IV

THE MAKING OF IMPLEMENTS

In all intelligence tests of the kind applied here, one circumstance is always repeated : if one *single part* of the " solutions " in the proceedings we have discussed (e.g. the beginning) be considered by itself and without any relation to the remaining parts, it represents behaviour which, in the face of the task, i.e. the attaining of the objective, seems to be either quite irrelevant or else to lead in the opposite direction. It is only when we consider the *whole course* of the solution (or, as later, at least considerable sections instead of those parts) that this whole seems to have some significance, and each of the parts previously isolated takes on a meaning as *a part of this whole.*

[Only for *one* section is this not true, namely, the last, in which each time, as a result of all the preceding acts, the objective is merely grabbed. This section, of course, has significance even when considered alone.]

The above is not philosophy, it is not even a theory of the actual proceedings, but a simple statement with which anyone must agree who distinguishes between " significant in relation to a task " and " non-significant ", or " meaningless ", and who will consider examples objectively.

When a man or an animal takes a roundabout way (in the ordinary sense of the word) to his objective the beginning —considered by itself only and regardless of the further course of the experiment—contains at least one component which must seem *irrelevant* ; *in very indirect routes there are*

usually some parts of the way which, when considered alone, seem in contradiction to the purpose of the task, because they lead away from the goal. If the subdivision in thought be dropped, the *whole* detour, and each part of it considered as a part of the whole becomes full of meaning in that experiment.

If, with the aid of a stick, I fetch an objective, otherwise unattainable, the same applies. The act of picking up the stick lying near me, considered separately, and without reference to the other part of the performance, the use of the stick as an implement, is quite irrelevant in relation to the objective. It does not, keeping always of course this supposed isolation in mind, bring me any nearer to my objective, and is, therefore, meaningless in this situation. But, on the other hand, considered as part of the total proceeding, it has the significance of a necessary part of a meaningful whole.

The same reflections applied to other "indirect ways" (used figuratively) illustrate the same circumstances, and that is why we call them all "indirect ways".

Thus matters stand from the point of view of a purely objective consideration. How the chimpanzee arrives at his actual solutions in such cases is another question, which we cannot investigate until later. But the purpose of all further experiments is to set up situations in which the possible solution becomes more complicated. Thus the objective consideration of the course of the experiment in parts will show up, ever more clearly and in greater number, sections which, *taken separately, are meaningless in relation to the task,* but which become *significant again,* when they are considered *as a part of the whole.* How does the chimpanzee behave in such situations?

One group of such cases, which will be considered in what follows, we characterize by the phrase "making of imple-

ments ". For practical reasons this name is here used in a wider sense; that is to say, every subsidiary action which treats an implement, which does not for the moment exactly fit the situation, in such a way that it *may* be utilized, is considered as the " making of implements ". This preliminary treatment, of whatever kind, forms the new constituent which, when isolated, has no relation at all to the goal, but which becomes significant as soon as it is considered with the rest of the proceeding, in particular the " utilization of the implement ".

(1)

It seems to be only a weak indication of such auxiliary action when Chica, chasing another animal in mock fight, sees a stone, wants to pick it up, and when it does not immediately come away from the ground, scratches and drags it until it becomes loose; in the same instant she is on the chase again behind her adversary, and throws the stone at him.

A more important performance, which took place several times afterwards, was observed by Teuber (my predecessor at the station): Sultan grabs at objects behind the bars and cannot reach them with his arm; he thereupon walks about searchingly, finally turns to a shoe-scraper, made of iron bars in a wooden frame, and manipulates it until he has pulled out one of the iron bars; with this he runs immediately to his real objective, at a distance of about ten metres, and draws it towards him.

[In this case it is pretty clear that the whole proceeding, part by part, contains *several* constituents which are meaningless when isolated. (1) Instead of keeping to his objective, Sultan goes away from it; this is quite senseless when taken by itself. (2) He breaks up one of the station's

iron shoe-scrapers, and this, taken by itself, has nothing whatever to do with his objective.

However, some additional remarks must be made about these two instances, in their actual occurrence: (1) The animal by no means strides away from the objective in the free, careless way which we are used to, in him and the others at times when they are seeking nothing, but goes away like someone who has a task before him. And here again, I wish to warn against anyone speaking of "anthropomorphism", of "reading into" the animals, etc. . . . where there is not the least ground for such reproaches. I merely ask whether there is not a difference of behaviour between people strolling about idly, and people looking for the nearest chemist's shop, or for any lost object? Of course their behaviour is different. Whether we can exactly analyze our total impression in both cases, has nothing whatever to do with the case. Now all I wish to state is that the two general impressions that are contrasted here *occur in chimpanzees, exactly as in man*; and it is these "impressions", which are not at all "something that has been read into" the chimpanzees, but which belong to the elementary phenomenology of their behaviour, that are meant when we say, for instance, "Sultan trotted about gaily" or "he went over the ground looking for something". If *this* is an anthropomorphism, so then is this sentence: "Chimpanzees have the same tooth formula as man". So as to leave no doubt whatever as to the meaning of the expression: "Walking about searchingly", I should like to add, that nothing is said therein as to the "consciousness" of the animal, but only as to his "behaviour". (2) While occupied with the shoe-scraper, Sultan's activity is concentrated exclusively on *loosening one of its iron bars*; but even when described more precisely thus, this action remains *irrelevant with reference to the real purpose as long as it is considered in isolation.*

At the time when Koko did not know any longer how to use his box (cf, p. 43), he came once to the same proceeding as Sultan, when the objective was hanging high up on the wall. Four metres away in front of the door was a shoe-scraper, exactly like the one mentioned. After a long look at the box, which did not lead to his making use of it, Koko turned away, espied the shoe-scraper, ran towards it, and began to pull at it with all his might, until the nails with which it was fastened to the ground, finally gave way. Satisfied, he then dragged the heavy board towards the objective. But he was startled on the way by a whistle near by, and dropped his burden, so that one could not say what would have happened further. But soon after, he again turned towards the board, stood on one of the edges running lengthways, and pulled and shook the iron staves as hard as he could, probably to tear them off; but as he was too weak, and also did not set about his task very efficiently, he had finally to stop his efforts.]

(17.2 1914) Beyond some bars, out of arm's reach, lies an objective; on this side, in the background of the experiment-room, is placed a sawed off castor-oil bush, whose branches can be easily broken off. It is impossible to squeeze the tree through the railings, on account of its awkward shape; besides, only one of the bigger apes could drag it as far as the bars. Sultan is let in, does not immediately see the objective, and, looking about him indifferently, sucks one of the branches of the tree. But, his attention having been drawn to the objective, he approaches the bars, glances outside, the next moment turns round, goes straight to the tree, seizes a thin slender branch, breaks it off with a sharp jerk, runs back to the bars, and attains the objective. From the turning round upon the tree up to the grasping of the fruit with the broken-off branch, is one single quick chain of action, without the least "hiatus," and without the slightest

movement that does not, objectively considered, fit into the solution described.

At a repetition soon after, things did not go so smoothly, but that was not Sultan's fault. The branch was taken away in Sultan's absence, a new objective put down, and Sultan again admitted. He at once broke off another branch, but tried in vain to reach the objective with it; for the branch, when the tree was sawn, had been bent in the middle. He pulled it back through the railings, bit through it at the bend and continued to work with the other half, but in vain, for now the implement was too short.

[In connexion with the biting through of the branch where it is bent, it should be added that all the small animals considered it a game to poke about with straws in holes and the joints of walls; the feeble straws kept on getting bent during this performance, and the animals kept on biting them off to make them of use again, until eventually they became too short altogether. In the experiment, the biting off at the bend is both correct and incorrect; *correct* because the half is really a better "stick" in the functional sense, *incorrect* because, even without being bitten off, one half would have served its purpose as an implement, had it been long enough.]

For adult man with his mechanized methods of solution, proof is sometimes needed, as here, that an action was a real achievement, not something self-evident; that the breaking off a branch from a *whole tree*, for instance, is an achievement over and above the simple use of a stick, is shown at once by animals less gifted than Sultan, even when they understand the use of sticks beforehand.

Grande was tested the same day. She stretches out her arm to get hold of the objective, but all her efforts are in vain; she cannot reach it. Finally she steps back from the bars, wanders slowly through the room, and squats close to the tree, chewing its branches for a while indolently. In

spite of her "landing at the tree" thus and chewing at it, we do not get the impression that it has anything to do with the objective, which is no longer noticed. After waiting for a long time, during which no sign of a solution is given, the test is abandoned. I might mention the fact that Grande is older and much stronger than Sultan, so that she could have broken off a branch with the greatest ease.

Four months later (16.6) the experiment is repeated, she has meanwhile become very much more accustomed to the use of sticks. The tree, consisting of three strong branches (without twigs) growing out of a thick trunk, is at the very back of the room, as far away as possible from the railings, and therefore from the objective (about five metres). Grande first of all tries to pull out from its metal rings an iron bar which is attached to a door of the room, as a temporary bolt. As her efforts do not meet with success, she looks about the room, lets her glance rest for a while on the tree, but looks away from it again, and then spies a strip of cloth quite close to the bars; this she seizes and makes attempts to whisk the objective to her (compare above, p. 34). When the cloth is taken away from her, she rattles the iron bar again and, as it does not loosen, she looks round the whole room, and especially at the tree in the background; she sees a stone on the floor, carries it to the bars and endeavours—in vain—to squeeze it through them, obviously it is meant to take the place of a stick. After a further glance back, she at last marches toward the tree, leans with one hand on the wall, puts the other one, and one foot, against the branch furthest to the front, with one jerk breaks it off, returns at once to the bars and attains her objective. In explanation we must add: the black iron bar, although *actually* much more firmly affixed to the door than are the branches to the tree, yet stands out *visually* better from the wooden door, *as a separate object*, especially as one end is bent in from the door to the

room. To "*see*" a branch of the tree, so to speak, *as a stick*, is much more difficult, and Grande did look at the tree twice, without this happening. From the moment she walks towards the tree, her procedure is just as determined and as "genuine" as Sultan's.

(1.3.1914) Tschego had used sticks as implements during the preceding days and even on the morning before the experiment to be described. A tree is placed about two metres away from the bars, and Tschego is then let into the room. She does not see the tree at first, but when her eye lights on the objective, goes as usual into her bedroom, fetches her blanket, stuffs it through the bars, throws it on to the objective, and tries thus to draw it towards her. For the blanket can be used in two ways, either of which might succeed: beating the goal towards her (compare above, p. 34), or pulling it towards her, after the cover has been thrown over it. The cover is taken away from her; she seizes the tree and makes a great effort to squeeze it, just as it is, through the bars. When that does not succeed, she takes a bundle of straw in her hand, stretches out with it like a stick, and endeavours to pull the objective towards her. As the bundle proves to be too soft, and does not drag the objective with it when pulled along, she takes hold of the straw in the middle with her teeth, and at one end with her hand, and bends one half over the other, so that a bundle half as long, but incomparably firmer, a real sort of stick, is formed; this she uses at once, and, since it remains long enough, again and again, with complete success. The whole proceeding, from the taking of the bundle of straw which is too soft, up to the use of the firmer one, is one cohering action; it lasts but a few seconds. In this way a method of making implements has been invented that is different from the one expected; Tschego did not, at any time, show any indication of breaking off a branch of the tree, but she clearly showed

that she " had present " the *use of the stick* all through the experiment. The tree, by the way, was only a very small one, which Tschego could easily manage as a whole. This explains why she wanted to use this whole as a stick; but the rough procedure by which she pushes it towards the bars, as if she could thus get it through, is, of course, not justified by the size of the little tree.

The next day the test is repeated; the little tree lies in exactly the same place as on the day before at the beginning. Tschego uses a bundle of straw as a substitute for the stick, and, when it proves too soft, folds it double just as in the first test, making it stiffer. This time, even after folding it, it still remains too flexible, so she hastily repeats the proceeding, and the bundle, now composed of four folds, thus becomes extremely firm. But now it is too short, and Tschego tries to squeeze the whole tree through the bars. As, of course, she fails in this also, she returns to the straw, and, after many failures, finally sits down quietly. But her eyes wander and soon fix on the little tree, which she had left lying a little way behind her, and all of a sudden, she seizes it quickly and surely, breaks off a branch, and immediately pulls the objective to her with it. This proceeding has no relation to her former attempts to push the tree through the bars. While breaking off the branch, Tschego turns one side towards the bars; the little tree does not touch them at all and is neither treated as a whole nor moved towards the bars; nothing else is involved but just the *breaking off of the branch.*

[In this experiment, what is particularly worth noting is the fact that, for a long time, not the slightest sign was given of the expected solution; when the branch is suddenly broken off, the proceeding goes on, without any " hiatus ", to the reaching out with the stick thus created: *both actions together make one united proceeding.*]

Koko attempted solutions of this sort from the very beginning, before we had undertaken such experiments with him On the first day of his stick experiment (compare above, p. 33) he pushed the objective still further away by some clumsy movement, so that he could not reach it at all with his stick, still less with a stalk that was lying close by. He therefore turned sharply to a geranium-bush that grew to one side, seized one of its stems, plucked it, and advanced with it toward the objective ; on the way he eagerly picked off one leaf after the other, so that only the long, bare stem was left ; with this he then tried—in vain—to pull the objective to him. The pulling off of the leaves is both correct and incorrect ; *incorrect,* because it does not make the stem any longer, *correct,* because it makes its length show up better and the stem thus becomes optically more like a " stick ". We shall see later how important such optical conditions are to the chimpanzee generally (during his attempts at solution), for optical impressions sometimes gain the victory over practical considerations. There can be no doubt that Koko did not pull off the leaves in play only ; his look and his movements prove distinctly that throughout the performance his attention is wholly concentrated on the objective ; he is merely concerned now with preparing the implement. Play looks quite different ; and I have never seen a chimpanzee play while (like Koko in this case) he was showing himself distinctly intent upon his ultimate purpose.

Two days later, just as he has forgotten the use he made of the boxes, Koko first of all reaches out his hand towards the objective in vain ; then he looks round searchingly, suddenly goes towards a bower thickly covered with foliage (three metres from the objective), climbs up the bars of the bower to a place where one woody branch stands out from the others, bites through the branch (whose end is far in among the bushes), first in one place, then again about ten

centimetres further on, climbs down again, runs underneath the objective, but remains sitting there without using the little stick he has brought with him, somewhat sulky, and sucking the wood. It is much too short. In this case the proceeding, from the time he started for the bower up to the return to the objective, is *one* united course. That a chimpanzee, after a glance at the distance to be traversed, will avoid the use of implements that are too small, can be seen again (compare above, p. 46). This, of course, provided that he does not act under strong "affect" (compare above, p. 88).

The animals themselves vary this proceeding and often produce strange solutions unexpectedly. Thus, embarrassed by the lack of a stick, their attention will be drawn to a piece of wire, partly separated and standing out from the coil, and thus seeming to have the shape of a stick. They will take great pains to pull it off altogether, and sometimes are successful. More frequently it happens that, in similar circumstances, they will go towards a box, a board, and so on, detach a piece of wood with their hands, feet, and teeth, and then use that as a stick. Cases where the animal works at the box or the board in play only and without taking the objective into consideration, until a piece of wood is detached which, *afterwards* (when the animal again turns to the objective), it may use as an implement—*such* cases must be excluded with severity, and I have made it a rule in this book that the least suspicion of this kind be considered enough to cancel the value of the experiment.

[One fact must be noted in reference to the breaking off of pieces from boxes, etc.: not everything that is obviously "*a part*" for man, is so for the chimpanzee. If a box be left with only its lid, and if this half consist of separate boards, the chimpanzee will not always behave in the same way, whichever way these "parts" are put together. If the

separate boards are nailed to the box in such a way that they make an unbroken surface, i.e. the joints not noticeable, the chimpanzee will not easily see "possible sticks" there, even if he be in urgent need of them; but if the last board towards the open half of the box is nailed in such a way that a small space or crack separates it from the next, it will be immediately torn off (cf. above). There must exist a kind of visual firmness, which makes the separating as an act of intelligence as difficult as the strongest nails would the actual pulling off of the board. For the optical firmness does not seem to affect the chimpanzee as if saying: "this board is firmly fixed"—but in such a way that he does not ever see any board as a "part." True, in principle, we do not differ from the chimpanzee in this, but, when in need, we will dissolve visual wholes of much greater firmness; or, to be more exact, under the same objective conditions, visual wholes are probably more easily analysed by the adult human than by the chimpanzee. Man is more likely to see "parts", when he needs them, than the ape.[1]

With some reservation, I should like to add to the above a still more far-reaching observation. It appears from our several observations that there need not be any actual connexion (in the technical sense) besides the (to the chimpanzee) apparent (optical) connexion, and that one object does not have to be "really" part of another, in order that the chimpanzee should regard it as if nailed to its surroundings, and not notice it at all as an independent object. If one places any implement—a window-grill, a compact table, etc.—in such a way that this object becomes as far as possible optically an integral part of its surroundings: for instance, if the table is placed carefully with one of its corners in the right

[1] If the object has been used frequently, the effectiveness of the purely optical is much diminished; the same is true here as in the case of the influence of the distance of configuration factors relative to the positions of objective and implement.

angle of a room, and the flat window-grill against a wall, so that it joins it completely: one will see the chimpanzee, in search of implements, pass by this object, as if it did not exist. The object is not hidden in this case, it merely forms with its surroundings a perfect integral whole. I have not been able to make many such experiments, for the simple reason that I did not wish for the moment to hinder attempts at solution, but, on the contrary, to favour them to a certain extent by circumstances. Every experimenter will probably, for the same reason, without much hesitation avoid putting the box, for example (which may come in as an implement), into the corner of a room so that it becomes visually part of it. But if one is seeking a theoretical explanation, then once we know what the chimpanzee can do, every experiment in which we succeed in preventing the usual solution is of the greatest importance.

The above obviously bears out M. Wertheimer's[1] findings which are concerned with the effectiveness of particular and forcible impressions of form.]

(2)

The objective is again out of reach on the other side of the bars; in the room itself, close to the bars, lies a piece of wire, but wound in an oval coil and, therefore, too short to be used as a stick; a small box which has been used in other experiments has also been left. (16.3.1914) Sultan is brought in, does not seem to see the wire, hesitates a moment, perplexed, and then breaks off a board from the lid of the box, with which he immeditaely pulls the objective toward him.

[1] *Experimentelle Studien uber das Sehen von Bewegung, Zeitschrift für Psych*, vol 61, p 161 seqq Cf p 243 seqq In my subject, even when I could least have expected it, I kept on discovering references to this paper.

As this solution is already familiar, the board is removed, and a new objective is put there. Sultan looks round, does not seem to see the wire, and turns towards a piece of wire sticking out on the wall, pulls it off, and tries in vain to reach the objective—it is too short.

It now seems sufficiently clear that the animal has not seen the coil at all, which does not stand out against the sanded floor. Assistance, meant to arouse his attention, is given him by lifting the wire from the ground indifferently, and immediately putting it down again. Sultan looks round, at once picks it up, pulls at it impatiently and unmethodically with his teeth. A piece of wire comes undone; the animal seizes it in his hands, bends it still straighter, and drags the objective towards him with the wire that is still half coil and only partly undone. The solution is undoubtedly *genuine*, but the way of treating the wire differs very much from a human adult's. To begin with, the coil is pulled blindly lengthways, without any regard to the way in which it is coiled, then, when, by pulling with the teeth, a part of the coil (a loose end) comes unwound. it is stretched further in a perfectly sensible manner. But, while a man would not be satisfied without methodically unwinding the whole thing, Sultan evidently has no such considerations, but uses the wire as an implement at once.

The previous experiment with the gymnastic rope is repeated, and made more difficult. The objective is on the same spot (about two and a half metres' distance from the gymnastic apparatus), but the rope, instead of hanging loose, is laid in three firm coils starting from the hook, around the upper cross-beam, into which the hook is screwed. The coils are neat and orderly, do not cross each other, and can be easily surveyed by the human observer. The free end of the rope is now the part furthest away from the objective and hangs only about thirty centimetres down from the cross-

beam. (10.4.1914.) As soon as Chica sees the objective, she climbs up the apparatus, seizes the middle coil of the rope underneath the cross-beam, and pulls it once downwards, then again with increased strength, so that the rope, except for one coil nearest the hook, is thrown over the beam, and hangs down. Without bothering about this last coil, she now tries to swing herself at once to the objective; twice running she is unsuccessful, as the rope like this is too short and cannot be swung properly. Instead of remedying this deficiency, Chica tries a third time, starting off with a still bigger jump; she jumps away from the rope in a big curve through the air and towards the objective, seizes it and tears it down with her as she falls. Apart from the gymnastic feat, this proceeding acts as a translation from Sultan's behaviour, above described, to the other kind of experiment. The solution is genuine, and the energetic attempts to make the rope hang down are made as soon as the animal has surveyed the situation; but she takes no notice at all of the nature of the coils, she merely seizes the rope in the middle and pulls it down. The fact that, in spite of the disturbing effect of the last coil, it yet remains unnoticed, makes the analogy perfect. Although it leads to the solution, the method at first looks untidy and unordered.

Sultan is tested on the same day. From the beginning he seems weary and lazy, does not trouble much about the objective, but after one attempt to use sticks for beating, he climbs the apparatus and lazily unwinds one coil. Obviously he is not concentrating, and soon after he runs away to play. When he comes back after a while, he again seizes the rope—*but by the hanging end, so that, when jerked, the coils become still tighter*—and pulls apathetically. After twenty minutes the experiment is broken off, undecided The animal is too drowsy, and when all his movements are so apathetic, it is not clear in how far they are connected, and

what the different phases of his conduct mean.[1] But, considering Sultan's manner of unwinding the coil of wire, there is a possibility that he meant to pull down the rope, but the second time attacked the thing blindly and without any regard for its structure; indeed, the actual proceeding, objectively considered, was in the very opposite direction.

The assiduous Rana gives no cause for doubts such as these. (23.4) The rope is wound (in somewhat firmer and tighter coils) *four* times round the cross-beam, the separate coils neither crossing nor touching each other. Rana espies the objective, at once climbs the apparatus, hangs by her hands from the cross-beam, where the rope usually hangs, and quite unmistakably indicates the motion of swinging herself towards the objective. Immediately thereupon she begins to pull at the rope in a downward direction, but she seizes it blindly, catches the *uppermost part*, which is laid over the bar in the shape of a coil, and, when it does not give way to her pulling, but only slips a little to and fro in the hook, *makes obvious efforts to slip off the knot from the hook.* In this she is not successful, so she turns to the free end, throws it round properly once, then after an interval again, and soon has the whole rope hanging free. She tries to swing herself to the objective at once, but several times fails to reach it, as the distance is too great, so once more she sets herself to the manipulation of the implement. The only thing that can still be altered is the fixing of the knot, and *actually Rana does not stop until the knot is off the hook.* Somewhat puzzled when she finds the rope free in her hand, she takes it up to the cross-beam, and slowly winds it round her neck.

In so far as Chica and Rana try in this experiment to put

[1] With reference to previous explanations (see above, p 16) we must conclude that experiments can only be carried out on animals when they are in a fresh condition, this is obvious, in any case.

the rope into place for their purpose, the experiment has a positive result. At the same time, however, we discover that the really critical part of the task does not lie in that operation but in mastering the structural connexion of the rope and the beam. Chica may be too impatient to unwind the rope properly, but when we see what Rana does with the rope at the beginning and toward the end of the experiment, a second possibility is suggested: Rana does not treat the rope as if *she could visually apprehend the course of the windings* —as an adult could—*but regards it as we would a tangle of string*. We, when we do not see the ends of such a tangle immediately, and are too heated to trace them out separately, will seize the whole thing angrily and tear at it to unravel it; so exactly does it look when Rana puts her hand into the middle of the rope-coils, and Chica too, excepting that she is, in addition, careless. It, therefore, seems possible that this relatively simple arrangement is at the very start "confused" to a chimpanzee, and as *optically incomprehensible* as much more complicated combinations are to us —such as tangled thread or wire or, to the author, even folding chairs. This is not contradicted by the fact that Rana got the rope to hang in a relatively short time, for her movements when doing this were not by any means completely sure, did not look as if they corresponded "to a plan" based on the arrangement of coils, and, indeed, one felt that success was partly a matter of chance. The fact that Sultan, even though drowsy, pulls at the rope in the direction *opposite* to that required, confirms our suspicion that chimpanzees do not grasp complicated forms as well as men.[1] I take it for granted that it is known that children up to the fourth year of their life, and even later, *treat* and, perhaps, actually

[1] Of course it remains true nevertheless, that the animals distinguish such different shapes as sticks, hat-brims, and shoes with complete assurance (cf. above, p. 36).

see coiled rope in the same way as it is thought the chimpanzee does, but probably there will be individual differences even among adults.

This is not yet all: Rana, not reaching the objective with the rope stretched out as far as it will go, busies herself with the knot above, and this activity seems to arise directly from the unsuccessful effort, thus becoming like an attempt to improve still further the lie of the rope. Thus we get the following possibility: Rana cannot distinguish between the *coils* wound round the beam, and the externally similar *knot*, by which the rope is attached to the hook, whose function, however, is quite different. This may also be expressed by saying that *Rana has no insight into the manner in which the rope is held.* Her first attempt to unhook the knot may be explained by the fact that the confusion of coils brought about an error which even a full-grown man might commit, provided it is sufficiently complicated. Afterwards, when the rope is hanging quite freely and Rana yet tries to get the knot to "drop," it seems very likely that she does not understand (and certainly that she has not noticed) how the rope is fastened. It should be recalled that even in the simplest attempts to create implements (pulling the objective tied to a string) there was a question whether the chimpanzee ever sees more in a connexion than rough optical contact (see p. 27).

It is possible that both factors, the optical and the technical, are internally connected, as the simple technical device (the knot slung over the hook) represents structurally an optical task (Wertheimer); but the technical factor further bears on the question of how much the chimpanzee knows about the gravity and falling of objects. All this must be treated in greater detail in further experiments.

[It does not seem at all stupid when Rana, at the beginning,

the rope being still coiled, hangs on to the cross-beam, and indicates that she is going to swing herself towards the objective ; and it certainly does not look as if the animal really were going to attain her goal in this way. It brings to mind rather that performance described before (p. 64) when Rana wanted to get the door of a cage free and, when unsuccessful, walked through the door of another cage close by, "as if buried in thought". In that case it did not look either as if she expected to find the objective in the box, or to get nearer to it thus. The impression made on the observer by this proceeding could perhaps be best described as a sort of "expressive gesture", expressing some such state as : "It all depends on getting through the door—to swing there from here, that is what matters !" (The animal is entirely deprived of expression in speech ; *we* mutter words of this kind to ourselves, even when no one can hear us, e.g. when speaking is of no use, but we are "so full of the thing" that our tongue starts to utter words. Rana's limbs are her tongue.)]

The experiment to be described was only made when a similar, but harder, test had turned out decidedly badly. (29.3) The iron hook is unbent, so that the rope-knot can be unhooked or hooked with equal ease ; the rope is taken down and put on the floor in a few coils exactly under the hook ; the objective hangs as in the original test (p. 57). When Sultan is brought in, he tries one after the other of his usual methods ; he fetches sticks, boxes, and pulls the keeper and the observer under the objective ; we allow none of these things ; sometimes he seizes the rope, he may even lift it a little, but none of his movements indicate the solution of "hanging it up" ; it rather looks as if he were about to beat at the objective with the rope and is only prevented from so doing by its height.

Chica is admitted. She actually picks up the rope, even

drags it after her on to the cross-beam, pays not the slightest attention either to the hook or to the cross-beam, from which alone the rope could be hung, but makes movements as if to beat about for the objective. Finally she hangs on to a trapeze, which is attached to the same apparatus, but further to the side, jumps hard sideways towards the objective, lets go, springs through the air, and pulls the objective down with her as she lands. Our ordinary human ideas of gymnastics are not sufficient to meet Chica's case when preparing experiments for her.

In the afternoon care was taken that the trapeze could not be used; but although both animals lifted the rope again several times, neither Chica nor Sultan made any attempt to hang it up; and Chica, at the end, sprang without any implement from the cross-bar in a wide parabola to the objective, which she actually succeeded in pulling down with her.

Supplement 1916. This experiment, performed on Sultan, Grande, Chica, and Rana, still gives the same negative result; the unwinding of the rope, on the other hand (the experiment had not been repeated in the interval), had quite a different issue with Chica, and a somewhat different one with Rana (8.3.1916). Chica perceives the objective, climbs up to the cross-beam at once, unwinds the rope as methodically as a human being would, and then swings herself over to the objective. Rana does not proceed quite so definitely; though also with greater assurance than before. The difference may quite easily be that the animals are now older, which may have heightened their power of attention, or have further developed their visual functions; or they may have been helped by frequently playing with the rope in the interval, though, it must be added, the animals were not let in to the place where the rope hung during the six months previous to this after-experiment. Thus *the low degree* of optical

apprehension[1] assumed in the above discussions is not necessarily characteristic of chimpanzees, for a certain improvement is possible with them, just as with human children, though in quite a different measure. But unfortunately, the other experiments showing how the animals deal with such, or somewhat more complex, forms, do not allow any change in the opinions I formed two years ago; a small difference of degree is not of great moment and, therefore, I leave the statements I made following on the first impressions, which remain substantially correct.

(3)

The objective is hung at a spot high up; a few metres away is a box, which is open at the side so that one can see three heavy stones in it (15.4.1914). Sultan comes up on the closed side of the box and immediately starts pulling it towards the objective. As it scarcely moves from the spot, he lets go, looks into it, and carefully takes out one of the stones. Then he again begins to pull with great effort, gives it up, and removes the second stone from the box. Without taking any notice of the third, he pulls and pulls until he gets the box underneath the objective. The experiment is immediatly repeated; Sultan pulls first at the box, then takes out one stone, and pulls the two others with the box underneath the objective, although this costs him a stiff effort. A third experiment has exactly the same result as the first one. At the fourth trial, Sultan pulls for a moment, then unpacks

[1] Motor-factors may play some rôle; but in such cases they are applied with too great facility, when it is a question of theory; and the *nature* of these factors, as well as their connexion with optics, is sometimes treated of in a way which cannot be considered a model of empirical proceeding. All the more care must be taken that such theories are not treated as proven facts.

the three stones one after the other all at once (16 4). Four stones are in the box, Sultan pulls a little at it, then rolls the four stones one after the other out of the box by a relatively great effort, and attains the objective with the empty box.

A month later (29.5), in other surroundings, the objective is again hung high up and, this time, the box is filled with sand up to the very top (which is open), and placed a long way off. Sultan goes immediately towards the box, dives into it with both his hands, and eagerly shovels out the sand. After a while, when there is still a great deal of sand left, he begins pulling at it again, on this occasion throwing the box on its side (very likely accidentally), so that more of its contents fall out, but he still cannot get away from the spot, as the rest of the sand is a heavy weight. He goes on unloading with both hands, eventually pulling the box underneath the objective, but without emptying it altogether, and, consequently, at some trouble.

One must not think that the chimpanzee, every time he sees stones in a box, begins by taking them out: Sultan takes out the stones every time, *when his pulling at the box has proved to be in vain*, and he also shows a strong tendency to limit this "auxiliary action" to the strict minimum. Here again, an experiment with less gifted animals will give us the information we want.

(18.4) Chica seizes the box, containing three stones, and pulls it (without any investigation as to the unusual weight) with all her might underneath the objective. On repeating the experiment, the weight is increased by a heavy stone which is put into the box *before Chica's eyes*. She pulls and pulls, without being able to budge the box, and finally gives up the useless effort, without having even touched the stones.[1]

Instead of the box, this time the *ladder* is to be used, which is lying on the floor some distance away, loaded with six

[1] In the autumn of 1914 a similar problem was solved fairly well

heavy lava blocks. (14:5) Grande tries with a tremendous effort to pull the ladder underneath the objective. Not successful, she drags away one, then another of the blocks, and uses them as a *substitute for the box*. She is not successful, so she seizes the ladder again, drags it along the ground *with the four remaining stones lying on top*, quite close to the objective, and stands it up in that curious manner, which will be described later; only now, all the stones fall off. The first two stones were certainly not taken away from the ladder to make it lighter; they were meant, from the start, to be used as building material; the acts of taking them down and dragging them from the ladder to the objective are merely parts of *one* action. Neither during the pulling along nor the setting up of the ladder does any movement occur that is intended to get rid of the remaining stones, which fall finally, only by accident, when the ladder is lifted.

An experiment with the box filled with stones worked out in the same way. (15.7) Grande tries first to break off a stick from the partition. When this fails, she approaches the box, but does not pull; she takes out a stone, carries it underneath the objective, puts it carefully in a perpendicular position, glances upwards, does not get on top (it is too low), returns to the box, and with a really great effort pulls it towards the objective. On the way she stops a little, lifts up one of the stones, but leaves it, and, by an extraordinary effort, pulls the box right under the objective. In this proceeding the only suspicious factor is that, in the beginning, the box is not considered as a tool at all, as it is immediately in all other cases. From similar experiments with Grande, it would seem quite possible that she sees the box is very heavy, without her consequently making an attempt to lighten it. The later fact of lifting the stone looked as if she was going to use it as building material.

Rana (15.4) begins to drag the box towards the objective,

without appearing to notice the great weight; on turning, the stones tumble out, and Rana is startled; she evidently does not expect such a thing. After that she does not go near the box again, but tries eventually to pull the observer underneath the objective.

This experiment with Rana was the first of the whole group: I considered the task an easy one and only wanted to verify my opinion by testing the least gifted animal. The result is curious enough and recalls very clearly the obstacle experiments (compare above, p. 59 seqq.); the internal relation between the two problems is obvious (here, as there, an otherwise quite indifferent body is by its mere presence on the spot, in the way).

Even if Sultan does *not* begin by taking out *all* the stones one by one, that does not make the solution any less important; it is merely æsthetically faulty in the eyes of the educated European; the animal made the same æsthetic fault during the uncoiling of the wire as did Chica when unwinding the gymnasium rope.

(4)

When the chimpanzee is not very excited or careless, he will usually, as previously reported,[1] not use implements (sticks and boxes) which are not big enough for his purpose. Often, it is true, he brings them along, but as soon as the tool is close to the critical distance, his formerly active movements begin to falter, something has happened that had not happened further away, and, whatever may be the nature of this occurrence, it has the effect of putting a feeble end

[1] Exceptions are already known. Compare also what follows. Of course the chimpanzee does make an attempt, when the implement is *nearly* long enough.

to the energetic action. When the chimpanzee's tool is only a small stick, he goes only just up to the critical distance, and pokes once, or throws his stick in the direction of the goal; but an observer with any experience will have been able to indicate at once the moment when the fresh hue of determination faded; the rest, then, is not a practical endeavour, but merely the expression of discouraged desire.

Besides this paralyzing effect, an increase in the critical distance may influence the animal positively, too; but still not in the direction of practical progress. But if the result represents an error on the part of the animal, it is, at any rate, a "good error".

It must be said that at the beginning happenings seem very curious: Chica is put a second time under observation while trying to reach an objective with the stick (26.1.1914). As she cannot quite reach it, she seizes a second stick which is a little shorter even than the first, puts it with its flat side against the equally flat side of the first stick, puts her hand round both of them carefully, and keeps fishing thus for the objective, although she does not extend the tool thus, or in any other way obtain a practical result by adding the second stick. Owing to the way in which she holds the short stick pressed against the long one, the short one does not even touch the ground. It might, of course, be said that the animal is too stupid to realize the senselessness of her proceeding. Roughly this may be true, *once the procedure has arisen*. The psychologist will, however, ask with astonishment how an animal, which, the day before, could barely manage to handle the stick with all the awkwardness of the beginner (though obtaining in a few days as much practice as possible) achieves all of a sudden this striking performance. What *started it* is a puzzle, especially as Chica, in the middle of her vain efforts, turns to the second stick and presses it so care-

fully against the other, that the whole action doubtless presents an attempt at tool-improvement.

Similar things can be seen often, but only so long as the use of the stick is not very familiar. A short time ago, Tschego, who experimented but little, on seeing that she could not reach the objective with her blanket, placed a stick on it, grasped the cover so that her fingers held the stick at the same time, and continued her useless efforts in this way; showing that, in this instance too, the improvement of the tool was the evident aim.

Rana, who, so to speak, can keep nothing in her brain, reaches one further stage in the experiment in which she had to jump with the stick; a stage which, in other animals, perhaps does not become visible. Curiously enough, she cannot manage to *strike at* an objective hung high up. Even after years (1916) of practice at using the stick as an extension of the arm, she is still quite clumsy, not knowing how to take hold of it correctly. She may raise the stick, but the next moment will use it again as a jumping-stick. Thus it happens that short pieces of wood, which might be used for beating down the objective, but would be of no use as vaulting-poles, if not actually utilized as poles (which is impossible), *seem* again and again to be going to be put to this use. Over and over again she puts small sticks of about thirty centimetres on the floor, raises one foot, as if to climb, and puts it down again (see p. 73). So too, once, with a box experiment. (15.4) Rana has placed a box underneath the objective, but, unable to reach it, she fetches a tiny little stick of about forty centimetres, puts it on the box in a position for a jump, and repeatedly makes the bodily movements preparatory to a jump, although, to keep the bottom end of the stick on the box at all, she has to stand quite bent—an attitude, of course, impossible for jumping. After a while, she fetches some more little sticks, holds them one against the other in

her hand, but, of course, does not jump. Suddenly she changes her tactics, keeps only two sticks out of the bunch, and *puts them carefully end to end so that they look to the eye like a stick of twice the length*; the ends of the two sticks are next to each other, though a distance of two fingers' width only, and so have to be held together with the hand. The whole thing is again set up like a jumping-stick, and the foot is raised as if to climb it. As Rana likes to attempt over and over again things which are in practice impossible, there is plenty of time to study her actions exactly. There is certainly no question of accident, for if the sticks slip and come together, they are always put back into a position which makes them at least look like one long stick, while they are held with the hand. It is astonishing to note how, apparently, the "optics" of the situation is decisive for the animal, how the endeavour to solve the problem takes no account of the "technically physical" point of view, but considers solely the optical aspect. The two sticks must be held together by the hand, and so, what according to the optical impression constitutes a solution by improvement of the implement, actually remains valueless. I may add that Rana really tries to utilize this lengthened stick.

Are the two sticks ever combined so as to become technically useful? This time Sultan is the subject of experiment (20.4). His sticks are two hollow, but firm, bamboo rods, such as the animals often use for pulling along fruit. The one is so much smaller than the other, that it can be pushed in at either end of the other quite easily. Beyond the bars lies the objective, just so far away that the animal cannot reach it with either rod. They are about the same length. Nevertheless, he takes great pains to try to reach it with one stick or the other, even pushing his right shoulder through the bars[1] When

[1] This is not in contradiction to the statement made above; in order not to discourage the animal from the very beginning, I put the objective only just out of reach of the single stick.

everything proves futile, Sultan commits a "bad error" or, more clearly, a great stupidity, such as he made sometimes on other occasions. He pulls a box from the back of the room towards the bars; true, he pushes it away again at once as it is useless, or rather, actually in the way. Immediately afterwards, he does something which, although practically useless, must be counted among the "good errors": he pushes one of the sticks out as far as it will go, then takes the second, and with it pokes the first one cautiously towards the objective, pushing it carefully from the nearer end and thus slowly urging it towards the fruit. This does not always succeed but if he has got pretty close in this way, he takes even greater precaution; he pushes very gently, watches the movements of the stick that is lying on the ground, and actually touches the objective with its tip. Thus, all of a sudden, for the first time, the contact "animal-objective" has been established, and Sultan visibly feels (we humans can sympathize) a certain satisfaction in having even so much power over the fruit that he can touch and slightly move it by pushing the stick. The proceeding is repeated; when the animal has pushed the stick on the ground so far out that he cannot possibly get it back by himself,[1] it is given back to him. But although, in trying to steer it cautiously, he puts the stick in his hand exactly to the cut (i.e. the opening) of the stick on the ground, and although one might think that doing so would suggest the possibility of pushing one stick into the other, there is no indication whatever of such a practically valuable solution. Finally, the observer gives the animal some help by putting one finger into the opening of the stick under the animal's nose (without pointing to the other stick at all). This has no effect; Sultan, as before, pushes one stick with the other towards the objective, and as this pseudo-solution does not satisfy him any longer; he

[1] The way in which he does that is reported on p. 174.

abandons his efforts altogether, and does not even pick up the sticks when they are both again thrown through the bars to him. The experiment has lasted over an hour, and is stopped for the present, as it seems hopeless, carried out like this. As we intend to take it up again after a while, Sultan is left in possession of his sticks; the keeper is left there to watch him.

Keeper's report: "Sultan first of all squats indifferently on the box, which has been left standing a little back from the railings; then he gets up, picks up the two sticks, sits down again on the box and plays carelessly with them. While doing this, it happens that he finds himself holding one rod in either hand in such a way that they lie in a straight line; he pushes the thinner one a little way into the opening of the thicker, jumps up and is already on the run towards the railings, to which he has up to now half turned his back, and begins to draw a banana towards him with the double stick. I call the master: meanwhile, one of the animal's rods has fallen out of the other, as he has pushed one of them only a little way into the other; whereupon he connects them again".[1]

The keeper's report covers a period of scarcely five minutes, which had elapsed since stopping the experiment. Called by the man, I continued observation myself: Sultan is squatting at the bars, holding out one stick, and, at its end, a second bigger one, which is on the point of falling off. It does fall. Sultan pulls it to him and forthwith, with the

[1] The keeper's tale seems acceptable to me, especially as, upon inquiries, he emphasized the fact that Sultan had first of all connected the sticks in play and without considering the objective (his task). The animals are constantly poking about with straws and small sticks in holes and cracks in their play, so that it would be more astonishing if Sultan had never done this, while playing about with the two sticks. There need be no suspicion that the keeper quickly "trained the animal"; the man would never dare it. If anybody continues to doubt, even that does not matter, for Sultan continually not only performs this act but shows that he realizes its meaning.

greatest assurance, pushes the thinner one in again, so that it is firmly wedged, and fetches a fruit with the lengthened implement. But the bigger tube selected is a little too big, and so it slips from the end of the thinner one several times; each time Sultan rejoins the tubes immediately by holding the bigger one towards himself in the left and the thinner one in his right hand and a little backwards, and then sliding one into the other.[1] (Plate III) The proceeding seems to please him immensely; he is very lively, pulls all the fruit, one after the other, towards the railings, without taking time to eat it, and when I disconnect the double-stick he puts it together again at once, and draws any distant objects whatever to the bars.

The next day the test is repeated; Sultan begins with the proceeding which is in practice useless, but after he has pushed one of the tubes forward with the other for a few seconds, he again takes up both, quickly puts one into the other, and attains his objective with the double stick.

(1.5) The objective lies in front of the railings, still farther away; Sultan has three tubes to resort to, the two bigger ones fitting over either end of the third. He tries to reach his objective with two tubes, as before; as the outer one keeps falling off, he takes distinct pains to push the thinner stick farther into the bigger one. Contrary to expectations, he actually attains his objective with the double tube, and pulls it to him. The long tool sometimes gets in his way when doing this, by its farther end getting caught between the railings, when being moved obliquely, so the animal quickly separates it into its parts, and finishes the task with one tube only. From now on, he does this every time when the objective is so close that *one* stick is sufficient, and the

[1] The illustration is culled from a cinematograph film that was taken a month later in other surroundings, more suitable for photographs.

double-stick awkward. The new objective is placed still farther away. In consequence, Sultan tries which of the bigger tubes is more useful when joined to the thin one; for they do not differ very much in length (64 and 70 cms.), and, of course, the animal does not lay them together in order to compare their lengths. *Sultan never tries to join the two bigger tubes*; once he puts them opposite to each other for a moment, not touching, and looks at the two openings, but puts one aside directly (without trying it) and picks up the third thinner one; the two wide tubes have openings of the same size.[1] The solution follows quite suddenly: Sultan fishes with a double-stick, consisting of the thinner one and one of the bigger ones, holding, as usual, the end of the smaller one in his hand. All of a sudden he pulls the double-stick in, turns it round, so that the thin end is before his eyes and the other towering up in the air behind him, seizes the third tube with his left hand, and introduces the tip of the double-stick into its opening. With the triple pole he reaches the objective easily; and when the long implement proves a hindrance in pulling the objective to him, it is disconnected as before.

According to observations in this experiment, Sultan never attempted to join tubes which would not have fitted together.[2] Once, when an experiment was to be shown to visitors, I put down the objective outside, and at the same time threw two different-sized tubes, which happened to be at hand, through the bars to Sultan. He took hold of them at once, the bigger one, as usual, in his left hand, the thinner in his right, and was already lifting his right hand to connect

[1] It can be shown that when the chimpanzee connects the double-stick he is guided by the relation between the two thicknesses of the tubes (compare *Nachweis einfacher Strukturfunktionen, etc Abh d Preuss Akad d Wiss* 1918, *Phys-Math Kl*, No 2, p 56 seqq)

[2] In those cases in which mere observation does not lead to a definite conclusion, a trial is, of course, made. Compare experiment of 6.8.

the tubes, when he suddenly stopped, without carrying out his intention, turned the thick tube round, looked at its other end, and immediately dropped both tubes to the ground. I let him pass them out to me and discovered that both ends of the wider one happened to have a nodule, thus closing the opening; in these circumstances Sultan did not even attempt to connect the tubes. When I cut away this closed part, he made the trial at once.

(6.8) The wide tube is closed at one end; a wooden block is put into the other end before the experiment; it sticks out just a little, being somewhat narrower than the tube, so that a space is left between it and the tube. Sultan seizes the tubes, looks for a moment at the block in the hole, tries to squeeze the thinner tube into the narrow opening between the block and the side of the tube, fails, and straightway pulls out the stopper, throws it aside, and connects the tubes.

Sometimes, however, he experiences a difficulty, where one would least expect it. Holding both tubes in his hand and wanting to proceed as usual to connect them, he hesitates for a few moments and seems strangely uncertain; this is when the tubes lie in his hand in certain positions, namely, almost parallel, or else across each other in the shape of a very narrow "X". This difficulty has now almost disappeared, but at first it occurred frequently. When Chica had, later on, adopted the same procedure, she showed exactly the same embarrassment when the two tubes were in this position, and her embarrassment was even more striking than Sultan's. As soon as the animals have again optically separated one tube from the other, the action proceeds quite smoothly. The optical factor in the situation, which at other times is a sure guide to the chimpanzee, making his acts and his behaviour appear the direct result of it, must in this case be so changed that it does not determine the motor

factor quite so definitely. We humans can always see the relative positions of two tubes like this clearly enough not to be thus embarrassed, but if slightly complicated conditions (unfolding a folding-couch) be introduced, we too take some seconds to readjust, before our vision can dictate our movements.

In cases of pure *alexia* (Wertheimer) this uncertainty seems to be greatly increased. Gradually it becomes obvious that to understand the capacities and mistakes of chimpanzees in visually given situations is quite impossible without a theory of visual functions, especially of shapes in space.

In another experiment, further manufacture of implements is demanded of Sultan. (17.6) Besides a tube with a large opening, he has at his disposal a narrow wooden board, just too broad to fit into the opening. Sultan takes the board and tries to put it into the tube. This is not a mistake; the different *shapes* of the board and the tube would tempt even a human being to try it, because the difference in thickness of both these objects is not obvious at first sight. When he is not successful, he bites the end of the tube and breaks off a long splinter from its side, obviously because the side of the tube was in the way of the wood ("good error"). But as soon as he has his splinter, he tries to introduce it into the still intact end of the tube; a surprising turn, which should lead to the solution, were not the splinter a little too big. Sultan seizes the board once more, but now works at it with his teeth, and correctly too, from both edges at one end towards the middle, so that the board becomes narrower. When he has chewed off some of the (very hard) wood, he tests whether the board now fits into the sound opening of the tube, and continues working thus (here one must speak of real "work") until the wood goes about two centimetres deep into the tube. Now he wishes to fetch the objective

with his implement, but two centimetres is not deep enough, and the tube falls off the top of the wood over and over again. By this time Sultan is plainly tired of biting at the wood; he prefers to sharpen the wooden splinter at one end and actually succeeds so far as to get it to stick firmly in the sound end of the tube, thus making the double stick ready for use. In connexion with this treatment of the wood it must be remarked that, contrary to my expectation, Sultan bit away wood almost exclusively from *one* end of the board, and, even if he took the other end between his teeth for a moment, he never gnawed blindly first at one, and then at the other. His way of dealing with the tube was also very satisfactory. The one opening of the tube that had been spoiled by breaking its side is thereafter left unheeded. I had some anxiety for the other opening during the further experiment, but although Sultan, when the wood and splinter did not fit in, put his teeth into it several times, he never really bit into the side of the tube, so that the opening could still be used. I could not guarantee that each repetition of the experiment would turn out so well. Sultan evidently had a specially bright day.

The apes have often sharpened wood, moreover, before this experiment. For instance, if Grande wants to poke somebody through the bars, she will swiftly bite a board in two and thus get the splinters she needs. Sultan too, if there is no key about, will occasionally sharpen a piece of wood in order to poke about in the keyhole; a fact noticed over and over again in the literature of this subject. But I was never quite clear about this sharpening business, and, therefore, we now investigated whether Sultan would proceed rationally with the very hard wood, which he would never have separated into serviceable splinters in mere play or by accident, but which he would have to work at somewhat methodically.

It will be obvious, after all the foregoing, that the double stick is made as promptly, when the objective is too high up to be knocked down with *one* stick only, and also that Chica, having adopted the new method, will apply it on occasion to the jumping stick procedure.