

T-48

Summary

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Professor Lishart, Ladies and Gentlemen:

The task has been given me to summarize this informative and exciting conference on human learning. When I listed for myself the topics covered, however, they presented such a bewildering, if brilliant, array of terms that at first the task of managing a reasonable synthesis seemed prohibitive. Listen to some of the key words which regularly recurred in the presentation: Discrimination, Arousal, Confirmation, Incentive, Information, Reward Value, Dissonance, Achievement, Salience, Utility, Representational, Stimulus Recoding, Associative, Set of Values, Control, Short Term Memory, Long Term Memory, Repetition, Interference, Uncertainty, Competence, Semantics, Surface Structure, Deep Structure, Markers.

This variety in expressions, however, seemed to me to cloak a smaller number of problems common to the participants of the conference. Perhaps a diversity of tongues had developed in psychology that made it difficult for subdisciplines to communicate. The diversity had enriched the parent science but at the same time brought the danger of disruption.

Several of the discussion leaders recognized this problem, having faced it in the analysis of their own experimental results. Thus both Berlyne (1960) and I (1967) have emphasized that arousal as used in physiological and clinical psychology is little different from the drive of S-R learning theorists.

and that both concepts can be more rigorously and quantitatively defined in terms of uncertainty as used in information-theoretic context.

Also, Berlyne and others (including Richard Thompson and myself in personal communications) have worried a good deal about making operational distinctions between the concepts of attention, memory consolidation and reinforcement. Such distinctions are not easily made and become even harder to accomplish when one begins to suspect as have Trabasso and Bover (1968) and I (in ^{press}) that the relevance, the salience of an hypothesis to be attended, deeply depends on reinforcement history.

Estes also voiced this concern with multiple ways to describe a common problem. Perhaps his most telling argument involved the parallels between Associative States and Memory States--an argument for association memory which computer oriented cognitive psychologists will find both illuminating and compatible.

Given this key to the problem of finding the commonalities that bound this conference together, I proceeded to explore the different languages used at the conference. The psycholinguists' contributions were, of course, especially useful in such a search. To abbreviate here what was a fairly long route, I came to the conclusion that psychologists, just as children, divided their world into two main categories, the

category of existences and the category of occurrences: the coordinate and the predicate. Thus there were the psychologies of how we perceive the world and the psychologies of how we are moved to act on the world.

This dichotomy took us a long way--into this morning, in fact. But this morning, the cognitive psychologists and some other groups as well, in their discussions approached their subject matter from a different set of distinctions. The concern was with mapping problem solution into coordinate systems so that transformations could readily be achieved. Again two major categories appeared--very simple and fundamental--the spatial and the temporal.

So, suddenly, I was given a matrix, a 2 x 2 table, into which most of the interests expressed in the conference might be fitted. Here it is:

Symbolic → Coordinate	<u>Hocinate</u>	<u>Predicate</u>
↓		
<u>Spatial</u>	Perception	Motivation
<u>Temporal</u>	Cognition	Conation

My own opening presentation fits well into this matrix:

	<u>Hocinate</u>	<u>Predicate</u>
<u>Spatial</u>	Configuration	Incentive
<u>Temporal</u>	Discrimination	Directive

rubric "motivation" appeared to be much broader than what would ordinarily be expected in a session bearing this title. Recourse to the matrix helped me to reconcile the actual with the expected. For instance Berlyne's opening remarks look like this:

	<u>Nominate</u>	<u>Predicate</u>
<u>Spatial</u>	Arousal-Information	Incentive
<u>Temporal</u>	Confirmation	Intention

Muttin's were confined to the spatial aspects of this system as were Heckhausen's who used the terms "dissonance" and "achievement" instead of "arousal and incentive."

The cognitive psychologists' presentations appeared in so many respects to cover interests expressed by Berlyne and other motivationists. Yet their data led to descriptions which did not immediately cross reference the concerns of the motivationists. The matrix helped me to see the relationships. Thus, Trabasso, interestingly, comes out on the Predicate and of the matrix only: he uses "salience" to describe the spatial and "utility" the temporal aspects of his concerns.

Dason appears to have a more complete system in operation. His looks to me like this:

	<u>Nominate</u>	<u>Predicate</u>
<u>Spatial</u>	Selection	Evaluation
<u>Temporal</u>	Decision	Judgment

Linhart talks about similar functions but calls them "sensory-intuitive experience" and "knowledge" on the nominate, and "thought operations" on the predicate side of the matrix.

The usefulness of any scheme would be severely limited if S-R psychology, especially in its mathematical form, could not be analyzed in these terms. Fortunately, Estes gave us three different ways to fill the matrix:

I.

	<u>Nominate</u>	<u>Predicate</u>
<u>Spatial</u>	Representational	Associative
<u>Temporal</u>	Stimulus Recoding	Set of Values

II

	<u>Nominate</u>	<u>Predicate</u>
<u>Spatial</u>	Uncertainty	Repetition
<u>Temporal</u>	Uncertainty Resolution	Interference-free Interval

III

	<u>Nominate</u>	<u>Predicate</u>
<u>Spatial</u>		Contiguity
<u>Temporal</u>	Long Term Memory	Short Term Memory

This last matrix is missing a term for the nominate, spatial aspect which might well be filled with some sort of buffer memory of the Averbach-Sperling type.

Thus encouraged, I even dared to try to put the psycholinguists into their appropriate linguistic slots. Thus Slobin came out:

	<u>Nominate</u>	<u>Predicate</u>
<u>Spatial</u>	Competence	Deep Structure
<u>Temporal</u>	Semantics	Surface Structure

and Kintch, difficult for me to be sure of, because for acoustic reasons I could not hear his paper fully, appeared to share the Predicate side of the matrix using the terms "associative" rather than "deep" structure and in this particular presentation "markers" rather than "surface structure."

Finally Rappaport, who brought social psychology to us in such elegant form seemed to be talking about Nominate "threat" vs. Predicate "control" functions.

But enough of this game. My message is clear--I may well have erred in detail but this can easily be corrected by each of the participants for himself. What I have tried to show is that psychologists have learned a great deal about human learning and that they have gone about this the way humans go about learning--they linguistically code their concerns and their results. It has been fun for me to "reduce" this diversity to some simpler coding operations that appear to be basic to all further coding. In doing so I have, of course, done violence to the rich variety, to the nuances and the subtle meanings which each linguistic system portrays to those who can

share that system. My attempt has been not to translate these nuances but to confirm their existence by showing the origins from which they came. Thus perhaps we can, by learning something of each other's languages, continue to enjoy such varied fare as that provided by the surface structure of this conference without losing sight of the deeper meanings derived from the common problems we, as psychologists, address.

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