# Minds and Managers: On the Dual Nature Of Human Information Processing And Management<sup>1, 2</sup>

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In this paper we present a concept of dual human information processing as an aid to understanding the decision styles and decision strategies of managers. Several threads of thought are woven together: neurological studies of "split-brain" persons, Jung's typology of personality, and philosophical explanations of human duality. The resulting framework differentiates a range of left- to right-hemisphere-dominant decision styles and integrates four decision strategies expressed as approaches to the person and the environment.

For hundreds of years, humanity has been intrigued by the dual nature of human consciousness. In art, philosophy, religion, and recently the behavioral and medical sciences, a dual perspective on the nature of human beings has emerged. From one perspective, people are logical and rational, goal-directed and scientific, technical and analytical. From the other, people are mysterious and intuitive, nonlogical and subjective, artistic and emotional.

These contrasting terms are most often used to describe differences among people, but recent neurophysiological research points to the existence of these two types of mind within each person. The two hemispheres of the brain process information in different ways. For most people, verbal and analytical thought processes are located in the left hemisphere, and the right hemisphere is responsible for spatial and intuitive thinking.

Although Barnard recognized the importance of

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duality over 40 years ago, only recently has its importance to management been examined. Stimulated by management's emerging interest, we present a conceptual framework that integrates several threads of thought: neurological studies in medicine, the psychological typology of Jung, and philosophical explanations of duality. The framework differentiates four basic decision styles that range from a left- to a right-hemisphere dominant mode. Complementing the decision styles, the framework integrates four decision strategies that suggest alternative managerial approaches to the person and environment.

#### Approaches to the Study of Human Information Processing

Human information processing (HIP) concerns how people gather and use information in making decisions. Because managers are decision makers, an understanding of HIP in the management context may well be useful. Several approaches to the study of HIP can be identified. One approach attempts to model the heuristics that individuals use in making choices [Newell & Simon, 1972]. Heuristics become very complex as the task becomes more intricate and as more people and interest groups become involved

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in the process [Mintzberg, Raisinghani, & Theoret, 1976].

The ultimate aims of this approach are two. The first is simply to build a descriptive model of how people process information, particularly in complex situations. Second, the applied purpose is to provide decision makers with "good" or "efficient" models so that their decisions can improve. As Bowman [1963] has demonstrated, regression weights derived from actual management decisions, when used to guide future decisions, produce a consistency that may be more important than a futile search for optimality. Developing models of decision behavior can thus provide basic findings on human information processing as well as normative decision tools.

A second approach to HIP deals with cognitive complexity, the relative complexity within an individual's conceptual system [Schroder, Driver, & Streufert, 1967]. An optimal level of environmental complexity is identified, suggesting that too little or too much environmental complexity results in reduced ability to process information. Individual differences in information processing are recognized: more complex processors are capable of processing more information at the optimal load point than are simpler processors. Research reveals a positive correlation between cognitive complexity and personality variables such as tolerance for ambiguity, and a negative correlation with other variables such as authoritarianism and dogmatism [Streufert, 1972].

Recently, Driver [1979] and Driver and Rowe [1979] have reviewed management research on cognitive complexity and have formulated a revised version of the complexity theory. They identify four decision styles, whereby individuals are typed on the basis of (1) the use of a single or multiple focus, and (2) the amount of information used (low or high). The four styles are: decisive (single focus, low usage), hierarchic (single focus, high usage), flexible (multiple focus, low usage), and integrative (multiple focus, high usage). Experimental studies of decision making show important but tentative differences between the four styles [Driver & Mock, 1975]. The most direct application of this work appears to be in matching managers to decision situations where their natural styles are most effective.

A third approach that has found more recent acceptance within management emphasizes the dual

nature of HIP. The duality approach differs from the heuristic modeling and cognitive complexity approaches in that it expressly identifies HIP styles that are qualitatively different. Some decision makers use logical routines to make decisions and are classified as analytic or systematic. Their nonlogical counterparts use unsystematic, intuitive processes to reach decisions.

A similar distinction has been made in education research to improve communication about curriculum development and test preparation. A taxonomy of educational objectives has been developed around two broad categories: cognitive and affective [Bloom, 1956; Krathwohl, Bloom, & Masia, 1964]. The cognitive objectives emphasize developing analytic and systematic capabilities; the affective objectives emphasize unsystematic and intuitive processes. This taxonomy highlights what should be two primary emphases in education. However, management education to date has focused on the cognitive aspects of decision making, virtually ignoring the affective.

It is this dual cognitive/affective, analytic/intuitive concept of HIP that we are dealing with here. In the following sections, we identify both classic and recent interest in dual processing as the basis for our conceptual framework. Of particular interest are the implications that successful management depends on the use of a full range of processing skills. This suggests the need for flexible, situationally dependent styles and strategies for decision making.

A significant concern for the dual perspective is the measurement of individual processing orientations. In a related paper, we [Robey & Taggart, in press] review three basic approaches to such measurement: those that infer style from physiological indicators, those that observe outward behavior directly, and self-description inventories. Further practical work with the conceptual framework presented here depends on the assessment of HIP style with combined psychological and physiological measures. This problem constitutes our current research interest.

#### **Tracing Management Interest in HIP**

Management interest in a dual classification dates back at least to Barnard's essay "Mind in Everyday Affairs," published as an appendix to his Functions of the Executive. Barnard highlighted the logical and nonlogical processes that, woven together, form the decision-making fabric of an organization. He found it convenient to recognize that "mental processes consist of two groups which I shall call 'non-logical' and 'logical' "[1938, p. 302]. By logical process, Barnard meant conscious thinking that can be expressed in words or other symbols. Such thinking is typically referred to as "reasoning." A nonlogical process is one that cannot be expressed in words or described as a thought process, but may be recognized in the result of some action such as a judgment or a decision. In Barnard's view, an effective manager has access to either mode as the situation demands.

Recently, Leavitt [1975a, 1975b] has discussed the consequences of over-emphasizing analytic problem solving in management education. He suggests that the intuitive and emotional aspects of information processing deserve the same attention as the logical and analytic. Leavitt urges moving in the direction of "integrating wisdom and feeling with analysis." Individuals who are capable of such integration "are worth a great deal" to an organization [1975b, p. 20]. Because management education emphasizes the analytic style, which blocks consideration of nonanalytic modes that use intuition and empathy, such integration may be difficult. In Leavitt's opinion, emphasis on the analytic mode breeds suspicion and even hostility toward the opposite, yet complementary, style. He believes that an integrated, flexible emphasis would better serve the needs of management education.

Mintzberg has developed this theme further. Citing research in psychology and medicine, Mintzberg contends that individuals who make good planners appear to exhibit the strengths of the left hemisphere processor while good managers exhibit the strengths of the right. He also suggests that planners and managers would both be more proficient if they could draw at will on the processing style appropriate to the circumstances. Mintzberg states that a major thrust in organizations since Frederick Taylor's work has been to shift management activities out of the intuitive realm into that of conscious analysis. But managers need to overcome this bias and carefully distinguish those activities which should be handled analytically from those "which must remain in the realm of intuition, where, in the meantime, we should be looking for the lost keys to management" [1976, p. 58].

## Neurological Evidence of Dual Processing

Substantial clinical evidence for the right/left duality in HIP has grown out of work with "splitbrain" surgical patients beginning in the early 1960s. In this surgery, patients suffering from a severe form of epilepsy have the corpus collosum, which connects the two hemispheres of the cerebrum, cut to prevent the onset of seizures. This procedure stops the seizures by eliminating bursts of seizureinducing neurological transmissions between the two hemispheres of the cerebrum.

After the surgery, patients lead normal lives except that cerebral functioning is impaired under certain conditions. For example, if an object such as a spoon is placed out of sight in the patient's left hand, the patient will not be able to name the object. The left hand "tells" the right hemisphere that a spoon is being held. But the left hemisphere, which is responsible for speech, cannot name the object since the image of the spoon cannot be communicated from the right to the left hemisphere for conversion to words, The patient knows, with one mind, what the object is but cannot verbally express it with the other mind.

A variety of evidence has made it clear that one hemisphere of the cerebrum is enough to sustain an individual's personality or mind. Bogen wrote that "we may conclude that the individual with two intact hemispheres has the capacity for two distinct minds" [1969, p. 157]. Bogen proposed the terms "propositional" for the orientation of the left hemisphere and "appositional" for the right. Leftmode processing is strongly developed and reinforced by Western educational traditions. Bogen believes that as we become better informed about new findings, we can design learning situations for the harmonious development of students' whole minds. In accord with this suggestion, a greater balance between developing left and right hemisphere abilities will enhance management.

## A Psychological Foundation For Decision Style

Another conceptual approach to a balanced view of HIP draws from the work of Carl Jung. Jung, one of psychology's classic theorists, provided strong roots for the study of duality in HIP. Jung's theory

of personality identifies two dimensions of HIP that seem directly related to right and left brain activity [1971]. Perception (gathering information) and judgment (processing information) are the two dimensions. Perception is achieved by either sensation (S) or intuition (N); judgment is made by either thinking (T) or feeling (F). Pairing a mode of perception with a mode of judgment yields four basic decision styles: sensation/thinking (ST), intuition/thinking (NT), sensation/feeling (SF), and intuition/feeling (NF). These four decision styles are arranged in sequence from left to right along the top of Figure 1. Myers [1976] distinguished these styles in terms of (1) personal focus of attention, (2) method of handling things, (3) tendency to become, and (4) expression of abilities. These characteristics are listed in the left column of Figure 1.

The ST processing style relies on sensing of the environment for perception and rational thinking for judgment. ST processors attend to *facts* and handle them with impersonal analysis. They tend to be practical and matter of fact and develop abilities more easily in technical work with facts and objects. In contrast, NF types rely on intuitive perceptions and nonrational feeling for judgment. Such people attend to possibilities and handle them with personal warmth. They tend to be enthusiastic and insightful, and their abilities are more easily expressed in understanding and communicating.

NT people attend to possibilities, as do NF's, but they approach them with impersonal analysis, like ST's. NT's are logical and ingenious, and express their abilities easily in theoretical and technical developments. SF people attend to facts, as do ST's, but they handle them with personal warmth, like NF's. SF's tend to be sympathetic and friendly, and find their abilities best developed in practical help and services for people. Occupationally, the NT is typified by a planner; the ST, a technician; the SF, a teacher; and the NF, an artist.

	LEFT HEMISPHERE RIGHT HEMISPH			RIGHT HEMISPHERE
	ST Sensation/Thinking	NT Intuition/Thinking	SF Sensation/Feeling	NF Intuition/Feeling
Focus of Attention	Facts	Possibilities	Facts	Possibilities
Method of HandlingThings	Impersonal analysis	Impersonal analysis	Personal warmth	Personal warmth
Tendency to Become	Practical and matter of fact	Logical and ingenious	Sympathetic and friendly	Enthusiastic and insightful
Expression of Abilities	Technical skills with facts and objects	Theoretical and technical developments	Practical help and services for people	Understanding and com- municating with people
Representative Occupation	Technician	Planner ———— Mai	Teacher nager ————————————————————————————————————	Artist

Figure 1 The Range of Decision Styles in Human Information Processing

In addition to these characteristic differences in style, Figure 1 suggests two other ideas that are fundamental to our framework. At the top of Figure 1, we suggest a link between left hemisphere domination and the ST type, and one between right hemisphere domination and the NF type. The two intermediate types, NT and SF, can be considered less indicative of hemispheric domination. The placement of NT to the left of SF suggests that thinking (T) judgment is more characteristic of left hemisphere processors than is intuitive (N) perception. The feeling (F) type, in contrast, is dominated by the right hemisphere, which "pulls" the SF person to the right of the NT. This implies that the secondnamed element (judgment) takes precedence over the first (perception); in other words, characterization of style depends more on how information is processed (judgment) than on how it is gathered (perception).

The second idea conveyed by Figure 1 is that managers should be flexible in processing style. This need for flexibility follows from the observations of Barnard, Leavitt, Mintzberg, and Bogen. Because managers face a wide variety of human, technical, and value questions, they are more effective if they can change their style to fit their problems. A manager may need to act like a technician, planner, teacher, or artist, depending on the circumstances.

Consider a manager who has rated a subordinate's performance as marginal. How the manager might handle the situation illustrates the range of styles. An ST manager responds with "Improve your performance or you're fired!" (factual, impersonal, practical). The NT manager's attitude moderates a bit with "If your performance does not improve, you will be transferred to another position" (possibilities, impersonal, ingenious). The SF manager approaches the problem with "You need to change, what can we do to help you?" (factual, personal, sympathetic). And the NF manager suggests "You can improve your performance, let me suggest an approach" (possibilities, personal, insightful). Any one of the responses may be best, depending on situational factors, such as who the subordinate is, the pressure of time, and group norms. The flexible manager recognizes the contingencies and chooses the most appropriate style.

# Philosophical Foundations For Dual Processing

The duality we are discussing has not gone unnoticed in the philosophies of either East or West. But the way the two mental processes are perceived and the emphasis placed on each varies according to the two philosophical traditions. The differences between Western and Eastern culture are evident in the divergent accounts of humanity's relation to nature.

Western philosophy, derived from its Greek heritage, assumes the original condition of nature as one of chaos or darkness. The human role is to impose order and shed light on the original chaos and darkness. In contrast, Eastern philosophy takes the original condition of nature to be one of order or integration of the light and the dark, One returns to this original state by letting go and permitting nature's inherent expression rather than by actively intervening.

Typically, Western philosophy seeks to explain how order comes about and how to maintain it. This yields the characteristic Western scientific view of encountering and manipulating things to achieve desired results. The Eastern view reverses the problem to consider how disorder arises and how to avoid it. The classical Chinese notion of wu wei or "taking no unnecessary action" expresses this attitude. This Taoist view accepts things as they are, permitting them to express an inherent result [Chan, 1963, pp. 225, 791].

The philosophy of wu wei contrasts sharply with the Western attitude that some action must be taken to achieve a desired result. Conceptually, the Western stress on action aligns with the lefthemisphere rational processing style. Conversely, the Eastern acceptance of things as they are corresponds to the right hemisphere. The Taoist symbol of overlapping light and dark (yang and yin), which we use in the center of Figure 2, symbolizes the inherent unity of hemisphere differentiation. It suggests a holistic, integrated information processor.

Although the integration of active yang and receptive yin principles is most often associated with Eastern thought, Western philosophers have recognized the importance of merging the two sides of man's nature. For example, Nietzsche used the Grecian dieties Apollo and Dionysus to symbolize duality. Apollo signifies order, restraint, and form - characteristics of the earthbound left hemisphere. Dionysus symbolizes the dynamic interplay that knows no restraints and defies limitations characteristics of the right hemisphere [1967, pp. 33-47].

Benedict used the Apollonian and Dionysian distinction to contrast two very different American Indian cultures [1934]. Many Indian cultures on the American continent were Dionysian, celebrating their deep bond with nature through elaborate ritual and ceremony freely entered into and freely expressed. In contrast, the Zuni were an Apollonian culture characterized by a single-minded attitude with a restrained middle-of-the-road outlook that distrusted individualism.

The essence of both these cultures is reflected in our current approach to management education. Management education stresses Apollonian values and methods, but management practice calls for both the Apollonian and the Dionysian. The philosophical position of the manager must integrate these paradoxical opposites by seeking balance. In terms of the Figure 1 range of decision styles, the successful manager must transcend the narrow orientation of one culture or one philosophy.



Figure 2 Human Information Processing in Management Decision Making

## Suggested Strategies for Management Decisions

The diverse threads of the previous discussion can be drawn together and the common theme expressed directly. Figure 2 shows the two cerebral hemispheres flanking the Taoist symbol representing different combinations of the active and receptive principles. We have mentioned the physiological, psychological, and philosophical bases for right and left hemisphere information processing. The essence of that discussion is represented by the antonymous adjectives in the two hemispheres. The left hemisphere's orientation to action (the yang principle), as reflected in most Western philosophies, is represented on the left (unshaded) side of the Taoist circle. The right hemisphere's receptivity, the Eastern wu wei (the yin principle), is on the right (shaded) side of the circle. The left/right duality provides a basis for organizing management decision strategies with respect to the person and the environment.

From a management perspective, action and nonaction can pertain to both the person and the environment. We have adopted Lewin's [1961] classic formulation that behavior (B) is a function of the interaction of the person (P) and the environment (E), or B = f (P,E). Our framework suggests four management decision strategies: changing both person and environment (P,E), changing the person but not the environment (P,e), changing the environment but not the person (p,E), and changing neither the person nor the environment (p,e).

In Figure 2, we have labeled the left hemisphere action strategies accommodation and adaptation, and the right hemisphere receptive strategies placement and prediction. Accommodation assumes that we adjust both the person (P) and environment (E) to bring about a desired state. Its complement, prediction, takes the person (p) and environment (e) as they are and forecasts the outcome of their interaction. The middle ground offers two partly active strategies. Adaptation treats the environment (e) as given, and changes the person (P) to fit the situation. The other intermediate strategy takes the person (p) as given and accomplishes an objective through placement in a selected or designed environment (E).

Adaptation describes the person changing to suit the demands of the environment. It is an active strategy for the person (P) because it involves personal change; however, it is a receptive strategy for the environment (e) because that remains unchanged. Adaptation describes the traditional training functions in management and the less formal processes of socialization and job experience. It assumes that individuals have the capacity to change in directions that the environment requires. It further implies that environmental demands (job requirements) can be meaningfully stated and related to personal characteristics.

*Placement* refers to the active manipulation of the environment to fit the individual. The person (p) assumes a receptive attitude and does not change, although he or she may be actively involved in changing the environment (E) or in finding a suitable one. In management, placement refers not only to placing persons into jobs that they can do, but also to task and organization design. It is the opposite of training the person to fit the job.

Accommodation reflects a combination of the first two approaches - adaptation and placement. Management action is maximized through the selective manipulation of person and environment. As interesting as debates between humanists (active P, receptive e) and behaviorists (active E, receptive p) are [Rogers & Skinner, 1956], the accommodation strategy suggests that practicing managers have more to gain from an understanding that behavior results from both the person and the environment.

Accommodation epitomizes the active, logical left hemisphere thought that most characterizes contemporary management. It regards results as sacred and emphasizes purposeful manipulation of both P and E to achieve results. Most modern contingency theorists employ this strategy in their search for the correct fit between people and their environments, with some ultimate criterion (organizational effectiveness, human performance, etc.) at stake.

The fourth strategy shown in the diagram is *prediction.* Unlike the preceding three, prediction assumes a receptive, nonlogical right hemisphere attitude toward the person (p) and the environment (e). Whatever happens, happens. The individual "goes with the flow" and does not manipulate the course of events. A willingness by the individual to harmonize with the situation is implied. Prediction calls for withholding intervention to permit the course of events to find its natural expression.

Because management seems to imply manipulation of things, people, or situations to accomplish goals, prediction is often ignored as a valid strategy. It is useful for managers to know what is going to happen so they can plan active strategies. But prediction, the receptive strategy described here, suggests that knowledge of outcomes is complete in itself and that this knowledge need not be used as the basis for devising active moves. Rather, successful use of this strategy is defined in terms of understanding one's own position in the flow - not in terms of using that information to change one's position.

The marginal performance situation, used earlier to illustrate the Jungian styles, can also illustrate the different action approaches implied by the four strategies. Using the left hemisphere accommodation strategy, a manager would seek to modify the subordinate's behavior as well as change the work assignment in an effort to improve the situation. This is characteristic of an active management attitude. Using the adaptation strategy, a manager would focus on changes in the subordinate's behavior while leaving the work content as it is. When the job content is considered acceptable, this approach would be appropriate. The placement strategy would be appropriate if the difficulty lies in the work design and not in the employee's behavior. In this case, performance will improve by adjusting the work to the skills of the employee.

If the manager foresees the unsatisfactory performance is transient and will clear up by itself, then the right hemisphere prediction strategy would be followed. The manager leaves the situation as it is, since the unsatisfactory performance will rectify itself without the subordinate or the job being changed. This last strategy is often overlooked because we tend to assume that a situation will improve only if we actively intervene. The ability to recognize when situations require inaction can conserve an organizations' resources.

#### **Implications for Management Education**

The educational question raised here is similar to one encountered in leadership theory: Should managers be trained in all styles and learn to apply them, or should situations be tailored to fit the manager's naturally dominant style? There may be nothing "natural" about the analytical decision style acquired through traditional management education. Rather, this style may well be a function of our entire educational process, beginning in kindergarten. Left-hemisphere-dominant teachers breed left-hemisphere-dominant students. However, we each have two hemispheres that deserve equal time in our educational experience.

This fact presents a significant challenge to management educators, who have traditionally stressed the left hemisphere analytic style and strategy of processing information. Without exposure to alternative styles and strategies, managers are less likely to see the value of a right-hemisphere approach, even though it may be appropriate to a particular problem, Moreover, there may be many creative, right-hemisphere people who do poorly in traditional business courses and who find unappealing the strictly rational approach to the study of management. These people could more readily see their potential contributions to the managerial world if business schools stressed the full range of HIP styles and strategies.

We are not suggesting that management education should foster basic changes in personality. But we are suggesting that opportunities to explore the full range of decision styles and strategies should be made available in business school curricula. We believe that managers can be more effective if they are aware of several styles and strategies (within a sound theoretical framework), and if they learn to use them appropriately. By widening our educational approach, we are more likely to produce aspiring managers who are effective in both the logical and nonlogical processes about which Barnard wrote so compellingly,

It is neither trite nor exaggerated to say that management is both an art and a science. But accepting this statement as valid presses us to consider how we can develop manager/artists by providing learning experiences to improve right-hemisphere decision skills. At the same time, we must continue to educate managers for success as manager/scientists. This means retaining the left-hemisphere curriculum that we are familiar and comfortable with. Balancing the curriculum to encompass the complete range of processing styles and strategies that our framework suggests is a major challenge for management education in the 1980s. Barnard, C.I. The functions of the executive. Cambridge: Harvard University Press, 1938.

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