ANALYTIC AND INTUITIVE THINKING*

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One can say many more concrete things about analytic thinking than about intuitive thinking. Analytic thinking characteristically proceeds a step at a time. Steps are explicit and usually can be adequately reported by the thinker to another individual. Such thinking proceeds with relatively full awareness of the information and operations involved. It may involve careful and deductive reasoning, often using mathematics or logic and an explicit plan of attack. Or it may involve a step-by-step process of induction and experiment, utilizing principles of research design and statistical analysis.

In contrast to analytic thinking, intuitive thinking characteristically does not advance in careful, well-defined steps. Indeed, it tends to involve maneuvers based seemingly on an implicit perception of the total problem. The thinker arrives at an answer, which may be right or wrong, with little if any awareness of the process by which he reached it. He rarely can provide an adequate account of how he obtained his answer, and he may be unaware of just what aspects of the problem situation he was responding to. Usually intuitive thinking rests on familiarity with the domain of knowledge involved and with its structure, which makes it possible for the thinker to leap about, skipping steps and employing short cuts in a manner that requires a later rechecking of conclusions by more analytic means, whether deductive or inductive.

The complementary nature of intuitive and analytic thinking should, we think, be recognized. Through intuitive thinking the individual may often arrive at solutions to problems which he would not achieve at all, or at best more slowly, through analytic thinking. Once achieved by intuitive methods, they should if possible be checked by analytic methods, while at the same time being respected as worthy hypotheses for such checking. Indeed, the intuitive thinker may even invent or discover problems that the analyst would not. But it may be the analyst who gives these problems the proper formalism.

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For a working definition of intuition, we do well to begin with Webster: "immediate apprehension or cognition." "Immediate" in this context is contrasted with "mediated" -- apprehension or cognition that depends on the intervention of formal methods of analysis and proof. Intuition implies the act of grasping the meaning, significance, or structure of a

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problem or situation without explicit reliance on the analytic apparatus of one's craft. The rightness or wrongness of an intuition is finally decided not by intuition itself but by the usual methods of proof. It is the intuitive mode, however, that yields hypotheses quickly, that hits on combinations of ideas before their worth is known. In the end, intuition by itself yields a tentative ordering of a body of knowledge that, while it may generate a feeling that the ordering of facts is self-evident, aids principally by giving us a basis for moving ahead in our testing of reality.

Obviously, some intuitive leaps are "good" and some are "bad" in terms of how they turn out. Some men are good intuiters, others should be warned off.

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What variables seem to affect intuitive thinking?...It seems unlikely that a student would develop or have confidence in his intuitive methods of thinking if he never saw them used effectively by his elders. The teacher who is willing to guess at answers to questions asked by the class and then subject his guesses to critical analysis may be more apt to build those habits into his students than would a teacher who analyzes everything for the class in advance. Does the providing of varied experience in a particular field increase effectiveness in intuitive thinking in that field? Individuals who have extensive familiarity with a subject appear more often to leap intuitively into a decision or to a solution of a problem -- one which later proves to be appropriate.

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In this connection we may ask whether, in teaching, emphasis upon the structure or connectedness of knowledge increases facility in intuitive thinking. Those concerned with the improvement of the teaching of mathematics often emphasize the importance of developing in the student an understanding of the structure or order of mathematics. The same is true for physics. Implicit in this emphasis, it appears, is the belief that such understanding of structure enables the student, among other things, to increase his effectiveness in dealing intuitively with problems.

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Should students be encouraged to guess, in the interest of learning eventually how to make intelligent conjectures? Possible there are certain kinds of situations where guessing is desirable and where it may facilitate the development of intuitive thinking to some reasonable degree. There may, indeed, be a kind of guessing that requires careful cultivation. Yet, in many classes in school, guessing is heavily penalized and is associated somehow with laziness. Certainly one would not like to educate students to do nothing but guess, for guessing should always be followed up by as much verification and confirmation as necessary; but too stringent a penalty on guessing may restrain thinking of any sort and keep it

plodding rather than permitting it to make occasional leaps.

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...But let us not confuse ourselves by failing to recognize that there are two kinds of self-confidence -- one a trait of personality, and another that comes from knowledge of a subject. It is no particular credit to the educator to help build the first without building the second. The objective of education is not the production of self-confident fools.

Yet it seems likely that effective intuitive thinking is fostered by the development of self-confidence and courage in the student. A person who thinks intuitively may often achieve correct solutions, but he may also be proved wrong when he checks or when others check on him. Such thinking, therefore, requires a willingness to make honest mistakes in the effort to solve problems. One who is insecure, who lacks confidence in himself, may be unwilling to run such risks.