

shall deal, in a later chapter, with the evolution of abstract thinking out of that which is relatively practical and direct; here we are concerned only with the common elements found in all the types.

Five distinct  
steps in  
reflection

Upon examination, each instance reveals, more or less clearly, five logically distinct steps: (*i*) a felt difficulty; (*ii*) its location and definition; (*iii*) suggestion of possible solution; (*iv*) development by reasoning of the bearings of the suggestion; (*v*) further observation and experiment leading to its acceptance or rejection; that is, the conclusion of belief or disbelief.

1. The occur-  
rence of a  
difficulty

I. The first and second steps frequently fuse into one. The difficulty may be felt with sufficient definiteness as to set the mind at once speculating upon its probable solution, or an undefined uneasiness and shock may come first, leading only later to definite attempt to find out what is the matter. Whether the two steps are distinct or blended, there is the factor emphasized in our original account of reflection—*viz.* the perplexity or problem. In the first of the three cases cited, the difficulty resides in the conflict between conditions at hand and a desired and intended result, between an end and the means for reaching it. The purpose of keeping an engagement at a certain time, and the existing hour taken in connection with the location, are not congruous. The object of thinking is to introduce congruity between the two. The given conditions cannot themselves be altered; time will not go backward nor will the distance between 16th Street and 124th Street shorten itself. The problem is *the discovery of intervening terms which when inserted between the remoter end and the given means will harmonize them with each other.*

(a) in the  
lack of  
adaptation  
of means  
to end

## ANALYSIS OF A COMPLETE ACT OF THOUGHT 73

In the second case, the difficulty experienced is the incompatibility of a suggested and (temporarily) accepted belief that the pole is a flagpole, with certain other facts. Suppose we symbolize the qualities that suggest *flagpole* by the letters *a, b, c*; those that oppose this suggestion by the letters *p, q, r*. There is, of course, nothing inconsistent in the qualities themselves; but in pulling the mind to different and incongruous conclusions they conflict—hence the problem. Here the object is the discovery of some object (*O*), of which *a, b, c*, and *p, q, r*, may all be appropriate traits—just as, in our first case, it is to discover a course of action which will combine existing conditions and a remoter result in a single whole. The method of solution is also the same: discovery of intermediate qualities (the position of the pilot house, of the pole, the need of an index to the boat's direction) symbolized by *d, g, l, o*, which bind together otherwise incompatible traits.

(b) in identifying the character of an object

In the third case, an observer trained to the idea of natural laws or uniformities finds something odd or exceptional in the behavior of the bubbles. The problem is to reduce the apparent anomalies to instances of well-established laws. Here the method of solution is also to seek for intermediary terms which will connect, by regular linkage, the seemingly extraordinary movements of the bubbles with the conditions known to follow from processes supposed to be operative.

(c) in explaining an unexpected event

2. As already noted, the first two steps, the feeling of a discrepancy, or difficulty, and the acts of observation that serve to define the character of the difficulty may, in a given instance, telescope together. In cases of striking novelty or unusual perplexity, the difficulty, however, is likely to present itself at first as a shock, as

2. Definition of the difficulty

emotional disturbance, as a more or less vague feeling of the unexpected, of something queer, strange, funny, or disconcerting. In such instances, there are necessary observations deliberately calculated to bring to light just what is the trouble, or to make clear the specific character of the problem. In large measure, the existence or non-existence of this step makes the difference between reflection proper, or safeguarded *critical* inference and uncontrolled thinking. Where sufficient pains to locate the difficulty are not taken, suggestions for its resolution must be more or less random. Imagine a doctor called in to prescribe for a patient. The patient tells him some things that are wrong; his experienced eye, at a glance, takes in other signs of a certain disease. But if he permits the suggestion of this special disease to take possession prematurely of his mind, to become an accepted conclusion, his scientific thinking is by that much cut short. A large part of his technique, as a skilled practitioner, is to prevent the acceptance of the first suggestions that arise; even, indeed, to postpone the occurrence of any very definite suggestion till the trouble—the nature of the problem—has been thoroughly explored. In the case of a physician this proceeding is known as diagnosis, but a similar inspection is required in every novel and complicated situation to prevent rushing to a conclusion. The essence of critical thinking is suspended judgment; and the essence of this suspense is inquiry to determine the nature of the problem before proceeding to attempts at its solution. This, more than any other thing, transforms mere inference into tested inference, suggested conclusions into proof.

3. The third factor is suggestion. The situation in

## ANALYSIS OF A COMPLETE ACT OF THOUGHT 75

which the perplexity occurs calls up something not present to the senses: the present location, the thought of subway or elevated train; the stick before the eyes, the idea of a flagpole, an ornament, an apparatus for wireless telegraphy; the soap bubbles, the law of expansion of bodies through heat and of their contraction through cold. (a) Suggestion is the very heart of inference; it involves going from what is present to something absent. Hence, it is more or less speculative, adventurous. Since inference goes beyond what is actually present, it involves a leap, a jump, the propriety of which cannot be absolutely warranted in advance, no matter what precautions be taken. Its control is indirect, on the one hand, involving the formation of habits of mind which are at once enterprising and cautious; and on the other hand, involving the selection and arrangement of the particular facts upon perception of which suggestion issues. (b) The suggested conclusion so far as it is not accepted but only tentatively entertained constitutes an idea. Synonyms for this are *supposition, conjecture, guess, hypothesis*, and (in elaborate cases) *theory*. Since suspended belief, or the postponement of a final conclusion pending further evidence, depends partly upon the presence of rival conjectures as to the best course to pursue or the probable explanation to favor, *cultivation of a variety of alternative suggestions* is an important factor in good thinking.

4. The process of developing the bearings—or, as they are more technically termed, the *implications*—of any idea with respect to any problem, is termed *reasoning*.<sup>1</sup> As an idea is inferred from given facts, so reasoning

3. Occurrence of a suggested explanation or possible solution

4. The rational elaboration of an idea

<sup>1</sup> This term is sometimes extended to denote the entire reflective process—just as *inference* (which in the sense of *test* is best reserved for

sets out from an idea. The *idea* of elevated road is developed into the idea of difficulty of locating station, length of time occupied on the journey, distance of station at the other end from place to be reached. In the second case, the implication of a flagpole is seen to be a vertical position; of a wireless apparatus, location on a high part of the ship and, moreover, absence from every casual tugboat; while the idea of index to direction in which the boat moves, when developed, is found to cover all the details of the case.

Reasoning has the same effect upon a suggested solution as more intimate and extensive observation has upon the original problem. Acceptance of the suggestion in its first form is prevented by looking into it more thoroughly. Conjectures that seem plausible at first sight are often found unfit or even absurd when their full consequences are traced out. Even when reasoning out the bearings of a supposition does not lead to rejection, it develops the idea into a form in which it is more apposite to the problem. Only when, for example, the conjecture that a pole was an index-pole had been thought out into its bearings could its particular applicability to the case in hand be judged. Suggestions at first seemingly remote and wild are frequently so transformed by being elaborated into what follows from them as to become apt and fruitful. The development of an idea through reasoning helps at least to supply the intervening or intermediate terms that link together into a consistent whole apparently discrepant extremes (*ante*, p. 72).

the third step) is sometimes used in the same broad sense. But *reasoning* (or *ratiocination*) seems to be peculiarly adapted to express what the older writers called the "notional" or "dialectic" process of developing the meaning of a given idea.

## ANALYSIS OF A COMPLETE ACT OF THOUGHT 77

5. The concluding and conclusive step is some kind of *experimental corroboration*, or verification, of the conjectural idea. Reasoning shows that *if* the idea be adopted, certain consequences follow. So far the conclusion is hypothetical or conditional. If we look and find present all the conditions demanded by the theory, and if we find the characteristic traits called for by rival alternatives to be lacking, the tendency to believe, to accept, is almost irresistible. Sometimes direct observation furnishes corroboration, as in the case of the pole on the boat. In other cases, as in that of the bubbles, experiment is required; that is, *conditions are deliberately arranged in accord with the requirements of an idea or hypothesis to see if the results theoretically indicated by the idea actually occur*. If it is found that the experimental results agree with the theoretical, or rationally deduced, results, and if there is reason to believe that *only* the conditions in question would yield such results, the confirmation is so strong as to induce a conclusion — at least until contrary facts shall indicate the advisability of its revision.

5. Corroboration of an idea and formation of a concluding belief

Observation exists at the beginning and again at the end of the process: at the beginning, to determine more definitely and precisely the nature of the difficulty to be dealt with; at the end, to test the value of some hypothetically entertained conclusion. Between those two termini of observation, we find the more distinctively *mental* aspects of the entire thought-cycle: (i) inference, the suggestion of an explanation or solution; and (ii) reasoning, the development of the bearings and implications of the suggestion. Reasoning requires some experimental observation to confirm it, while experiment can be economically and fruitfully conducted only

Thinking comes between observations at the beginning and at the end

on the basis of an idea that has been tentatively developed by reasoning.

**The trained mind one that judges the extent of each step advisable in a given situation**

The disciplined, or logically trained, mind — the aim of the educative process — is the mind able to judge how far each of these steps needs to be carried in any particular situation. No cast-iron rules can be laid down. Each case has to be dealt with as it arises, on the basis of its importance and of the context in which it occurs. To take too much pains in one case is as foolish — as illogical — as to take too little in another. At one extreme, almost any conclusion that insures prompt and unified action may be better than any long delayed conclusion; while at the other, decision may have to be postponed for a long period — perhaps for a lifetime. The trained mind is the one that best grasps the degree of observation, forming of ideas, reasoning, and experimental testing required in any special case, and that profits the most, in future thinking, by mistakes made in the past. What is important is that the mind should be sensitive to problems and skilled in methods of attack and solution.