as to allow that the representations could be there, but to deny that they were necessary, were inevitably present, that the impulse was connected to the sense-impression through them. It would then claim that the effective part of the association was a direct bond between the situation and the impulse, but would not cut off the possibility of there being an aura of memories along with the process. It then becomes a minor question of interpretation which will doubtless sooner or later demand an answer. I shall not try to answer it now. The more radical question, the question of the utter exclusion of representative trains of thought, of any genuine association of *ideas* from the mental life of animals, is worth serious consideration. I confess that, although certain authentic anecdotes and certain experiments to be described soon, lead me to reject this exclusion, there are many qualities in animals' behavior which seem to back it up. If one takes his stand by a rigid application of the law of parsimony, he will find justification for this view which no experiments of mine can overthrow.

至少无人自然地以带动物做动作来开始教学；若可行，这大概早成驯兽师的传统方法。总体没有理由修改我们的主张：没有冲动，动物不能学会动作。

读者或已看出可进一步简化动物意识理论的可能：动物或许完全没有心理表象、记忆，也没有可联结的观念。全部联结事实，也许仅是感觉印象与某冲动经随后的愉快联系，所以且仅所以某情境引出某行动。回到编号分析：没有9、10、3、4，感觉印象在不适伴随下直接引出5，无食物味、出箱经验、自己做动作的表象介入。

也可修改为允许这些表象出现，但否认其必要、必然存在，否认冲动必须经它们与感觉印象相联。有效部分仍是情境与冲动的直接联系，不排除过程周围伴有记忆的光晕。这变成次要的解释问题，迟早须回答，我现在不答。更激进的问题--把表象性的思路和真正观念联想，完全排除出动物心理生活--值得认真考虑。我承认，某些可靠轶事及下文实验令我否定这种排除；但许多动物行为特性似乎支持它。严格遵守简约法则，就能为这一观点找到我的实验无法推翻的依据。

Of one thing I am sure, and that is that it is worth while to state the question and how to solve it, for although the point of view involved is far removed from that of our leading psychologists to-day, it cannot long remain so. I am sorry that I cannot pretend to give a final decision.

The view seems preposterous because, if an animal has sense-impressions when his brain is excited by currents starting in the end-organs, it seems incredible that he should not be conscious in imagination and memory by having similar excitations caused from within. We are accustomed to think of memory as the companion of sensation. But, after all, it is a question of fact whether the connections in the cat-brain include connections between present sensation-neuroses and past sensation-neuroses. The only connections may be those between the former and impulse-neuroses, and there is no authoritative reason why we should suppose any others unless they are demonstrated by the cat's behavior. This is just the point at issue. Such evidence as the phenomena of animals' dreams does not at all prove the presence of memory or imagination. A dog may very well growl in his sleep without any idea of a hostile dog. The impulse to growl *may* be caused by chance excitement of its own neurosis without any sensation-neurosis being concerned. *Acts* of recognition may have no *feelings* of recognition going with or causing them. A sense-impression of me gets associated in my dog's mind with the impulses to jump on me, lick my hand, wag his tail, etc. If, after a year, the connection between the two has lasted, he will surely jump on me, lick my hand and wag his tail, though he has not and never had any representation of me.

The only logical way to go at this question and settle it is, I think, to find some association the formation of which requires the presence of images, of ideas. You have to give an animal a chance to associate sense-impression A with sense-impression B and then to associate B with some act C so that the presence of B in the mind will lead to the performance of C. Presumably the representation of B, if present, will lead to C just as the sense-impression B did. Now, if the chance to associate B with A has been improved, you ought, when the

我确信，值得提出问题及解决方式。此视角虽远离当今主要心理学家，却不可能长期如此。我遗憾不能给最终裁断。

它看似荒谬，是因为既然感官末梢发出的神经流令脑兴奋、产生感觉印象，难相信内部相似兴奋不能产生想象、记忆意识。我们习惯把记忆视作感觉的伴随者。但猫脑是否存在当前感觉神经活动与过去感觉神经活动之间的连接，终究是事实问题；连接也可能只在当前感觉过程与冲动过程之间。除行为证明外，无权威理由必假定别种连接。这正是争点。

梦之类现象，绝不证明记忆、想象存在。狗睡中低吼，可能没有敌狗的观念；只是自身冲动神经过程偶然兴奋，无感觉神经过程参与。辨认行为也可能没有辨认体验伴随或引起。我的感觉印象，可在狗心理中与跳向我、舔手、摇尾的冲动相联；一年后连接若保留，它仍会如此，即使没有、也从未有过我的表象。

逻辑上唯一可解决的途径，是找一种必须有表象、观念才能形成的联结。先使动物有机会把感觉印象A与B相联，再让B与动作C相联，使心理中的B引出C。若B的表象存在，理应同B的实际感觉印象一样引出C。若A与B的联结机会被利用，那么当出现A时，

animal is confronted with the sense-impression A, to get a revival of B and so the act C. Such a result would, if all chance to associate C with A had been eliminated, demonstrate the presence of representations and their associations. I performed such an experiment in a form modified so as to make it practicable with my animals and resources. Unfortunately, this modification spoils the crucial nature of the experiment and robs it of much of its authority. The experiment was as follows:

A cat was in the big box where they were kept (see page 58) very hungry. As I had been for a long time the source of all food, the cats had grown to watch me very carefully. I sat, during the experiment, about eight feet from the box, and would at intervals of two minutes clap my hands four times and say, "I must feed those cats." Of course the cat would at first feel no impulse except perhaps to watch me more closely when this signal was given. After ten seconds had elapsed I would take a piece of fish, go up to the cage and hold it through the wire netting, three feet from the floor. The cat would then, of course, feel the impulse to climb up the front of the cage. In fact, experience had previously established the habit of climbing up whenever I moved toward the cage, so that in the experiment the cat did not ordinarily wait until I arrived there with the fish. In this experiment:

A=The sense-impression of my movements and voice when giving the signal.

B=The sense-impression of my movements in taking fish, rising, walking to box, etc.

C=The act of climbing up, with the impulse leading thereunto.

The question was whether after a while A would remind the cat of B, and cause him to do C before he got the *sense-impression* of B, that is, before the ten seconds were up. If A leads to C through a memory of B, animals surely *can* have association of ideas proper, and probably often *do*. Now, as a fact, after from thirty to sixty trials, the cat does perform C immediately on being confronted by A or some seconds later, at all events before B is presented. And it is my present opinion

就应唤回B、引出C。若已排除A与C直接联结的机会，这将证明表象及其联结存在。我为现有动物、资源改作可行形式；不幸改动损害实验的关键判别性，削弱其权威。

猫很饿，留在饲养大箱中，见第58页。我长期提供全部食物，它们已很注意我。我坐距箱约8英尺，每两分钟拍手四次，说“我该喂这些猫了”。最初信号大概只使猫更注意我。10秒后我拿鱼、起身、走到箱边，在距地3英尺处伸过网。猫便有上爬冲动；事实上先前已学会我一走向箱便爬，通常不等我持鱼到达。

A＝我发信号的动作、声音的感觉印象；B＝我拿鱼、起身、走向箱等的感觉印象；C＝上爬动作及引向它的冲动。

问题是，A以后是否使猫想起B，在B实际出现前、即10秒结束前作C。若A通过B的记忆引出C，动物肯定能有严格意义的观念联想，而且大概常有。事实是30-60次后，猫一见A或几秒后、总在B出现前，就作C。我目前认为行动应由联结所唤起的B观念解释。

that their action is to be explained by the presence, through association, of the idea B. But it is not impossible that A was associated *directly* with the impulse to C, although that impulse was removed from it by ten seconds of time. Such an association is, it seems to me, highly improbable, unless the neurosis of A, and with it the psychosis, continues until the impulse to C appears. But if it does so continue during the ten seconds, and thus get directly linked to C, we have exactly a representation, an image, a memory, in the mind for eight of those ten seconds. It does not help the deniers of images to substitute an image of A for an image of B. Yet, unless they do this they have to suppose that A comes and goes, and that after ten seconds C comes, and, passing over the intervening blank, willfully choses out A and associates itself with it. There are some other considerations regarding the behavior of the cats from the time the signal was given till they climbed up, which may be omitted in the hope that it will soon be possible to perform a decisive experiment. If an observer can make sure of the animal's attention to a sequence A——B, where B does not arouse any impulse to an act, and then later get the animal to associate B with C, leaving A out this time, he may then, if A, when presented anew, arouses C, bid the deniers of representations to forever hold their peace.

Another reason for allowing animals representations and images is found in the longer time taken to form the association between the act of licking or scratching and the consequent escape. If the associations in general were simply between situation and impulse and act, one would suppose that the situation would be associated with the impulse to lick or scratch as readily as with the impulse to turn a button or claw a string. Such is not the case. By comparing the curves for Z on pages 22, 23 with the others one sees that for so simple an act it takes a long time to form the association. This is not a final reason, for lack of attention, a slight increase in the time taken to open the door after the act was done, or an absence of preparation in the nervous system for connections between these particular acts and definite sense-impressions, may very well have been the cause of the difficulty in forming the associations. Nor is it

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但不能排除A直接与C冲动联结，虽相隔10秒。除非A的神经过程和相应心理过程持续到C冲动出现，否则此直接联结在我看来很不可能。若持续10秒并直接连到C，那么十秒中的八秒，心理中恰好有表象、意象、记忆。把B意象换成A意象，并不帮助否定意象者；若不这样，就须假定A来去，10秒后C越过中间空白，任意选出A与之联结。

信号后到上爬前的猫行为，还有若干考虑，此处省去，希望很快可做决定性实验：先保证动物注意A-B顺序，此时B不引起动作冲动；以后把B与C相联，期间不出现A；若重新出现A便引起C，就能让否定表象者永远闭嘴。

承认动物有表象、意象的另一理由，是舔、搔自身与随后逃出联结得较慢。若联结只在情境与冲动、动作之间，舔搔应同转旋钮、抓绳一样容易；并非如此，第22、23页Z曲线显示，动作虽简单，学习很长。但这不是最终理由：缺少注意、动作后开门略迟、神经系统缺少将这些特定动作与明确感觉印象连接的准备，都可能造成困难。也不能确定抓圈的观念，比舔搔自己的观念更易形成，问题仍未解决。

certain that *ideas* of clawing loops would be easier to form than ideas of scratching or licking oneself. The matter is still open to question. But, as said before, my opinion would be that animals *do* have representations and that such are the beginning of the rich life of ideas in man. For the most part, however, such are confined to specific and narrow practical lines. There was no evidence that my animals habitually *did* form associations of ideas from their experience throughout, or that such were constantly revived without the spur of immediate practical advantage.

Before leaving the topic an account may be given of experiments similar to the one described above as performed on cats 3 and 4, which were undertaken with Cat 13 and Dogs 1, 2 and 3.

Cat 13 was fed with pieces of fish at the top of the wire netting 45 times, to accustom it to climbing up when it saw me come with fish. I then went through the same process as with 3 and 4, but at intervals of 60 to 90 seconds instead of 120. After 90 such trials it occasionally climbed up a little way, but though 135 trials in all were given it never made the uniform and definite reaction which 3 and 4 did. It reacted, when it reacted at all, at from 5 to 9 seconds after the signal. Whether age, weight, lack of previous habitual climbing when I approached, or a slowness in forming the association made the difference, is uncertain.

Dog 1 was experimented on in the following manner: I would put him in a big pen, 20–10 feet, and sit outside facing it, he watching me as was his habit. I would pound with a stick and say, "Go over to the corner." After an interval (10 seconds for 35 trials, 5 seconds for 60 trials) I would go over to the corner (12 feet off) and drop a piece of meat there. He, of course, followed and secured it. On the 6th, 7th, 16th, 17th, 18th and 19th trials he did perform the act before the 10 seconds were up, then for several times went during the two-minute intervals without regarding the signal, and finally abandoned the habit altogether, although he showed by his behavior when the signal was given that he was not indifferent to it.

Dogs 1, 2 and 3 were also given 95, 135 and 95 trials, re-

如前所说，我倾向动物确有表象，是人类丰富观念生活的开端；但大多限于特定、狭窄、实际的路线。没有证据显示我的动物习惯从全部经验形成观念联想，或这些联想没有直接实利刺激也持续复现。

离开主题前，介绍与3、4号猫信号实验相似的13号猫及1、2、3号狗实验。13号在网顶喂鱼45次，习惯见我持鱼便爬；再同3、4号流程，但间隔60-90秒而非120。90次后偶尔略爬；共135次，仍从不作3、4号那样稳定、明确的反应。有反应则在信号后5-9秒。差异来自年龄、体重、先前未习惯见我接近便爬，还是联结形成慢，未确定。

1号狗放20×10英尺大围栏，我坐外面对它，它习惯看我。我敲杖，说“到角落去”；先35次隔10秒、再60次隔5秒，走到12英尺外角落放肉，狗跟去吃。第6、7、16、17、18、19次在10秒前行动；后来数次在两分钟间隔中无视信号走去，最终彻底放弃此习惯，虽信号时的表现说明不是漠不关心。

还给1、2、3号分别95、135、95次试验动作分别是靠围栏网站起、把爪搭桶顶、跳上箱。

spectively, the acts done being (1) standing up against the wire netting inclosing the pen, (2) placing the paws on top of a keg, and (3) jumping up onto a box. The time intervals were 5 seconds in each case. No dog of these ever performed the act before I started to take the meat to feed them, but they did show, by getting up if they were lying down, when the signal was given, or by coming to me if they were in some other part of the pen, that something was suggested to them by it. Why these cases differ from the cases of Cats 3 and 4 (10 and 12 also presented phenomena like those reported in the cases of 3 and 4) is an interesting though not very important question. The dogs were not kept so hungry as were the cats, and experience had certainly not rendered the particular impulses involved so sensitive, so ready to discharge. Dogs 2 and 3 were older. There is no reason to invoke any qualitative difference in the mental make-up of the animals until more illuminating experiments are made.

Association by Similarity and the Formation of Concepts.

What there is to say on this subject from the standpoint of my experiments will be best introduced by an account of the experiments themselves.

Dog 1 had escaped from AA (0 at front) 26 times. He was then put in BB (0 at back). Now, whereas 2 and 3, who were put in without previous experience with AA, failed to paw the loop in BB, No. 1 succeeded. His times were 7.00, .35, 2.05, .40, .32, .10, 1.10, .38, .10, .05, and from then on he pawed the loop as soon as put in the box. After a day or so he was put in BB1 (0 at back high). Although the loop was in a new position, his times were only .20, .10, .10, etc. After nine days he was put in a box arranged with a little wooden platform 2½ inches square, hung where the loop was in BB1. Although the platform resembled the loop not the least save in position, his times were only .10, .07, .05, etc.

From the curves given in Figure 19, which tell the history of 10, 11 and 12 in B1 (0 at back) after each had previously been familiarized with A (0 at front), we see this same

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每次间隔5秒。没有狗在我开始拿肉前行动；但信号时，躺者起身、远处者过来，表明信号有所唤起。为何不同于3、4号猫，10、12号猫也类似，虽有趣但不很重要。狗没猫那么饿，经验也未令相应冲动那么敏感、容易释放；2、3号更老。在做更明确实验前，无须假定心理构造有质差。

通过相似性建立联结及概念的形成

先从实验说明。1号狗已从AA前圈逃26次，再入BB后圈。没有AA经验的2、3号不能抓BB圈，1号却成功。用时依次7分、35秒、2分5秒、40、32、10秒、1分10秒、38、10、5秒，此后入箱立即抓圈。约一天后进BB1高后圈，圈位置虽新，只用20、10、10秒等。九天后改为在BB1圈原位置悬挂边长2½英寸木平台；除位置外全不像圈，仍只用10、7、5秒等。

图19为10、11、12号猫熟悉A前圈后，在B1后圈箱中的记录；同样显示先前对某机关反应的练习，影响对相似机关的反应时间。

influence of practice in reacting to one mechanism upon the time taken to react to a mechanism at all similar. It naturally takes a cat a longer time to accidentally claw a loop in the back than in the front, yet a comparison of these curves with those on page 18, Figure 2, shows the opposite to have been the case with 10, 11 and 12. The same remarkable quickness was noted in Cats 1 and 3 when put into B (o at back) after learning A (o at front). Moreover, the loops were not alike. The loop in A was of smaller wire, covered with a bluish thread, while the loop in B was covered with a black rubber compound, the diameter of the loop being three times that of A's loop.

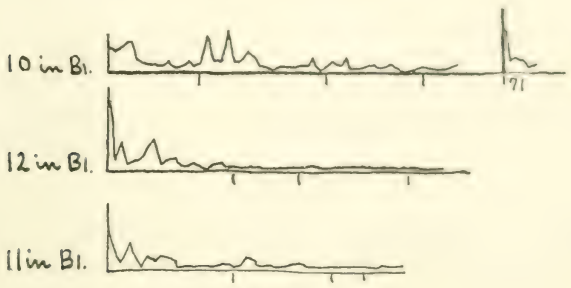


FIG. 19.

If any advocate of reason in animals has read so far, I doubt not that his heart has leaped with joy at these two preceding paragraphs. "How," he will say, "can you explain these facts without that prime factor in human reason, association by similarity? Surely they show the animal perceiving likenesses and acting from general ideas." *This is the very last thing that they show.* Let us see why they do not show this and what they do show. He who thinks that these animals had a general notion of a loop-like thing as the thing to be clawed, that they felt the loop in B, different as it was in size, color and position, to be still a loop, to have the essential quality of the other, must needs presuppose that the cat has a clear, accurate sensation and representation of both. Only if the cat discriminates can it later associate by noticing similarities. This is what such

猫偶然抓后圈通常比前圈更慢；但对照第18页图2，这3猫反而更快。1、3号学A后入B，同样极快。而圈也不同：A圈细金属线覆蓝线，B圈覆黑橡胶，圈径为A的三倍。

图19：10、11、12号猫在后圈箱中的时间曲线。图中数字为猫的编号，字母为对应的箱子代号；“in”译为“在相应箱中”。

主张动物理性的人若读到此，大概心头欢喜：“不用人类理性的首要因素--相似联想--怎能解释？这肯定表明动物觉察相似、凭一般观念行动。”这恰恰是这些事实最不能表明的。认为动物有“圈样物应抓”的一般观念，觉得B圈虽大小、颜色、位置不同，仍是圈、仍有共同本质者，必须先假定猫对两者均有清楚、准确的感觉和表象。只有先辨别，才能后来注意相似而联结。这正是这些思想者预设的。

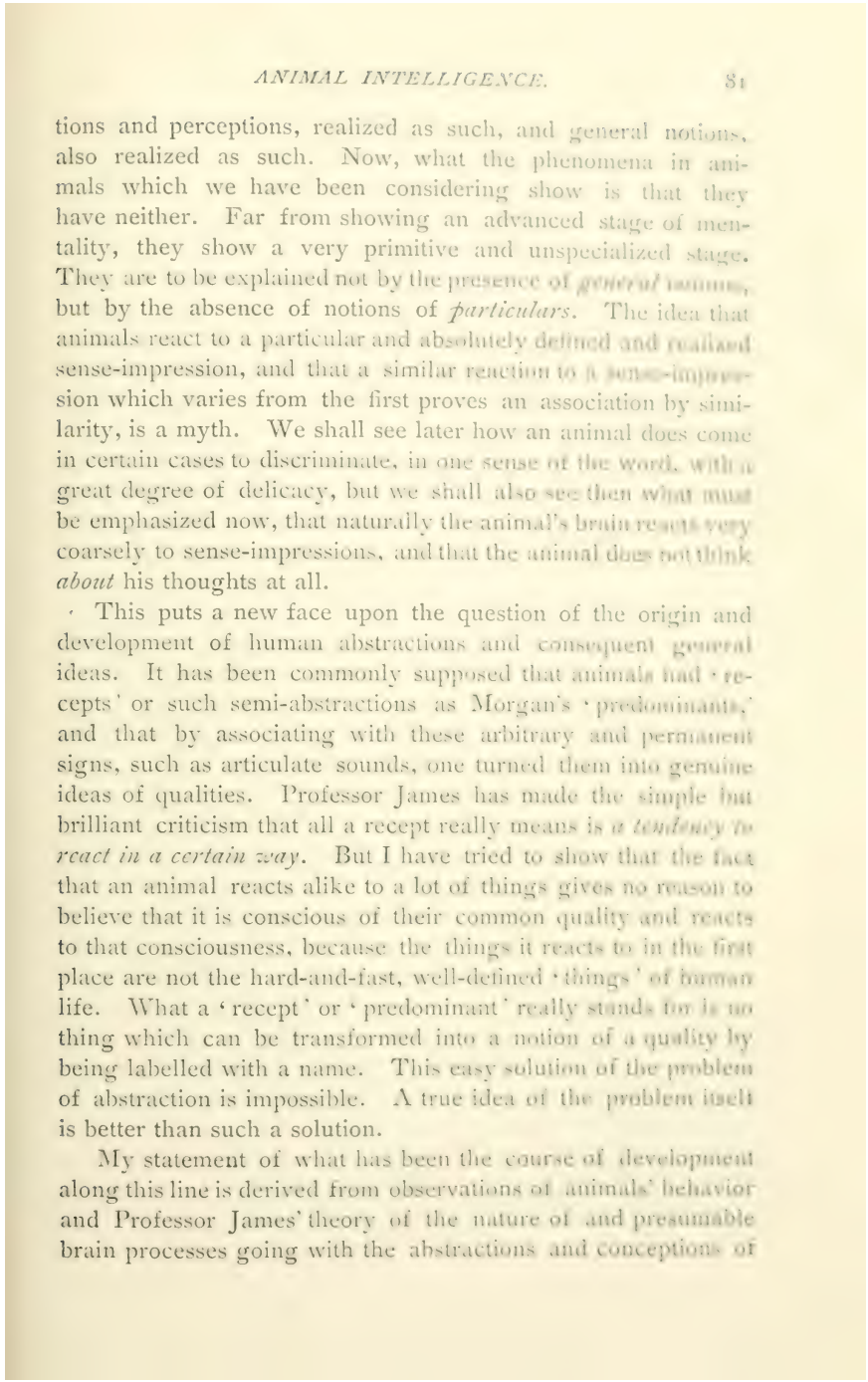
thinkers do presuppose. A bird, for instance, dives in the same manner into a river of yellow water, a pond or an ocean. It has a general notion, they say, of water. It knows that river water is one thing and pond-water another thing, but it knows that both are water, *ergo*, fit to dive into. The cat who reacts to a loop of small wire of a blue color knows just what that loop is, and when it sees a different loop knows its differences, but knows also its likeness, and reacts to the essential. Thus crediting the cat with our differentiation and perception of individuality, they credit it with our conceptions and perceptions of similarity. Unless the animal has the first there is no reason to suppose the last. Now, *the animal does not have either*. It does not in the first place react to that particular loop in A, with recognition of its qualities. It reacts to a vague, ill-defined sense-impression, undiscriminated and even unperceived in the technical sense of the word. Morgan's phrase, "a bit of pure experience," is perhaps as good as any. The loop is to the cat what the ocean is to a man, when thrown into it when half-asleep. Thus the cat who climbed up the front of the cage whenever I said, "I must feed those cats," would climb up just as inevitably when I said, "My name is Thorndike," or "To-day is Tuesday." So cats would claw at the loop or button when the door was open. So cats would paw at the place where a loop had been, though none was there. The reaction is not to a well-discriminated object, but to a vague situation, and any element of the situation may arouse the reaction. The whole situation in the case of man is speedily resolved into elements; the particular elements are held in focus, and the non-essential is systematically kept out of mind. In the animal the whole situation sets loose the impulse; all of its elements, including the non-essentials, get yoked with the impulse, and the situation may be added to or subtracted from without destroying the association, provided you leave something which will set off the impulse. The animal does not think one is like the other, nor does it, as is so often said, mistake one for the other. It does not think *about* it at all; it just thinks *it*, and the *it* is the kind of "pure experience" we have been describing. In human mental life we have accurate, discriminated sensa-

中文译文

例如鸟用同样方式潜入黄水河、池塘、海洋，他们说它有水的一般观念：知道河水、池水不同，但都为水，所以都可潜。对细蓝圈反应的猫，被认为知道此圈是什么，看见另圈知道差异、又知道相似，响应共同本质。先赋予猫我们辨别和知觉个体性的能力，再赋予概念及相似知觉；没有前者，便无理由假定后者。

实际上，动物两者皆无。它原先对A圈反应，并不识其性质，而响应模糊、不明确、未辨别，甚至在知觉技术意义上未被知觉的感觉印象。摩根所谓“一点纯粹经验”也许最好。圈之于猫，如半睡着被投入海中的人对海的感觉。听我说“该喂猫了”便爬的猫，听“我叫桑代克”或“今天星期二”也同样爬；门开了仍抓圈、旋钮；圈没了仍抓原位置。反应对象不是精确辨别的物体，而是模糊情境，任何要素都可能引出反应。

人很快把情境分成要素，集中于特定要素，系统排除无关者；动物则整个情境释放冲动，所有要素、包括无关者都同冲动捆绑。只要保留能激发冲动之物，情境增减也不破坏联结。动物不是想两物相似，也不如常说的把一物误认另一物；它不思考此物，只是体验此物，体验属于所说的纯粹经验。人类心理中有准确、已辨别且被意识为如此的感觉、知觉，以及同样被意识到的一般观念。



ANIMAL INTELLIGENCE. 81

tions and perceptions, realized as such, and general notions, also realized as such. Now, what the phenomena in animals which we have been considering show is that they have neither. Far from showing an advanced stage of mentality, they show a very primitive and unspecialized stage. They are to be explained not by the presence of *general* notions, but by the absence of notions of *particulars*. The idea that animals react to a particular and absolutely defined and realized sense-impression, and that a similar reaction to a sense-impression which varies from the first proves an association by similarity, is a myth. We shall see later how an animal does come in certain cases to discriminate, in one sense of the word, with a great degree of delicacy, but we shall also see then what must be emphasized now, that naturally the animal's brain reacts very coarsely to sense-impressions, and that the animal does not think *about* his thoughts at all.

This puts a new face upon the question of the origin and development of human abstractions and consequent general ideas. It has been commonly supposed that animals had 'recepts' or such semi-abstractions as Morgan's 'predominants,' and that by associating with these arbitrary and permanent signs, such as articulate sounds, one turned them into genuine ideas of qualities. Professor James has made the simple but brilliant criticism that all a recept really means is *a tendency to react in a certain way*. But I have tried to show that the fact that an animal reacts alike to a lot of things gives no reason to believe that it is conscious of their common quality and reacts to that consciousness, because the things it reacts to in the first place are not the hard-and-fast, well-defined 'things' of human life. What a 'recept' or 'predominant' really stands for is no thing which can be transformed into a notion of a quality by being labelled with a name. This easy solution of the problem of abstraction is impossible. A true idea of the problem itself is better than such a solution.

My statement of what has been the course of development along this line is derived from observations of animals' behavior and Professor James' theory of the nature of and presumable brain processes going with the abstractions and conceptions of

上述动物现象表明它们两者皆无；非高级，而是原始、未分化的心理阶段。解释不是有一般观念，而是没有关于个别事物的观念。动物响应明确、被意识到的特定印象，并且对稍变印象作相同反应就证明相似联想，这是一种神话。后文会见动物在某意义上可学会很精细的辨别，但现在应强调：动物脑自然地粗略响应感觉印象，动物全不思考自身思想。

这使人类抽象及一般观念的起源问题改观。通常假定动物有“recepts”，可译准概念表象，或摩根的“predominants”，主导成分等半抽象物；给它们联结任意、固定符号，如语音，便转成真正的性质观念。詹姆斯简单而精彩地批评：recept实际只意味着以某方式反应的倾向。我则说明，对许多物作相同反应，并不证明意识到共同性质并响应它，因为起初响应的对象并不是人类生活中界定明确的“事物”。recept或predominant所代表的，不能仅贴名称就变成性质观念；这种轻易解决抽象问题的方式不可能。正确认识问题本身，比这种解决好。

我对发展过程的陈述，来自行为观察及詹姆斯关于人类抽象、概念的性质和可能脑过程的理论但主要根据，是它与“概念，即拥有一般观念的功能，因有用而受自然选择”的观点一致。

human consciousness, but it is justified chiefly by its harmony with the view that conception, the faculty of having general notions, has been naturally selected by reason of its utility. The first thing is for an animal to learn to react alike only to things which resemble each other in the *essential* qualities. On an artificial, analytic basis, feelings of abstract qualities might grow out of reacting alike to objects similar in such a respect that the reaction would be useless or harmful. But in the actual struggle for existence, starting with the mammalian mind as we have found it, you will tend to get reactions to the *beneficial* similarities by selection from among these so-called mistakes, *before you get any general faculty of noticing similarities*. In order that this faculty of indifferent reaction to different things shall grow into the useful faculty of indifferent reaction to different things *which have all some quality that makes the reaction a fit one*, there must be a tremendous range of associations. For a lot of the similarities which are non-essential have to be stamped out, not by a power of feeling likeness, but by their failure to lead to pleasure. With such a wide range of associations we may get reactions on the one hand where impulses have been connected with one particular sense-impression because when connected with all others they had failed to give pleasure, and on the other hand reactions where an impulse has been connected with numerous different impressions possessing one common quality, and disconnected with all impressions, otherwise like these, which fail to have that one quality.

Combined with this multiplication of associations, there is, I think, an equally important factor, the loosening of the elements of an association from one another and from it as a whole. Probably the idea of the look of the loop or lever or thumb-latch never entered the mind of any one of my cats during the months that they were with me, except when the front end of the association containing it was excited by putting the cat into the box. In general, the unit of their consciousness, apart from impulses and emotions, is a whole association-series. Such soil cannot grow general ideas, for the ideas, so long as they never show themselves except for a particular practical business, will not be thought about or realized in their nature

首先，动物须学会只对必要性质相似的物作同样反应。在人为、分析性基础上，即使某相似之处令同一反应无用或有害，性质的抽象体验也可能由此生长；但实际生存竞争中，以现有哺乳动物心理为起点，在有一般觉察相似的能力之前，便会从所谓错误中选择对有益相似性的反应。

要把对不同物无差别反应，变成对共享某性质、使此反应恰当的不同物作无差别反应的有用功能，须极广联结范围。很多非必要相似性，须因不能带来愉快而被消除，不是凭觉察相似的能力。广泛联结可使某冲动只接一个特定印象，因为连其他者不获愉快；又可使某冲动连许多共享性质的不同印象，且与其他相似、但缺该性质者脱离。

除联结增多，我认为同样重要的是联结要素彼此、以及同整体的联系松动。几个月中，我的猫大概只有入箱激发联结前端时，才有圈、杠杆、门闩的外观观念。除冲动、情绪，其意识单位通常是完整联结序列。这样的土壤无法孕育普遍的思想。思想若始终囿于具体事务之中，便难以成为人们自觉思考的对象；其内在本质及彼此间的联系，也就无从为人所认识。

or connections. If enough associations are provided by a general curiosity, such as is seen among the monkeys, if the mental elements of the association are freed, isolated, felt by themselves, *then* a realization of the ideas, feelings of their similarity by transition from one to the other, feelings of qualities and of meanings, may gradually emerge. Language will be a factor in the isolation of the ideas and a help to their realization. But when anyone says that language has been the cause of the change from brute to man, when one talks as if *nothing but it* were needed turn animal consciousness into human, he is speaking as foolishly as one who should say that a proboscis added to a cow would make it an elephant.

This is all I have to say, in this connection, about association by similarity and conception, and with it is concluded our analysis of the nature of the association-process in animals. Before proceeding to treat of the delicacy, complexity, number and permanence of these associations, it seems worth while to attempt to describe graphically, not by analysis, the mental fact we have been studying, and also to connect our results with the previous theories of association.

One who has seen the phenomena so far described, who has watched the life of a cat or dog for a month or more under test conditions, gets, or fancies he gets, a fairly definite idea of what the intellectual life of a cat or dog feels like. It is most like what we feel when consciousness contains little thought about anything, when we feel the sense-impressions in their first intention, so to speak, when we feel our own body, and the impulses we give to it. Sometimes one gets this animal consciousness while in swimming, for example. One feels the water, the sky, the birds above, but with no thoughts *about* them or memories of how they looked at other times, or esthetic judgments about their beauty; one feels no *ideas* about what movements he will make, but feels himself make them, feels his body throughout. Self-consciousness dies away. Social consciousness dies away. The meanings, and values, and connections of things die away. One feels sense-impressions, has impulses, feels the movements he makes; that is all.

This pictorial description may be supplemented by an ac-

若像猴子的一般好奇带来足够联结，联结中的心理要素被释放、分离、单独体验，那么对观念的认识、从一观念转到另一观念时的相似体验、性质及意义的体验，便可能渐渐出现。语言帮助分离和认识观念；但说语言造成动物变成人，仿佛只添语言便够，荒唐程度如同说给牛添象鼻就成象。

关于相似联想和概念，我在此只有这些话。对动物联结过程性质的分析至此结束。接着讨论精细、复杂、数量、持久性前，值得用形象而非分析方式描写心理事实，并与旧联结理论联系。

凡是见过前文所述种种现象，并在实验条件下观察过猫或狗一个月乃至更久的人，都会觉得自己对猫狗的内心体验已有了相当清晰的认识——至少他自以为如此。

这种体验，最接近于我们几乎不思考任何事情时的意识状态。那时，我们只是直接感受着外界的种种刺激，感受着自己的身体，以及驱使身体行动的种种冲动。

有时，比如游泳的时候，我们便能体会到这种近似动物的意识状态。我们感受着水，感受着天空，感受着头顶的飞鸟，却不去思索它们，不去回忆它们往日的模样，也不去评判它们的美丑。我们不去构想自己将要做出的动作，而只是感受着动作的发生，感受着身体的一举一动。

自我意识渐渐隐去，社会意识也随之消散。事物的意义、价值及其相互联系，都从意识中退去。此时，我们只感受到外界的种种刺激，生起种种行动的冲动，并觉察到自己身体的动作。除此之外，再无其他。

count of some associations in human life which are learned in the same way as are animal associations; associations, therefore, where the process of formation is possibly homologous with that in animals. When a man learns to swim, to play tennis or billiards, or to juggle, the process is something like what happens when the cat learns to pull the string to get out of the box, provided, of course, we remove, in the man's case, all the accompanying mentality which is not directly concerned in learning the feat.[1] Like the latter, the former contains desire, sense-impression, impulse, act and possible representations. Like it, the former is learned gradually. Moreover, the associations concerned cannot be formed by imitation. One does not know how to dive just by seeing another man dive. You cannot form them from being put through them, though, of course, this helps indirectly, in a way that it does not with animals. One makes use of no feelings of a common element, no perceptions of similarity. The tennis player does not feel, "This ball coming at this angle and with this speed is similar in angle, though not in speed, to that other ball of an hour ago, therefore I will hit it in a similar way." He simply feels an impulse from the sense-impression. Finally, the elements of the associations are not isolated. No tennis-player's stream of thought is filled with free-floating representations of any of the tens of thousands of sense-impressions or movements he has seen and made on the tennis-court. Yet there is consciousness enough at the time, keen consciousness of the sense-impressions, impulses, feelings of one's bodily acts. So with the animals. There is consciousness enough, but of this kind.

[1] A man may learn to swim from the general feeling, "I want to be able to swim." While learning, he may think of this desire, of the difficulties of the motion, of the instruction given him, or of anything which may turn up in his mind. This is all extraneous and is not concerned in the acquisition of the association. Nothing like it, of course, goes on in the animal's mind. Imagine a man thrown into the water repeatedly, and gradually floundering to the shore in better and better style until finally, when thrown in, he swims off perfectly, and deprive the man of all extraneous feelings, and you have an approximate homologue of the process in animals. He feels discomfort, certain impules to flounder around, some of which are the right ones to move his body to the shore. The pleasure which follows stamps in these and gradually the proper movements are made immediately on feeling the sense-impression of surrounding water.

学游泳、网球、台球、杂耍，多少像猫学拉绳逃箱；当然须从人的情形中剔除与学技能无直接关系的伴随心理［原注］。两者都含欲望、感觉印象、冲动、动作和可能的表象，都逐渐学会；相关联结也不能仅靠模仿形成，看到别人跳水不等于知道怎样跳。也不能靠别人带着完成形成，虽然对人有动物所无的间接帮助。

这些学习没有共同要素的体验、相似性的知觉。网球员不想“此球角度、速度与一小时前另一球角度相同、速度不同，故类似击打”；他只是从感觉印象体验冲动。最后，联结要素不独立：思想流没有自由漂浮的、球场上数万感觉印象和动作的表象。但当时仍有充足而鲜明的感觉、冲动、身体动作意识。动物也有充足意识，只是这一类型。

原注：人可出于“我想会游泳”而学习，学时想欲望、动作困难、指导或别的念头；这些都不直接参与联结获得，动物也无这些。想象人反复被投入水，逐渐更好地扑腾上岸，最终一入水就熟练游走；去掉所有无关体验，便近似动物过程。他体验不适、扑腾冲动，其中正确者让身体到岸；随后愉快巩固正确者，逐步在感到四周是水时立即作恰当动作。

Thus, the associations in human life, which compare with the simple connections learned by animals, are associations involving connections between novel, complex, and often inconstant sense-impressions and impulses to acts similarly novel, complex and often inconstant. Man has the elements of most of his associations in isolated form, attended to separately, possessed as a permanent fund, recallable at will, and multifariously connected among themselves, but with those associations which we have mentioned, and with others like them, he deals as the animals deal with theirs. The process, in the man's mind, leaving out extraneous mental stuff, may be homologous to the association-process in animals. Of course, by assiduous attention to the elements of these associations, a man may isolate them, may thus get these associations to the same plane as the rest. But they pass through the stage we have described, even then, and with most men, stay there. The abstraction, the naming, etc., generally come from observers of the game or action, and concern things as felt by them, not by the participant.

Criticism of Previous Theories.

We may now look for a moment at what previous writers have said about the nature of association in animals. The complaint was made early in this book that all the statements had been exceedingly vague and of no value, except as retorts to the 'reason' school. In the course of the discussion I have tried to extricate from this vagueness definite statements about imitation, association of ideas, association by ideas. There is one more theory, more or less hidden in the vagueness: the theory that association in animals is the same as association in man, that the animal mind differs from the human mind only by the absence of reason and what it implies. Presumably, silence about what association is, means that it is the association which human psychology discusses. When the silence is broken, we get such utterances of this theory as the following:

"I think we may say then that the higher animals are able to proceed a long way in the formation and definition of highly complex constructs, analogous to but probably differing some-

因此，人类中可与动物简单联系相比的联结，是新颖、复杂、常不稳定的感觉印象，与同样新颖、复杂、常不稳定的动作冲动之间的联系。人多数联结的要素，可独立受到注意、永久储存、随意回忆、彼此多样连接；但上述及类似联结，人像动物一样处理。排除无关心理内容，过程可能与动物同源。当然，人若持续注意，可分离要素，使其达到其他联结水平；但即使如此仍经过上述阶段，多数人还停留其中。抽象、命名通常来自比赛或动作的观察者，涉及观察者的体验，而非参与者的体验。

对以往理论的批评

稍看以往作者关于动物联结性质的说法。本书早已抱怨，它们极模糊，除反驳理性学派外无价值。我一直试图从模糊中析出关于模仿、观念联想、借助观念联结的明确陈述。还有一理论多少隐藏其中：动物联结与人相同，动物心理只缺理性及其含义。不说明联结是什么，大概默认是人类心理学所讨论的联结。明确说时，则如：

"我们可以说，高等动物在形成、明确高度复杂的建构上能走很远；这些与人的建构类似，但可能有些不同。

what from those which we form ourselves. These constructs, moreover, through association with reconstructs or representations, link themselves in trains so that a sensation, or group of sensations, may suggest a series of reconstructs, or a series of remembered phenomena." (C. L. Morgan, 'Animal Life and Intelligence,' p. 341.)

"Lastly, before taking leave of the subject of the chapter, I am most anxious that it should not be thought that, in contending that intelligence is not reason, I wish in any way to disparage intelligence. Nine-tenths at least of the actions of average men are intelligent and not rational. Do we not all of us know hundreds of practical men who are in the highest degree intelligent, but in whom the rational, analytic faculty is but little developed? Is it any injustice to the brutes to contend that their inferences are of the same order as those of these excellent practical folk? In any case, no such injustice is intended; and if I deny them self-consciousness and reason I grant to the higher animals perceptions of marvellous acuteness and intelligent inferences of wonderful accuracy and precision—intelligent inferences in some cases, no doubt, more perfect even than those of man, who is often disturbed by many thoughts" (ibid., p. 376–377).

"Language and the analytic faculty it renders possible, differentiate man from the brute" (ibid., p. 374).

Here, as elsewhere, it should be remembered that Lloyd Morgan is not quoted because he is the worst offender or because he represents the opposite in general of what the present writer takes to be the truth. On the contrary, Morgan is quoted because he is the least offender, because he has taken the most advanced stand along the line of the present investigation, because my differences from him are in the line of his differences from other writers. With the theory of the passages just quoted, however, which attribute extensive association of ideas and general powers comparable to those of men minus reason, to the brutes, and which repeat the time-honored distinction by language, I do not, in the least, agree. Association in animals does not equal association in man. The latter is built over and permeated and transformed by inference and

而这些建构经同重构或表象联结，又串成系列，使一感觉或感觉组能唤起一系列重构、记忆现象。"（C. L. Morgan，《动物生活与智慧》，第341页。）

"最后，我极不希望人们以为，我说智慧不是理性，是要贬低智慧。普通人的行动至少十分之九聪明而非理性。我们都认识许多极聪明、但理性分析功能少有发展的实干者。说动物的推断与这些优秀实干者同类，对动物不公平吗？至少绝无此意。虽否认高等动物有自我意识和理性，我却赋予它们极敏锐的知觉，以及极准确、精密的智慧推断；有些甚至比常被许多念头干扰的人更完善。"（同书第376-377页。）

"语言及由它成为可能的分析功能，使人区别于动物。"（同书第374页。）

此处如别处引用洛伊德·摩根，不因他最有过错或代表我认为真理的反面；恰恰因他过错最少，立场最接近本研究，我与他的差异也沿他与其他人的差异方向。但是，以上把广泛观念联想、可比人类但缺理性的一般能力归于动物，并重复以语言区别人兽的古老说法，我完全不同意。动物联结不等于人类联结；后者受到推论判断、比较的重构、渗透、改变；包含迁移联结这一狭义模仿；

judgment and comparison; it includes imitation in our narrow sense of transferred association; it obtains where no impulse is included; it thus takes frequently the form of long trains of thought ending in no pleasure-giving act; its elements are often loose, existing independently of the particular association; the association is not only thought, but at the same time thought *about*. None of these statements may be truthfully made of animal association. Only a small part of human association is at all comparable to it. My opinion of what that small part is has already been given. Moreover, further differences will be found as we consider the data relating to the delicacy, complexity, number, and permanence of associations in animals. I said a while ago that man was no more an animal with language than an elephant was a cow with a proboscis. We may safely broaden the statement and say that *man is not an animal plus reason*. It has been one great purpose of this investigation to show that even after leaving reason out of account, there are tremendous differences between man and the higher animals. The problem of comparative psychology is not only to get human reason from some lower faculties, but to get human *association* from animal association.

Our analysis, necessarily imperfect because the first attempted, of the nature of the association-process in animals is finished and we have now to speak of its limitations in respect to delicacy, complexity, number and permanence.

Delicacy of Associations.

It goes without saying that the possible delicacy of associations is conditioned by the delicacy of sense-powers. If an animal doesn't feel differently at seeing two objects, it cannot associate one with one reaction, the other with another. An equally obvious factor is attention; what is not attended to will not be associated. Beyond this there is no *a priori* reason why an animal should not react differently to things varying only by the most delicate difference, and I am inclined to think an animal could; that any two objects with a difference appreciable by sensation which are also able to win attention may be reacted to differently. Experiments to show this are very tedious

即使无冲动也可存在，常形成不以愉快动作收尾的长思想链；要素常游离，独立于特定联结；不仅被体验，也被思考。这些陈述都不适于动物联结。人类只有小部分可比，前已说明。考察精细、复杂、数量、持久性，还会发现更多差异。此前说人不是加语言的动物，如象不是加象鼻的牛；可推广说，人不是动物加理性。本研究一个主要目的，就是显示即使不计理性，人和高等动物仍有巨大差异。比较心理学不只要解释人类理性怎样出自低级功能，还须解释人类联结怎样出自动物联结。

这是第一次分析，难免不完善，但已结束；接着讨论各方面限制。

联结的精细程度

可有的精细程度当然受感觉能力制约。看两物没不同体验，就不能各联不同反应。注意同样重要，未受注意者不能被联结。此外，没有先验理由否认动物可对仅有极微差的物作不同反应。我倾向认为，任何感觉能辨且能吸引注意的差异，都可形成不同反应。证明这点的实验非常繁琐，实际问题是动物自然注意什么。

and the practical question is, "What will the animal naturally attend to?" The difficulty, as all trainers say, is to get the animal's attention to your signal somehow. Then he will in time surely react differently, if you give him the chance, to a figure 7 on the blackboard from the way he does to a figure 8, to your question, "How many days are there in a week?" and to your question, "How many legs have you?" The chimpanzee in London that handed out 3, 4, 5, 6 or 7 straws at command was not thereby proved of remarkable intelligence or of remarkably delicate associative power. Any reputable animal trainer would be ashamed to exhibit a horse who could not do as much 'counting' as that. The maximum of delicacy in associating exhibited by any animal, to my knowledge, is displayed in the performance of the dog 'Dodgerfield,' exhibited by a Mr. Davis, who brings from four cards, numbered 1, 2, 3 and 4, whichever one his master shall *think of*. That is, you write out an arbitrary list, *e. g.*, 4, 2, 1, 3, 3, 2, 2, 1, 4, 2, etc., and hand it to Mr. Davis, who looks at the list, thinks of the first number, says "Attention! Dodger!" and then, "Bring it." This the dog does and so on through the list. Mr. Davis makes no signals which anyone sitting even right beside or in front of him can detect. Thus the dog exceeds the human observers in delicacy and associates each with a separate act four attitudes of his master, which to human observers seem all alike. Mr. Davis says he thinks the dog is a mind-reader. I think it quite possible that whatever signs the dog goes by are given unconsciously and consist only of some very delicate general differences in facial expression or the manner of saying the words, "Bring it," or slight sounds made by Mr. Davis in thinking to himself the words one or two or three or four. Mr. Davis keeps his eyes shut and his hands behind a newspaper. The dog looks directly at his face.

To such a height possible delicacy may attain, but possible delicacy is quite another thing from actual untrained and unstimulated delicacy. The difference in reaction has to be brought about by associating with pleasure the reaction to the different sense-impression when it itself differs and associating with pain tendencies to confuse the reactions. The animal does

所有驯兽师都说，困难在设法使它注意信号。只要给机会，迟早会对黑板7和8、对“一周几天？”和“你几条腿？”作不同反应。伦敦黑猩猩按命令交3、4、5、6、7根草梗，并不证明智慧或精细联结能力异常；有名驯兽师若展示一匹连这种数数都做不到的马，会感羞愧。

我所知最精细的联结，见Davis先生表演的狗Dodgerfield。它从标1、2、3、4的四卡中，拿主人心想的一张。写任意数字列表给Davis，如左页例子；他看首数字、想着它，说“注意，Dodger！”再说“拿来”；狗照做，依序完成。坐他身旁或正前方，也察觉不到信号。故狗在精细程度上超过人类观察者，把人看来完全相同的主人四种状态各连一动作。

Davis认为狗读心。我认为很可能是无意识信号：面部极微变化、说“拿来”的方式差异，或默想一、二、三、四时发出的细微声音。Davis闭眼、手藏报后，狗直看他的脸。

可能的精细可到此高度，但与未经训练、刺激时实际精细不同。须在不同感觉印象下，把相应不同反应同愉快联系，把混淆倾向同痛苦联系，才能产生差别反应。动物并不自然地凭感觉能力作精细辨别。

not naturally as a function of sense-powers discriminate at all delicately. Thus the cat who climbed up the wire netting when I said, "I must feed those cats!" did not have a delicate association of just that act with just those words. For after I had dropped the clapping part of the signal and simply used those words it would react just as vigorously to the words, "To-morrow is Tuesday" or "My name is Thorndike." The reaction naturally was to a very vague stimulus. Taking cat 10 when just beginning to learn to climb up at the signal, "I must feed those cats!" I started in to improve the delicacy, by opposing to this formula the formula, "I will not feed them," after saying which, I kept my word. That is, I gave sometimes the former signal and fed the cat, sometimes the latter and did not. The object was to see how long the cat would be in learning always to go up when I gave the first, never to do so when I gave the second signal. I said the words in both cases as I naturally would do, so that there was a difference in emphasis and tone as well as in the mere nature of the syllables. The two signals were given in all sorts of combinations so that there was no regularity in the recurrence of either which might aid the animal. The cat at first did not always climb up at the first signal and often *did* climb up at the wrong one. The change from this condition to one of perfect discrimination is shown in the accompanying curves, one showing the decrease in *failures* to respond to the right signal, the other showing the decrease in responses to the wrong signal. The first curve is formed by a line joining the tops of perpendiculars erected at intervals of 1 mm. along the abscissa. The height of a perpendicular represents the number of times the cat failed to respond to the food-signal in 20 trials, a height of 1 mm. being the representative of one failure. Thus, the entire curve stands for 280 trials, there being no failures after 60 trials, and only 1 after the 40th.

In the other curve, also, each 1. mm. along the abscissa stands for 20 trials, and the perpendiculars whose tops the curve unites represent the number of times the cat in each 20 *did* climb up at the signal which meant no food. It will be seen that 380 experiences were necessary before the animal learned that the second signal was different from the first. The

听“我该喂猫了”爬网的猫，并非恰把该动作与那句话精细相联。去掉拍手、只说话后，它听“明天星期二”或“我叫桑代克”也同样强烈反应；自然响应的是极模糊刺激。

10号刚开始学信号上爬时，我用“我不会喂它们”与“我该喂猫了”对立；前者说后真不喂，后者说后喂。检验多久能做到第一信号总爬、第二从不爬。两话按自然语气说，除音节外，重音、语调也不同；两信号任意组合，无重复规律可帮助动物。初时，正确信号不总爬，错误信号却常爬。向完全辨别的转变，由两曲线表示：一条表示漏响应正确信号减少，一条表示响应错误信号减少。

第一曲线横轴每1毫米一组20次试验；垂线高度为这20次中未响应食物信号的次数，每1毫米一次失败，再连各顶端。全曲线代表280次，第40次以后仅一次失败，第60次以后无失败。

第二曲线也每1毫米代表20次；高度为该20次中对“不喂食”信号仍上爬的次数。需380次经验，动物才学会第二信号与第一不同。这一实验极好地显示动物的获得方式。

experiment shows beautifully the animal method of acquisition. If at any stage the animal could have isolated the two ideas of the two sense-impressions, and felt them together in comparison, this long and tedious process would have been unnecessary.

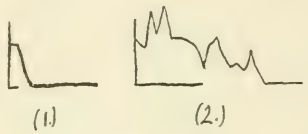


FIG. 20.

It might be stated here that the animals also acquired associations of moderate delicacy in discriminating between the different boxes. No cat tried to get out of A or B by licking herself, for instance.

The question may naturally be raised that if naturally associations are thus vague, the common phenomenon of a dog obeying his master's commands, and no one else's, is inexplicable. The difference between one man and another, one voice and another, it may be said, is not much of a difference, yet is here uniformly discriminated, although we cannot suppose any such systematic training to reject the other slightly differing commands. My cats did not so discriminate. If anyone else sat in my chair and called out, "I must feed the cats," they reacted, and probably very many animals would, if untroubled by emotions of curiosity or fear at the new individual, go through their tricks as well at another's voice as at that of their master. The other cases exemplify the influence of attention. Repeated attention to these sense-impressions has rendered them clear-cut and detailed, and the new impression consequently does not equal them in calling forth the reaction.

The main thing to carry away from this discussion is the assurance that the delicacy of the animal in associating acts with impressions is nothing like the delicacy of the man who feels that a certain tone is higher, or weight is heavier, than another, but *is* like the delicacy of the man who runs to a certain spot to hit one tennis ball and to a different spot to hit one coming with a slightly different speed.

中文译文

若任何阶段能分离两种感觉印象的观念，把它们一起体验、比较，这漫长繁琐过程就无须发生。

图20：曲线（1）为未响应食物信号的次数；曲线（2）为对不喂食信号仍响应的次数。比例及分组见第89页。

动物在区分不同箱子时，也取得中等精细的联结，例如没有猫试图靠舔自身逃出A、B。

有人自然会问：联结既如此模糊，狗为何只听主人、不听别人？人、声音间差别不大，却能稳定辨别，又不能假设曾系统训练它拒绝微异命令。我的猫却不这样辨别：任何人坐我的椅子、说“该喂猫了”，它们都响应。很多动物若不因新人而好奇、害怕，对别人声音大概同主人一样表演。其他案例体现注意影响：反复注意这些印象，使其明确、细致，新印象便不能同样引出反应。

本讨论关键是：动物把动作同印象联结的精细性，并不像人意识到某音较高、某重物较重；而像网球员跑到某处击一球，稍异球速便跑另一处。

COMPLEXITY OF ASSOCIATIONS.

An important question, especially if one wishes to rate an animal in a scale of intelligence, is the question of how complex an association it can form. A man can learn that to open a door he has to put the key in its hole, turn it, turn the knob, and pull the door. Here, then, is a complex act connected with the simple sense-impression. Or, conversely, a man knows that when the ringing of a bell is followed by a whistle and that by a red light he is to do a certain thing, while if any of the three happen alone he is not to. How far, then, we ask, can animals go along the line of increased complexity in the associations?

We must not mistake for a complex association a series of associations, where one sense-impression leads to an act such as to present a new sense-impression which leads to another act which in its turn leads to a new sense-impression. Of the formation of such *series* animals are capable to a very high degree. Chicks from 10 to 25 days old learned to go directly through a sort of big labyrinth requiring a series of 23 distinct and in some cases fairly difficult associations, of which 11 involved choices between two paths. By this power of acquiring a long series animals find their way to distant feeding grounds and back again. But all such cases are examples of the *number*, not of the complexity, of animal associations.

Some of my boxes were such as did give a chance for a complex association to be formed. Such were G (*thumb-latch*), J (*double*), K and L (triples) for the cats, and O (triple) for the dogs. It would be possible for a cat, after stepping on the platform in K, to notice that the platform was in a different position, and so feel then a different sense-impression from before, and thus turn the thing into a serial association. The cat would then be like a man who on seeing a door should feel only the impulse to stick the key in the hole, but then, seeing the door plus a key in the hole, should feel the impulse to turn the key and so on through. My cats did not give any signs of this, so that with them it was either a complex association or an irregular happening of the proper impulses. Probably the same was the case with dog 1. Cats 10, 11, 12 in L knew all the movements separately before being experimented on with the

中文译文

联结的复杂程度

尤其想按智慧给动物分级时，须问能形成多复杂联结。人可学把钥匙插孔、转钥匙、转把手、拉门开门：简单印象连复杂动作。反之，也可知道铃后哨、再红灯才做某事，三者任何单独出现则不做。动物能达到何等复杂?

不能把联结序列误作一个复杂联结：第一印象引动作，动作带来第二印象，第二再引动作，依次下去。动物很能形成这种序列。10-25日龄小鸡学会直接通过大迷宫，需23个分立、某些相当难的联结，11个涉及两路选择。长序列使动物到远觅食地再返回；这些是联结数量、不是复杂性的例子。

一些箱子确让复杂联结成为可能：猫用G、J、K、L，狗用O。猫踩K平台后，可能注意平台位置已变、得到新印象，从而转成序列联结；就像人见门只想插钥匙，见门加孔中钥匙再想转，依此。但猫无此迹象，所以或为复杂联结，或是恰当冲动不规则出现；1号狗大概同样。10、11、12号试L组合前，已分别会全部动作2、3、4号也曾在D用绳，

combination. Cats 2, 3, 4, had had some experience of D, which worked by a string something like the string part of K. The string in K was, however, quite differently situated and required an altogether different movement to pull it. Since further No. 2, who had had ten times as much experience in D as 3 or 4, succeeded no better with the string element of K than they, it is probable that the experience did not help very much. All else in all these compound associations was new. At the same time the history of these animals' dealings with these boxes would not fairly represent that of animals without general experience of clawing at all sorts of loose or shaky things in the inside of a box. These cats had learned to claw at all sorts of things. The time curves were taken as in the formation of the other associations, and, in addition, the order in which the animal did the several things required was recorded in every trial.

In the case of all the curves, except the latter part of 3 in G, one notices a very gradual slope and an excessive irregularity in the curve throughout. Within the limits of the trials given the animals are unable to form a perfect association and what advancement they make is very slow. The case of 3 in G is not an exception to this, but a proof of it. For 3 succeeded in making a perfect association, by accidentally hitting on a way to turn the compound association into a simple one. He happened one time to paw down the thumb-piece at the same time that his other fore-limb, with which he was holding on between the door and the top of the box, was pressing against the door. This giving him success he repeated it in later trials and in a short time had it fixed as an element in a perfect association. The marked change in his curve from an irregular and gradual slope at such a height as displayed a very imperfect association to a constant and very slight height shows precisely the change from a compound to a simple association.

Compound associations are formed slowly and not at all well. Further observation shows that they were really not formed at all. For the animals did not, except 3 in K for a certain period, do the several things in a constant order, nor did they do them only once apiece. On the contrary, an animal would pull the string several times after the bolt had gone up with its custom-

但K绳位置很不同，拉法全不同；2号D经验为3、4号十倍，K绳部分却不更好，说明经验大概少有帮助。其他组合部分都新。不过，不能把这些记录当作没有“抓箱内松动物”一般经验的动物的记录；猫已会抓各种物。除像别的联结计时间曲线，还逐次记动作顺序。

除“3号在G”后段，所有曲线都极缓降且始终很不规则。在给定次数内不能完善联结，进展很慢。3号G不是例外，反而证明：它偶然找到把组合变简单的方式，才完善联结。一前爪抓压拇指片时，另一前肢原撑在门与箱顶间，正好压门。成功后重复，很快形成完善联结。曲线从高且不规则的缓降，转成恒定极低，精确显示由组合到简单的变化。

组合联结形成慢、不好；进一步观察，实际上根本未形成。除3号在K中一段时期，动物没有固定顺序，也不每步只做一次。相反，门闩已按惯常响声升起，仍会多次拉绳，有时先做这件，有时先做那件。

ary click, and would do sometimes one thing first, sometimes another. It may also be noted here, in advance of its proper place, that these compound associations are far below the simple in point of permanence. The conduct of the animals is clearly not that of minds having associated with a certain box's interior the idea of a succession of three movements. The animal does not feel, "I did this and that and that and got out," or, more simply still, "this and that and that means getting out." If it did we should soon see it doing what was necessary without repetition and in a fairly constant time.

I imagine, however, that an animal could learn to associate with one sense-impression a compound act so as to perform its elements in a regular order. By arranging the box so that the second and third elements of the act could be performed *only after the first had been*, and the third *only after the first and second*, I am inclined to think you could get a very vigorous cat to learn the elements in order and form the association perfectly. The case is comparable to that of delicacy. The cat does not *tend* to know what he is doing or to depart from the hit-or-miss method of learning, but by associating the other combinations of elements with failure to get pleasure, as in delicacy experiments we associated the reactions to all but the one signal, you could probably stamp out all but the 1, 2, 3 order.

The fact that you have to thus manœuvre to get the animals to have the three impulses in a regular order shows that even when they are so there is no idea of the three as in an order, no thinking about them. Representations do not get beyond their first intention. They are not carried up into a free life which works them over anew. A complex *act* does not imply a complex *thought*, or, more exactly, a performance of a series does not imply the thought of a series. Consequently, since the complexity of the act depends on the power which failure has to stamp out all other combinations, it is far more limited than in man.

Number of Associations.

The patent and important fact is that there are so few in animals compared to the human stock. Even after taking into

先提一点，组合联结的持久性也远差于简单联结。行为明显不是把箱内同“三动作序列”的观念联结；动物不体验“我做这、这、这就出去”，甚至不体验“这、这、这意味着出去”。若如此，就会很快无重复地完成、用时稳定。

不过我想，动物可能学会把一个印象与组合动作联结，并按固定顺序做。若装置使第一步未做，第二、第三不能做，第二未做第三不能做，极活跃猫大概能依序学、完善联结。类似精细辨别：猫不倾向知道自己在做什么，也不离开试错；但把别种组合与未获愉快相联，如辨别实验排除错误信号的反应，大概能消除除1-2-3以外一切顺序。

必须这样安排才能有规则冲动顺序，表明即使成功，也没有“三者处于顺序”的观念，不思考它们。表象不超出直接意义，未进入自由的、能重新加工的观念生活。复杂动作不意味着复杂思想，更准确说，做出序列不等于想到序列。复杂性依赖失败消除别种组合的力量，故比人类有限得多。

联结的数量

显然且重要的是，与人类储备相比，动物联结很少。即使考虑各种气味与各种动作的联系，甚至夸大动物在此人类缺少领域的储备，也须承认纯数量远少于人。

account the various acts associated with various smells, and exaggerating the possibility of getting an equipment of associations in this field which man lacks, one must recognize how far below man any animal is in respect to mere quantity of asssociations. The associations with words alone of an average American child of ten years far outnumber those of any dog. A good billiard-player probably has more associations in connection with this single pastime than a dog with his whole life's business. In the associations which are homologous with those of animals man outdoes them and adds an infinity of associations of a different sort. The primates would seem, by virtue of their incessant curiosity and addition to experience not for any practical purpose but merely for love of mental life, to represent an advanced stage toward this tremendous quantity of associations. In man not only this activity and curiosity, but also education, increases the number of associations. Associations are formed more quickly, and the absence of need for self-support during a long infancy gives time. Associations thus formed work back upon practical life, and by showing better ways decrease the need of work, and so again increase the chance to form associations. The result in the case of a human mind to-day is the possession of a thesaurus of valuable associations, if the time has been wisely spent. The free life of ideas, imitation, all the methods of communication, and the original accomplishments which we may include under the head of invention, make the process of acquisition in many cases quite a different one from the trial and error method of the animals, and in general much shorten it.

Small as it is, however, the number of associations which an animal may acquire is probably much larger than popularly supposed.

My cats and dogs did not mix up their acts with the wrong sense-impressions. The chicks that learned the series of twenty-three associations did not find it a task beyond their powers to retain them. Several three-day-old chicks, which I caused to learn ten simple associations in the same day, kept the things apart and on the next morning went through each act at the proper stimulus. In the hands of animal trainers some animals

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普通10岁美国儿童，仅词语联结便远多于任何狗。优秀台球员单此消遣的联结，可能就多于狗全部生活。人不仅在与动物同源的联结上胜出，还添无数异类联结。灵长类不停好奇，不为实际目的、单因爱心理生活而添经验，似代表朝巨大数量迈进的阶段。

人除活动、好奇，还由教育增联结；形成更快，长幼年无须自食其力也给时间。联结反馈实际生活，显示更好方式、减少工作需要，又增学习机会。时间善用者，今天的心理有价值联结的宝库。自由观念生活、模仿、交流、可统称发明的原初成就，使获得过程在很多情况下完全不同于动物试错，也通常大为缩短。

然而动物可获联结虽少，可能比通常想的大。我的猫狗不把动作与错误印象混淆；学23联结的小鸡，保持并非超出能力。数只3日龄小鸡同一天学10简单联结，也分清，次晨各正确刺激引正确动作。驯兽师手中一些动物完全掌握大量联结。

get a large number of associations perfectly in hand. The horse Mascot is claimed to know the meaning of fifteen hundred signals! He certainly knows a great many, and such as are naturally difficult of acquisition. It would be an enlightening investigation if some one could find out just how many associations a cat or dog could form, if he were carefully and constantly given an opportunity. The result would probably show that the number was limited only by the amount of motive available and the time taken to acquire each. For there is probably nothing in their brain structure which limits the number of connections that can be formed, or would cause such connections, as they grew numerous, to become confused.

In their anxiety to credit animals with human powers, the psychologists have disregarded or belittled, perhaps, the possibilities of the strictly animal sort of association. They would think it more wonderful that a horse should respond differently to a lot of different numbers on the black-board than that he should infer a consequence from premises. But if it be made a direct question of pleasure or pain to an animal, he can associate any number of acts with different stimuli. Only he does not form any association until he has to, until the direct benefit is apparent, and, for his ordinary life, comparatively few are needed.

On the whole our judgment from a comparison of man's associations with the brutes' must be that man's are naturally far more delicate, complex and numerous, and that in as far as the animals attain delicacy, complexity, or a great number of associations, they do it by methods which man uses only in a very limited part of the field.

Permanence of Associations.

Once formed, the connections by which, when an animal feels a certain sense-impression, he does a certain thing, persist over considerable intervals of time. With the curves on pages 18 to 26 and 33 to 34 are given in many instances[1] additional

[1] See 10 in A, 3 in A, 10 in D; 10 in C, 4 in C, 3 in C; 6, 2, 5, 4 in E; 4 in F; 10 in H, 3 in H; 3, 4, 5, in I; 4 in G, 3 in G; 3 in K; 10 in L; dog 1 in N and CC; dog 1 in G and O.

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马Mascot据称懂1500信号！它肯定懂很多，且有些自然很难学。若有人谨慎、持续给机会，确定猫狗究竟可形成多少，会很有启发。
结果大概显示，只限于可用动机量和每一联结的学习时间；脑结构大概没有限制连接数量，也不必因增多而混乱。

心理学家急于赋予动物人类能力，可能忽略、贬低严格属于动物式联结的可能。他们会把马对黑板许多不同数字作不同反应，看作比从前提推结论更神奇。但若直接成为愉快或痛苦问题，动物可把任意多动作与不同刺激联结；只是直到不得不学、直接利益明显，才形成，而日常生活所需较少。

总体，人类联结自然地远更精细、复杂、众多；动物若也达到这些程度，所用方法却仅在人类联结领域一小部分使用。

联结的持久性

一经形成，印象引动作的连接可保持相当长间隔。第18-26、33-34页许多曲线后附有无练习间隔后熟练程度的附加曲线。

原注：见猫10在A、3在A、10在D；10、4、3在C；6、2、5、4在E；4在F；10、3在H；3、4、5在I；4、3在G；3在K；10在L；狗1在N、CC、G、O。

curves showing the animal's proficiency after an interval without experience. To these data may be added the following:

The three chicks that had learned to escape through the long labyrinth (involving twenty-three associations) succeeded in repeating the performance after ten days' interval. Similarly the chicks used as imitators in V, W, X and Y, did not fail to perform the proper act after an interval of twenty days. Cat 6, who had had about a hundred experiences in C *(Button)*, had the association as perfect after twenty days as when it left off. Cat 2, who had had 36 experiences with C and had attained a constant time of 8 sec., escaped fourteen days later in 3, 9 and 8 secs. respectively, in three trials. Cat 1, after an interval of twenty days, failed in 10 minutes to escape from C. The signal for climbing up the front of the cage was reacted to by No. 3 after an interval of twenty-four days. No. 10, who had learned to discriminate between 'I must feed those cats' and 'I will not feed them,' was tried after *eighty days*. It was given 50 trials with the second signal mingled indiscriminately with 25 trials with the first. I give the full record of these, 'yes' equalling a trial in which she 'forgot' and climbed up, 'no' equalling a trial in which she wisely stayed down. Dashes represent intervening trials with the first signal, *to which she always reacted*. It will be observed that 50 trials put the cat in the same position that 350 had done in her first experience, although in that first experience she had had only about a hundred trials after the association had been perfected. The association between the first signal and climbing up was perfect after the eighty days.

Trials 1–7.	Trials 8–17.	Trials 18–27.	Trials 28–35.	Trials 36–42.	Trials 43–50.
——	yes	no	——	——	——
——	yes	yes	——	no	——
yes	yes	no	——	no	——
yes	——	no	no	——	——
no	yes	——	no	no	——
——	yes	——	yes	no	no
yes	no	yes	no	no	no
yes	yes	yes	——	——	yes
no	no	yes	no	——	no
no	——	yes	yes	no	no
——	——	no	no	no	no
——	yes	no	no		no
——	yes				no
	——				

再补充：3只学会23联结长迷宫的小鸡，隔10天仍完成；用于V、W、X、Y模仿实验的小鸡，隔20天仍能恰当动作。6号猫在C约百次经验，20天后仍完善；2号在C有36次经验、稳定8秒，14天后三试为3、9、8秒；1号隔20天在C十分钟失败。3号24天后仍响应上爬信号。

10号学会区分“该喂猫了”“我不会喂它们”，80天后再试。第二信号50次，与第一信号25次任意混排。左表给全记录：yes＝“忘了”而上爬；no＝正确留在下面；横杠＝中间插入第一信号，它对此始终响应。各组标题是第1-7、8-17、18-27、28-35、36-42、43-50次第二信号试验。每次结果和横杠位置完整保留。

可见50次便恢复最初350次达到的状态，尽管最初完善后只再有约100次练习。第一信号与上爬的联结，80天后仍完善。

All these data show that traces of the connections once formed are very slow in being lost. If we allow that part of the time in the first trial in all these cases is due to the time taken to realize the situation (time not needed in the trials when the association is forming and the animal is constantly being dropped into boxes) we may say that the association is as firm as ever for a considerable time after practice at it is stopped. How long a time would be required to annul the influence of any given quantity of experience, say of an association which had been gone through with ten times, I cannot say. It could, if profitable, easily be determined in any case. The only case of total loss of the association (No. 1 in C) is so exceptional that I fancy something other than lapse of time was its cause. The main interest of these data, considered as quantitative estimates, is not psychological, but biological. They show what a tremendous advantage the well-developed association-process is to an animal. The ways to different feeding grounds, the actions of enemies, the appearance of noxious foods, are all connected permanently with the proper reaction by a few experiences which need be reinforced only very rarely. Of course, associations without any permanence would be useless, but the usefulness increases immensely with such a degree of permanence as these results witness. An interesting experiment from the biological point of view would be to see how infrequently an experience could occur and yet lead eventually to a perfect association. An experiment approximating this is recorded in the time-curves for Box H in Fig. 4, on page 20. Three trials at a time were given, the trials being two or three days apart. As may be seen from the curves, the association was readily formed.

The chief psychological interest of these data is that they show that permanence of associations *is not memory*. The fact that a cat, when after an interval she is put into box G, proceeds to immediately press the thumb-piece and push the door, does not at all mean that the cat feels the box to be the same from which she weeks ago freed herself by pushing down that thumb-piece, or thinks about ever having felt or done anything in that box. She does not refer the present situation to a situation

这些数据表明，形成的连接痕迹消失很慢。若考虑每例首试部分时间用于重新意识到情境--反复入箱学习期间不需要--可说停止练习后相当久，联结仍同样牢固。抹去一定经验量，如练过十次的联结，需要多久，我不能说；若值得研究，容易确定。唯一完全丧失案例，1号在C，异常到我怀疑并非时间流逝所致。

定量资料的主要兴趣在生物学而非心理学：完善联结给动物巨大优势。觅食地路径、敌人行动、有害食物外观，经少数经验便同正确反应持久联系，只需极少再次强化。无持久性联结无用；达到本结果的程度，有用性大增。有趣的生物学实验，是经验多罕见还可最终完善联结。近似实验见第20页图4的H箱：每次给三次试验，两组间隔两三天，曲线表明仍容易形成。

主要心理学兴趣，是联结持久性不等于记忆。猫隔一段时间入G，立即压片推门，并不意味着它体验“这是数周前我压片逃出的同一箱”，或想到曾在箱中感觉、做过什么。它并不把当前情境同过去相联系并意识其相同；

of the past and realize that it is the same, but simply feels on being confronted with that situation the same impulse which she felt before. She does the thing now for just the same reason that she did it before, namely, because pleasure has connected that act above all others with that sense-impression, so that it is the one she feels like doing. Her condition is that of the swimmer who starts his summer season after a winter's deprivation. When he jumps off the pier and hits the water he swims, not because he remembers that this is the way he dealt with water last summer and so applies his remembrance to present use, but just because experience has taught him to feel like swimming when he hits the water. All talk about recognition and memory in animals, if it asserts the presence of anything more than this, is a gross mistake. For real memory is an absolute thing, including everything but forgetfulness. If the cat had real memory it would, when after an interval dropped into a box, remember that from this box it escaped by doing this or that and consequently, either immediately or after a time of recollection, go do it, or else it would not remember and would fail utterly to do it. On the contrary, we have all grades of *partial* 'forgetfulness,' just like the grades of swimming one might find if he dropped a dozen college professors into the mill-ponds of their boyhood, just like the grades of forgetfulness of the associations once acquired on the ball-field which are manifested when on the Fourth of July the 'solid men' of a town get out to amuse their fellow citizens. The animal makes attacks on a spot around the vital one, or claws at the thing—but not so precisely as before, or goes at it a while and then resorts to instinctive methods of getting out. Its actions are exactly what would be expected of an animal in whom the sense-impression aroused the impulse imperfectly, or weakly, or intermittently, but are not at all like the actions of one who felt, "I used to get out of this box by pulling that loop down." In fact, the record of No. 10 given on page 96 seems to be final on this point. If at any time in the course of the 50 trials it had *remembered* that 'I will not feed them' meant 'no fish,' it would thenceforth have failed to react. It would have stopped short in the 'yes' reactions, instead of gradually decreasing their percentage. 'Memory'

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只在同一情境体验从前同一冲动。如今行动的理由与从前一样：愉快把此动作比其他动作更强地连到此印象，所以它想做。像游泳者冬季未游，夏天从码头跳水便游，不是记得去年怎样应对水、运用回忆，而是经验已教会遇水便有游的冲动。关于动物辨认、记忆，若主张超过此点，便是严重错误。

真正记忆是绝对的，除遗忘外都包含。若猫有真正记忆，隔时入箱，就会记得靠某动作逃出，立即或回想一阵去做；否则不记得，彻底失败。实际却有各种程度的部分“遗忘”，像把一打教授投入童年磨坊池塘所见游泳水平，或镇上“稳重人士”在7月4日上球场娱同胞时显出的旧技能遗忘程度。动物攻击关键点附近、抓得不如从前准确，或尝试后回到本能逃法。像印象引冲动不完整、微弱、断续，绝不像体验“我以前靠拉下这圈逃出”。

第96页10号记录似乎决定性：若50次中任何时刻记得“我不会喂它们”意味着“无鱼”，以后就不再反应；“yes”应突然停止，而非比例逐渐下降。动物的“记忆”若仍用此词，是联结持久，不是把经验观念认作属于过去。

in animals, if one still chooses to use the word, is *permanence of associations*, not the presence of an idea of an experience attributed to the past.

To this proposition two corollaries may be added. First, these phenomena of incomplete forgetfulness extend the evidence that animals do not have a stock of independent ideas, the return of which plus past associates equals memory. Second, there is, properly speaking, no continuity in their mental streams. The present thought does not clutch the past to its bosom or hold the future in its womb. The animal's self is not a being 'looking before and after,' but a direct practical association of feelings and impulses. So far as experiences come continuously they may be said to form a continuous mental life, but there is no continuity imposed from within. The feelings of its own body are always present and impresssions from outside may come as they come to us. When the habit of attending to the elements of its associations and raising them up into the life of free ideas is acquired, these permanent bodily associations may become the basis of a feeling of self-hood and the trains of ideas may be felt as a continuous life.

Inhibition of Instincts by Habit.

One very important result of association remains to be considered, its inhibition of instincts and previous associations. An animal who has become habituated to getting out of a box by pulling a loop and opening the door will do so even though the hole in the top of the box be uncovered, whereas, if, in early trials, you had left any such hole, he would have taken the instinctive way and crawled through it. Instances of this sort of thing are well-nigh ubiquitous. It is a tremendous factor in animal life, and the strongest instincts may thus be annulled. The phenomenon has been already recognized in the literature of the subject, a convenient account being found in James' *Psychology*, Vol. II., pages 394–397. In addition to such accounts, one may note that the influence of association is exerted in two ways. The instinct may wane by not being used, because the animal forms the habit of meeting the situation in a different way, or it may be actually inhibited. An instance

有两推论。第一，不完全遗忘进一步表明，动物无独立观念储库，其观念复现并带回旧联结而成记忆。第二，严格说，心理流无连续性：当前思想不拥抱过去、不孕育未来。动物自我不是“瞻前顾后”的存在，而是体验与冲动的直接实用联结。经验连续到来，可说心理生活连续，却无内部赋予的连续。身体体验始终在，外印象可如人类般来到；学会注意联结要素、提升为自由观念生活后，这些永久身体联结，可能成为自我感基础，观念序列可被体验为连续生活。

习惯对本能的抑制

联结还有重要作用：抑制本能和旧联结。动物习惯拉圈开门逃箱后，即使顶孔不盖，仍这样做；而早期若有孔，便本能钻出。此类例子几乎无处不在，是动物生活中巨大因素，最强本能也可被取消。文献已认识这一点，见詹姆斯《心理学》第一卷第394-397页。可补充，联结影响有两种：养成别种应对方式，令本能因不使用而衰退；或实际抑制它。一例是猫学会拉圈逃顶板钉死的箱。

of the former sort is found in the history of a cat which learns to pull a loop and so escape from a box whose top is covered by a board nailed over it. If, after enough trials, you remove a piece of the board covering the box, the cat, when put in, will still pull the loop instead of crawling out through the opening thus made. But, at any time, if she happens to notice the hole, she *may* make use of it. An instance of the second sort is that of a chick which has been put on a box with a wire screen at its edge, preventing her from jumping directly down, as she would instinctively do, and forcing her to jump to another box on one side of it and thence down. In the experiments which I made, the chick was prevented by a second screen from jumping directly from the second box also. That is, if in the accompanying figure, A is a box 34 inches high, B a box 25 inches

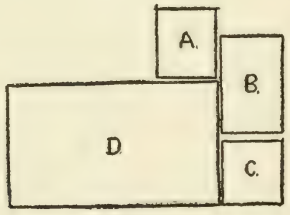


FIG. 21.

high, C a box 16 inches high, and D the pen with the food and other chicks, the subject had to go A–B–C–D. The chick tried at first to get through the screen, pecked at it and ran up and down along it, looking at the chicks below and seeking for a hole to get through. Finally it jumped to B and, after a similar process, to C. After enough trials it forms the habit and when put on A goes immediately to B, then to C and down. Now if, after 75 or 80 trials, you take away the screens, giving the chick a free chance to go to D from either A or B, and then put it on A, the following phenomenon appears. The chick goes up to the edge, looks over, walks up and down it for a while, still looking down at the chicks below, and then goes and jumps to B as habit has taught it to do. The same actions take place on B. No matter how clearly the chick sees the

充分练习后移去一块顶板，仍拉圈、不钻孔；但任何时候若恰注意孔，仍可能用。这是第一类。

第二类：小鸡放箱顶，边缘网阻止本能直接跳下，迫使跳侧边另一箱再下；第二箱也有网。图中A箱34英寸高，B为25，C为16，D是同伴、食物围栏，须走A-B-C-D。初时啄网、沿网跑、望下找孔；最终跳B，重复过程后跳C。足够试验后，置A即去B、C再下。75或80次后撤网，让它从A或B都可直达D，再放A：它到边缘、往下看，沿边来回、仍望下方同伴，然后按习惯跳B；B上同样。不论多清楚看到直跳D的机会，仍不这样做。

图21：习惯抑制实验的箱子和围栏布局。A、B、C为不同高度的箱子，D为有食物、同伴的围栏；原图中的字母与正文对应。

chance to jump to D, it does not do so. The impulse has been truly inhibited. It is not the mere habit of going the other way, but the impossibility of going *that* way. In one case I observed a chick in whom the instinct was all but, yet not quite inhibited. When tried without the screen, it went up to the edge to look over *nine times*, and at last, after seven minutes, did jump straight down.

Attention.

I have presupposed throughout one function which it will be well to now recognize explicitly—attention. As usual, attention emphasizes and facilitates the process which it accompanies. Unless the sense-impression is focussed by attention, it will not be associated with the act which comes later. Unless two differing boxes are attended to, there will be no difference in the reactions to them. The really effective part of animal consciousness, then, as of human, is the part which is attended to; attention is the ruler of animal as well as human mind.

But in giving attention its deserts we need not forget that it is not here comparable to the whole of human attention. Our attention to the other player and the ball in a game of tennis *is* like the animal's attention, but our attention to a passage in Hegel, or the memory which flits through our mind, or the song we hear, or the player we idly watch, is *not*. There ought, I think, to be a separate name for attention when working for immediate practical associations. It is a different species from that which holds objects so that we may define them, think about them, remember them, etc., and the difference is, as our previous sentence shows, not that between voluntary and involuntary attention. The cat watching me for signs of my walking to the cage with fish is not in the condition of the man watching a ball game, but in that of the player watching the ball speeding toward him. There is a notable difference in the permanence of the impression. The man watching the game can remember just how that fly was hit and how the fielder ran for it, though he bestowed only a slight quantity of attention on the matter, while the fielder may attend to the utmost to the ball and yet not remember at all how it came or how he ran for

冲动真正被抑制：不只是习惯另一方式，而是不能用原方式。一只小鸡本能几乎、但未完全被抑制；撤网后到边缘望9次，终于7分钟后直跳下。

注意

全书预设的一项功能，现在须明确承认，即注意。如通常，注意强调、促进它所伴过程。印象若无注意聚焦，便不与随后动作联结；两异箱若未受注意，反应便无差异。动物和人的意识中，真正有效的是受到注意的部分，注意支配两者心理。

但不能据此把它等同于全部人类注意。网球中对对手、球的注意像动物；注意黑格尔一段、心中闪过的记忆、所听歌曲、闲看比赛则不同。为直接实用联结服务的注意，应有另名，区别于把对象保持住、供定义、思考、记忆的注意；差异不是随意与不随意。猫看我是否持鱼走向箱，不像看比赛的人，而像球员注意飞来的球。

印象持久性明显不同。观众稍注意便可记得高飞球怎样击出、外场手怎样跑；外场手全神注意球，却可能全不记得球怎么来、自己怎么跑。

it. The one sort of attention leads you to *think* about a thing, the other to *act* with reference to it. We must be careful to remember that when we say that the cat attended to what was said, we do not mean that he thereby established an idea of it. Animals are not proved to form separate ideas of sense-impressions because they attend to them, for the kind of attention they give is the kind which when given by men results in practical associations, not in establishing ideas of objects. If attention rendered clear the idea, we should not have the phenomena of incomplete forgetfulness lately mentioned. The animal would get a definite idea of just the exact thing done and would do it or nothing. The human development of attention is in closest connection with the acquisition of a stock of free ideas.

Social Consciousness.

Besides attention there is another topic somewhat apart from our general one, which yet deserves a few words. It concerns animals' social consciousness, their consciousnes of the feelings of their fellows. Do animals, for example, when they see others feeding, feel that the others are feeling pleasure? Do they, when they fight, feel that the other feels pain? So level-headed a thinker as Lloyd Morgan has said that they do, but the conduct of my animals would seem to show that they did not. For it has given us good reason to suppose that they do not possess *any* stock of isolated ideas, much less any abstracted, inferred or transferred ideas. These ideas of others' feelings imply a power to transfer states felt in oneself to another and realize them as there. Now it seems that any ability to thus transfer and realize an idea ought to carry with it an ability to form a transferred association, to imitate. If the animal realizes the mental states of the other animal who before his eyes pulls the string, goes out through the door and eats fish, he ought to form the association, 'impulse to pull string, pleasure of eating fish.' This we saw the animal could not do.

In fact, pleasure in another, pain in another, is not a sense-presentation or a representation or feeling of an object of any sort, but rather a 'meaning,' a feeling '*of the fact that*.' It can exist only as something thought *about*. It is never 'a bit of

一类注意引人思考事物，另一类引人对事物行动。说猫注意听，并不意味着形成独立观念；动物的注意，正是人用来形成实用联结、而非对象观念的类型。若注意使观念明确，就不会有前述不完全遗忘；动物应取得所做精确动作的明确观念，要么做它，要么全不做。人类注意发展，与自由观念储库的获得最紧密相关。

动物的社会意识

除注意，还值得略谈偏离主主题的社会意识，即对同伴体验的意识。看其他动物进食，会体验它们有愉快吗？争斗时，会体验对方痛苦吗？像摩根这样清醒者说会，我的动物行为却似乎显示不会：它们没有独立观念储备，更不用说抽象、推论、迁移的观念。对他者体验的观念，须把自己体验过的状态移到对方，并意识其在对方身上。任何这类迁移、认识能力，似也该能形成迁移联结、模仿。若意识同伴拉绳、出门、吃鱼的心理状态，就应形成“拉绳冲动-吃鱼愉快”的联结；已见不能。

实际上，别人身上的愉快、痛苦，不是感觉呈现或表象，也不是任何对象的体验；更像“意义”、对“某事实成立”的体验，只能作为被思考的东西存在。它从不是“一点直接经验”，

direct experience,' but an abstraction from our own life referred to that of another.

I fancy that these feelings of others' feelings may be connected pretty closely with imitation, and for that reason may begin to appear in the monkeys. There we have some fair evidence for their presence in the tricks which monkeys play on each other. Such feelings seem the natural explanation of the apparently useless tail-pullings and such like which make up the attractions of the monkey-cage. These may, however, be instinctive forms of play-activity or merely examples of the general tendency of the monkeys to fool with everything.

Interaction.

I hope it will not be thought impertinent if from the standpoint of this research I add a word about a general psychological problem, the problem of interaction. I have spoken all along of the connection between the situation and a certain impulse and act being stamped in when pleasure results from the act and stamped out when it doesn't. In this fact, which is undeniable, lies a problem which Lloyd Morgan has frequently emphasized. *How are pleasurable results able to burn in and render predominant the association which led to them?* This is perhaps the greatest problem of both human and animal psychology. Unfortunately in human psychology it has been all tangled up with the problems of free will, mental activity, voluntary attention, the creation of novel acts, and almost everything else. In our experiments we get the data which give rise to the problem, in a very elementary form.

It should first be noted about the *fact* that the pleasure does not burn in an impulse and act themselves, but an impulse and act *as connected with that particular situation*. No cat ever goes around clawing, clawing, clawing all the time, because clawing in these boxes has resulted in pleasure. Secondly, the connection thus stamped in is *not contemporaneous, but prior to* the pleasure. So much for the fact; now for the explanation. I do not wish to rehearse or add to the arguments with which so many pages have been already filled by scientists and philosophers both. What we need most

而是从自己生活抽象出来、指向他者生活的东西。我想，对他者体验的体验，可能与模仿密切相联，因而开始见于猴。猴互相捉弄提供一些证据；看似无用的拉尾巴等猴笼乐趣，自然可如此解释。但也可能只是本能游戏形式，或猴总爱摆弄一切的一般倾向。

相互作用

希望从本研究立场略谈一个一般心理学问题--心物相互作用--不显冒昧。我一直说，情境与冲动、动作之间的连接，在动作带来愉快时被巩固，无愉快则消除。这一不可否认事实，包含摩根常强调的问题：愉快结果怎样使导致它的联结加深、占优势？可能是人类和动物心理学最大问题。人类心理学却把它同自由意志、心理活动、随意注意、新动作创造等纠缠。实验把引出问题的事实以极简单形式给出。

首先，愉快巩固的不是冲动、动作本身，而是同特定情境连接的冲动、动作。猫不会因箱内抓挠获愉快，就到处不停抓。其次，被巩固连接不与愉快同时，而在愉快之前。事实如此，解释呢？我不愿重述或增添科学家、哲学家已写无数页的论证。最需要的是准确说明心理事实、脑过程，不是争辩。

is not argument, but accurate accounts of the mental fact and of the brain-process. But I do wish to say to the parallelist, what has not to my knowledge been said, that if he presupposes, to account for this fact, a 'physical analogue of the hedonic consciousness,' it is his bounden duty to first show how any motion in any neuron or group of neurons in the nervous system can possess this power of stamping in any current which causes it. For no one would, from our present knowledge of the brain, judge *a priori* that any motion in any part of it could be conceived which should be thus regnant over all the others. And next he must show the possibility of the current which represents the association being the excitant of this regnant motion in a manner direct enough for the purpose.

I wish also to say that whoever thinks that, going along with the current which parallels the association, there is an accompanying minor current, which parallels the pleasure and which stamps in the first current when present with it, flies directly in the face of the facts. *There is no pleasure along with the association. The pleasure does not come until after the association is done and gone.* It is caused by no such minor current, but by the excitation of peripheral sense-organs when freedom from confinement is realized or food is secured. Of course, the notion of such a secondary sub-current is mythology, any way.

To the interactionist I would say: "Do not any more repeat in tiresome fashion that consciousness *does* alter movement, but get to work and show when, where, in what forms and to what degrees it does so. Then, even if it turns out to have been a physical parallel that did the work, you will, at least, have the credit of attaining the best knowledge about the results and their conditions, even though you misnamed the factor."

Besides this contribution to general psychology, I think we may safely offer one to pedagogical science. At least some of our results possess considerable pedagogical interest. The fundamental form of intellection, the association-process in animals, is one, we decided, which requires the personal experience of the animal in all its elements. The association cannot be taught by putting the animal through it or giving it a chance to imitate. Now every observant teacher realizes how often the cleverest

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但要对心物平行论者说一点：
若假定“愉悦意识的物理对应物”解释此事，有责任先证明，神经系统某神经元或神经群的活动，怎能巩固导致自身出现的神经流。现有脑知识不足让人先验设想，某部分活动能如此支配其他全部活动；还须证明代表联结的神经流，能以足够直接的方式激发这种支配活动。

认为联结的平行神经流旁有小副流，对应愉快，同时在场就巩固主流者，直接违背事实。联结过程中没有愉快，联结完成、消逝后才有；来自解除禁闭或食物获得时外周感觉器官兴奋，不是这种副流。副流的想法，本来也属神话。

对相互作用论者则说：“不要再乏味重复意识确实改变运动；去证明何时、何处、何种形式、何种程度发生。即使最终是物理平行过程起作用，你至少取得了关于结果、条件的最好知识，只是把因素叫错了。”

除一般心理学贡献，还可为教育科学提供一点。某些结果有教育意义。基本思维形式--动物联结过程--要求动物亲自经验全部要素；不能靠带做或看模仿教会。每位善观察的教师都知道，最巧妙的解释、最好的模仿范本，也常失败。

explanation and the best models for imitation fail. Yet often, in such cases, a pupil, if somehow enticed to do the thing, even without comprehension of what it means, even without any real knowledge of what he is doing, will finally get hold of it. So, also, in very many kinds of knowledge, the pupil who does anything from imitation, or who does anything from being put through it, fails to get a real and permanent mastery of the thing. I am sure that with a certain type of mind the only way to teach fractions in algebra, for example, is to get the pupil to do, do, do. I am inclined to think that in many individuals certain things cannot be learned save by actual performance. And I think it is often a fair question when explanation, imitation and actual performance are all possible methods, which is the best. We are here alongside the foundations of mental life, and this hitherto unsuspected law of animal mind may prevail in human mind to an extent hitherto unknown. The best way with children may often be in the pompous words of an animal trainer, 'to arrange everything in connection with the trick so that the animal will be compelled by the laws of his own nature to perform it.'

This does not at all imply that I think, as a present school of scientists seem to, that because a certain thing *has been* in phylogeny we ought to repeat it in ontogeny. Heaven knows that Dame Nature herself in ontogeny abbreviates and skips and distorts the order of the appearance of organs and functions, and for the best of reasons. We ought to make an effort, as she does, to omit the useless and antiquated and get to the best and most useful as soon as possible; we ought to change what *is* to what *ought to be*, as far as we can. And I would not advocate this animal-like method of learning in place of the later ones unless it does the same work better. I simply suggest that in many cases where at present its use is never dreamed of, it may be a good method. As the fundamental form of intellection every student of *theoretical* pedagogy ought to take it into account.

There is one more contribution, this time to anthropology. If the method of trial and error, with accidental success, be the method of acquiring associations among the animals, the slow

然而这时，若设法引学生亲做，即使不懂意义、不真知道自己在做什么，最终也可能掌握。很多知识中，仅模仿或被带着做的学生，不能获得真正、永久掌握。我确信某类心理的学生，学代数分式等，唯一方式是做、做、不断做。某些人、某些内容，可能只能通过实际操作学习。解释、模仿、实作都可行时，问哪种最好，常合理。

我们已接近心理生活根基；这一此前未发现的动物心理规律，可能以未知程度存在于人。对儿童最好的方法，有时或如驯兽师浮夸地说："把技能相关一切安排好，使动物由自身自然规律迫使完成。"

这绝不意味着我同某科学学派一样，认为演化史上发生过，就应在个体发展中重复。自然自身也因最佳理由，缩短、跳过、改造器官功能的出现顺序。应如自然一样省无用、过时者，尽快达到最好、最有用者；尽可能把现状变成应然。若动物式学习不比后来方法做同样工作更好，我不会提倡替代；只是建议，在很多从未想到用的场合，它也可能是好方法。作为基本思维形式，理论教育学学生都该考虑。

还有人类学贡献：若动物凭试错、偶然成功取得联结，原始人的缓慢进步，如石器到铁器漫长间隔，便有启发。

progress of primitive man, the long time between stone age and iron age, for instance, becomes suggestive. Primitive man probably acquired knowledge by just this process, aided possibly by imitation. At any rate, progress was not by seeing through things, but by accidentally hitting upon them. Very possibly an investigation of the history of primitive man and of the present life of savages in the light of the results of this research might bring out old facts in a new and profitable way.

Comparative psychology has, in the light of this research, two tasks of prime importance. One is to study the passage of the child-mind from a life of immediately practical associations to the life of free ideas; the other is to find out how far the anthropoid primates advance toward a similar passage, and to ascertain accurately what faint beginnings or preparations for such an advance the early mammalian stock may be supposed to have had. In this latter connection I think it will be of the utmost importance to bear in mind the possibility that *the present anthropoid primates may be mentally degenerate*. Their present aimless activity and incessant, but largely useless, curiosity may be the degenerated vestiges of such a well-directed activity and useful curiosity as led *homo sapiens* to important practical discoveries, such as the use of tools, the art of making fire, etc. It is even a remote possibility that their chattering is a *relic* of something like language, not a *beginning* of such. Comparative psychology should use the phenomena of the monkey-mind of to-day to find out what the primitive mind from which man's sprung off was like. That is the important thing to get at, and the question whether the present monkey-mind has not gone back instead of ahead is an all-important question. A natural and perhaps sufficient cause of degeneracy would be arboreal habits. The animal that found a means of survival in his muscles might well lose the means before furnished by his brain.

To these disconnected remarks still another must be added, addressed this time to the anecdote school. Some member of it who has chanced to read this may feel like saying: "This experimental work is all very well. Your cats and dogs represent, it is true, specimens from the top stratum of animal intelli-

原始人可能正以此取得知识，也许模仿辅助；至少进步不是看透事物，而是偶然碰到。依据本研究审视原始人历史及现存原始族群生活，可能从旧事实发现新的、有益的意义。

比较心理学据此有两个首要任务：研究儿童如何从直接实用联结生活转向自由观念生活；查明类人灵长类接近此转变多少，以及早期哺乳动物有什么微弱开端、准备。后者须尤其记住，现存类人灵长类在心理上可能退化。如今无目标活动、持续却大多无用的好奇，可能是良好定向、有用好奇的退化遗迹；后者曾使智人发现工具、取火等。甚至有极小可能，喋喋叫声是类似语言的遗迹，非开端。

应通过今天猴心理，了解人类心理分支出来的原始心理；这才重要。今天猴心理是后退还是前进，极重要。树栖习惯可能是自然、甚至充分的退化原因；靠肌肉找到生存方式的动物，可能丧失此前靠脑的方式。

还须对轶事学派补一段。某读者可能说："实验很好。猫狗确属动物智慧上层；基于它们行为的否定，对普通典型哺乳动物心理也许有权威。

gence, and your negations, based on their conduct, may be authoritative so far as concerns the average, typical mammalian mind. But our anecdotes do not claim to be stories of the conduct of the average or type, but of those exceptional individuals who have begun to attain higher powers. And, if even a few dogs and cats have these higher powers, our contention is, in a modified form, upheld." To all this I agree, provided the anecdote school now realize just what sort of a position they hold. They are clearly in pretty much the same position as spiritualists. Their anecdotes are on pretty much the same level as the anecdotes of thought-transference, materializations of spirits, super-normal knowledge, etc. Not in quite the same position, for far greater care has been given by the Psychical Research Society to establishing the criteria of authenticity, to insuring good observation, to explaining by normal psychology all that can be so explained, in the case of the latter than the anecdote school has done in the case of the former. The off-hand explanation of certain anecdotes by invoking reason, or imitation, or recognition, or feelings of qualities, is on a par with the explanation of trance-phenomena and such like by invoking the spirits of dead people. I do not deny that we may get lawfully a super-normal psychology, or that the super-normal acts it finds may turn out to be explained by these functions which I have denied to the normal animal mind. But I must soberly declare that I think there is less likelihood that such functions are the explanation of animal acts than that the existence of the spirits of dead people is the true explanation of the automatisms of spiritualistic phenomena. So much for the anecdote school, if it calls itself by its right name and pretends only to give an *abnormal* animal psychology. The sad fact has been that it has always pushed forward these exceptions as the essential phenomena of animal mind. It has built up a general psychology from abnormal data. It is like an anatomy written from observations on dime-museum freaks.

Conclusion.

I do not think it is advisable here, at the close of this paper, to give a summary of its results. The paper itself is really only such a summary with the most important evidence, for the ex-

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但轶事并非关于平均类型，而是开始获得高级能力的例外个体。只要少数猫狗有，我们的主张经修改仍成立。”我同意，条件是他们认识自己立场。他们同通灵论者几乎相同，故事层次也同思想传递、灵魂显形、超常知识的故事相近。还不完全同，因为心灵研究学会在建立真实性标准、保证好观察、尽量用正常心理解释方面，比动物轶事学派谨慎得多。

轻率借理性、模仿、辨认、性质体验解释某些轶事，犹如借死者灵魂解释恍惚现象。我不否认可合法研究超常心理，其行为最终或由我否定普通动物拥有的功能解释。但我必须审慎声明：这些功能解释动物行为的可能性，在我看来还低于死者灵魂真实解释通灵自动行为的可能性。若轶事学派正确命名、只提供异常动物心理学，就说到这里。可悲事实是，它总把例外作为动物心理的根本现象，用异常资料构建一般心理学；如从廉价展览中的畸形者观察写解剖学。

结论

我不认为文末适宜再总结。本文本身就是附最重要证据的总结；因为覆盖广、须简洁，不能充分解释、举例。

tent of territory covered and the need of brevity have prevented completeness in explanation or illustration. If the reader cares here, at the end, to have the broadest possible statement of our conclusions and will take the pains to supply the right meaning, we might say that our work has described a method, crude but promising, and has made the beginning of an exact estimate of just what associations, simple and compound, an animal can form, how quickly he forms them, and how long he retains them. It has described the method of formation, and, on the condition that our subjects were representative, has rejected reason, comparison or inference, perception of similarity, and imitation. It has denied the existence in animal consciousness of any important stock of free ideas or impulses, and so has denied that animal association is homologous with the association of human psychology. It has homologized it with a certain limited form of human association. It has proposed, as necessary steps in the evolution of human faculty, a vast increase in the number of associations, signs of which appear in the primates, and a freeing of the elements thereof into independent existence. It has given us an increased insight into various mental processes. It has convinced the writer, if not the reader, that the old speculations about what an animal could do, what it thought, and how what it thought grew into what human beings think, were a long way from the truth, and *not on the road to it*.

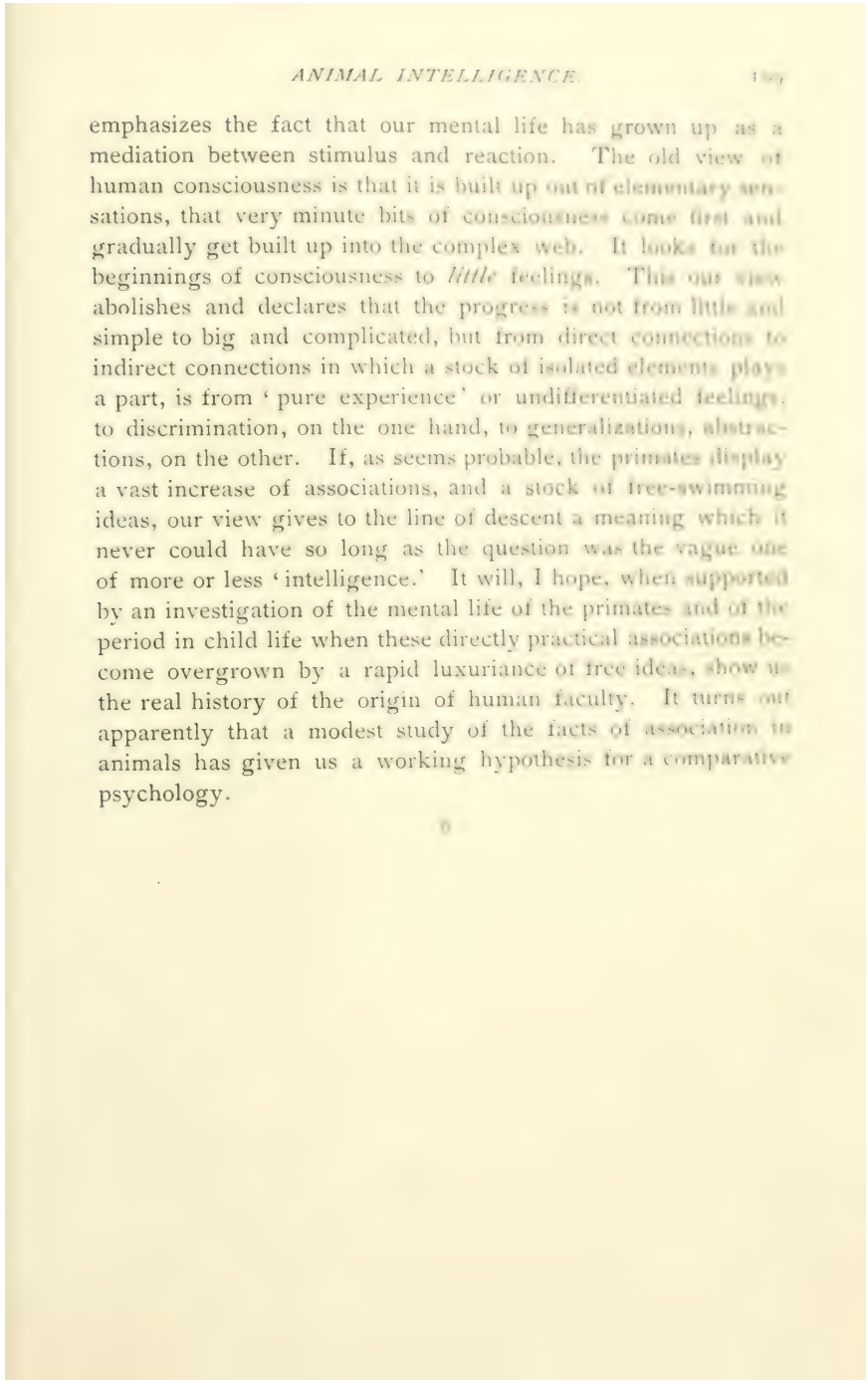
Finally, I wish to say that, although the changes proposed in the conception of mental development have been suggested somewhat fragmentarily and in various connections, that has not been done because I think them unimportant. On the contrary, I think them of the utmost importance. I believe that our best service has been to show that animal intellection is made up of a lot of specific connections, whose elements are restricted to them, and which subserve practical ends *directly*, and to homologize it with the intellection involved in such human associations as regulate the conduct of a man playing tennis. The fundamental phenomenon which I find presented in animal consciousness is one which can harden into inherited connections and reflexes, on the one hand, and thus connect naturally with a host of the phenomena of animal life; on the other hand, it

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若读者想要最广结论，并愿自行补充正确含义，可说：本研究描述一种粗糙但有前途的方法，开始精确估计动物能形成哪些简单、组合联结，速度多快，保持多久；说明形成方式，并在被试有代表性的条件下，否定理性、比较、推论、相似知觉、模仿。

它否认动物意识中有重要的自由观念或冲动储备，因此否认动物联结与人类心理学通常联结同源，而把它与人类某有限类型对应。提出人类能力演化的必要步骤：联结数量巨大增加，灵长类已有迹象；要素释放、独立存在。增进对各种心理过程的理解；使作者，即使未使读者，相信旧推测--动物能做什么、想什么、它们思想怎样长成人类思想--离真理很远，也不在通往真理的路上。

最后，关于心理发展的概念改变，虽在不同上下文零散提出，绝非因为不重要；我认为极重要。最好贡献，是显示动物思维由大量特定连接组成，要素限定其中，直接服务实际目的，并把它同网球员行为等人类联结中的思维对应。动物意识的基本现象，一方面可固化为遗传连接、反射，自然连到许多动物生活现象；另一方面强调人类心理生活是作为刺激、反应之间的中介发展起来的。



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emphasizes the fact that our mental life has grown up as a mediation between stimulus and reaction. The old view of human consciousness is that it is built up out of elementary sensations, that very minute bits of consciousness come first and gradually get built up into the complex web. It looks for the beginnings of consciousness to *little* feelings. This our view abolishes and declares that the progress is not from little and simple to big and complicated, but from direct connections to indirect connections in which a stock of isolated elements plays a part, is from 'pure experience' or undifferentiated feelings, to discrimination, on the one hand, to generalizations, abstractions, on the other. If, as seems probable, the primates display a vast increase of associations, and a stock of free-swimming ideas, our view gives to the line of descent a meaning which it never could have so long as the question was the vague one of more or less 'intelligence.' It will, I hope, when supported by an investigation of the mental life of the primates and of the period in child life when these directly practical associations become overgrown by a rapid luxuriance of free ideas, show us the real history of the origin of human faculty. It turns out apparently that a modest study of the facts of association in animals has given us a working hypothesis for a comparative psychology.

旧观点认为意识由基本感觉构成，极微小意识片段先出现，逐渐编成复杂网络，寻意识开端于“小体验”。我们的观点废除此说：发展不是由小而简单到大而复杂，而是从直接连接，到独立要素储备参与的间接连接；从纯粹经验、未分化体验，一方面到辨别，另一方面到概括、抽象。

若如很可能的那样，灵长类有大量增加的联结及自由游动的观念储备，此观点便赋予演化谱系以旧的模糊“智慧多少”问题所不能给予的意义。我希望，研究灵长类心理生活，以及儿童直接实用联结迅速被繁茂自由观念覆盖的时期后，此观点能显示人类心理能力起源的真实历史。看来，对动物联结事实的一项适度研究，已给比较心理学提供一个可工作的假说。