

29 December 1952.Lecture Ten.Intelligence and Responsibility.

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I finished my last lecture by reflecting on our knowledge of the most primitive perceptions and conscious actions. From this reflection I want to ascend today in rapid stages to an analysis of the grounds on which we acknowledge persons in their full stature. The first step will be to pass from the simpler consummatory acts of feeding, mating or breeding, to the complex natural habits of hunting, courting and nesting.

In contrast to the consummatory acts with their relatively fixed motoric pattern, the extensive preparations which lead up to them and the consequential arrangements made for following them up, show a much wider variability. Baerends has described how the peregrine falcon roaming around its hunting territory and exploring many places miles apart, may end its search by many different ways of catching its prey. It may be hunting a flock of teal executing flight manoeuvres, a sick gull swimming apart from its flock or a running mouse. The discovery of any of these objectives may cause the falcon to abandon its search, but what follows then is not yet a consummatory act, but another subsidiary behaviour if of a more specialised and restricted kind. The flock of teal evokes a series of sham attacks serving to isolate individual birds from the flock; and only after this is achieved is the final swoop carried out, followed by capturing, killing, plucking and eating as relatively stereotyped consummatory acts. The sick gull may also be approached first by a faint, designed to frighten it into flight, and only if this fails will it be deftly picked up from the surface of the water. A mouse will be approached directly and immediately captured, killed and devoured.<sup>1</sup>

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1. Baerends (1941) quoted by Tinbergen, "The Study of Instinct", Oxford, 1951, p.106/7.

In view of the wide range of alternative actions selected according to circumstances by which the animal persistently pursues, often for a long time, the chance for a particular kind of consummation, naturalists have placed this preparatory behaviour in a higher category of instinctive actions than the final consummations which form the lowest level of such actions. The impulses which sustain the higher forms of instinctive behaviour may appear clearly continuous with the appetites satisfied by the consummatory acts towards which they are directed, as when hunger prompts the animal to go hunting. Or the connection may be more remote, as in the migration of fishes to distant spawning grounds. Yet we appreciate in either case the presence in the animal of a sustained endeavour towards a remote end, even though we are unable to gauge what this urge feels like to the animal.

When we thus see a sentient animal's external behaviour wholly engaged over an extensive period of time in a consistent sequence of resourceful actions, designed to overcome an indefinite number of not quite foreseeable situations steadily directed towards a definite final consummation, we acknowledge in the animal a new level of personhood. Such behaviour reveals a certain degree of natural sagacity, as measured by the intelligence that would be required for its deliberate performance. In order to study it in detail the naturalist must guess its general purpose beforehand and then proceed to evaluate the animal's achievements as several solutions to problems set to him by his supposed purpose, in view both of the external situation and of the natural means at its command, as given to him by his sense organs and his motoric system. And he may try to analyse the animal's achievements further by separating out what is the work of innate sagacity and what might be regarded as intelligent improvisation.

Indeed, the higher levels of instinctive behaviour can be properly characterised only by such an appraisal of

personhood. The naturalist's interest which keeps his attention intent for many hours on the movements and postures, the manoeuvres and emotional expressions of the animals under observation, ~~ix~~ necessarily seeks contact with this kind of person. By a feat of imaginative participation he must gain entry into the animal's situation as felt by itself and unravel from its point of view the pattern of its progress. And to the extent to which the naturalist apprehends the animal's cravings and records its successes, he will inevitably establish himself also as the critic of its failures. I shall return to this later.

Of the broad flow of higher instinctive strivings suitable artificial segments can be segregated for experimental study by the animal psychologist. For this purpose the psychologist places the animal in a situation which constitutes a problem for the satisfaction of some of its major drives like hunger, fear or pain. A significant result will be obtained from this arrangement only if (a) the animal responds to the problem set to it by the situation and (b) this problem demands an appreciable measure of ingenuity, but not more than the animal in fact possesses. By realising that an experimental situation constitutes a problem which it might solve, the animal brings it within the scope of the higher instinctive behaviour by which it normally strives for the kind of consummatory act to which the solution of the problem should lead. At the same time the setting of limited alternatives forces the animal to respond, if it responds at all, in a manner that can usually be classed as strictly correct or strictly false, and the experiment can be so devised that the animal's choice between a correct and a false response has to be made at a particular point in time and space. The narrowness of experimental situations tends to key up the animal's state of perplexity at a choice point to a tension which is not likely to be reached in the wider circumstances of nature, and thus the laboratory spotlights and also intensifies the moments of intellectual effort, by which the

animal's personhood is once more elevated to a new level; the level at which it performs an act of intelligent judgment.

In order to compress my argument I shall concentrate on one form of intelligent performance, namely on the recognition of signs pointing towards an event. I shall consider particularly the kind of experiment in which the animal has to discriminate between two alternative signs, one true and the other false. In all such cases we rely on our capacity to observe a change in the animal's habits. A change of habit which is thought to manifest that the animal has solved the problem set to it is called 'learning'. In a sign event problem, the process of learning clearly amounts to the drawing of a correct inductive inference from observed facts. Take an experiment in which a rat is faced with two different signs, say a white triangle and a red circle, placed in a random sequence on either side of a discrimination box, with food presented if and only if the animal chooses the white triangle. The animal who has mastered this situation has arrived at the correct empirical generalisation that a white triangle ( $p$ ) is a sign of food ( $q$ ) whereas absence of a white triangle ( $\text{not-}p$ ) signifies no-food ( $\text{not-}q$ ); in symbolic terms, if  $p$  then  $q$  and if  $\text{not-}p$  then  $\text{not-}q$ .

This shows that the question, How does an animal learn to recognise a sign? (or if the reflex language is preferred, How is an animal conditioned to a particular stimulus?) co-incides with the philosophic question, How are correct generalisations drawn from experience? The fact that the animal is generalising about events engineered by ourselves does not distinguish it from us in the above parallelism, since as subjects we are both faced with events beyond our control. At this point the two-storied structure of biological observations comes fully into view. The experimental setting presented to the animal is at the zero level; the generalisation 'if  $p$  then  $q$ , etc.' referring to the Zero Level is made on Level One, and the psychologist's enquiry into the

origins of this generalisation is on Level Two. I propose to show now at some length how the analysis of the animal's performance, carried out at this level reveals the rudiments of responsible personhood in the animal.

The analysis of a process of learning entails two antecedent judgments on the part of the psychologist; namely, first that the animal has arrived at some generalisation (i.e. has established a habit implying some generalisation) rather than is acting obsessively or at random and secondly that the generalisation made by it is correct.

Let me illustrate how we can discriminate between the various alternatives mentioned here. Take first an example of an erroneous generalisation. When grains are spread equally over a dark grey paper A and adjoining light grey paper B the grains on the darker grey ground A being glued to it while those on the lighter grey ground B are loose, a chicken will learn to peck only at the grain on the lighter grey ground B, where the grains are loose. But when the dark grey paper A (which had the grains glued on to it) is replaced by a new strip A of an even lighter grey than B, the chicken will abandon the grains on B and start pecking from A. It turns out then that the animal had not learned to associate the particular hue of B with the looseness of the grains found on B but rather with the relation of B to A as the lighter of two papers. Within the standard procedure of the discrimination experiments this generalisation is false. There is strong evidence (Lashley, Krechewskj) that animals placed in a discrimination box will start by acting on the lines of some usually false generalisation, such as 'Turn right' or 'Choose alternately right and left', and that learning is arrived at by abandoning these successive errors for the correct solution of the problem.

An animal acting on the lines of any generalisation is acting rationally. If the generalisation is erroneous its

behaviour is rational only in view of its own premiss; while we may regard it as objectively rational, if the generalisation is correct. The distinction will depend on the observer's judgment as to what is the true state of affairs confronting the animal. A behaviour sequence lacking either kind of rationality will be classed as random, as senseless or as obsessive and may be regarded as a symptom of mental deficiency or neurosis.

We may now resume the question "How can we justify the attribution to an animal of the capacity for acquiring a rational mode of behaviour that corresponds to the facts?" and try to answer it in two parts. We should remember first that our standards of intelligence are originally based on ordinary experience, and that intelligence tests are devised to conform with this anterior assessment of intelligence. They are accepted on the grounds that they approximate this informal assessment by a more formalised method. Our conception of intelligence and rationality in animals is likewise anterior to the formal investigation of these faculties. They are personal facts which we know by identifying ourselves with the animal in the same way as with other intelligent beings. Hence follows the second part of the answer; namely that the animal's capacity for establishing correct empirical generalisations can be ascribed to it only with such qualifications as we attach to our own capacity for doing so by virtue of our own similar mental powers.

These qualifications will be found to carry far-reaching implications. They were expressed in the First Series in the framework of commitment and were reformulated since in this year's Lectures in the conception of personal knowledge. They affirm that I believe myself called upon to make sense of my experience as best I can, even though the act must necessarily appear rash on a further reflection which I have refused to entertain. Empirical generalisations are personal facts which we discern by our subsidiary awareness of the evidence supporting them.

They are molar features of experience of which the particulars are largely unspecifiable and in which we participate by virtue of our own ultimately unaccountable standards of order, coherence etc. They can never be strictly determined by the evidence which can only furnish clues for their discovery; indeed, empirical inferences may set up standards of perfection by which experience itself will henceforth be valued. And finally, true generalisations, true standards, true valuations are the universal pole of a personal commitment. They can only be affirmed by persons who believe them to be true; but these can affirm them only as valid for everybody and thus personal knowledge implies its own universal intent.

If pressed to justify our personal knowledge, we can always be brought to admit having set aside conceivable doubts at some point, by the act of our own judgment. We may say therefore that such acts are indispensable, in order to bridge the logical gap between the evidence and the inference that we draw from it. The great scientist may be said to possess specific gifts for crossing wide logical gaps which afterwards can be much reduced by adducing further evidence. We may distinguish here between the initial or heuristic gap, the traversing of which measures the scientist's originality and the residual gap, which persists throughout the process of subsequent verification but is plastered over by current scientific opinion. Our appreciation of a scientist's originality by which he is acknowledged as a scientist, and granted his proper distinction and responsibility involves an estimate of the logical gaps closed by his discoveries.

The Patent Law also presupposes the capacity on the part of its administrators for assessing ingenuity. Courts of law have regularly to consider the grade of ingenuity involved in an invention and only if it reaches a certain level, sufficiently surpassing by common consent that of routine inferences, will a claim for a patent be upheld. The ingenuity displayed by an

invention may be estimated by reconstructing the intensity of surprise which it would be reasonable to feel for someone familiar with the state of the art before the invention, when being first told of the new invention. This procedure seems to equate ingenuity with the power for crossing a logical gap, since surprise should be felt when a gap is suddenly crossed from premisses to inferences and the surprise will be the greater the wider the gap that has been crossed.

Psychologists setting problems to animals in order to study the process of learning, also trust themselves to grade the ingenuity required for mastering these problems, so that they may correspond approximately to the animal's ingenuity, as assessed likewise by the psychologist himself. How well this can be achieved, was shown in his famous experiments on apes by W. Köhler, who was able to devise a large number of problems which his more ingenious animals could just solve by making an effort, while the less gifted members of the group failed altogether.

The act of guessing right by which a logical gap is bridged is inherently unspecifiable for if we could exhaustively represent it as a process carried out according to strict rules the logical gap would be eliminated. Discoveries made according to known rules are not discoveries at all, but merely routine surveys, requiring no creditable measure of ingenuity. Consequently any explanation of the process of learning in terms of exact science must dissolve the conception of intelligence if regarded as the exercise of ingenuity.

When learning occurs, as it does for example in earthworms and paramecia, without any appreciable participation of intelligence a similar argument applies in a wider form. If we could describe exactly, i.e. in terms of a mathematical relationship between exactly measurable data the process by which an animal acquires a true knowledge of a sign event relationship,

this would represent an exact method for carrying out and verifying an inductive inference; and since inductive inferences can never be exact it follows that no exact representation of learning can exist either. We must acknowledge instead that when we accredit an animal with having reached a correct empirical generalisation we rely on our knowledge of what is the correct generalisation ascertainable by the animal in view of what we believe to be the facts known to it and the drives determining its interest in them, and that we appraise its behaviour as expressing a belief in this generalisation. It suffices accordingly to replace the animal by a subject much better informed than ourselves about the relevant facts, guided perhaps by sensory capacities of which we are ignorant or merely dominated by appetites which we fail to appreciate, to baffle completely any attempt to observe the reaching of a correct inductive inference by the subject. This shows that only so long as we feel competent to criticise the animal by standards of inference which we ourselves accept, can we study in it the process of learning.

There is evidence that animals can appreciate the ingenuity of a solution discovered by them, quite apart from the material advantages achieved by it. Köhler has observed how chimpanzees will repeat an ingenious trick which they had invented in the first place for the purpose of getting hold of a food, by way of a game in which they use it to collect pebbles instead. The young chimpanzee brought up by Kellog and Kellog in company with their own child showed as much joy in learning a new trick as did the child. The appeal which a rational structure possesses to the animal's intellect is also shown by its retention of it, when once discovered, ready for use for the solution of new problems to which it can be applied. The point is further illustrated by the easy acquisition of a trick by a chimpanzee watching its performance by another. Köhler insists that the

chimpanzee will not imitate a behaviour that it does not understand and I am prepared to accept his authority on this point. Indeed, the attraction which a rational insight exercises on the intelligent mind may be presumed to serve as a guide to its original discovery. On a higher level this heuristic process may become distinctly apparent, as when the intellectual pleasure offered by a new kind of geometry has eventually led to the discovery of physical laws that could be expressed most readily in its terms.

The exercise of ingenuity, as the acts of belief and understanding are several forms of tension in which we commit ourselves to the acceptance of a rational structure, such as for example an empirical generalisation. A decision accepting such a view of the facts is usually prepared by a state of suspense during which this tension is specially intense. This can be observed even in animals. Köhler describes how chimpanzees regularly went through a period of perplexity and quiet, before producing the solution which was finally successful. On one occasion his ape Sultan made one attempt at a solution, and then a second and a third; "but (Köhler writes) nothing made so great an impression on the visitor as the pause after that, during which Sultan slowly scratched his head, moved nothing but his eyes and his head gently, while he most carefully eyed the situation."<sup>1</sup> I have mentioned before how this intensification of mental tension is evoked artificially by placing the animal at a choice point in a discrimination test. The heuristic tension thus generated differs from an appetite by the rational character of its target, but these tensions resemble appetites in the way they seek to overwhelm and involve our entire persons. Consequently both kind of tensions can endanger the personality that commits itself to their dominance; if the expectations

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1. W. Köhler, "Mentality of Apes" 1925, p.

involved in a commitment are sharply frustrated by reality, or if a rival tendency develops within a person which conflicts with its hitherto dominant commitment, its apprehension of rationality may be impaired and its internal rationality destroyed.

Rationality whether apprehended or performed may be seen to entail the coherence of a large number of particulars which must for the time being be excluded from participation in alternative molar features. In the First Series I have illustrated this for the field of perception by the example of ambiguous figures which we can see only in one way at a time, and Sherrington has shown that the principle of mutual exclusion operates already at the lowest level of animal behaviour, as between alternative systems of reflexes. Common experience shows that the same holds normally for the higher instinctive habits, as when an animal driven by sex will leave its food untouched and disregard menaces which would otherwise put it to flight. Yet opposing drives can occasionally be excited simultaneously in animals and when such a conflict is sufficiently intensified this may produce an irrational behaviour which is known as 'displacement activity'. For example, a male stickleback whose home territory is invaded by a dummy operated by the naturalist will be torn between fear and fury, as a result of which it will neither flee nor attack but vent its excitement by digging a pit in the sand, as it normally does for the purpose of nesting. Tinbergen and Van Iersel have observed that if male sticklebacks are forced to nest very close together, they will show nearly continuous displacement digging and the result is that their territories are littered with pits, or even become one huge pit.<sup>1</sup> Again, the frustration of the sexual instinct may lead to the production of various fragmentary behaviour patterns which taken

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1. Tinbergen, l.c. p.117.

out of their proper context, appear unreasonable and can be supposed to achieve only subjective satisfaction.

This disintegration of instinctive coherence may lead to absurdities, but cannot be said to destroy the integrity of an intelligent personality of which the subject is devoid or which at any rate is not involved at this level of conflict. The danger of mental breakdown arises only when the animal becomes capable of intelligent decisions and is induced to make such decisions for the bridging of a logical gap. To begin with the animal must be capable of responding to a problem. It must feel perplexed by the presence of a logical gap across which lies, faintly perceptible and yet out of reach, some rational structure as for example an unrevealed sign-event relationship, as which he is tempted to guess. The exercise of this faculty can be strained to the breaking point by making the problem increasingly more difficult while keeping up the animal's determination to solve it. This is what Pavlov did when he first produced experimentally the nervous breakdown of dogs. A circle or a nearly circular ellipse was established as a sign for immediately forthcoming food, while the showing of a flat ellipse would mean, and be accepted for, "no food just now". The hungry animal would be watching these signs and committing itself, as shown in the variations in secretion of its saliva, to the expectations which they indicated. So long as the two signs of opposite significance were widely different - the ellipses being either very flat or nearly circular - the dogs reacted to them without developing symptoms of nervous strain. But when the hungry animal was repeatedly shown intermediate shapes, its behaviour underwent a profound change. It turned wild and angrily strained and snapped to set itself free. At the same time it had lost its previous powers of discrimination, giving false reactions to signs to which it had been perfectly conditioned before. After a while the animal would fall into abnormal listlessness and refuse to react altogether to any of the previously established signs.

We can observe here the nervous strain setting in as the evidence for the existence of a rational structure becomes less distinct, or - in the terms which I used before - as the logical gap between premisses and conclusions is widened. As this gap is increased, the burden of decision shouldered by the animal's intelligence is continuously augmented until eventually its powers are pitted against problems of excessive difficulty, which it would not have otherwise recognised or essayed at all. With the consequent breakdown of the animal's rationality its whole person disintegrates emotionally as well as intellectually. The neurosis can be healed by presenting the animal for a while with signs of a clearly distinguishable kind and accompanying these consistently with the offer of food, or the reverse. The successful solution of these simple problems seems to restore the animal's self-confidence, much as occupational therapy helps to restore the shattered personality of the neurotic.

Later experiments have confirmed from new angles that an animal keyed up to an intelligent choice is exposing his personality to serious hazards. If a rat is presented with a discrimination problem in which he must jump at one of two cards of which one will yield and give him access to food, while the other bumps him back into a net, he will learn to discriminate between the two cards if they are consistently used as signs of reward or punishment. But if the problem is rendered insoluble by offering food or rebuff at random, the rat will develop an obsessional behaviour.<sup>1</sup> It will usually take to jumping to one particular side, and contrary to habits acquired by learning, this habit will persist against consistent punishment through a long series of trials. A similar obsessional habit can be developed in rats by subjecting them to an electric shock at the choice point of a discrimination box.<sup>2</sup> It seems that when the

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1. Meier quoted by Hilgard p.302.

2. Hamilton and Krechevsky (1933) quoted by Hilgard, l.c. p.302.

animal's efforts at making sense are over-strained or consistently balked, or when he is punished every time he tries to take an intelligent decision, his reason is eventually crushed. Its healthy curiosity and alert self confidence decline into inertia or yield to tantrums or are fettered by obsessions.

We realise then, if we had not done so before, that the intelligence of the animal and our appreciation of it was a link between his person and ours. The neurotic dog which can only snarl or sulk has ceased to be a companion to us, and even when a rat is driven into an obsession, we are deprived of a personal intercourse in which we stood with it previously.

This is confirmed by the fact that an appeal to the neurotic animal's affection may help to restore its intelligence. A visit by a person to whom the afflicted animal is attached may heal its neurosis. Again, according to Meier and Klee<sup>1</sup> the most effective Method for breaking down a neurotic fixation in the rat is to apply gentle manual guidance directing it away from its fixated behaviour, "rather in the manner of an animal trainer".<sup>2</sup> The animal responds to personal contacts where all mechanical procedure fails to restore him to sanity.

The personal conception of intelligence which I have adopted here by regarding it as a form of guessing right, naturally links the faculty for intellectual judgment to the centre of personal responsibility. The connection is strikingly borne out by the fact discovered by Jacobsen that in chimpanzees intellectual frustration no longer leads to neurotic disturbances if the animal's prefrontal lobes are cut off from the stem or eliminated. The animal now ceases to worry and is no longer exposed to any danger from mental stress even though its ability to solve problems has been seriously impaired. A similar

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1. Quoted by Hilgard p.302.

2. Hilgard, p.306.

operation, when performed on man may relieve neurotic depression and at the same time reduces the depth of personality, rendering it crude, improvident and tactless.

This is as far as I wish to go in my gradual ascent towards the acknowledgment of rising levels of personhood. It suffices to show that a continuous transition has been made from the I-It of the exact sciences to the I-Thou of interpersonal relations, as the result of attending from the start to our personal participation in establishing what we believe we know. From the rudiments of personal participation as revealed in classical mechanics, in chance, randomness or symmetry, we ascended gradually to instances of inanimate things such as tools or the particulars of what I have called a physiognomy, which we know how to handle or to understand by being instrumentally or subsidiarily aware of them, in our focal awareness of some comprehensive feature which they subserve. This participation admittedly became far more complex and significant as we passed on to our knowledge of living beings, and it gained progressively in scope at the higher levels of life where the core of the molar feature that we were appraising, became sentient and finally even intelligent and responsible.

Let me expand this last point. We can see now how the final establishment at this last stage of three logical levels in place of the original two was pre-figured from the start in the evaluative nature of personal knowledge. The moment we know something in our own personal way we set a standard to the things known, grading them according to the extent to which they make sense to us. More specially, when appreciating molar entities we inevitably tend to criticise their particulars as to their aptitude in composing the whole which they subserve, and to this extent our criticism presupposes an acceptance of the whole as logically anterior to its parts. To this extent we accept uncritically the core of such a molar feature and agree to criticise

its composition from its own point of view. We recognise thereby things that are not only meaningful to us but rational in themselves. Such contemplative participation suffices altogether for the recognition of individual fellow beings on the level of plants. The transition to animals is made when our existential participation in the core of an individual reveals to our fellow feeling its striving and sentience. We are then ready to reach out to it and watch for an intelligent response from it as from its person to ours. In higher animals this approach brings us into contact with a centre of intelligent commitment. Then the circle is closed for the justification which we have granted to our own personal knowing has confirmed itself in our knowing of fellow persons who can be understood only by accrediting them the very faculties by which we know them. Conversely, we find also that since the study of living beings includes us as its objects, it leads back to the critical reflections concerning our own judgment against which we had consolidated our position by accepting the framework of commitment. So that this conception is now automatically extended to the acknowledgment of responsible choices and the ensuing hazards of intelligent personhood in others.

Tools and symbols find their place in this scheme as extensions of living beings, that is of ourselves, contrived by ourselves. When used confidently they have a meaning to us as instruments for the shaping and satisfaction of our needs and as terms in which we may elucidate our raw experiences. Then again, in mathematics, music and all great arts these artefacts acquire a rationality of their own, to which we have access by dwelling in them, while in doing so we accept their inherent standards of perfection.

I have said that all knowing implies an appraisal of experience as to its appositeness in making sense. These critical valuations are rudimentary and sometimes perhaps not of practical importance in the exact sciences but they are massive and not to be overlooked with impunity in the study of life and mind. Wherever

we believe that we know that something can be wrong or go wrong we believe also that we know how it can be right or go right. By doing so we lend justification to a whole system of questions as to the criteria of being right or going right. If something is believed to be a machine this implies that it can be out of order or alternatively function rightly, and we may accordingly set up an enquiry into the manner of its correct functioning, to which it will be proper to answer by stating the operational principles on which the machine is thought to be based. Similarly if something is said to be an organ this implies that it can function rightly, which sets up a field of enquiry, namely physiology, studying the principles of operation in healthy organs. All answers given to the question as to how an acknowledged rightness is achieved set up standards of perfection or rules of success; which being concerned only with the nature of rightness cannot account for failures. Even though the assertions of mechanical engineering or of physiology explaining the proper functioning of a machine or a living organ may themselves be mistaken, they would still allege an ideal and not refer to mistakes.

Answers to questions of the form, Why is this right? are given in mathematics in the form of proofs, and the proof of a theorem is said to offer a sufficient reason for accepting the theorem proved by it. A proof may be mistaken and it may of course prove the erroneousness of an alleged theorem, but it would be nonsense to say that we have proved a mistake. Mathematical errors are not unaccountable, but we cannot account for them in terms of mathematical reasoning. Logic, closely allied to mathematics is yet another analysis of rightness in terms of rules for obtaining right results.

We may say in general that an enquiry into the structure of a rational achievement can only lead to rules of successful procedure or to reasons for acknowledging an achievement and can never account for failure as it has no bearing on failure.

To understand the disturbance of rational order we must go beyond ideal principles of rationality and take notice of the manner of their actual embodiment. We must pass, for instance, from the operational principles which define a certain type of machine to the material objects which represent such machines. In these objects we then find things happening - such as watch-springs snapping, boilers bursting, trains derailing - which conflict with the rules of operation which these objects are intended to embody. I have said before that by regarding a machine as an aggregate of mere physical happenings we dissolve its characteristic ordering principle and can no longer see it as a machine. It now appears that we have to see the two incommensurable aspects of a machine simultaneously if we are to characterise a machine as having gone out of order. This is worth noting, for a broken-down machine therein presents us with a simple prototype of all rational structures stunted by faulty embodiment.

There exist great systems of rules for reasoning right and for acting right. The domain of rationality formed by these rules can be represented in terms of the circumstances in which it operates, in the same manner as a machine can be analysed in terms of the physical and chemical processes that may embody and subserve its functioning. Indeed, a responsible person can exist only embodied in a framework for which he has no responsibility. He dwells in a body with its peculiar needs and its particular range of sensibilities, he is brought up in an idiom of conceptions, and has acquired certain idiosyncrasies of his own; within a given historical situation which borders his horizon. What he feels or does can be largely accounted for by these factors, as studied by psychology, physiology, heredity, cultural environment etc., and yet to him as an intelligent and responsible person, these factors merely determine his opportunities, including the temptations against which he has to struggle. To the responsible person this framework represents the totality of conditions in terms of which his calling is assigned to him and I shall never

meet and acknowledge a responsible person except within such a relation to a set of internal and external facts.

Such is my conception of the intelligent and responsible mind. It is a molar feature of certain living beings, even as their life itself is. Mind (like life) cannot be given by its particulars, not only because these are actually unspecifiable, but for the deeper reason which makes them so, namely that they can appear to us as the workings of the mind only if we attend to them subsidiarily while focussing on the mind of which they are expressions or instruments. Nor is there any other way of encountering a person's mind than by attending subsidiarily to the workings of his mind.

But it is misleading to say that these particulars are his mind. For it leaves out the vital distinction as to how we attend to these particulars. Take the controversy which raged for a number of years about the intellectual powers of Clever Hans. There was no question about it that the horse had tapped out with his hoof the correct answer to the questions put to him on the blackboard. What opinions were divided on was whether these answers were the workings of the horse's mind; and in the end it turned out that their interpretation as mental operations was in fact mistaken. They were something quite different, namely responses to unintentional signals given by the investigator, and quite unrelated to the questions on the blackboard, except through the working of the investigator's mind. The tappings could not therefore have been in themselves the workings of the horse's mind, and while they were supposed to be the workings of the horse's mind this involved attending through them to its supposed mind. Those who believed in the genuineness of Clever Hans' performances saw them as clues to a tremendously important fact, and the passionate controversy aroused by their claims confirmed their revolutionary significance. The question was not whether

certain tappings would take place, but whether in the horse they had discovered and reached out to an intelligent fellow mind, hitherto hidden and unsuspected.

When I acknowledge my ultimate responsibility for the judgments of my intelligence, I acknowledge the presence of the same responsibility in the minds of others. Only by granting them equal status can I enter into companionship with them and justify my respect for their judgment. There is a whole universe of human relations which I accept as binding on me and which imply at every juncture the presence of an unspecifiable fellow-centre to which I listen and address myself in return. The pattern of these junctures involves the whole fabric of the society to which I belong. It forms the very network of roots from which I drew the idiom of my thought. I can therefore never hope to do more than to respond in my own way to what I have absorbed by relying on the great thoughts of the past and any reference to other minds which would fail to acknowledge my submission to other minds would contradict the very foundation of all my utterances. What ultimate independence I claim for myself I must recognise to an immeasurably higher degree in the great community of minds which first instilled it in me.

Admittedly, much of my intellectual responsibility is delegated to my nervous system, as when I allow it to carry out important perceptive functions on my behalf. But as a sane person I retain my claim to be the ultimate judge of anything my nervous system decides for me and its deliberate operations are by their very nature under my direct control. I can regard the services of my nervous system, therefore, only as those of a tool which, though it may be operated unconsciously and occasionally may even get out of hand, can yet be said to function rightly only if accredited by me as my tool.

The neurological evidence lends support to this position by the fact that the experimental excitation of motoric centres produces only involuntary actions with which the subject does not identify himself. Admittedly, it seems possible to excite animals to violent emotions, like rage, by stimulating other nervous centres. I would regard such a condition, however, like a state of insanity, as lying beyond the range of the subject's responsibility.

I feel justified in appraising the evidence in this personal manner, for I have never proposed to do more than to give consistent expression to the belief which, after having considered the evidence, I find myself holding. Having found that only an interpretative framework in which I acknowledge ultimate responsibility for my beliefs is consistent with the act of its own affirmation, I regard any conception of intellectual acts which does not acknowledge this responsibility as denying its very premiss.