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Mindscapes and Science Theories

by Magoroh Maruyama

INTRODUCTION

Recent developments in the study of the relationship between cognitive types and science-theory types, on the one hand, and the relationship between individual differences and cultural differences in cognitive/cogitative/perceptual patterns, on the other, raise the following questions: To what extent are cognitive/cogitative/perceptual patterns phenotypically (individually) innate or culturally learned? If learned, how early in the life of the individual are they formed? Once formed, can they be changed, for example, in cases of cross-cultural migration or culture change? What are the effects of individual and cultural processes of pattern formation on the development of science-theory types? This article deals with these questions.

Until recently, the study of epistemological types has been conducted mainly in two separate fields with two different sets of variables. On the one hand, psychologists have focused on individual differences in patterns of cognition and/or perception, often in relation to personality characteristics. Research has ranged from psychological tests on personality and world view (Adorno and Sanford 1950, Rokeach 1960) and the psychoanalytic bases of researchers' choice of theories in the physical, biological, and social sciences (Kubie 1956) and in philosophy (Feuer 1959) to large-scale statistical testing (Harvey 1966). On the other hand, sociologists and anthropologists have concentrated on cultural and social differences in patterns of cognition, perception, behavior, and causal explanation, often averaging the individual differences within a culture or a social group (see, for example, Mannheim 1929, Mead 1937, Kluckhohn 1949, Camara 1975, and to some extent Kuhn 1962).

I have been studying patterns of cognition, perception, conceptualization, design, planning, and decision making from a

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different direction. In the course of my study of various causal models (Maruyama 1961a, 1963) in the physical, biological, and social sciences, it became increasingly evident that the choice of causal model types in research depended on researchers' epistemological types, which were related to their personality characteristics and cultural backgrounds (Maruyama 1974a). Moreover, differences in epistemological types were found not only among academic researchers, but also among professionals such as urban and regional planners, engineers, architects, composers, and other professionals and nonprofessionals (Maruyama 1974b, 1978a, c). Furthermore, epistemological differences were found not only among different fields of specialization within a culture, but also among researchers of different cultures within the same field and, within the same field in the same culture, among individuals. Each culture was found to contain all the individual epistemological types found in others, though the percentage distribution of types varied. To add to the complication, it became evident that the same theory might be advocated on several epistemologically different grounds and, conversely, that many apparently different or opposite theories might stem from a single epistemological type and therefore have the same fallacies (Maruyama 1978d). It therefore seemed necessary to reorganize these findings into a new conceptual framework in order to examine the implications of epistemological types for the development of types of scientific theories.

CAUSAL METATYPES IN SCIENCE THEORIES

Science theories can evolve at different levels: (1) within the same causality type but with different sets of "causes" for the same "effect" or different sets of "effects" for the same "cause" and (2) across different conceptualizations of "causality." I shall deal with the latter in the light of recent theoretical developments in the social and biological sciences. Among current social and biological theories, it is useful to recognize at least four different metatypes of causality:

1. *Nonreciprocal causal models*, in which causal relations may be either probabilistic or deterministic, but there are no causal loops; causal relations obey the transitive law.

2. *Independent-event models*, in which the most probable states of the universe or of an isolated system are states of random distribution of independent events, each having its own probability; nonindependent relations and nonrandom structures exist but are less probable, tending to decay into more random, unstructured, homogeneous states.

3. *Homeostatic causal-loop models*, in which causal relations may be probabilistic or deterministic and may form loops; structures and patterns of heterogeneity are maintained by homeostatic causal loops.

4. *Morphogenetic causal-loop models*, in which probabilistic or deterministic causal loops can increase heterogeneity, generate patterns of mutually beneficial relations among heterogeneous elements, and raise the level of sophistication of the system.

There are, of course, also types other than these, mixtures of types, and subtypes within each. For example, homeostatic causal-loop models may either (a) asymptotically converge to an equilibrium or (b) periodically retrace the same path in the state-space.

Of the four metatypes, morphogenetic causal-loop models are the newest. The conceptualization and elaboration of these models took place in several more or less separate networks of researchers. One network developed from mathematical modeling and computer simulation and grew out of the conceptualizations of Stanislaw Ulam, Maruyama (1961a, 1963, 1974a, 1977, 1978a), Buckley (1968), Milsum (1968), and others. Operations researchers and economists applied these concepts to several types of computer simulation models, among them Jay Forrester's. Another network centered around biological self-organization and included Henri Atlan, Henri Laborit, Heinz von Foerster, and Rupert Riedl. There were other networks. One of them included Wolpert, Gustafson, and Waddington. Another had Stern. There were also networks doing research on similar topics without knowledge of one another. For example, Ehrman and Prober, on the one hand, and Watanabe and Kawanishi, on the other, worked on mate selection among *Drosophila* based on the criteria of rare characteristics rather than on the more traditional assumption of the existence of "optimal" characteristics, without citing one another's similar findings. There were some earlier precursors, whose effect on the later generations varied. Spemann (1938) in embryology had a lasting effect in biology, while Myrdal's (1944, 1957) pioneering works in economics have until today not been appreciated for their implications as new causal-loop models. Engineering applications of the causal loops occurred as early as the 1910s with the invention of oscillators in radio transmitters and receivers, but the concept was not picked up by other fields until a few decades later.

Morphogenetic causal-loop models are increasingly supplementing or replacing homeostatic models, which developed during World War II with the use of error-correcting feedback systems in such devices as anti-aircraft artillery connected with radar by computer (Wiener 1949). During the 1950s and 1960s, homeostatic causal-loop models of equilibrium and self-regulation were widely used in neurology, physiology, and, to some extent, psychology. They were also congruent with traditional economic equilibrium theory and anthropological functionalist theory, whose shortcomings are becoming increasingly apparent.

I have discussed the theoretical implications of causal metatypes in detail elsewhere (Maruyama 1963, 1974a, 1977, 1978a). Here I shall confine myself to three issues: the conceptualization of heterogeneity, the conceptualization of cultural and biological evolution, and procedures of hypothesis formulation.

The theoretical treatment of intracultural heterogeneity in anthropology, intragroup heterogeneity in sociology, and intraspecific heterogeneity in animal behavior has mainly been confined to one or several of the following conceptual formulations: (1) statistical distribution around the mean; (2) variations which have no particular interactional advantage; (3) division of labor serving the whole; (4) dominance relations, pecking orders, and hierarchical stratification; (5) abnormalities, deviants, errors, or accidents; and (6) reciprocal interactions between heterogeneous individuals who maintain equilibrium or periodic cycles. The first, third, fourth, and fifth of these formulations are based on a homogenistic and/or hierarchical epistemology, which tends to use nonreciprocal causal models. The second is based on independent-event models. The sixth is based on homeostatic causal-loop models. There are often mixtures and mutual reinforcements of these formulations.

It is often assumed that variations occur in a Gaussian (normal) distribution around the mean. This assumption holds if the variations are due to random fluctuations or random errors, which are independent from one another. However, in many biological and social processes, heterogeneity is non-random and interrelated. Therefore the distribution is often non-Gaussian (non-normal). Even in such cases, however, a normal distribution is often assumed in order to "simplify" matters. This assumption enables the researcher to ignore the nature of variations; they become just a matter of degree, which can be measured in terms of standard deviation. They also become expected accidents and abnormalities which need no explanation and play no important role. What counts is the mean, which is the major trend, the trend, the mainstream, the "real."

Independent-event models may appear to be the opposite and indeed are a reaction to the above, but they are merely the other side of the same coin, Aristotelian logic. Studies of individual differences, especially in psychology, usually identify different types or tabulate their numerical distribution. Very few examine the interaction between types. Individual-difference studies usually end up distinguishing categories within each of which there is a mean and a standard deviation and between any two of which there is a statistically "significant" difference. Interestingly, the few interaction studies that exist tend to focus on pathological "symbiosis," such as sado-masochistic combinations and schizophrenogenic families.

Equally frequent is the tendency to conceptualize heterogeneity as hierarchical relations such as dominance, pecking order, and vertical stratification. Nonhierarchical interactions are seldom studied except in terms of division of labor, but this latter is another version of hierarchical conceptualization, in which the parts serve the whole. Until recently, the only genuinely nonhierarchical models occurred in homeostatic causal-loop models, in which heterogeneous elements interact for mutual benefit and the pattern is maintained because it is beneficial to all interacting parties. However, homeostatic causal-loop models cannot explain or account for change. I have shown (Maruyama 1963) how differentiation-amplifying causal loops can generate heterogeneity and develop new patterns in evolution, in the growth of a city, and in other biological and social processes. In this causal metatype, heterogeneity is not an error or abnormality, but basic and indispensable to such processes.

The conceptualizations of evolution within the various causal metatypes are exemplified in the following sketch:

In nonreciprocal causal models, evolution is characterized by survival of the "strongest," by competition. All civilizations follow the same path of evolution; therefore, if two civilizations are different, one is more "advanced," the other more "primitive" and "childlike." The most advanced civilizations are the European and the white American. *Homo sapiens* is the most advanced of all animals. The less advanced should serve the more advanced. Society consists of leaders and followers. Phenotypically, evolution depends on mate selection. Among animals, mate selection is based on optimal or supernormal characteristics in terms of strength, size, shape, color, or aggressiveness. Evolution progresses in the direction of characteristics selected in mating and by external pressure. All individuals prefer the same characteristics in mating. Therefore there is a unified, homogeneous direction of evolution. In human history, major changes are made by heroes, by discoveries and inventions, or by large-scale natural, biological, or human-made disasters. Therefore changes in cultural evolution and human history occur in leaps and jumps.

In independent-event models, evolution is due to random changes. Whatever happens to get established perpetuates itself until another random change wipes it out. Stability is punctuated by sudden random changes in unpredictable directions, which are followed again by stability. Evolution is haphazard and has no coherent direction. Random influences can

TABLE 1

MINDSCAPE TYPES AND THEIR CHARACTERISTICS

MIND-SCAPE TYPE	COMPONENTS	RELATION BETWEEN COMPONENTS	PROCESS
H.....	homogenistic	hierarchical	classificational
I.....	heterogenistic	individualistic	random
S.....	heterogenistic	interactive	homeostatic
G.....	heterogenistic	interactive	morphogenetic

make established structures decay little by little, but they are not likely to accumulate in a consistent direction so as to form a new structure. Consequently, the emergence of a new form must occur in a leap, such as a sudden genetic change due to exposure to radioactivity.

In homeostatic causal-loop models, evolution is the result of interactions among heterogeneous elements. For a given local condition (size of space, energy supply, temperature, types of nonorganic materials available, etc.), evolution will either proceed toward a stable configuration of interactions with a stabilized number of species and a stabilized number of individuals in each species or go into repetitive, periodic cycles. When the local condition changes, a new configuration arises. Existing cultures are the result of a long evolutionary process. Each culture fits its local condition and has attained a stable internal configuration which is satisfactory and perfect and should not be disturbed. Changes are due to influences from outside or occasional inventions within the culture. Cultures tend to remain stable, occasionally changing stepwise.

In morphogenetic causal-loop models, interactions continuously generate heterogeneity and new patterns of mutually beneficial relations among heterogeneous elements. The development may be gradual or rapid. Changes need not occur in leaps; usually they occur continuously and gradually. However, leaps may occur because of either very rapid change or the exceeding of a threshold. Since "kicks" in various directions may be amplified by causal loops, there are many possible directions of evolution, even within the same local condition. Mate selection may be based on rare characteristics (Ehrman 1972, Ehrman and Propper 1978, Watanabe and Kawanishi 1979) instead of optimal characteristics. This leads to heterogenization within the species. Evolution does not stop; if some external limits are reached, either new forms may develop to alter the nature of the internal configurations or some device may be created to change the external limits. (For example, if coal and oil are exhausted, solar energy may be collected in outer space.)

There are also differences in the procedures of hypothesis formulation in different metatypes of causality. Often the wrong causal metatype is used for a particular study, making it "miss the point." In nonreciprocal causal models, it is assumed that similar conditions produce, with some probability distribution, similar results. Therefore, if dissimilar results (for example, differences between identical twins) are found, it is inferred that the conditions must have been dissimilar. A hypothesis is formulated as to what was different in the conditions (for example, nutrition, social environment). In homeostatic causal-loop models, however, dissimilar conditions may lead to similar results. This makes the above procedure impossible. In morphogenetic causal-loop models, another logical impossibility may be encountered. Because of differentiation-amplification, similar conditions may lead to very dissimilar results, and small fluctuations, which are highly probable, may lead to large differences, which seem to have low probability. Consequently, dissimilar results may not be due to differences in initial conditions. To look for a proportional difference in initial conditions is a waste of effort. Instead, one must look for amplifying causal loops. For example, many sociologists and psychologists have attempted to explain the differences between Swedish culture and Danish culture on the hypotheses of climatic, dietary, geographic, and other differences. None of these hypotheses have proven satisfactory. Analysis of internal amplification within Danish culture has been more fruitful (Maruyama 1961b).

MINDSCAPES

Having described some causal metatypes in science theories, I want to go on to examine the epistemological types that

correspond to them. Epistemological types have been variously labeled "models," "logics," "paradigms," and "epistemologies." I have spoken of "psychotopology" in this connection (1978b). None of these labels seems satisfactory. Recently I have been using the term "mindscapes," which seems to me to suggest something richly varied. In this article I use the term "mind-scape" to mean a structure of reasoning, cognition, perception, conceptualization, design, planning, and decision making that may vary from one individual, profession, culture, or social group to another.

There are many types of mindscapes, possibly as many as there are individuals. For practical purposes, it is useful to distinguish four and their combinations (see table 1).

Homeostatic interactions maintain a certain pattern among heterogeneous elements. Morphogenetic interactions generate more heterogeneity and create new patterns among increasingly heterogeneous elements.

Mixtures of these types can be indicated by letter combinations, for example, HI, predominantly hierarchical but slightly individualistic; IG, mainly individualistic and somewhat morphogenetic, etc. It is important to note that S and G are *not* between H and I: they are in a different dimension.¹

The characteristics of these four mindscape types are listed below in some detail, showing the very close and complex inter-

¹ There are different degrees of mixtures between the four "pure" mindscape types. How can mixtures be represented graphically? Let us consider a tetrahedron, a pyramid shape with a triangular base. The four corners (three on the ground plus the summit) are equidistant from one another. Let the four corners represent the four "pure" types H, I, S, and G. The order in which these corners are named is irrelevant, because the pyramid is symmetrical with respect to any corner. The side *opposite* the Corner H is called a zero-H plane, because it is most distant from H. The side opposite the Corner I is called a zero-I plane, and similarly for zero-S plane and zero-G plane.

A mixture is represented as a point inside the pyramid. The degree of mixture corresponds to the distances from the four planes.

Let us for the time being focus our attention on the *qualitative* aspects rather than the quantitative aspects of this representation. The following considerations are important: (1) The four types, H, I, S, and G, do *not* line up on a straight line. S and G are *not* between H and I. In fact, none of the four is between any of the others. (2) The corners are equidistant from each other. (3) The line connecting S and G is perpendicular to the line connecting H and I: the two lines are *not parallel*. The representation is very appropriate in these *qualitative* aspects.

On the quantitative side, the representation is *too* accurate, i.e., it has an unrealistic accuracy. Mathematically, for any given point inside the pyramid, the sum of its distances from the four planes always equals the height of the pyramid. In other words, the four components always add up to exactly 100%. But we must emphasize that in reality the mixtures are qualitative, not quantitative. The components cannot be separated into volumes which add up to exactly 100%. The mixtures are not additive. To use a metaphor, the mixtures are more chemical than physical. Or, in another metaphor, it is like mixing several colors. Therefore I must caution readers against being carried away by the quantitative elegance of the representation.

It is interesting to observe how a person would put the tetrahedron on the table. H-type thinkers would undoubtedly put the H vertex pointing to the ceiling, while others would probably not care which corner was "at the top." (For further details, see Maruyama 1979a: 22.)

relations between the ways each mindspace type organizes social view, ethics, decision making, aesthetic principles, design, social activity, causality, logic, knowledge, perception, cosmology, and science. I will then discuss the implications of these interrelations for the development of science-theory types.

1. *Overall philosophy*

H: The parts are subordinated to the whole. There is a best way for all individuals. Universal principles apply to all. Society consists of categories, supercategories, and subcategories, structures, superstructures, and infrastructures.

I: Society is merely an aggregate of individuals who think and act independently. Only individuals are real.

S: Society consists of heterogeneous individuals who interact to mutual advantage. Interactions maintain a harmonious pattern of heterogeneity or go in cycles. Interactions are non-hierarchical.

G: Heterogeneous individuals interact for mutual benefit. Nonhierarchical interactions generate new diversity, new patterns, and new harmony and seek new relations for mutual benefit.

2. *Ethics*

H: The stronger should dominate the weaker. One individual's gain is another's loss (zero sum). Decisions should be made by comparative number of votes (domination by quantity) or by consensus (assumption of the existence of a best solution for everyone). What benefits a greater number of people is better than what benefits a smaller number of people. What is good for the majority is also good for minorities. Minorities may be sacrificed or ignored. Differences generate conflict, while sameness fosters peace; therefore all persons should be made equal or similar or persons who are different should be eliminated. The weak, the sick, the poor should die; the superior race or social class should survive and rule. Those who are not "standard" are abnormal, deviant, or delinquent and should be punished or eliminated.

I: Everybody should be self-sufficient. Being poor is a person's own fault. One should do his/her own thing, grow his/her own potatoes. Social obligations should be minimized or eliminated; privacy, insulation, and isolation should be stressed. Interactions are mutually harmful (negative sum). One should vote in one's own interest (statistical tabulations will take care of the rest and legitimize one as democratic).

S: Different individuals help one another by virtue of being different. Differences are desirable, necessary, and beneficial. Sameness generates competition and conflict, while diversity enables mutual benefit. All parties can gain from interaction (positive sum). There is harmony among diverse individuals. Harmony should be maintained.

G: Different individuals should help one another. Differences are desirable, necessary, and beneficial. Sameness generates competition and conflict, while diversity enables mutual benefit. All parties can gain from interaction (positive sum). New diversity should be generated. Mutually beneficial relations with new elements and aliens should be sought. New patterns of harmony should be generated.

3. *Decision making*

H: Decisions are made by majority rule (voting), consensus, or leaving it up to experts who know the best way. The decision, once made, is applied uniformly to everyone.

I: Each person should be independent of others.

S: Plans are generated by members of the community and pooled. The overall plan makes use of heterogeneity and individual differences. Ways to combine heterogeneous elements in mutually beneficial relations are sought. If a particular decision would create hardship for some individuals, ways to compensate for the hardship should be devised.

G: Same as S.

4. *Environmental policy*

H: The relationship between industry and environment is

zero-sum. One person's gain is another's loss. Therefore, to protect the environment it is necessary to reduce industry; to improve industry environment must be sacrificed. One must think in terms of tradeoffs.

I: If people abandon the city for the countryside and each person grows his/her own potatoes, there will be no environmental problem.

S: Nature has attained a very delicate, static equilibrium. Killing a single insect is disturbing nature. Nature should be kept unchanged.

G: Nature is changing all the time. It is unnatural for the environment to be kept unchanged. The relationship between humans and environment can be mutually beneficial (positive-sum). Mutually beneficial relations between humans and environment should be sought or created. (For example, human urine and feces could be used as fertilizer with the help of advanced transportation systems and treatment systems to kill the eggs of intestinal worms.)

5. *Values*

H: Values may be rank-ordered (e.g., Maslow's hierarchy of values), and the ranking is valid for all cultures because human nature is the same everywhere. A list of "basic human needs" can be applied to all cultures uniformly. "Consciousness" is separate from and nobler than body. "The inner frontier" (exploration of mind) is more important than the "outer frontier" (geographic, technological, or scientific exploration). Values can be classified neatly into categories. The meaning of each value can be defined and does not change from community to community, from culture to culture, or from individual to individual. Universally valid scales to measure the "quality of life" can be constructed. Personal integrity consists in adhering to higher values regardless of the situation.

I: Each person has his or her own value system. Furthermore, each value is independent of other values. The meaning of "quality of life" varies from individual to individual. How a person behaves depends entirely on his or her personal value system. Personal integrity consists in adhering to one's own value system regardless of what other people say or think.

S: Values are interrelated. They cannot be separated into independent categories. They cannot be rank-ordered. The meaning of each value depends on situations, contexts, and cultures. It cannot be defined universally. "Basic needs" will vary with the culture. How a person behaves is determined mostly by his or her relationship to others and by the social situation and context. A person's opinion is contextual (neither an abstract categorical principle nor an individually isolated opinion which disregards other people). Personal integrity consists in behavior and opinion which reflect social situation and context. (This type of integrity is often interpreted as inconsistency, dishonesty, or deception by those who have H or I mindscapes.)

G: Values are interrelated and cannot be classified or rank-ordered. Values can interact and generate new values and new meanings. New situations and new contexts arise. Personal integrity consists in inventing new patterns of behavior which generate mutual benefit in new situations and new contexts.

6. *Aesthetic principles in urban design and architecture* (Maruyama 1978c)

H: Unity is achieved through repetitions, similarities, and symmetry. The dominant theme is reflected in subdominant themes. Mass opposes space; space is defined as between masses. There is tension between objects or points. Lines are extended from objects to form shafts of space. Curves are defined by the contour of physical mass. Space is a transparent mass and has boundary, volume, identity, and specialized function.

I: Emphasis is on randomness, capriciousness, the unexpected.

S: Repetitions and similarities are avoided. There is harmony of diverse elements and interrelations between elements.

The aim is to create a self-contained miniature universe, a completed pattern which cannot be disturbed. Objects are a condensation of the quality of the locality or space and do not oppose space. Outdoors and indoors interpenetrate, lacking boundaries. The building sucks the outdoors in rather than standing out against its environment. Rooms are convertible, connectable, nonspecialized, and not filled with specialized furniture.

G: Repetitions and similarities are avoided. There is a *changing* harmony of diverse elements. Buildings are designed for multiple and changing interpretations, with deliberate incompleteness to allow additions and alterations. Interrelations between elements represent a growth process, a flow. An imaginary curve or spiral may be suggested by the relative positions of objects, but *not* by the objects themselves. Curves extend and may not return. Objects represent space and do not oppose it. Outdoors and indoors interpenetrate. Rooms are connectable, convertible, nonspecialized.

7. *Choice of alternatives in design and architecture*

H: There is a best design for all persons.

I: Each person should have a "cubicle" in which to do anything he/she chooses. The role of the architect is to provide people with recombinable parts which can be assembled in many different ways. Each person makes his/her own design, unrelated to other people's. Similarly, each ethnic or cultural group should have a separate community within the city, unrelated to one another.

S: Each person has his/her own specific needs and specific ways of relating to others. Therefore each person's house (apartment, room) is different from others' and has a different type of relationship to others' houses (apartments, rooms). Likewise, each community or cultural group has its specific needs and specific ways of relating to other communities or cultural groups. The role of the architect or planner is to find mutually beneficial combinations of many different types and to relocate or reorganize the combinations which are not mutually beneficial. Once a satisfactory pattern is found, it can be considered semipermanent. Each pattern is a miniature universe consisting of heterogeneous elements.

G: Each person, community, and cultural group has specific needs and specific ways of relating to other persons, communities, or cultural groups. These relations keep changing. Interactions generate new needs and new relations. Therefore houses and communities must be designed to allow for changes. The budget must allow for small annual (or quarterly) alterations instead of a large, lump-sum, one-time expenditure on a permanent design (Alexander 1975).

8. *Social activity*

H: One should socialize within a homogeneous group (same culture, same social class, same age-group, etc.). There is a hierarchy of groups, subgroups, and supergroups. Activities are organized hierarchically. Group cohesion is important.

I: One should avoid social obligations and commitment and emphasize caprice as opposed to scheduling and planning.

S: Emphasis is on mutual dependency, sharing of intimate concerns, perpetuation of familiar relations and familiar events, preservation of established harmony.

G: Emphasis is on making new contacts, generating new purposes and activities through interaction, generating new mutually beneficial relations and dissolving relations which are no longer beneficial.

9. *Religion*

H: A creator and prime mover, who is omnipotent, omniscient, and perfect, designed the universe and its elements. Either he has already predetermined the events of the universe or he is constantly monitoring and controlling them. Missionary work should be undertaken to convert others. All religions worship the same god by different names. Another version of H-type religion is mysticism advocating convergence into one-

ness or to the same end state (such as Teilhard de Chardin and some versions of Hinduism).

I: Each individual has his/her own beliefs.

S: There is harmony and interaction among many gods as well as between gods, humans, animals, plants, natural forces, and spirits of the dead. There is no hierarchy among gods or between gods, humans, animals, plants, natural forces, and spirits of the dead. Each can influence others. Gods are not perfect, omniscient, or omnipotent. They may or may not be personalized. In the latter case, they may be either supernaturals or part of natural phenomena. Religious practice consists in maintaining harmony and restoring disturbed harmony.

G: Similar to S, with the difference that G is more oriented toward change and looks for new harmony when new elements are added or new events occur.

10. *Causality*

H: Two things cannot cause each other. Cause-effect relations may be deterministic or probabilistic. Many things may jointly cause one thing, and one thing may cause many other things at the same time, but there are no causal loops.

I: Independent events, each having its own probability, are the most natural. Nonrandom patterns and structures are improbable and tend to decay.

S: Many things can cause one another through short or long causal loops. (It is neither necessary nor true that everything causes everything else directly.) Interactions maintain a pattern of heterogeneity. Deviations from the pattern are corrected by mutual interactions. Cause-effect relations may be probabilistic or deterministic.

G: Many things can cause one another through short or long causal loops. Interactions generate more heterogeneity and produce new patterns of mutually beneficial relations.

11. *Logic*

H: Logic is deductive and axiomatic. The more general has priority over the more specific. The law of identity holds (A is A ; A is not B). Categories are mutually exclusive (if one is a Buddhist, one cannot be a Christian). Logic may be either bivalued (yes or no) or multivalued. If multivalued, the values can be ordered (for any two values A and B , one and only one of the following is valid: $A > B$, $A = B$, or $A < B$). Circular reasoning is forbidden. Reasoning must be sequential, without loops.

I: Each question has its own answer, unrelated to others. (This is different from "inductive logic," which obeys the laws of deductive and axiomatic logic.)

S: Logic involves the simultaneous understanding of mutual relations (no sequential priority). Definitions are mutual, not hierarchical. The law of identity is irrelevant (A is not just A by itself, but something which exists in relation to B , C , D , etc.; its meaning changes depending on its relations to others). Categories are not mutually exclusive (one goes to a Shinto shrine to get married, to a Christian church for Christmas, to a Buddhist temple when one dies). Logical values cannot be ordered.²

G: Same as S.

12. *Knowledge*

H: There is only one truth. If people are sufficiently educated or informed, they will agree. There is a best way for all persons. Knowledge of general rules is higher than the knowledge of specifics. One should seek universal principles. Facts reflect

² The Japanese children's game Jan-ken-pon illustrates a non-hierarchical logic. In the game, two or more persons show a hand simultaneously at the signal "jan-ken-pon." There are three hand shapes one can choose: a fist representing a pebble, a spread palm representing paper, or two fingers stretched out representing a pair of scissors. Pebble defeats scissors, scissors defeat paper, and paper defeats pebble. No one shape is an absolute winner. Whether a person wins or loses depends on the other persons' hand shapes.

universal principles. Objective reality exists independent of the perceiver. Differences in perception are due to error and lack of objectivity. Quantitative measurement is basic to knowledge. Unmeasurables are unreal or invalid.

I: One should seek the specific pieces of information needed for one's activity; it is useless to look for universal principles or to learn beyond one's interest.

S: Binocular vision enables us to see three-dimensionally, not because the two eyes see different sides additively, but because the difference between the two images enables the brain to compute the dimension which is invisible to both eyes. Likewise, subjective differences between several persons enable them to compute the dimensions which are invisible to all. This is called "polyocular vision" (Maruyama 1978e) or "cross-subjective analysis." Objectivists consider differences as errors and discard as unreal the parts of an object on which the eyes do not agree. This procedure eliminates all parts of the object except the flat portions perpendicular to the viewer. The result is much less than a monocular vision and is a gross distortion of reality. "Let us stick to the parts on which we agree and ignore the parts on which we disagree" is a widely practiced objectivist principle which distorts reality not only far more than the polyocular principle, but also more than a simple monocular vision.

G: Same as S.

13. Perception

H: One rank-orders, classifies, and categorizes, looking for regularity and universal validity. Differences and variations are exceptional, accidental, abnormal, delinquent, or deviant; they play no central role and are to be ignored in overall considerations. One perceives sequentially.

I: One isolates. Everything is unique and unrelated to others.

S: Meaning depends on the context and the situation. If these are known, meaning can be known. One perceives simultaneously.

G: Things change and relations change. Contexts and situations also change. Therefore meanings change and new meanings arise. Multiple meanings and ambiguity are basic to further development and change. One perceives potentials and alternatives.

14. Cosmology

H: The universe is homogeneous in time and space. Processes are repeatable with the same probability at different times and in different places if the conditions are the same (probabilistic or deterministic).

I: The most probable state is random distribution of independent events, each having its own probability. Structures are nonrandom and improbable and therefore tend to decay. The universe *decays*.

S: There is harmony among heterogeneous elements. Harmony is maintained because mutual interactions correct disharmony. Decay can be counteracted. The universe *maintains itself*.

G: Interactions generate more diversity, new combinations of mutually beneficial relations, new patterns, and a rising level of sophistication of biological, social, and some physical systems. The universe *grows*.

I have described some aspects of four "pure" mindscapes at the overt, covert, and abstract levels, but in actuality the types are quite mixed. In European cultures, H mindscapes have been predominant. Most of the rebels within the European tradition, including the medieval nominalists and some of the existentialists of the 19th and 20th centuries, have had mostly I mindscapes. In most of the philosophers, however, we find mixtures of mindscape types. Kierkegaard's version of existentialism was one of extreme individual isolation; the only possible communication between two individuals was through God. Although the main orientation of his philosophy was that of an I mindscape, his notion of God gave it the flavor of an H mind-

scape. Therefore he might be said to have had an IH mindscape. Sartre stressed the individual's responsibility and freedom to choose without any possibility of blaming others for his decisions. In this regard his mindscape was strongly I-type. His notion of responsibility toward others, however, made his philosophy a nonisolationist one. Furthermore, his emphasis was on visualizing new alternatives and making choices in directions different from the present one. Thus he may be said to have had an IG mindscape. Heidegger was even more preoccupied with the individual's care and concern for others; psychologically he was dependency-oriented. His was an IS mindscape.

Islam is more hierarchical and homogenistic than Christianity, but in many African and Asian countries Islam is reinterpreted in ways compatible with the local culture, which may be homeostatic or morphogenetic.

Japanese culture has three main sources: the somewhat morphogenetic Jomon culture, which began 9,000 years ago; the homeostatic Yayoi culture, which began 2,300 years ago; and the hierarchical Yamato culture, which arrived via Korea about 1,500 years ago. Each Japanese incorporates these three cultures and some additional influences from Europe, the U.S.A., and other countries. In some Japanese, the H mindscape is predominant, while in others the S type is more conspicuous. Most Japanese have either an HSG mindscape or an SHG mindscape. Occasionally one finds a GSH mindscape, but I-dominated mindscapes are very rare.

Similarly, various combinations may be found in other cultures. The mindscapes of many Mandenkas (Camara 1975) are GH-type. Navajos (Kluckhohn 1949, Maruyama 1967) tend to have SGI mindscapes.

Readers can more or less determine their own mindscapes by the ways in which they have reacted to the scheme of categories just presented. The reader who has asked himself/herself whether the classifications and the categories were universally valid, nonoverlapping, and comprehensive (exhaustive), found that they were not, and tried to replace them with his/her own has an H mindscape. The reader who rejects any categorical scheme has an I mindscape. The one who feels that any categorization depends on the context and may vary from situation to situation has either an S or a G mindscape. My own mindscape is G-type. I do not use categories in my thinking. I have learned, however, that most Europeans and white Americans cannot think without categories. Therefore I have devised a categorical scheme for the convenience of those who think in categories. When I make such a categorization, however, it comes out differently each time, depending on the context.

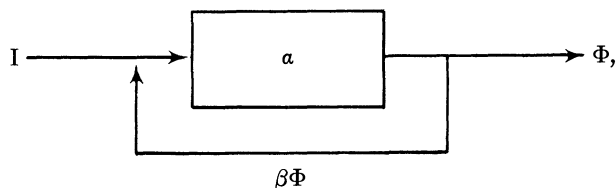
The relationship between mindscapes and scientific theories is very intricate and complex and has deep roots. A mindscape is formed over a long period in the life of an individual. Therefore, it is not easy for an individual to switch between scientific theories that correspond to different mindscape types. Some concepts can only be grasped in terms of a particular mindscape. The mindscape called for by a given concept may be "natural" for some persons and unnatural or inconceivable for others. The latter may "learn" to "understand" the concept through an intellectual process such as a mathematical model but will tend to slip back from this understanding or distort it. More often, the individual will simply be unable to accommodate concepts calling for mindscapes different from his or her own and interpret them, without realizing it, incorrectly (Maruyama 1979b).

One example of the distortion produced by mindscape differences—that involved in the social scientific conceptualization of heterogeneity—has already been mentioned. Two others come to mind from my own experience.

In my immediately postgraduate years, I spent five years in Germany, Denmark, and Sweden (1954–59). At that time, cybernetics was already widely known among intellectuals. For me the concept of simultaneous reciprocal causality was so natural that I assumed that everybody understood it. When I

tried to discuss it with my social science colleagues in Europe, however, I found that they had a great deal of difficulty in grasping it. In order to "understand" it, they had to break down the causal loops into a sequence of one-way causal relations going back and forth. I thought it might help them understand it if I explained it mathematically, since mathematicians have no difficulty in putting simultaneous relations into a set of mathematical equations and solving them. Therefore I presented them with the following simple example:

In an audio amplifier or a telephone circuit, there is a tendency for most stages to boost one range of sound pitch more than another. Alternatively, the vacuum tube or the transistor may get old and change the amplification factor. One method commonly used to counteract this tendency is to subtract a certain percentage of the output from the input of the stage. Simplifying the mathematics to the bare minimum, one may state the relationship as follows:



where I is the amplitude of the input, Φ is the amplitude of the output, α is the amplification factor, and β is the feedback factor. (The feedback is taken as voltage with very little current and therefore does not affect the output.) Thus we obtain $(I - \beta\Phi)\alpha = \Phi$ or $\Phi/I = \alpha/(1 + \alpha\beta)$, which is the stage gain. If α is 1,000 and β is 0.1, then the stage gain is $1,000/101 = 9.90990$ If α drops to 500, the stage gain is $500/51 = 9.8039$ In other words, the stage gain remains fairly constant when α varies for different frequency ranges or with time. This can be calculated because both the feedback and the amplification are given simultaneously in an equation. For more complicated simultaneous relations, the variables may be given in many equations which are solved together simultaneously.

If one attempts to "understand" the relations by considering the process as a sequence of one-way causal relations going in one direction at a time, then the input is I , the output without feedback is $1,000 \times I$, and the feedback factor is 0.1, making the feedback amplitude $100 \times I$. Subtracting $100 \times I$ from the input, however, is a logical impossibility.

Even with this explanation, my colleagues could not "visualize" simultaneous reciprocal relations. They still had to decompose them into sequential relations. At the time I attributed this to their lack of mathematical training. I was not yet experienced enough to diagnose it in terms of their mindscapes.

At a conference at Princeton University in May 1979, I heard John Freeman of Rice University describe his klystron, a device very much like a vacuum tube that emits radio waves or microwaves when sunlight strikes it. Before its invention, the conversion of sunlight into microwaves had to go through several intermediate steps. One way was to convert sunshine to electricity by means of solar cells (photovoltaic devices) and use the electricity to run microwave generators and amplifiers. Another way was to convert sunlight into heat by means of focused mirrors and use the heat to turn a turbine or other device to generate electricity for microwave generators and amplifiers. The klystron bypasses these steps. Since each klystron transmits a limited amount of energy, an array of many klystrons is needed to transmit a large quantity of energy.

The first thing that occurred to me on hearing all this was the problem of mutual induction among klystrons. The microwave emitted by each klystron will affect other klystrons. The klystrons in an array will excite or inhibit one another, syn-

chronize one another, or pull one another out of phase, depending on how they are spaced in relation to the wavelength. The easiest solution that occurred to me was to make use of the mutual induction and let the klystrons synchronize themselves by carefully spacing them in relation to wavelength and the phase shifts which may occur within each klystron. Klystrons could be arranged in a two-dimensional plane, each having six immediate neighbors 60° apart at a distance to be determined by wavelength and internal phase shifts. The effects of klystrons other than immediate neighbors would be weaker because of their distance and could be ignored. Further, mutual induction could be used to keep the klystron oscillations at the desired frequency. Tuning in the microwave range is different from tuning in the radio frequency range. At radio frequencies where the wavelength is over 10 meters (the high end of the shortwave radio range), tuning is accomplished by the coil or capacitor, which is part of the resonant circuit. At the microwave range, where the wavelength is on the order of centimeters, the lengths of the circuit components have considerable effect on the resonant frequency, and adjustment of these lengths can be used for tuning. Similarly, adjustment of the distance between klystrons related by mutual induction could be so used.

If the klystrons in a two-dimensional array are synchronized, the resultant beam will be perpendicular to the plane of the array. Freeman's notion of a beam angle of 45° , using phase-giving signals from outside to trigger each klystron, overlooked the mutual-induction effect, which would be nonlinear and could easily override the external signals. Freeman had simply not thought of the mutual-induction effect. After his lecture, I mentioned this problem to him and several other physicists present. Their immediate reaction to the idea, which reflected their H mindscapes, was that the klystrons would have to be *insulated* from one another. They wanted to eliminate the mutual induction instead of making use of it and impose an external signal hierarchically. They may eventually come to recognize the advantage of making use of mutual induction or at least attempt to evaluate its effects. What is crucial is that in so doing they will be approaching the idea intellectually, against their psychological pattern, while I arrived at it psychologically and then confirmed it intellectually.

Whether a mindscape is innate or learned, how early in life it is formed, and whether, once formed, it can be changed are questions for which the available data provide only partial answers. I shall discuss some of these data, the partial answers they offer, and the needed directions of future research.

The most extensive data on epistemological types are those of Harvey (1966). He has administered psychological tests to university students over a number of years and identified four epistemological types (pp. 44-46):

System 1: "high absolutism and closedness of beliefs; high evaluativeness; high *positive* dependence on representatives of institutional authority; high identification with social roles and status positions; high conventionality; and high ethnocentrism"

System 2: "deep feelings of uncertainty, distrust of authority, rejection of the more socially approved guidelines to action" accompanied by lack of alternative referents; "psychological vacuum," "rebellion against social prescriptions," "avoidance of dependency on God, tradition."

System 3: "manipulating of people through dependency upon them. . . . fairly high skills in effecting desired outcomes in his world through the techniques of having others do it for him"; some "autonomous internal standards, especially in the social sphere," some "positive ties to the prevailing social norms."

System 4: "high perceived self-worth despite momentary frustrations and deviation from the normative, . . . highly differentiated and integrated cognitive structure," flexible, creative, and relative in thought and action; "internal standards

that are independent of external criteria, in some cases coinciding with social definitions and in others not."

Readers may have noticed some similarities between my types and Harvey's, but they were developed quite independently. I published the distinction between the homeostatic type and the morphogenetic type in 1961, as well as their differences from the H type and the I type, although I did not call them by these names at that time. In 1974 I published three epistemological types, and in May 1976 I completed a manuscript on five epistemological types which was published in 1977. In June 1976 I met Harvey by coincidence, and when he and I compared notes we were surprised and delighted by the fact that our typologies had many similarities: his Systems 1, 2, and 4 were almost identical with my H, I, and G types, though his 3 was considerably different from my S.

Harvey's voluminous data indicate that approximately one-third of first-year university students are of System 1, another third are distributed among the other three systems, and the rest consist of mixed types; the percentage of System 1 is smaller in the higher academic years among liberal-arts majors but greater among education majors. The data are not longitudinal; therefore it is not known whether the percentage change over the years is due to attrition or to "brainwashing." If longitudinal studies were made, Harvey's tests could show whether mindscapes can be changed by learning. However, they cannot be administered to children: the stimuli are verbal statements, and the responses are degrees of agreement or disagreement.

Cohen (1969, 1971) has used nonverbal tests (Sigel's Test of Conceptual Style) to study mindscapes among schoolchildren. Each stimulus is a set of three pictures. The subject is asked to choose the two pictures that are alike. Depending on which two pictures are chosen, the subject is scored either "analytical" or "relational." Cohen found that Chicano and black children tended to be relational, while white middle-class children tended to be analytical. She also applied this test to different professional groups and found differences among professions (Cohen 1973). Since the test is nonverbal, it can easily be administered to children and in cross-cultural studies. If the test were used in longitudinal studies, it could answer two of our questions: How early in life is the mindscape formed? and Can the mindscape be changed?

A third set of data comes from Japan. Tsunoda (1978) found that natural sounds such as wind, waves, animal cries, bird songs, and insect songs are processed primarily in the dominant brain hemisphere in Japanese individuals but in the nondominant hemisphere in Europeans. Similarly, nonverbal human vocalizations such as laughing, snoring, sighing, and yawning were processed primarily in the dominant hemisphere in Japanese individuals and in the nondominant hemisphere in Europeans. Furthermore, Tsunoda found that Japanese brought up in the Americas showed the same pattern as Europeans, while some Europeans brought up in Japan showed the same pattern as Japanese. Therefore these differences are cultural rather than genetic. Data on a few individuals who had moved from one culture to another in childhood suggest that the pattern formed in childhood does not change after the age of 10, but a larger sample would be required to ascertain the age at which the pattern becomes irreversible.³

³ Tsunoda (1978) reports on the results obtained by seven methods:

1. *Delayed auditory feedback.* In these experiments, the subjects performed electrical key-tapping tasks much like the old telegrapher. Prior to the testing, the subjects practiced tapping of simple patterns such as three dots, three dots, three dots or four dots, four dots, four dots until they could repeat the patterns indefinitely without much effort. In the tests, auditory feedback reached one ear without delay and the other with a 0.2 second delay by means of stereophonic headsets while the subjects performed the key-tapping tasks. (The sensitivity difference between the two ears had been pretested and the amplifier levels had been preadjusted accordingly.) Each tap acti-

Harvey's, Cohen's, and Tsunoda's data cover some, but not all, aspects of mindscapes. Other types of tests are needed. The following types of stimuli might be incorporated into new tests to examine other aspects of mindscapes.

In my lectures on cultural differences in epistemological and aesthetic principles, I usually begin with slides showing design principles with which the American and European audience is familiar—for example, a Gothic cathedral or a palace—and ask my audience: "What are the principles of this design?" The first response is, as one would expect, "Symmetry." Then I say that there are other, more basic principles and ask the audience what they are. Usually no one responds. These principles are so taken for granted that no one is conscious of them. I point out that one of the principles is unity through repetition and similarity, another hierarchy, and a third reflection of the main

vated various types of tape-recorded sounds for 50–75 milliseconds. This short duration was chosen to prevent the subjects from identifying the nature of the sound. What the subjects heard were clicking sounds. The delayed-channel sound amplitude was gradually increased to the level that disturbed the tapping task. Then that decibel level was registered. Then the channels were exchanged between the two ears and the procedure was repeated. The difference between the two levels of disturbance threshold was interpreted to indicate which cerebral hemisphere was primary for that particular type of sound: the more sensitive to the interference, the more primary the hemisphere for that type of sound.

The initial series of experiments employed two types of sounds: pure 1,000-cycle waves and the vowel "a" (pronounced as in Italian or Spanish). Both a Japanese voice and a European voice were used for the vowel. Data on 25 Europeans indicated that both the 1,000-cycle waves and the "a" had primarily in the nondominant hemisphere. Data on 9 Japanese born in South America and 1 mixed-blood born in the U.S.A. showed, except for one subject, the same pattern as for Europeans. In the exceptional subject, the "a" had primarily in the dominant hemisphere while the 1,000-cycle waves had primarily in the nondominant hemisphere. This subject had been brought up Japanese until the age of 10, when she began to go to school and shifted to non-Japanese education.

The second series of experiments used four types of sounds: (1) vowels and consonants; (2) nonlanguage vocalizations such as humming, an infant's cry, laughing, snoring, sighing; (3) insect songs, animal cries, and bird songs; (4) pure 1,000-cycle waves, an orchestra playing one tone in unison, a church bell, a whistle, helicopter noise. Each subject was tested at least on five different days. Data on 14 Japanese subjects showed that in 13 of them, vowels, nonlanguage vocalizations, and the voices of insects, animals, and birds had primarily in the dominant hemisphere while the mechanical sounds (including the orchestra) had primarily in the nondominant hemisphere. In the one exceptional subject, all sounds had primarily in one hemisphere. (Such monohemispheric individuals are discussed in a separate chapter.) Data on 14 Europeans showed that in all subjects, the consonant-vowel-consonant combinations (speeded up by four times and activated longer than 75 milliseconds) had primarily in the dominant hemisphere, while nonlanguage vocalizations, voices of animals, birds, and insects, white noise, "a," 1,000-cycle waves, and frequency-modulated tones had primarily in the nondominant hemisphere. Data on 7 Japanese born in the Americas showed the same pattern as for Europeans. This result is of particular interest to anthropologists, as it indicates an important cultural, nongenetic difference in the cerebral processing of nonverbal vocalizations, animal cries, and insect and bird songs.

Further experiments were made using harmonic sounds and inharmonic sounds in order to find clues as to on what sound characteristics the brain distinguishes biological sounds from mechanical sounds. Examples of harmonic sounds used were 1,000-cycle waves plus 2,000-cycle waves (which gives the ratio of 1 to 2, or the interval of an octave); 1,000-cycle waves plus 3,000-cycle waves (with the ratio of 1 to 3, or the interval of an octave and a perfect fifth). Subjects responded to harmonic sounds as they did to pure 1,000-cycle waves and mechanical sounds and to inharmonic sounds as they did to vowels and frequency-modulated sounds.

Moreover, Japanese responded to Japanese musical instruments with the dominant hemisphere and to European musical instruments with the nondominant hemisphere, while in Europeans and South American Japanese both types of musical instruments had primarily in the nondominant hemisphere. In other words, Japanese treated Japanese musical instruments in the same way as for biological sounds, while processing the European musical sounds as mechanical sounds. On the other hand, Europeans treated all musical sounds as mechanical sounds.

The traditional way to play Japanese music instruments is to make

theme in subthemes. Sometimes I also show a slide of the Pei Towers in Philadelphia and explain that one of the reasons this design was chosen was that the proportions of the rectangular grids on the surfaces of the towers are an enlarged repetition of those of the windows of the old historical buildings which serve as a foreground for them. Next I show a slide of a Japanese garden and ask my audience what the design principles are. Invariably the first answer is "Asymmetry," which does not explain anything about the Japanese garden but indicates the audience's preoccupation with symmetry. When I press further, the response is usually that the Japanese garden is "natural," and when I ask what they mean by "natural" they usually say "random." It does not occur to the respondents that nature has patterns; anything that is not symmetrical is perceived to be random or chaotic. Then I explain some of the principles underlying the Japanese garden, among them avoidance of repetition,

the music instruments imitate human voices, while in the European music human voices are made to sound like music instruments. This is a probable reason for the fact that in Japanese the brain treats Japanese music instrument sounds in the same manner as human voices, while processing the European music instrument sounds as it does mechanical sounds. In order to check this possibility further, experiments were made in which some European instruments were played in such a way as to incorporate human vocal elements using two methods, *Flatterzunge* and U-blow. *Flatterzunge* is said to have been invented by Richard Strauss in order to play very rapid successions of notes, ascending or descending by half-tone steps, with woodwind instruments (flute, oboe, clarinet). The player vibrates his/her tongue "drrrrr" while blowing air into the instrument. U-blow is a method of playing a flute or a recorder in which the player vocalizes the vowel "u" (pronounced as in German or in Italian) while blowing air into the instrument. Experiments using flutes and recorders showed that in Japanese subjects *Flatterzunge* and U-blow were primary in the dominant hemisphere, while the normal blow was primary in the nondominant hemisphere. On the other hand, in European subjects all three were primary in the nondominant hemisphere.

Additional experiments using frequency-modulated sounds, elimination of vowel formant bands, and whispering (which has no formants) showed that in Japanese subjects vowels with all formants left intact and whispers had primarity in the dominant hemisphere, while vowels without upper formants (upper formants were removed by filtering) had primarity in the nondominant hemisphere along with frequency-modulated sounds, sawtooth waves, square waves, and pulse-wave forms. Thus, mutilated vowels were treated like mechanical sounds while intact vowels and whispers were processed as human voices.

2. *Sound-type loading.* In addition to the delayed auditory feedback, a third input in the form of sound vibration was applied to the middle of the forehead for bone conduction to create interference. In other words: (a) one type of sound was fed without delay for 50–75 milliseconds to one ear as the key was tapped; (b) the same sound was fed with 0.2 second delay for 50–75 milliseconds to the other ear; (c) another sound of a different type was continuously fed to the middle of the forehead.

In 18 European and American-born Japanese subjects, loading consonant-vowel-consonant combinations on vowels at 40 decibels above the threshold had the effect of moving the "a" from the nondominant to the dominant hemisphere. In other words, loading by a dominant-hemisphere sound on a nondominant-hemisphere sound moved the primarity of the latter to the dominant hemisphere. In the Japanese subjects, on the other hand, "a" is a dominant-hemisphere sound and was used to load on 1,000-cycle waves. In 5 Japanese subjects, at 10 decibels of loading, the primarity level of 1,000-cycle waves in the nondominant hemisphere decreased to about one-half of the original level; at 20 decibels of loading, the primarity of 1,000-cycle waves began to cross over to the dominant hemisphere; at about 40 decibels of loading, the primarity level of 1,000-cycle waves in the dominant hemisphere exceeded the original primarity level in the nondominant hemisphere. In 3 Japanese subjects, loading insect songs, Japanese music, and human humming at 30 decibels on 1,000-cycle waves moved the latter from the nondominant to the dominant hemisphere, while loading piano and cello solos had no effect.

3. *Delayed loading interference.* In this method, there was no time difference between the two ears. The two ears were treated as one with threshold adjustment between them. One type of sound was used as feedback without delay. Another type of sound with a 0.2 second delay was superimposed on the first in both ears to create interference. As a control prior to tests, the masking effect of white noise without delay on the "a" was measured, and no difference was found between Japanese and Europeans. In tests with delayed load-

ing, delayed "a" and insect songs interfered with nondelayed white noise more strongly than the interference of white noise on nondelayed "a" and insect songs in Japanese subjects. No difference was found in European subjects.

4. *Frequency-modulated sounds/ band-noise combinations.* In order to examine further what constitutes the characteristics distinguishing human voices from mechanical sounds, the following tests were made: A frequency-modulated sound centered near 1,800 cycles, with a band width of x (which was made to vary), was combined with a band noise centered at one-half of the middle frequency of the frequency-modulated sound, with a fixed band width of 100 cycles. The duration of the compound sound was 50 milliseconds, within which about two cycles of frequency modulation took place. The amount of x , as a percentage compared to the band width of band noise, was increased until the primarity of the compound noise moved from the nondominant hemisphere to the dominant hemisphere. Among 12 Japanese subjects, the level at which this occurred was 2.5%. In 11 Europeans and 3 South American Japanese, the level was between 10% and 20%. In 4 Korean subjects, the level ranged from 20% to more than 40%.

5. *Injection of chemicals into hemispheres.* Effects of intracarotid injection of chemicals such as pentobarbital were compared between Japanese subjects and Italian subjects. In Japanese subjects euphoria, laughing, etc., were induced by injection into the dominant hemisphere, while in Italian subjects the same effect is produced by injection into the nondominant hemisphere. This would seem to suggest that in the Japanese subjects the "emotional" has primarity in the dominant hemisphere, while in the Italian subjects its primarity is found in the nondominant hemisphere. In order to examine this possibility further, the following experiments were conducted.

6. *Olfactory loading, alcohol, and tranquilizer loading.* The hypothesis is that, if the "emotional" has primarity in the dominant hemisphere in the Japanese subjects, then various types of emotional "loading" should move the primarity of 1,000-cycle waves from the nondominant to the dominant hemisphere. In 13 Japanese subjects, olfactory loading by perfume moved the primarity of 1,000-cycle waves from the nondominant to the dominant hemisphere. It is important to note the duration of the effect, which is relevant to later discussions: After 60 minutes the primarity began to move back into the nondominant hemisphere, and after 90 minutes it returned to the original level in the nondominant hemisphere. In 4 subjects, the smell of cigarettes moved the primarity of 1,000-cycle waves from the nondominant hemisphere to the dominant hemisphere. The effect lasted between 15 and 120 minutes. In 2 subjects, consumption of 633 cc of beer moved the primarity of 1,000-cycle waves from the nondominant to the dominant hemisphere. The effect lasted between 120 and 135 minutes. The effect of a tranquilizer (Japanese name *Jazepam*, or "serenamin") was as follows: In 2 subjects, it moved the primarity of 1,000-cycle waves from the nondominant to the dominant hemisphere, and the effect lasted for 180 minutes. Among European subjects, perfume, alcohol, and tranquilizer loading has no such effect.

7. *Unilateral olfactory loading.* The next step was to test the effects of unilateral olfactory loading. This was complicated by the fact that there are two neural paths between the nose and the brain: ipsilateral and lateral crossing. When care was taken to distinguish the two, the findings not only were interesting but led to the discovery of the existence of a number of subjects who habitually or temporarily use one hemisphere only, even though the other hemisphere is not dysfunctional (see below).

It was found that ethyl alcohol had the same effects as perfumes. Since the smell of alcohol dissipates faster than perfume and is more convenient for experiments, alcohol was used.

In 35 Japanese subjects, loading on the nondominant side had no effect on the primarity of 1,000-cycle waves, though the shape of the

space. This difference originated in prehistoric times and is still very much alive.

In the European conceptualization, mass and space are in opposition. An example is the Parliament Library in Ottawa, Canada, which protrudes into space. Furthermore, space is often defined as something between masses. The Naval Hospital in Greenwich, England, is an example (Bacon 1974). It consists of two buildings situated side by side, separated by a space. The sides of the buildings facing the space are lined up with the two edges of a small Queen's House in the background. This defines a shaft of space, which extends from the Queen's House through the two hospital buildings toward the waterfront landing on River Thames. Such a space is a volume and a transparent mass.

In contrast, in one of the buildings at Katsura Palace in Japan (Tange and Kawazoe 1965), there is no opposition between mass and space. The garden penetrates into the building like a deep recess and as a sort of room. There is no wall to separate indoors from outdoors. In another building in Katsura Palace, the eaves extend over the stepping stones in the garden, and in the main building complex the Moon-viewing Platform protrudes into the garden beyond the cover of the roof. In many other palace-type old buildings, the walls lift up like garage doors, and indoors becomes outdoors. I call this the "outside-in principle." Another principle is the "black-hole principle." A building at Katsura Palace looks dark and inconspicuous from outside, as if camouflaged. Yet from the inside it is bright, because all the daylight is sucked into the building.

In the European concept of space, each space has an "identity," permanence, and a specialized function and obeys the Aristotelian law: A is always A; A is not B. Therefore rooms are permanently specialized as bedroom, dining room, etc., with specialized furniture. Most of the space in the room is taken up by furniture. In the traditional Japanese house, in contrast,

distribution curve changed slightly. However, loading on the dominant side shifted the primarity of 1,000-cycle waves from the nondominant to the dominant hemisphere. Moreover, the distribution curve was the mirror image of the curve without load (*not* the mirror image of the curve with nondominant side loading). In 7 European subjects, the effect of loading on the nondominant side was similar to that in the Japanese subjects, but loading on the dominant side did *not* shift the primarity of 1,000-cycle waves from the nondominant hemisphere. Moreover, the distribution curve of the 1,000-cycle waves changed to resemble the curve of "a." Of the American subjects born in Japan, 2 showed the same pattern as the Japanese subjects. Polynesians who grew up with Polynesian languages had the same pattern as the Japanese, while English-speaking Polynesians had the same pattern as Europeans.

Tests using four other of the ten standardized smells (rose smell, burning smell, dirty-sock smell, and peach smell) produced the same results as the tests using ethyl alcohol.

A number of monohemispheric (ahemispheric, not dyshemispheric) persons were discovered during the unilateral olfactory loading tests. This symptom was more frequent among intellectuals than among others. In one person, all types of sounds showed primarity in the right hemisphere. Dysfunction of left hemisphere was suspected. However, unilateral olfactory loading in the right nostril by ammonia moved the primarity of 1,000-cycle waves from the right hemisphere to the left hemisphere. There were also persons who became monohemispheric from time to time.

Relating to this discovery, it was also found that bilateral olfactory loading by smoking, as well as loading by tranquilizers and alcoholic beverages, can make Japanese temporarily monohemispheric for the duration of time previously indicated. Europeans do not suffer from this effect. Tsunoda cautions Japanese against frequent smoking (remember that the effect lasts between 15 and 120 minutes for each smoking).

8. *Additional tests on congenitally blind subjects.* It is often said that pictorial writing systems (such as Maya, Korean, Chinese, and Japanese) would exercise the mind differently from phonetic writing systems. In order to examine this possibility, Tsunoda included in the tests congenitally blind Japanese subjects, who had never seen pictorial writings. The 3 subjects showed the same pattern as sighted Japanese. It may be added that the Korean subjects showed European, and even super-European, patterns in the frequency-modulated-sounds/band-noise combination tests. Chinese subjects were found to have the same patterns as Europeans.

most rooms are unspecialized: the same room may be a bedroom at night, a dining room at mealtime, and a living room for the rest of the day. Mattresses, folding tables, etc., are stored away, and most of the space is free of obstacles and available to human movement. Furthermore, partitions between rooms are removable, and rooms are combinable. An unimpeded view of the garden may be obtained through two or three layers of rooms.

The concept of "boundary" is a preoccupation of European architecture. This applies to both the boundary between the outside and the inside and the boundary between rooms. Even when architects in this tradition talk about interpenetration, what they mean is a zigzag boundary, not boundarilessness.

Two other important principles in European architecture are tension and extension. The Champs Elysées in Paris developed from a straight-line extension of a medieval garden built outside the old city wall. The seven obelisks erected by a pope in medieval Rome created tension between them and became connected by straight roads for pilgrims. The principles of tension and extension generated the radiating and converging patterns of straight streets in Paris.

In European architecture, curves are defined by the actual contours of physical masses. A Japanese looking at a floral arrangement can visualize lines and curves between elements, but these lines and curves are not at all physically present; they are generated in the mind by the intricate patterns of interpenetration of the elements and the air. (Some modern floral arrangements use principles of opposition between mass and space and between color masses, definitely under the influence of Western aesthetics.)

Why are there such striking differences between the Japanese concept of space and that of Europeans? For the answer, we must look into prehistory (Tange and Kawazoe 1965). The earliest conceptualization of space in Japanese culture is related to the concept of *mononoke*. Each locality had a *mononoke* which, like the mana of the Polynesians, permeated the locality. In the beginning, the *mononoke* was quite undifferentiated and undefined, but later it was considered to condense into rocks, not very large in size. Rocks came to represent the special quality of the *mononoke* of the locality. Hence a rock represented the space instead of opposing it. The rock was the quality of the space, not a mass. This concept was incorporated into Japanese garden design and architecture. Hence there is no opposition between space and matter. With the cultivation of rice, land came to be conceived as property. Boundaries were marked with stakes, ropes, or pebble carpets, however, not by any physical mass or wall. Such space was still continuous with the outside. The concept of a space enclosed by a fence or wall arose with the arrival 1,500 years ago via Korea of the hierarchical Yamato culture, which had considerable influence on the mindscapes of Japanese, especially among the ruling class. At the same time, the principle of continuity survived and is still basic to Japanese mindscapes.

Katsura Palace teaches us another set of important principles (Tange 1972) which are quite morphogenetic. The main building of Katsura Palace was not designed with a master plan. Many changes and additions were made over a period of several generations. Its main building consists of three parts built at different times but intricately integrated. The pattern was capable of growing. In the garden there are different systems of stepping stones interwoven and existing side by side. There are also several pattern systems of pavement. Morphogenetic systems are designed for alternatives, multiple meanings, and deliberate incompleteness to enable further heterogenization, harmonization, and development.

Toward the end of my lecture, I show some slides intended to counteract stereotyped notions of "Eastern" and "Western" design principles—one from Pergamon, in Greece, showing a morphogenetic principle, and another of an ancient Chinese city design which is quite hierarchical.

The various design principles will provide us with a rich source of visual stimuli for testing mindscapes, especially those aspects of them not yet covered by Harvey's, Cohen's, and Tsunoda's tests. At the same time, their tests can be extended in content to cover many more aspects of mindscapes.

If carefully selected, slides presenting different design principles could be built into tests for mindscape types. The stimuli would be slides; the responses could be verbal or non-verbal or both. If verbal responses were sought, the test might elicit "explanations" of the slides or be used as a more open-ended Thematic Apperception Test. For nonverbal tests, the slides might be combined in the manner of Sigel's Test of Conceptual Style (but with a different rationale and different principles) or presented as a preference test.

A number of observations indicate that it is difficult to change one's mindscape in adulthood. For example, many of the members of the various counterculture movements of the '60s have either adopted I mindscapes or fallen back into the fallacies of the H mindscapes against which they originally rebelled; very few have incorporated S or G mindscapes. Do-your-own-thingism and the small-is-beautiful movement have often been distorted into isolationism and regionalism instead of heterogenistic interactive symbiosis, the ecology movement into static harmonism instead of the morphogenetic harmonism of natural systems, the "consciousness" movement into a mental-physical dichotomy and a rank-ordering of values, the new religions into universalistic homogenism, and holism into abstractionism instead of the relational study of specific contexts in real-life situations. With regard to the latter, I have found that for many students who consider themselves "holistic" what they mean by holism is "everything relates to everything else." This is a version of generalism and homogenism and belongs to an H mindscape. This type of holism is not only useless, but also provides students with an excuse to avoid studying anything specific. It simply ignores heterogeneity of elements and heterogeneity of interrelations. What we need is a study of specific types of interrelations among specific elements in specific situations and contexts—which I would call "relationism" in order to avoid confusion with the homogenistic version of "holism." Often "holists" say that they are against "reductionism," but the homogenistic version of holism is reductionism *par excellence*.

That changing one's mindscape as an adult is not impossible is suggested by a close examination of the work of Ilya Prigogine. Until recently, I had assumed that Prigogine had a G mindscape. Mathematically, his theory has many features of G mindscapes; it deals with differentiation-amplifying causal loops, increase of heterogeneity, and rise of structures. Yet in the discussions which took place at a conference in 1978 and in his writings, I have begun to discover that *psychologically* he has *come from* the background of an IH mindscape and still shows many traces of it:

1. He considers Democritus to be the forerunner and prototype of heterogenistic thinking. Democritus is known for his "atomistic" (individualistic) theory of the universe; he had an IH mindscape. Furthermore, he was rebelling against the predominantly H-mindscape philosophers of this time. This indicates that Prigogine's notion of heterogeneity may have an I-type basis.

2. He stresses "dissipation" in arguing against traditional thermodynamics. Traditional thermodynamics is based on the assumption that the most basic and probable state of the universe or of an isolated system is a state of random and even distribution of independent events, each having its own probability. On this assumption, structures and uneven heterogeneity are improbable and tend to decay with great probability into a random and even distribution. There are two main alternative ways to break away from this theory. One is to assume that events are not independent, but related by causal

loops. Because of the causal loops, structures and heterogeneity can either counteract the decay and maintain themselves or increase. The other is to assume that the "system" is not "isolated." The two assumptions are *logically independent of each other*, even though most physicists tend to think that the second is required for the first. Whether the second is a necessary condition or not, it is not a sufficient condition for structures and heterogeneity to grow. It does not explain *how* structures and heterogeneity can grow. If someone asks how a baby becomes an adult, the answer "the baby eats food" is neither interesting nor relevant, even though it is true. Similarly, if someone asks me how a computer works, I will not stress the fact that it is plugged into a wall socket. The clues to the differences in mindscapes lie not in whether the statement is true or logical, but in where the emphasis is put. Prigogine titled his theory "Non-equilibrium thermodynamics" and used the subtitle "Dissipative structures." In his talks and writings, "dissipative" is a key word. This can be interpreted in two ways: either Prigogine has to use it in order to communicate his idea to other theorists who have H mindscapes and are preoccupied with the question "What drives the system?" or he is himself preoccupied with this question.

3. What is important in a differentiation-amplifying causal loop system is not the initial kick, but the nature of the causal loops which amplify it (Maruyama 1961a, 1963). Mathematically, Prigogine is a champion of the amplification in causal-loop systems, but his conceptual emphasis on fluctuation seems too great to belong to a G mindscape. It is as if he were seeking a prime mover (a central concept in H mindscapes) and finding it in fluctuation.

4. Prigogine uses the term "equilibrium" in the sense of decay into a random, homogeneous state, while many others use it in the sense of homeostasis. This indicates that he has come from an I mindscape rather than from an S mindscape.

5. He is extremely interested in the process of bifurcation, particularly in connection with René Thom's catastrophe theory and its notion of "singular points" (branching points at which a smooth surface begins to fold into several wrinkled layers). A theorist with a G mindscape would consider any point in the process a potential branching point, but "singular points" occur rather infrequently and cannot be everywhere in the process. This indicates that Prigogine has more affinity with H mindscapes than with G mindscapes. Moreover, the branching point has the flavor of an identifiable "cause" of the change. Furthermore, Thom's theory rests on the contrast of dependent vs. independent variables and is not based on reciprocal causality, although it allows reciprocal causality among the independent variables.

6. Prigogine has shown a noticeable interest in the big-bang theory, which is congruent with an H mindscape.

These points are more psychological than logical. Logically and intellectually, Prigogine has a G mindscape, but psychologically he has probably *come from* an IH mindscape.

In summary, the currently available data seem to indicate that most mindscapes are learned rather than innate, that they are mostly formed in childhood, and that it is extremely difficult to change them later in life. This has serious implications for the development of science theories. As I have said, it is not easy for an individual to shift from one theory to another if these theories are based on different types of mindscapes. Since mindscapes cannot easily be changed in adulthood, then if we need new types of science theories we need to develop new types of mindscapes in children. Because we do not know what types of theories will be needed in the future, we need to encourage children to develop a wide range of mindscapes. At the same time, we must develop more sophisticated tests of mindscape types.

Comments

by KENNETH L. BEALS

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Serendipity is one of life's small pleasures. It sometimes comes from reading a contribution and recognizing that it has a use beyond its explicit purpose. I am intrigued by the heuristic value of the mindscape typology. To illustrate, guided design is a fairly new approach to instruction in which students are guided through a decision-making process while receiving written feedback to the decisions they make. It is a promising method for problems in applied anthropology, which frequently involve epistemological differences between societies. The list of type characteristics proved useful in writing guided-design feedback and in suggesting the kinds of conflict which might be anticipated if particular decisions were socially implemented. For someone who reportedly does not use categories in his thinking, Maruyama has remarkable skill in describing them.

I have no doubt of the relevance of mindscape types to the formation and defense of scientific theories. One merely needs to examine the interaction between commentators and contributors in this journal to realize the debates are often mindscape propaganda skirmishes with crossed epistemologies as tactical weapons.

Maruyama's paper, however, goes past a classification of pure types to inquire into mindscape nature—particularly whether mindscapes are “innate or culturally learned.” The author acknowledges one of the major difficulties in answering the question by urging that more sophisticated tests be developed. More bluntly stated, the question of whether different epistemologies are innate or culturally learned is not answerable without a valid and reliable instrument to differentiate them. Moreover, the data of Harvey, Cohen, and Tsunoda are considered to deal with mindscapes only in certain aspects.

It occurred to me that the cognitive-mapping profiles already devised by psychologists might serve as a model for a mindscape differentiation test. Cognitive maps have been used to measure components of perception, bias, and preference—which are (like mindscapes) mixed together in different proportions among people. The quantitative data from such maps have incidentally been applied to practical situations such as matching individuals with similar cognitive styles in an effort to enhance their mutual productivity. Such profiles are definite improvements over crude and subjective reports of modal personality types. One drawback is that many of the specific test items are culture-bound and would require modification for comparative ethnographic use. Nonetheless, the format and measurement scales could be adaptable.

Assuming that one were to create a valid and reliable mindscape differentiation test, a heritability study could in principle be performed. It is a virtual certainty that the results would lie somewhere between zero and unity rather than at either extreme. Furthermore, for technical reasons, an analysis of heritability is an approach to the problem which is somewhat different from the innate/learned causal assumption.

I would like to add to mindscape types the “either/or fixation,” which appears to fall in mindscape stereotype H. The fixation has a high frequency among the general public and a surprisingly high frequency among social scientists (where one might expect interactive mindscape models to predominate). It views human biology and culture as independent entities rather than interactive parts of a whole. If one has it, the question of whether mindscapes are innate or cultural (or predominantly one or the other) is indeed a sensible one to ask. Maruyama does so himself, although I presume he is putting the situation in common terms deliberately. I doubt that the question is genuinely meaningful when evidence for all organ-

isms, including people, shows that we are life cycles in which genetic endowment and life experience interact. Thus the either/or (even “predominately either/predominately or”) framework is at best an artificial one. Broad aspects of inferences from human behavior, such as mindscapes, intelligence, and aggressive predispositions, are composite abstractions in which the difficulty of ascertaining genetic influence is compounded by the ever present problem of what it is which is actually being measured.

by AGEHANANDA BHARATI

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While I am not sanguine about the anthropological utility of metatheory and of typological models whose complexity or abstruseness far exceeds the situations modelled, I am positively hostile when the situational packages cited as instantiations do not fit the model. For example, European mainstream philosophy does *not* reflect Maruyama's H mindscape. Wittgenstein, the ordinary-language tradition which is mainstream philosophy in Britain, and its followers in Vienna (Krafft, in particular, and all of his students who now hold Continental European philosophy chairs) all refute and rebut most of the requirements of the H mindscape. If Maruyama excludes British philosophy and its partly Viennese inspiration from mainstream European philosophy, then this is as funny as the alleged British weather report that “the Continent is isolated.” If, *pace* Lévi-Strauss, one selects such authors and themes as fit one's model (Kierkegaard, Sartre) and excludes what doesn't from the “mainstream,” then one implies that models are more important than their *explicanda* without the benefit (or lack of it) of “morphogenetic causal-loop” or other models.

by HELMUTH FUCHS

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I have read Maruyama's article with great benefit, despite my conviction in principle that mindscapes and causal (mind you, not always causal) metatypes are the result of postnatal experiences, fundamental in formulating the cultural identification of the individual, and of course irreversible once acquired. There is no doubt in my mind that there are many more than four types, with an array of possible combinations between many if not all of them.

The lack of reference to early-childhood studies disappoints and surprises, since these often touch upon the questions raised by Maruyama, though their approach is different. On the other hand, his studies would be of interest to early-childhood studies in general.

This paper's implication for the philosophy of science is clear: a call for greater flexibility in preschool and primary education aiming at the inclusion of different mindscapes. Contrarily, present educational systems in the under-10 age-group throughout the many nations of our world are geared towards the indoctrination of specific sociopolitical, economic, and socioreligious characteristics. With this goes the direction of youngsters into one of the available one-way streets of thinking. Once mentally imprinted, the individual will be unable to escape the set framework of thought.

Instead of recommending that we develop more sophisticated tests of mindscape types, I would have liked to see the author indicate some ways of bridging the gaps between the types (or are they archetypes?) already known to the benefit of intra-specific understanding among mankind.

by PETER M. GARDNER

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Maruyama asserts, "I do not use categories in my thinking." This seeming koan is best read as an abbreviated statement about absolute or "categorical" thought. Interpreting it thus allows us to understand Maruyama's purpose in writing this paper, his method, and several (otherwise puzzling) problems and errors in his work.

One of his interests is the relative productivity of different styles of scientific enquiry. This is promising and timely, but, unless attention is devoted to some crucial questions of method, Maruyama's approach is unlikely to carry us far toward more reflexive scholarship. He has undertaken an ethnographic survey of scientific patterns of thought and has characterized the four main "mindscapes" in what he believes to be Euro-American terms. It is generous of him to have devised such a scheme solely for the "convenience" of certain colleagues, but, in doing so, he has made his biggest mistake; errors in the original ethnography have become integral to his overall scheme. Space permits mention of three related errors of this kind: (1) In his eyes, "most Europeans and white Americans" are wedded to the use of reified concepts. He regards this practice as alien but fails to see that for many of his Western readers it will be equally so. Incredible as it may seem, his own reification is a conscious device (used against his better judgment). (2) Related to the above, he views us as operating with the trait lists of early anthropology and psychology. Again, for communication's sake, he follows suit. This is anachronistic by at least half a century. Many examples are possible. His portrayal of the "three main sources" of Japanese culture is a good case in point. It is constructed much as was W. H. R. Rivers's 1914 portrait of cultural strata in Melanesia (but without the documentation), using a research framework last defended systematically in 1939 by Wilhelm Schmidt. (3) Although he anticipates a particular set of reactions to his paper, his ethnography has not allowed him to foresee what may be a common response—that his scheme needs to be translated into a testable form.

If there is to be the dialogue Maruyama desires, we must prevail upon him either to give us operational knowledge of his own thinking or to use (heuristically and where appropriate) such pedestrian conceptual instruments as (a) systematic sets of definitions, (b) alertness to fallacies of misplaced concreteness, and (c) a distinction between empirical generalizations (astute ones abound in his writings) and falsifiable hypotheses.

Maruyama's intriguing classificatory scheme has seen print before. It deserves and is long overdue for empirical testing. While he mentions "tests" in his closing sentence, he produces nothing in the way of a program for effecting them (his recent interest in Tsunoda's research will not fill the bill). Only he can tell us his long-term intentions in this regard. The way in which he phrases his ideas in the present article invites the inference that, for now, his categorization is not a theory or hypothesis; it remains simply an empirical generalization which he holds to be true. Given the evident state of his enquiry, he is getting far ahead of himself when he presses for applied research in the subject area and manipulation of child training for the epistemogenesis he values.

by GEORGE M. GUILMET

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This comment focuses on Maruyama's use of the concepts "innate" and "culturally learned" in an attempt to extend the author's analysis rather than attack his effort. To begin, he states correctly that the dominant types of causal metatypes in

science theories and their corresponding mindscapes vary with cultural context. However, it does not follow from this line of reasoning that the potential for acquiring such cognitive systems is not innate, especially if one considers, as Maruyama implies, that all cultures contain the same finite set of causal metatype and mindscape possibilities. It would be useful for him to make at least the range of these sets of possibilities explicit. A computer analogy to human cognition may clarify this: There exists a mechanical-physical substrate (genes/physiological systems) upon which is recorded a finite set of programs (causal metatypes and mindscapes) which display the ability to process an infinitely large set of data (cultural information). This simple analogy is of course limited, but the point is clear: Human cognitive systems are culturally learned, but the learning potential is generated and limited by the innate physiological cognitive-processing system.

Three examples of the limiting influence of this innate system are as follows: First, during ontogenesis there are genetically controlled developmental stages which limit the child's rate of cognitive development, whether it be language acquisition (Fishbein 1976), intellectual development (Ginsburg and Opper 1969), or dream symbolism elaboration (Foulkes 1978). Second, individuals strive to eliminate disharmony, inconsistency, or incongruity between their opinions, attitudes, and values (Festinger 1957). Thus, individuals will reduce the cognitive dissonance by (1) changing one or more of the elements involved in dissonant relations, (2) adding new cognitive elements that are consonant with already existing cognition, or (3) decreasing the importance of the elements involved in dissonant relations. This pattern in humankind tends to inhibit behavioral and cognitive change and increase the frequency of habitual responses. Third, the amount of information an individual can process is limited by such factors as the capacity of short-term memory to hold data and transfer selected experience to long-term memory and the limitations on the type and amount of information which can be processed by human sensory organs (Furst 1979).

The potential for learning causal metatypes and mindscapes is surely innate. Maruyama himself recognizes the possibility of susceptible periods during development after which it may be quite difficult to change a culturally acquired mindscape. Hominids expanded their territorial range through the evolution of the potential for cultural systems which could adapt to a wide variety of ecological niches with a diverse set of socio-cultural and technoeconomic formations. If one assumes that these sociocultural and technoeconomic systems constitute a finite set and that causal metatypes and mindscapes are in equilibrium with these forms, it follows that these ideological systems also form a finite set. Indeed, critical theory has shown that the ideological forms which are dominant in any given culture almost always function to legitimize the established social order. Further, it appears that new ideological systems are concomitant with the rise of new social movements (Disco 1979). Do different socioeconomic class groups within the same culture display different mindscapes? Would one expect the H mindscape amongst the elite, who control power, and the I mindscape amongst the less powerful, who must adjust to structural constraints? Do dominant nations in the world system show a greater frequency of H mindscape than the poorest, dependent nations?

The notion of the human child as a blank slate may at last be passing. The belief was perpetuated by ethnographers who became specialized in describing the seemingly infinite variety in differing cultural contexts, but ethnography has long since lost its ability to entrance or shock by virtue of communicating variety. It is now time to focus on new cross-cultural models which conceive of human development as a genetically con-

trolled biological process that generates and limits a potential which is elaborated ontogenetically in a finite set of sociocultural and technoeconomic contexts.

by ROBERT A. HAHN

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Epistemology is the mind, if not the heart, of our everyday and our more disciplined adventures of knowing. If not explicit, an epistemology is at least implicit in our knowledge. In our epistemologies we define the means and ends of this knowledge. In our psychological and anthropological knowing of others, epistemology has a double life: both as our version of epistemology informs our own knowing and as the epistemological version of those we observe informs their knowing.

The reflexivity of epistemology, its reiterative self-reference, knowing about knowing about ———, is at once a curse and a blessing. We are severely limited in our quest for knowledge by the assumptions we must make in knowing, by our partial blindness to these assumptions, and by the implication that what must be assumed in order to know is therefore logically exempt from examination by the knowledge gained. Yet reflexivity also provides a crucial test for any theory of knowledge which we develop: Our theory must account not only for the ways in which those we observe know of the world, but for our own knowing as well; and to this subject of knowledge we have unique access.

Comparative epistemology is a complex undertaking; we are easily lost in its prismatic space. Maruyama's attempt to develop a framework for the comparison of epistemologies covers a great breadth of disciplines and illustrative topics. With such breadth, it is difficult to penetrate the intricacies of this pervasive and compelling domain of comparison. Maruyama's ideal-typologies, their sources, methodology, purpose, and implications are suggestive but not yet clear. What he calls "causal metatypes" are interesting general models for phenomena, models of which the understanding of causality is only a part. His related "mindscapes" adds another member to the overpopulated, underdeveloped race of concepts. Nevertheless, schemes such as those Maruyama proposes are necessary; they should be systematically explicated. Maruyama's claims about the ontogeny of "mindscapes" are neither new nor well attested here.

The comparison of epistemologies is itself a part of a reflexive epistemology. I recommend that this comparison proceed with several cautions:

1. Comparative epistemology is logically limited as is the epistemological venture as a whole (see above). Knowledge of self and other, moreover, are close ventures whose proximity should be explored and made more explicit.

2. At least by my epistemology, ethnography, like all description and explanation, is an inherently comparative enterprise. Describing a society as *x*, or explaining its *x*-ness, presumes that some societies are *x* and others are not, that these others are *y* or *z* or something else. A framework which sets out these alternatives on given issues of ethnographic interest thus underlies any ethnographic report. The degree of completeness and exclusiveness of alternative categories, as well as the ways in which these categories are "empirically" manifested and recognized, should be made clear in any such framework. A framework may evolve through revisions in theory as well as through encounters with new and "anomalous" information from observation.

3. The difficulties of ascribing beliefs, including epistemological beliefs, to others should be more profoundly studied and confronted in the disciplines of person and of society. (For one version of belief ascription, see Hahn 1973.)

4. While the sociology (or anthropology) of knowledge is a

commonly recognized field, the physiology of knowledge is not. Maruyama's discussion of the importance of brain hemispheres suggests such a perspective. Yet Maruyama also asks the apparently either-or question "Is the mindscape innate or learned?", to which the answer is "Probably both. Some differences in mindscape may be learned." We understand little of consciousness, the seat of our knowledge. Yet we know that consciousness reaches the known world by means of our bodies. Thus we should ask how our bodily function (for example, the receptivity of our eyes to only a certain range of light frequencies) constrains what we know and what we ignore.

by LUCY JAYNE KAMAU

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Maruyama's mindscapes are a jargon-laden rehash of 1960s clichés, complete with bad guys at one end of the continuum and good guys at the other. His descriptions of what he labels H-mindscapes carry negative affect (note, for example, his description under the subheading "Ethics," with its initial statement that H types believe that "the stronger should dominate the weaker"), whereas his G-mindscapes descriptions are positive ("Different individuals help one another."). Maruyama states that he has a G mindscape. How fortunate for him! Unfortunately for him, Reich (1970), Riesman (1950), and others have already devised similar classifications and, whatever their failings, have been considerably more coherent in expressing their ideas. What is more, one can find definitive articles in any trendy publication of the decade. The significance of such a paper to serious anthropological scholarship escapes me.

Maruyama's references display little familiarity with the anthropological literature. His cross-cultural data are weak, with virtually no empirical evidence concerning European cultures and only four citations regarding Japan, one of which concerns *Drosophila* and another of which is written by a speech therapist. Nevertheless, he uses these two culturally diverse geographic areas as primary supporting evidence for his classification system. One wonders what he might do if confronted by detailed ethnographies on such peoples as the Tallensi, the Ainu, the Eskimo, the Dogun, or the Kikuyu. Could their thought processes be so easily categorized into one of four groups? I think not. In fact, I seriously doubt the utility of reducing the thought processes of the entire human population into four categories on what seems to be an a priori basis strongly reminiscent of that of the early Christian theologians. It is a pity that a subject so important and so complex as human thought can be, literally, so easily written off.

by DAVID B. KRONENFELD

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Maruyama's paper is unusual, intriguing, and stimulating. The advantages of organic solidarity (which I see as the basis of S and G mindscapes) over mechanical solidarity (which I see as underlying the H mindscape) or no solidarity at all (i.e., the I mindscape) have long been proposed but seldom believed—at least outside of factory assembly lines. Maruyama does us a service by taking these benefits seriously and by showing their application to a much wider range of phenomena than we are commonly wont to recognize.

My only query concerns how one who "do[es] not use categories in [his] thinking" can be so certain about the closed and rigidly bounded nature or content of the various mindscapes. Why can S or G not use a "consensus" about which interactive plan to use? How else, anyway, are individual plans "pooled"? Do S thinkers really never change anything at all, or do they not, instead, readily change small subsystems in order to maintain larger systems? Might not an S thinker, for example,

kill some individual insects in order that nature's relations among the species be preserved? Can an S or a G thinker never work around a "dominant theme," never use repetition creatively? Can repetition, even in the hands of an H thinker, ever be exact? Can even an I thinker ever produce a totally "random" or "capricious" design? Is Japanese architecture not itself a "category"—even if a most attractive one? Is the human condition ever so unchanging that any single "best design" can be held "best" for very long, even by an H or an S thinker? Under "Logic," do we really have different logics, or do we instead just have the application of logic to different situations about which we are willing to make different assumptions? Transitivity is not an attribute of logic per se; it is simply a property which we may or may not have recourse to.

What I really can't see is how the various mindscapes can be felt to apply so clearly and unambiguously across so many such diverse situations. I don't see how the logic forces all our actions into four such tightly defined categorical boxes, and I know of no human being (not even a social scientist) who has actually exhibited such consistency. What I think Maruyama means to say is that we should not trap ourselves into believing that any particular goal or method is automatically best for all people at all times in all situations; we need always to reflect on who we are, what we want, and with whom we have the need (and the privilege) to coexist. I too believe that such a creative approach to environmental design—whether physical, social, or other—is necessary to our survival and essential to our humanity.

by CHARLOTTE O. KURSH

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Although I enjoyed Maruyama's article, I thought its introduction misleading. One expects some hard evidence, perhaps relating scientific styles to previous cultural learning or to genotypes; what one gets is a typology of very general mental styles, perhaps most recalling Maslow's "peak experience" typology, together with some interesting comparisons of Japanese and American ways of handling space. Maruyama himself seems to lean towards cultural acquisition fixed before the age of 10 for such patterns but presents almost no evidence. I would tend to question this; while many people do indeed seem to get along for a lifetime without changing the language, culture, mental paradigms, and other habits acquired in childhood, many others do not. Many psychiatrists and psychoanalysts found themselves forced to abandon such "childhood determinism" some dozen years ago. Isn't it time we anthropologists caught up?

I am amused by the contrast between the form Maruyama uses and that he advocates; in many respects this is an impassioned plea for G-mindscapes thinking couched in H-mindscapes terms. G is presented as only slightly lower than the angels, while hardly a good word can be said for those unfortunate enough to be afflicted with H. Maruyama himself sees this as a necessary and inevitable result of the kind of categorization that he claims is alien to him but necessary for those benighted H thinkers who need such aids. This appears to me to make several unwarranted and unjustified assumptions about the nature of categorization. While it *may* involve rigidity and rank ordering, it need not. I find no insuperable difficulty in separating north from south, red from green, or even Japanese from Americans without thinking them Platonic essences or claiming that one is better than the other, while without some form of categorization, either conscious or unconscious, it is impossible to use language. One cannot avoid categorization; what one needs to avoid is bad categorization.

One key to Maruyama's own use of the H mindscapes in the article may lie in the striking fact that in none of the discussions

of G-mindscapes ways of looking at the world is any mechanism even suggested for dealing with a genuine, irreconcilable conflict of interests. This seems unrealistic; if G cannot deal with so common a situation as this at all, it is a fair-weather friend indeed. Some differences can be creatively used for the benefit of all, and it's nice work if you can get it—but *all* of them? H at least acknowledges that some conflicts of interest may not be negotiable by such sweetness-and-light methods, though it doesn't always handle the resulting conflict creatively or well. Perhaps it might be suggested that the H mindscapes as presented is essentially battle-readiness and battle style? And that nobody thinks that way all the time, but everyone does whenever he feels strongly enough about a particular issue to be sure that the other party isn't merely different but, dammit, stupid and wrongheaded and should be stopped before he messes up the world for the rest of us? Even Maruyama, alas, abandons his congenial G mindscapes and *becomes* an H thinker when confronted with those wrongheaded H's.

As to the contrast between Japanese "flexibility" and Western "rigidity," it is notoriously easier to perceive the mote in one's neighbor's eye than the beam in one's own. I am no Orientalist, but I have made a number of visits to Japan, have many Japanese friends, have struggled a bit with the language, and have done some reading. I wouldn't say that the Japanese are noticeably less rigid in their perceptions, thought patterns, or methods of spatial and temporal organization than Westerners—only that their rigidities are in different places. I suspect that this would be true of almost any two cultures one cared to contrast. Of course, it is true and may be important that a culture can seem most free to itself just where it seems most rigid to an outsider. Is there anything more rigid and determined than a Western "free-form" swimming pool or cocktail table? They're invariably kidney-shaped. Similarly, though Japanese gardens or flower arrangements or architecture may rigidly avoid bilateral symmetry, a very complex and arbitrary set of rules is followed to achieve this "naturalness." But we in the West can do this, too—as is apparent in those windblown hairdos on television that take a studio hairdresser three hours to achieve, or, for that matter, New York's Central Park, carefully designed to look as natural as possible. I am deliberately using homely examples, and I applaud Maruyama's efforts to do just that. Very general patterns of thought affect everything from the sublime to the ridiculous, and they are perhaps easier to see—and abandon—in oneself on the plane of the ridiculous. We all seem to defend what we feel to be sublime like dedicated H-mindscapes fighters.

by JOSEPH W. MEEKER

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Any comment upon Maruyama's paper must be influenced by his prediction of how representatives of the various mindscapes will respond to his article. I admit to much admiration (and some talent) for S and G mindscapes, some scorn for I-type thinking, and a powerful dose of H-type mentality which often troubles me. One of my problems—and my culture's—is how to get the H out. Maruyama's article is a useful step in that direction.

It has long been known to philosophy that descriptions of reality represent the describing mind at least as much as they represent external reality. Much of Western scientific history has proceeded either to minimize the effects of mental processes upon scientific results or to pretend that no such effects exist. Maruyama has shown us more clearly than we have seen before that our vision of a landscape, whether it be a garden or the view through an electron microscope, is also a mindscapes.

by A. K. BALAKRISHNA PILLAI

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Maruyama's conclusion that most mindscapes are learned rather than innate is in conformity with advances in psychological anthropology (for instance, Hallowell 1955, Whiting 1969, LeVine 1973, Montagu 1974, Williams 1975, and Spindler 1980) and with my own research findings with reference to the mindscapes of people of agrarian (with emphasis on India) and industrial (with emphasis on North America) culture. While Maruyama deserves compliments for reinforcing the psychological anthropological foundation of mindscapes through explorations of multidisciplinary causal models, the limitations of his approach, it seems to me, have led him to certain observations that are not sufficiently clear.

Maruyama states that it is difficult for adults to change mindscapes and that "this has serious implications for the development of science theories." As his discussions reveal, the differences in the mindscapes of North Americans and Japanese arise from differences in environmental/cultural/human-relational conditions. If mindscapes are to be changed, the environmental conditions of human relationships need to be changed.

Maruyama argues that in order to create the theories that may be needed in the future, "we need to encourage children to develop a wide range of mindscapes." He does not say how we can do this. Children cannot choose their mindscapes, as mindscapes evolve from environmental/cultural/human-relational processes among which the highly complex nature of socialization itself is a major factor. To develop better mindscapes in children so that they can cope with the problems of industrial culture, we will have to make changes in social organization and culture. In this context, two major factors need to be considered. First, we need a scientific understanding of culture—its origin, structure, function, and processes—and a scientific understanding of the mindscape. With reference to culture, anthropology has come a long way through the research and writings of scholars such as Steward, White, and Harris. Harris's *Cultural Materialism: The Struggle for a Science of Culture* (1979) is a landmark for all those who are concerned with that struggle. Second, we should study the cultural-psychological manifestations of mindscapes in time and space, with emphasis on the characteristics that are positive and adaptive. This will result in the absorption of such psychological potentialities from other cultures, especially the agrarian ones. A case in point is the growing relevance of the human "self" of Asian psychology in Western psychotherapy. Such trends are a response to the needs of people of industrial culture, and I feel that these needs themselves will create new mindscapes and new theories.

The limitations of Maruyama's approach emerge from his causal models' not being developed in the context of the totality of the environmental/cultural/behavioral frame of reference. If they were so developed, it would be possible to identify both the unifying and the variant characteristics of mindscapes in the context of the nomothetic and universalistic foundations of culture. For instance, the basic differences between the mindscapes of Japanese and North Americans that he has pointed out could be seen as due to differences in environment and culture; the Japanese, although industrialized, still possess a great many of the characteristics of agrarian culture, while North Americans function essentially in the realm of industrial culture. Accordingly, the causal explanations of the organization of the lifeways of the peoples of these cultures would be more comprehensive than Maruyama's. For example, the unique organization of the "traditional Japanese house" would be seen as due to the need for optimum use of space in adapting to the reality of limited space in an island ecology.

Causality is a major concern in the explanation of culture and behavior. It can be fully and reliably explored only in the

context of the totality of the cultural system concerned and its relationship to universal cultural processes (Pillai 1975). The theoretical treatment of cultural causality, as it has evolved from Steward (1949, 1955) to Harris (1968, 1979), would provide a testing ground for Maruyama's causal models. His approach would become a valuable contribution to psychological anthropology if it were developed in the context of the totality of the environmental/cultural/human-relational frame of reference. His concern for developing "more sophisticated tests of mindscape types" deserves special mention.

by KARL H. PRIBRAM

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Maruyama's provocative paper strikes a resonant chord in me. My interest has been to identify different modes of doing "science," much as Maruyama has done here. Some years ago (Pribram 1965), I noted that in the hierarchy of sciences (the hierarchy defined in terms of the size of aggregates that compose the science) two modes of thought could be identified: a downward causal-reductive path and an upward relativistic path. The reductive route is commonplace in the "hard" sciences. Only occasionally does an Einstein or a Walter Cannon (who conceptualized homeostasis) come along to reverse the trend. By contrast, the so-called soft social sciences of necessity operate in the upward mode. Ordinarily, their problem consists of establishing context; only occasionally do they find the luxury of an established context within which they can operate reductively.

Maruyama's mindscapes take us beyond this rather simple up-down view. He identifies the reductive and the relativistic-homeostatic approaches as did I but adds two other modes of thought: homogenistic and individualistic. I believe that these characterizations cut across the other two: scientists and nonscientists alike may emphasize similarities or they may emphasize differences. Thus, there may be reductive scientists searching for common causes (laws) and reductive scientists who simply describe the terrain of their chosen territory. And there are relativists who glory in the universals of cosmology while others point to the uniqueness of each man.

To all this I would like to add still another dimension: the transformational. Up to now, this mode of thought has been paid little heed among scientists. Kuhn (1962), however, notes that science does transform from epoch to epoch. More recently, in developing the holographic model of brain function (Pribram 1979), I found not only that transformation was based upon rigorous mathematical foundations, but also that transformation encompassed both the reductive and the relativistic procedures. Thus while David Bohm sought answers to problems in quantum mechanics and cosmology in his holographic-like implicate order, other scientists (e.g., Wigner 1969, Capra 1975) were pointing out the relevance of this transform domain to subjectivity, consciousness, and the mystical esoteric traditions derived from Far Eastern cultures. What is new here is that now this transformational mode can be incorporated into scientific procedure. At the moment, I do not see this mode reflected in Maruyama's mindscapes.

by DUANE QUIATT

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For someone who claims not to use categories in his thinking but simply to have "devised a categorical scheme for the convenience of those who think in categories" (i.e., among others, presumably, "most Europeans and white Americans"), Maruyama has performed his exercise energetically, I think skillfully, and—the expression seems to me apt—with flair. He argues that readers can more or less determine their own mind-

scapes in terms of how they react to his scheme. This gives me pause, for I too want to have a G mindscape, oriented toward change, looking for new harmony. Maruyama stimulates me enormously, and I want to be wholly G, but alas, I have other tendencies. The H mindscape in me has a set of categories it wishes to substitute for Maruyama's. It is more interested in behavioral-studies methodology and in the imposition of observational units on observed phenomena than it is in scientific theory per se and in causal metatypes. It would prefer to speak of (1) no order but random placement, (2) unidirectional order, (3) multidirectional order in equilibrium systems, and (4) multidirectional order in nonequilibrium systems. The I mindscape in me thinks the ego is at work here: on the one hand, it doesn't see much real difference between the contrastive concepts *homeostatic/morphogenetic* and *equilibrium/nonequilibrium*; on the other, it rejects my and Maruyama's and all such broadly inclusive classifications as idle as far as any general applicability and consequent utility are concerned. The S mindscape in me protests that Maruyama's classification, at least, is not idle, that his approach enables him to answer satisfactorily the questions with which he opens: there *are* typical "cognitive/cogitative/perceptual patterns"; they vary within and between cultures and are learned early in life; their learning may be directed, but since we don't know "what types of [scientific] theories will be needed in the future, we need to encourage children to develop a wide range of mindscapes." The S mindscape also yearns to harmonize Maruyama's observations with others long familiar to it: with Ruth Benedict's, for instance, since the notion of linking personality and culture determinants with epistemological sets with causal-model types seems to fit squarely into a patterns-of-culture/configuralist/modal-personality-learning model tradition; also, it sees parallels (not entirely comfortable ones) between Maruyama's mixed mindscapes and the mixed categories of constitution typers.

Maruyama's paper seems to me a universalist's tour de force, one which I thoroughly enjoyed reading. Whether it is correct in detail seems almost immaterial, as does whether or not it can have any direct impact on "the development of science-theory types." I have found it useful in clarifying my own thinking about theory formation (as, indeed, I am accustomed to finding Maruyama's work useful), and I assume that it is intended primarily to serve some such function as that. Maruyama is a tough-minded general social theorist whose underlying rigor and consistency easily match those of others of the class.

by MILES RICHARDSON

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The issue that this provocative statement provokes in me concerns the location of mindscapes. Maruyama suggests that they are to be found in our various heads. True, mindscapes are not genetic. We do not inherit them in the same manner we inherit skin color and hair form, yet evidence indicates, Maruyama continues, that mindscapes are learned at an early age and apparently become more or less permanently fixed into our perception of things. He goes on to imply that different architectural spaces in different cultures are the products of different mindscapes. As an example, he points to the European concept of space which assigns an identity to each room (bedroom, dining room, etc.) and to the Japanese concept which provides for multiple use of a single room. For a person who says he has a G mindscape, Maruyama's reasoning here looks suspiciously like what an H mindscape would generate. For all of his talk about differences, he seems to be saying that for a particular culture mindscape is a fixed, uniform category and causes, in a straight, unidirectional manner, architectural forms to appear. Thus, mindscapes are located in our individual heads, and, directed by their strong, if not deterministic,

presence, we build an environment congruent with their dictates.

An alternative perspective is suggested by the S mindscape. According to Maruyama, the S mindscape sees the world as contextual and situational. The meaning of architectural space is not fixed, but situated in the surrounding material and behavioral context. If this perspective is turned upon itself—upon mindscapes themselves—then mindscapes are no longer fixed categories, learned early in youth and carried in the head until death, but perspectives arising out of particular situations. As the symbolic interactionists would argue (Blumer 1969) and as Geertz (1973:3–32) certainly would agree, mindscapes are public. They are located in the symbolic communicative process occurring among us. They are part of the social discourse that we engage in as we go about interpreting one another's actions. Further, just as mindscapes are public and their meaning situational, so architectural spaces are lodged in particular contexts and the meaning that they have rests upon our responses to them. Consequently, our understanding of European and Japanese domestic space does not consist of seeing them as lineal descendants of fixed images located in individual heads; it stems instead from placing them within the immediate context of the communicative process—that is, the ways in which the two peoples create, out of their efforts to organize and to interpret social behavior, the symbols of place and space—and, ultimately, within the increasingly distant and perhaps causal context of status aspirations, family relations, ecological constraints, natural resources, and even primate sociality. (See Richardson 1980 for an expanded treatment; see also Bunting and Guelke 1979 for a telling criticism of the mental-map, fixed-image stance.)

by MARY BLACK ROGERS

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The apparent contradiction of Maruyama's "not thinking in categories" yet presenting an elongated display of typologies is of course on purpose. He says he does it to please us European thinkers (who are not advanced enough to operate without categories), but I find them less than useful and the G mindscape type not yet clear. Perhaps this is because the categories as he treats them are something like the functions of a Japanese room: real people (phenotypes) are made up of different mixtures and presumably can change their balance of ingredients according to the occasion. If the possibility of changing categories is meant to show the uselessness of categories, the point is made.

The point about the relativity of epistemologies—especially at the unaware level meta-learned during childhood—is more effectively made with the architectural and design material. Japanese houses' "boundarylessness" is easier to imagine than the G mindscape's apparent categorylessness for illustrating an epistemology in which contrast does not count. Perhaps my conviction that wiping out contrast (differentiation within a context) destroys meaning (symbols for communicating information) is a culturally relative notion, one of those very notions for which we do not normally imagine an alternative, so I try to imagine how the Japanese get along without contrast. I can entertain the idea of houses (non-houses?) with unspecialized rooms (and non-rooms?)—although of course they sound less comfortable and a lot more work. As for indoor/outdoor boundaries, would that we all could dwell in a land where nature does not dictate a rather sharp contrast—on the one side one freezes to death! The notion of a world in which everything is a great undifferentiated glob is not entertaining in my mindscape, however, and a second glance suggests that

Maruyama does not entertain it, either. (He just *thinks* he thinks without categories.) The G mindscape sponsors the development of "heterogeneous elements," which of course means elements of different *kinds*. It is against sameness and for diversity, therefore depends upon categories. The rooms of a Japanese house are not heterogeneous and diverse; they are undifferentiated and the same. (European or American houses have diverse rooms.) Of course, a Japanese room has a diversity of *functions*. My point is that it's impossible to talk about diversity and sameness (in English, anyway) without specifying or implying the contrastive context and without grouping individuals or specimens (each unique in actuality) into something like types or categories. Therefore, when Maruyama wished to talk about a diversity of mindscapes, he had first to make a typology of kinds of mindscapes. It wasn't just to please us!

Finally, regarding Maruyama's action plan: As I understand it, he would change the world so that children within a cultural group would develop "diversified" mindscape types—this in the interest of future scientific theories. I am not myself inclined to do much meddling with the world, but in the interest of future generations, here is a thought: we are already disregarding Sapir's (1949 [1927]) insight that it might be "mischievous" to attempt to bring into awareness the underlying patterns by which we unknowingly function and communicate. Is it not pushing the mischief a bit far to want to control our culturally learned implicit communicational metastructures? (A four-letter word would be more economical, but I've sworn off "emic" forever.) Further, would not controlling them in the manner suggested by Maruyama amount to destroying these communicational structures that culture-members share and presumably need?

by LOIA ROMANUCCI-ROSS

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Felicitously, Maruyama's "mindscapes" join other intellectual creations (see Bateson 1979) in drawing attention to the need for new "subjects" for scholars of all ages. Programmatically, this is a stimulating and important essay. I noted, however, several problems:

As an assertion of categories and linkages, its deficits become apparent through lack of data. To say that different epistemological types might express the same perceptual or architectural styles but for different reasons is a statement about deep structures and manifest surface structures which call for documentation; so too with linkages from mind-sets to ethics and morals. It is conceivable that all the individual epistemological types are found in all cultures. If so, this is possibly the nearest idea of part-whole cultural comparability since Goldenweiser's theory of limits as to what can possibly be invented in culture-bound problem solving. For such a statement, however, detailed descriptors, if not absolute proof, are crucial.

Causal metatypes are described in a mode that might be called author-preferential. Reviews of studies of acculturative processes would reveal "morphogenetic causal-loop models" of a quite pedestrian sort, in the past noted as assimilation-accommodation-innovation strategies in cultural and individual survival. Such strategies, often compounding error, have not always led to a better world or a better life-style. Yet Maruyama invites us to believe that such ideological-praxeological architectonics will be our salvation.

Maruyama's classifications do not escape the classificatory schemata he regrets as he assigns them to the lower circle. His one scheme leaves unexplained his assertion that a predominantly hierarchical mindscape may often develop a severe case of creeping individualism. Nor is it possible to learn why some cultures or persons have threefold or fourfold mindscapings.

Whether mindscapes are innate or culturally learned could, as a problem, benefit from a perusal of the literature on a parallel problem of mental processes and competence in language acquisition (see the references in Chomsky 1966). One might also take up case histories such as that of Frank Lloyd Wright, Welsh and Wisconsinian, who radicalized architectural styles after a turn-of-the-century trip to Japan.

Finally, Maruyama's own mindscape joins the class of classical paradoxes or koan puzzlers. He claims not to have a categorizing mind but has nonetheless laid out a categorical scheme. The mystery will persist, since he feels he cannot communicate with Western readers any other way. But none of the above are intended to detract from the importance of the problem that Maruyama has had the courage to attack. It is fervently to be hoped that he and others of us will succeed in our task, which I think is now "to develop a grammar of perceptual and conceptual linkages so that the opposition of the syntactic structures of daily living to the rhetoric of mythology and science can be overcome" (Romanucci-Ross 1978).

by PENNY VAN ESTERIK

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Like Maruyama, I would like to think of myself as possessing a G mindscape—sensitive to new alternatives, seeking diversity, dynamic, and oriented toward harmonious change. Therefore, I will seek out the potential in his argument after raising some critical questions.

1. What is the basis for Maruyama's epistemological types? With so few historical and ethnographic illustrations, it is unclear whether the typologies are based on his own or others' field research or whether they are simply logical relations derived from unstated assumptions about human cognitive and cultural systems.

2. How does the term "mindscape" relate to concepts such as cognitive style, cognitive map, or personality type? Innovative approaches to such basic questions in cultural anthropology as whether cognitive patterns are culturally learned are admirable but would be more valuable if they could be tied to existing approaches. How can we evaluate and use this typology productively if these connections are not made?

3. Maruyama asks to what extent cognitive patterns are phenotypically innate or culturally learned, how early they are learned, whether they can be altered, and what their effects are on the development of science-theory types. Any anthropology undergraduate student should be able to answer the first questions, and the paper does not provide answers for the latter ones. The conclusion that we need to develop new types of mindscapes in children is enigmatic but does not follow from the paper.

4. The complex interrelations between mindscape and social view, ethics, logic, etc., create ideal opportunities for stereotypic interpretation. Unfortunately, Maruyama takes this opportunity by stating that most Europeans and white Americans cannot think without categories (I was under the impression that no human could think without categories) or that European and white American architects are preoccupied with the concept of boundaries. Any conceptual scheme which orients us toward such fixed molds or patterns has implications beyond mere model building.

The latter part of the paper, however, hints at some fascinating potential relations between laterality, symmetry, and structural theories such as Piaget's genetic epistemology. I suspect that Maruyama could write a significant paper using Japanese gardens and formal flower arrangement to illustrate these themes. Rather than opposing the Japanese and American approaches to design, perhaps they could be related by broadening our view of symmetry. Symmetry and asymmetry define

aspects of the environment of all humans, and each sets certain constraints on design production. While the Americans viewing Maruyama's slides may have been responding to bilateral symmetry on the vertical plane, the most easily recognized plane of symmetry (Corballis and Beale 1976:11), symmetry rules also include bilateral, rotational, and radial symmetry around one or more axes. Use of what I call higher-level symmetry rules (Van Esterik n.d.) encourages experimentation with structurally ambiguous designs and creates opportunities for visual punning. Perhaps the extent to which these higher-level symmetry rules are utilized in a particular design system in a society is related to the individual's capacity to visualize spatial relations. These cognitive skills are probably related to laterality in complex but poorly understood ways. The fact that the Japanese process natural sounds and nonverbal communication in the dominant hemisphere is interesting in that regard. It would be particularly valuable to consider laterality, symmetry, and conceptualization of space in evolutionary perspective using a Piagetian developmental approach as Wynn (1979) has recently done. It is this kind of integration of biological and cultural systems that I think will further our understanding of the adaptive significance of different human "mindscapes."

Reply

by MAGOROH MARUYAMA

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I am fortunate to receive such a large number of comments providing me with additional references, data sources, and suggestions for further research. To a great extent, the questions raised by some of the commentators are answered by other commentators. Of course, there are many questions for which nobody has answers yet. I see the need for the following types of research:

1. Development of psychological tests to identify mindscape types. Stimuli will be, at least for one type of test, visual design patterns using different epistemological principles. (Some samples are available upon request, but more different patterns will have to be developed.) The responses may take three forms: (a) preferences among various patterns and reasons for these preferences; (b) verbal responses in a manner similar to those of Rorschachs and TATs; (c) the subject's wishes to modify (add to, delete, or change) the patterns given in the stimuli.

2. Study of the frequency distribution of various mindscape types in different academic disciplines, subdisciplines, professions, and cultures.

3. Longitudinal study of mindscape formation and change in sampled individuals, taking into consideration cultural, social, academic, and other influences.

4. Examination of whether, in the individual's life, there is a "critical age" when the mindscape is formed and becomes irreversible or almost irreversible. A part of the data will come from longitudinal study. Another set of data will come from the study of cross-cultural migrants.

Some federal funding agencies have shown interest in such researches. However, I am faced with an administrative problem: I am in a school of business, and neither the dean nor the department head would process a research proposal on such a topic. I must move to a new place before I can undertake this type of research.

References Cited

ADORNO, T. W., and N. SANFORD. 1950. *The authoritarian personality*. New York: Harper.

- ALEXANDER, C. 1975. *The Oregon experiment*. Oxford: Oxford University Press.
- BACON, E. N. 1974. *Design of cities*. New York: Viking Press.
- BATESON, GREGORY, 1979. *Mind and nature: A necessary unity*. New York: E. P. Dutton. [LRR]
- BLUMER, HERBERT. 1969. *Symbolic interactionism*. Englewood Cliffs: Prentice-Hall. [MR]
- BUNTING, TRUDI E., and LEONARD GUELKE. 1979. Behavioral and perception geography: A critical appraisal. *Annals of the Association of American Geographers* 69:448-63. [MR]
- BUCKLEY, W. 1968. *Modern systems research for the behavioral scientist*. Chicago: Aldine.
- CAMARA, S. 1975. The concept of heterogeneity and change among the Mandenka. *Technological Forecasting and Social Change* 7: 273-84.
- CAPRA, FRITJOF. 1975. *Tao of physics*. Boulder, Colo.: Shambhala. [KHP]
- CHOMSKY, NOAM. 1966. *Cartesian linguistics*. New York: Harper and Row. [LRR]
- COHEN, R. A. 1969. Conceptual styles, culture conflict, and nonverbal tests of intelligence. *American Anthropologist* 71:828-56.
- . 1971. "The influence of conceptual rule-sets on measures of learning ability," in *Race and intelligence*, pp. 41-57. Anthropological Studies 8.
- . 1973. "Relational and analytic intelligence among designers and researchers," in *Environmental design research. Vol. 1. Selected papers*. Edited by Wolfgang Preisler. Stroudsburg, Pa.: Dowden, Hutchinson and Ross.
- CORBALLIS, M. C., and I. L. BEALE. 1976. *The psychology of left and right*. New York: Wiley. [PV]
- DISCO, CORNELIS. 1979. Critical theory as ideology of the new class: Rereading Jürgen Habermas. *Theory and Society* 8:159-214. [GMG]
- EHRMAN, L. 1972. Rare male advantages and sexual isolation in *Drosophila immigrans*. *Behavior Genetics* 2:79-83.
- EHRMAN, L., and J. PROBBER. 1978. Rare *Drosophila* males. *American Scientist* 66:216-22.
- FESTINGER, LEON. 1957. *A theory of cognitive dissonance*. Stanford: Stanford University Press. [GMG]
- FEUER, L. S. 1959. The bearing of psychoanalysis upon philosophy. *Philosophy and Phenomenological Research* 19:323-40.
- FISHBEIN, HAROLD D. 1976. *Evolution, development, and children's learning*. Pacific Palisades, Calif.: Goodyear. [GMG]
- FOULKES, DAVID. 1978. Dreams of innocence. *Psychology Today* 12: 78-88. [GMG]
- FURST, CHARLES. 1979. *Origins of the mind: Mind-brain connections*. Englewood Cliffs: Prentice-Hall. [GMG]
- GEERTZ, CLIFFORD. 1973. *The interpretation of cultures*. New York: Basic Books. [MR]
- GINSBURG, HERBERT, and SYLVIA OPPER. 1969. *Piaget's theory of intellectual development*. Englewood Cliffs: Prentice-Hall. [GMG]
- HAHN, ROBERT A. 1973. Understanding beliefs: An essay on the methodology of the statement and analysis of belief systems. *CURRENT ANTHROPOLOGY* 14:207-29. [RAH]
- HALLOWELL, A. IRVING. 1955. *Culture and experience*. Philadelphia: University of Pennsylvania Press. [AKBP]
- HARRIS, MARVIN. 1968. *The rise of anthropological theory*. New York: Crowell. [AKBP]
- . 1979. *Cultural materialism: The struggle for a science of culture*. New York: Random House. [AKBP]
- HARVEY, O. J. 1966. *Experience, structure, and adaptability*. New York: Springer.
- KLUCKHOHN, C. 1949. "The philosophy of Navajo Indians," in *Ideological differences and world order*. Edited by F. S. C. Northrop. New Haven: Yale University Press.
- KUBIE, L. S. 1956. Some unsolved problems of the scientific career. *American Scientist* 41:3-32.
- KUHN, T. 1962. *The structure of scientific revolutions*. Chicago: University of Chicago Press.
- LEVINE, ROBERT A. 1973. *Culture, behavior, and personality*. Chicago: Aldine. [AKBP]
- MANNHEIM, K. 1929. *Ideologie und Utopie*. Frankfurt-am-Main: Schulte-Bulmke.
- MARUYAMA, M. 1961a. Morphogenesis and morphostasis. *Methodos* 12:251-96.
- . 1961b. Multilateral mutual causal relationships in the Danish culture. *Phylon* 22:41-58.
- . 1963. The second cybernetics: Deviation-amplifying mutual causal processes. *American Scientist* 51:164-79, 250-56.
- . 1967. The Navajo philosophy: An esthetic ethic of mutuality. *Mental Hygiene* 51:242-49.
- . 1974a. Paradigmatology and its applications. *Cybernetica* 17: 136-56, 237-81.
- . 1974b. Hierarchists, individualists, and mutualists: Three paradigms among planners. *Futures* 6:103-13.

- . 1977. Heterogenistics. *Acta Biotheoretica* 26:120-36.
- . 1978a. Heterogenistics and morphogenetics. *Theory and Society* 5:75-96.
- . 1978b. "Psychotopology," in *Perspectives on ethnicity*. Edited by R. E. Holloman and S. Arutiunov. The Hague: Mouton.
- . 1978c. Epistemologies and esthetic principles. *Journal of the Steward Anthropological Society* 8:155-67.
- . 1978d. New movements in old traps. *Futurics* 2: 59-62.
- . 1978e. "Endogenous research and poly-ocular anthropology," in *Perspectives on ethnicity*. Edited by R. E. Holloman and S. Arutiunov. The Hague: Mouton.
- . 1979a. Limits to thought. *World Future Society Bulletin* 13: 13-23.
- . 1979b. "Transepistemological understanding: Wisdom beyond theories," in *Currents in anthropology*. Edited by R. Hinshaw. The Hague: Mouton.
- MEAD, M. Editor. 1937. *Cooperation and competition among primitive peoples*. New York: McGraw-Hill.
- MILSUM, J. 1968. *Positive feedback*. Oxford: Pergamon.
- MONTAGU, ASHLEY. 1974. *Culture and human development: Insights into growing human*. Englewood Cliffs: Prentice-Hall. [AKBP]
- MYRDAL, G. 1944. *The American dilemma*. New York: Harper and Row.
- . 1957. *Economic theory and underdeveloped regions*. London: Duckworth.
- NODA, M. 1975. Low rise urban housing design. *Japan Architect*, February.
- PILLAI, A. K. BALAKRISHNA. 1975. The culture of social stratification: The economics, politics, and rituals of marriage (a case study of the Nayers). Unpublished Ph.D. dissertation, Columbia University, New York, N.Y. [AKBP]
- PRIBRAM, K. H. 1965. "Proposal for a structural pragmatism: Some neuropsychological considerations of problems in philosophy," in *Scientific psychology: Principles and approaches*. Edited by B. Wolman and E. Nagle, pp. 426-59. New York: Basic Books.
- . 1979. Behaviorism, phenomenology, and holism in psychology: A scientific analysis. *Journal of Social and Biological Structures* 2:65-72.
- REICH, CHARLES A. 1970. *The greening of America*. New York: Random House. [LJK]
- RICHARDSON, MILES. 1980. "Culture and the urban stage: The nexus of setting, behavior, and image in urban places," in *Environment and culture*. Edited by Irwin Altman and Joachim F. Wohlwill, pp. 209-41. New York: Plenum. [MR]
- RIESMAN, DAVID. 1950. *The lonely crowd*. New Haven: Yale University Press. [LJK]
- ROKEACH, M. 1960. *Open and closed minds*. New York: Basic Books.
- ROMANUCCI-ROSS, LOLA. 1978. On the researching of lost images. Paper presented at the annual meetings of the American Anthropological Association, Los Angeles, Calif., November 16. [LRR]
- SAPIR, EDWARD. 1949 (1927). "The unconscious patterning of behavior in society," in *Selected writings of Edward Sapir*. Edited by D. Mandelbaum. Berkeley: University of California Press. [MBR]
- SPEMANN, H. 1938. *Embryonic development and induction*. New Haven: Yale University Press.
- SPINDLER, GEORGE D. Editor. 1980. *The making of psychological anthropology*. Berkeley: University of California Press. [AKBP]
- STEWART, JULIAN. 1949. Cultural causality and law: A trial formulation of early civilization. *American Anthropologist* 51:1-27. [AKBP]
- . 1955. *Theory of culture change*. Urbana: University of Illinois Press. [AKBP]
- TANGE, K. 1972. *Katsura*. New Haven: Yale University Press.
- TANGE, K., and N. KAWAZOE. 1965. *Ise*. Cambridge: M.I.T. Press.
- TSUNODA, T. 1978. *Nipponjin no noo*. Tokyo: Taishuukan.
- VAN ESTERIK, PENELOPE. n.d. Symmetry and symbolism in Ban Chiang painted pottery. *Journal of Anthropological Research*. In press. [PV]
- WATANABE, T., and M. KAWANISHI. 1979. Mating preference and the direction of evolution in *Drosophila*. *Science* 205:906-7.
- WHITTING, JOHN W. M. 1969. "Methods and problems in cross-cultural research," in *Handbook of social psychology*, vol. 2. Edited by G. Lindzey and E. Aronson. Cambridge: Addison-Wesley. [AKBP]
- WIENER, N. 1949. *Interpolation, extrapolation, and smoothing of stationary time series with engineering applications*. Cambridge: M.I.T. Press.
- WIGNER, EUGENE P. 1969. "Epistemology of quantum mechanics: Its appraisals and demands," in *The anatomy of knowledge*. Edited by M. Grene. London: Routledge and Kegan Paul. [KHP]
- WILLIAMS, THOMAS R. Editor. 1975. *Psychological anthropology*. Chicago: Aldine. [AKBP]
- WYNN, TOM. 1979. The intelligence of Later Acheulian hominids. *Man* 14:371-91. [PV]

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