A DIMENSION THEORY OF THE NATURE OF MIND

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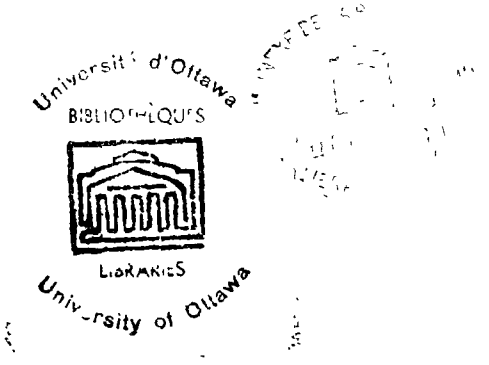

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CURRICULUM STUDIORUM

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TABLE OF CONTENTS

Chapter		page
	INTRODUCTION	viii
I.-	PRESENT CONCEPTIONS OF THE NATURE OF MIND. . .	1
	1.Only matter exists	9
	2.Mind versus matter	13
	3.Only mind exists	18
	4.Mind and matter as a unity	19
	5.Evaluation of the existing theories of mind	22
II.-	INADEQUACY OF THE PRESENT CONCEPT OF A FOUR DIMENSIONAL UNIVERSE TO EXPLAIN MIND	26
III.-	DEVELOPMENT OF THE MATHEMATICAL FOUNDATION OF THE THEORY IN SPACE OF GREATER THAN FOUR DIMENSIONS.	45
	1.The relationship of mathematics to experience	48
	2.Development of the mathematical basis of the theory	55
	A.Brief history of the important errors made in dimension theory	58
	B.The geometry of n dimensions	63
	C.The topology of n dimensions	67
	D.The mathematical logic of n dimensions	73
	E.Group theory and dimension theory	78
	3.The relationship of this mathematics to real space	84
IV.-	THE IDENTITY OF THE OPERATIONS OF MIND TO THOSE IN CERTAIN LEVELS OF HYPERSPACE.	91
	1.The mathematical development of real four space	92
	2.Five dimensional space and alpha mind	99
	3.Six dimensional space and beta mind	115
	4.Seven dimensional space and gamma mind	128

Chapter page

V.- THE FUNCTIONING OF MIND IN HYPERSPACE 135
1.Principles of relations in dimension theory 136
2.Relations within levels; quality of awareness 146
3.Relations between levels within mind 155
A.Simple functioning from higher to lower levels - creativity 159
B.Simple functioning from lower to higher levels - learning 163

VI.- FURTHER FUNCTIONING OF MIND IN HYPERSPACE . . 166
1.Complex functioning within mind 168
2.The mind-body relationship 176
3.Boundaries of the individual 188

VII.- IMPLICATIONS AND CONCLUSIONS. 198
1.Conclusion 215

BIBLIOGRAPHY. 219

APPENDIX - Abstract of the thesis 224

LIST OF TABLES

Table page

I. - A suggestive representation of equivalents between alpha and beta levels of mind . . . 122

II. - Summary descriptions of the nature of existence in spaces at dimensional levels from minus one to seven 133

LIST OF FIGURES

Figure page

1. Structure of this work xiii

2. Schematic representation of four and five space. 103

INTRODUCTION

We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time.
Through the unknown, remembered gate
When the last of earth left to discover
Is that which was the beginning;
At the source of the longest river
The voice of the hidden waterfall
And the children in the apple-tree
Not known, because not looked for
But heard, half heard, in the stillness
Between two waves of the sea.
T.S. Eliot, Little Gidding.

Probably the greatest theoretical problem in the science of psychology is that of the nature of mind itself. But beyond psychology it is one of the major problems in philosophy and in science in general. Man has worked out the physical world in great detail, and in modern physics he has penetrated beyond appearances. Yet the mind that surveys the physical universe, and surveys itself is unknown in its essential nature. The many psychologies have catalogued its phenomena into so many conflicting systems as to demonstrate their uncertainty. Yet the mind which is the beginning and end of all that man knows of, which is the very heart of man, is unknown in itself. The self-assigned, ambitious aim of this work is to solve this bedrock theoretical problem in psychology; to discover what is the fundamental nature of mind.

It is felt that until recently issues inherent in the problem were unsolvable. In the last fifty years or so

necessary forerunner discoveries were made so that this problem may now be open to a scientific solution. There were at least two forerunners that had to come first. The main one is the conceptual change involved in Relativity Theory leading up to the discovery that this physical world is a real four space. Having added one dimension to the three that have been held to since the time of the Greeks, it was natural enough to ask what reality in higher dimension would be like. This whole theory was born out of such a simple and obvious question. The next discovery involves the little known and little recognized work of parapsychology. Until this work it was always possible for psychology especially, and science in general, to expect that mind would be found in the physical neurophysiology of the brain. Perhaps to philosophers and even laymen of common sense this was an obvious falsity, but it is still the most common expectation among scientists. Parapsychology gives a jolt to this thinking for in its great mass of work it has apparently found a mind related phenomena (extra-sensory perception) which transcends space and time and thence must lie outside of four space. The discovery that the physical world is four dimensional, and the demonstration of a mind related phenomena outside of four space led to the development of this theory of the nature of mind.

The question as to what is the nature of mind is seen by many as an invalid problem. Many reasons for its invalidity have been given; even that mind does not exist. If a valid solution to the problem can be proposed perhaps such apparently defensive denials of its existence can be overcome. Contrary to this trend, many will say the problem is already solved, and they will refer to one of the many theories of the mind-body relation in philosophical systems. The whole point of view of this work is one governed and limited by the knowledge and means of science. If philosophy has solved the problem, and science offers a valid solution, the two should agree. They will complement each other. What separates them is the way of attacking things, and partly in the kinds of issues raised. Any opposition between them should be cleared away as science approaches closer to the truth and as scientists and philosophers come to understand more aptly what the other is saying. But from the outset this work is in the view of science, deliberately taking upon itself the limitations and means involved in that view. Because it is a work of science all things said here are held in some doubt. In this view there are only degrees of certainty or probability, but no absolute certainty. To economize on words, appears, seems to be, and other expressions of doubt will often be omitted; but the reader is to understand

that at least some uncertainty runs all through this. The only certain thing in this whole work is the existence of the given--mind as it is experienced.

Like one of the many aspects of this work reflected in the above quote from T.S. Eliot, the basic datum is experience itself. The work must begin with experience and return to experience if it is to be of any value. This is an unusual point of view in psychology, but it is adopted both because mind as it finds itself is a primal datum, and because it appears feasible to deal with it in this manner instead of being forced to reduce it to measurable behavior. Mind seen in terms of behavior is the view, for instance, of Robert R. Sears' recent presidential address to the American Psychological Association in which he maps out the framework of personality and social psychology[1]. The philosopher, G.P. Adams, well expresses the empirical

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1 R.R. Sears, "A Theoretical Framework For Personality and Social Behavior", The American Psychologist, Vol. 6, 1951, p. 476-483.

roots of this work.

> The mind possesses the immediacies of all the conscious experiences which it undergoes and enjoys and through which it lives. Experience reveals a modality of existence incommensurable with all observed structures, events and relations spread out in the dimensions of space and time. All of man's experience discloses to him what it means to be a mind and to have experiences. In the observation and contemplation of everything objective, we are enjoying something immediately possessed in conscious experience. In the absence of these immediate possessions, there could be neither man's living nor his knowledge[2].

But in understanding mind there will be found, if not a commensurability with events spread out in the dimensions of space and time, an intimate relationship with them--which is not surprising in view of the nearness of objects experienced to experience.

The basic hypothesis of this work is that levels of mind (to be specified later) exist in, and are part of the kinds of events that are natural to a real (existing) space of five, six, and seven dimensions. This main hypothesis may be broken down into three stages of hypothesizing:

1) that the real, existing dimensions of the space of

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2 G.P. Adams, Man and Metaphysics, N.Y., Columbia University, 1948, p. 94.

this universe include spaces of five, six, and seven dimensions.

2) that only certain kinds of operations can naturally exist in these levels of hyperspace.

3) that the certain kinds of operations that exist in these spaces bear a relation of identity to the operations in levels of mind.

The second sub-hypothesis is contingent on the first and the third on the first two. This is perhaps the best simplification of the main hypothesis that could be made. Yet it will not be possible to develop the basic hypothesis in these stages. For instance, in order to show that the dimensionality of the universe includes these higher dimensions (#1 above) it would be necessary to show that something exists in those spaces (#3 above). In order to show that some existing thing (#3 above) has the characteristics which only apply to entities in that level of hyperspace it would be necessary to postulate the existence of that space (#1 above) and develop its characteristics (#2 above).

The design of this work must incorporate all these stages at onee. Figure 1. represents how this can be done. There are two kinds of things to be related; one side there are the operations of three levels of mind; the other there are operations in three levels of hyperspace. The relationship between these two series has two basic features. They

will both contain 1) the same objects, and 2) the same

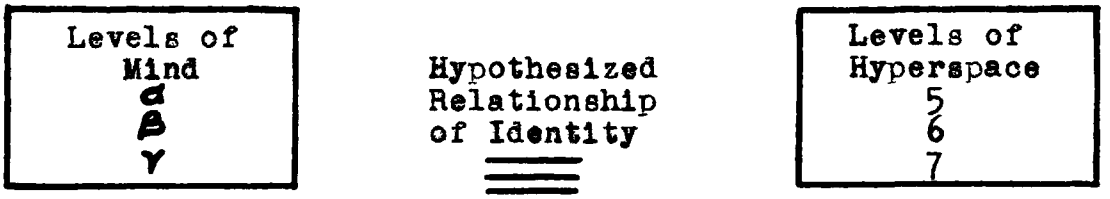

Figure 1. Structure of This Work

definite structure of operations. Because the objects and the structure of operations in each is the same, it is hypothesized that there is a relationship of identity between them. The single step of hypothesizing identity fulfills at once the three stages involved in the hypothesis. Stage #1 assigns existence to these levels of dimensionality. By identifying them with an existing thing (mind, the given datum) they are given existence. This partly defines the meaning assigned to identity as used here. Stage #2, that only certain kinds of operations can naturally exist in these levels of hyperspace, is part of the structure of the dimension theory itself and is more of an implicit than an explicit part of this single step of identifying mind and levels of hyperspace. In Chapter III in which the mathematics of this theory are set forth the confirmation of Stage #2 will be more apparent. Stage #3, which is nearly a repetition of the basic hypothesis, brings in the new idea of identifying mind and hyperspace which is of course fulfilled by the single step of identification

above. The essential components of the hypothesis and the hypothesis as a whole are then supported by a structure as in Figure 1.

Things to be identified must be of like nature and one may wonder at the possibility of identifying levels of hyperspace with mind, since the former is supposedly in the second degree of abstraction and the latter is in the first. What actually is done is to apply the mathematics of hyperspace to real objects and their relations. These then are identified with mind validly since mind is shown to consist of the same objects and relations between the objects. The point is that the mathematical structure itself is not compared to mind. Mind is identified with real objects and object relations which are structured by mathematics.

The general plan of the thesis will expose and develop the consequences of the above hypothesis and will reflect the basic structure in Figure 1. This introduction, having stated the problem and the structure of its solution, will take up the definition of the ideas involved. The first chapter will survey the present theories of the nature of mind, which survey is the general background of this work. Chapter II will begin the development of the theory by showing it to be unlikely that mind is contained within the present conception of a four dimensional universe. If it is not in four space, the likelyhood of its existence in

higher spaces is greater. The third chapter will lay the mathematical foundations of the right half of Figure 1., the levels of hyperspace. Because the nature of objects and relations in hyperspace is not known at present, in Chapter IV they will be developed out of the mathematics of space. The possible identity of the objects and operations of hyperspace with levels of mind will be immediately shown. Chapters V and VI will use the same mathematics to describe the dimension theory of the functional and dynamic processes within mind. The last chapter will broadly survey the implications of the theory and will sum up the results of this work in order to arrive at a final conclusion. This is how a theoretical solution to the problem of the nature of mind will be developed.

Several aspects of this solution should be made clear. The solution offered is a speculative and theoretical one. This thesis only offers support for the hypothesis, it does not prove it. The relationship of identity is only hypothesized, it cannot be shown to be necessarily true. This theory is a speculative attempt to unite and synthesize all the phenomena of mind in one scheme, a scheme which may reflect the nature and structure of mind and part of existence itself. It is not, like most schemas in psychology, a pattern adopted as a convenient description of phenomena, but one that is proposed as reflecting the

basic nature of the phenomena. The structure of the ideas are determined as soon as the hypothesis is set up. When dimension theory is adopted as a basis the arbitrariness is immediately taken out of the pattern of ideas to be developed here. This dimension theory can only fit those elements which have the same structure. The task here becomes one of faithfully developing the implications of this dimensional structure both in its strengths and its weaknesses. There is no arbitrariness here. A faithfully developed dimension theory can only carry one in certain directions.

This is a type of work which is in accord with certain modern thinking as to what is the purpose of scientific work. Maslow incisively pointed out the difference between means-centering in research (seeing the essence of science in its instruments and procedures) and problem-centering (stressing what is true in any area)[3]. The two are often confused so that statistical labor is sometimes looked upon as original research. This attitude leads to

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3 A.H. Maslow, "Problem Centering Versus Means Centering In Science", Philosophy of Science, Vol. 13, 1946, p. 326-331.

fitting problems to techniques, and to an emphasis on polish of means rather than on the vitality and meaningfulness of a problem. Both in its unusual query and unusual attempt at a solution this is a problem-centered work. It is also in accord with Lewin's Galilean type of approach to problems[4]. Maslow and others have raised the unanswered question as to whether science in general and a research project in particular are an exercise in orthodox procedure; or whether the quest for what is true is primary and the means are bent to that end.

The problem, the structure of its solution, and its implications have been given. Before undertaking the development of the theory it would be well, for purposes of effective communication, to define the main conceptual tools involved. Some have been implicitly defined already, but communication is more certain on an explicit level. The main conceptual tools are theory, nature, mind, identity, space and dimension.

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4 K. Lewin, Principles of Topological Psychology, N.Y., McGraw-Hill, 1936, p.82.

A theory is a general principle or an ideal construction which is said to relate phenomena. It is made plausible but not certain by factual evidence or by the exactness of the reasoning from facts. A hypothesis is a provisional conjecture while a theory is usually at least partly supported by facts and usually relates to more phenomena than a hypothesis. The serious question may be raised as to why there should be theories at all. Theories not only order and relate facts but also contain postulates that can be investigated. Fact collecting and theory making are two different processes, one analytic and the other synthetic; one discovers bits and the other discovers wholes. A science that is all facts has little relatedness or meaning; while one that was all theory would be too distant from the real phenomena it seeks to explain. Theory making is a complement to fact finding. Theories vary in value from those which merely relate facts descriptively to those that attempt to get behind phenomena and define their inner relatedness or nature.

The nature of a thing is not a question ordinarily asked in psychology. The concept of nature has in general three confused meaning; 1) creative force, 2) created being in essential character, and 3) the created universe. The word is taken here in Aristotle's true meaning, the essence of things which have in themselves a principle of

activity[5]. The essence of mind would be its essential being, while the nature of mind is the principle of activity of this being. To get at the nature of mind will require getting behind mind's manifestations to find the principle which underlies and orders those manifestations. This is the kind of explanation that is sought.

The thing to be explained is mind. Basically mind is taken to refer collectively to those operations which are experienced--as they are experienced. At various times mind has been equated with intellect, spirit, consciousness, memory, and so on. Broadly it is here thought to be, "The individual's conscious process, together with the dispositions and predispositions which condition it"[6]. The dispositions will be taken as memory, will, the unconscious, intellect, and any others which psychology can establish as an aspect of mind. By such a definition experience is thought to be not only the conscious processes but as also including the intra-psychic determiners of consciousness. The 'any other' clause is meant to leave the definition

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5 R.G. Collingwood, The Idea of Nature, Oxford, Clarendon, 1945, p. 81.

6 J.M. Baldwin (Ed.), "Mind" in Dictionary of Philosophy and Psychology, N.Y. Peter Smith, 1940, Vol. 2, p. 82.

open to future discoveries. This then is the mind to be explained.

The relationship between mind on one hand and levels of hyperspace on the other will be said to be one of identity. The main question that might arise with the use of this term would be reflected in the question, how identical? The term is used here to refer to complete identity: by referring to existence in these levels of hyperspace one is referring to levels of mind, andby levels of mind one is referring to existence in levels of hyperspace. Similarly, to relate the idea to common knowledge, the same relation of identity is conceived to exist between a linear entity and a real one dimensional entity, a surface and a real two dimensional entity, an extension and a real three dimensional entity. Identity is then taken to mean a sameness of essential character. In extending space to higher levels the same relation of identity is conceived between existing higher space and its contents as between the existing four lower spaces and their respective contents.

The two most important concepts of this thesis are space and dimension. Practically all the failures to completely grasp the inner structure and implications of this work will center in the failure to conceive of the meanings of space. There are two related but different kinds of space and dimension. There is the empirical space of three

and four dimensions. This is the space of the physical world. It corresponds to the idea of line, surface, extension, and movement of a solid. Not only does four space include all these, but it includes nothing else! This is empirical space.

There is also the abstract spaces of mathematics. As will be taken up in Chapter III, in the first four dimensions the abstract space of mathematics are the form of empirical space. Mathematical space is different in having a freedom to range beyond four space and can even consider infinite dimensionality. The abstract space of mathematics can describe all spaces, and in its first four levels it describes empirical space. Dimensionality simply refers to levels of either empirical or mathematical space. Hyperspace simply refers to any space beyond three dimensions. The space-time of physics is an empirical, existing level of hyperspace.

In order to follow the development of the ideas in this work it will be necessary to expand one's conceptions of the meaning of the word space beyond that of extension. Not only do the spaces beyond the three dimensions happen to be different from the three dimensional, they must be different. To range beyond the three dimensional one must interiorize and immediately grasp conceptions of space that are more than extension. Even beyond perfection in exposition

there is demanded of the reader a certain amount of effort toward the interiorizing of new concepts. Failure to do so will make this theory incomprehensible regardless of any amount of perfection in explanation. The transition between levels will not seem reasonable simply because a person tends to think of higher space (i.e. space-time) as nothing more than some special kind of extension. Discard the notion that space means extension for this is only one of an infinite number of kinds of space, and an extremely simple kind at that.

Instead it would be quite helpful to conceive of space as meaning, the mediums in which existence takes place. Some existence takes place in a surface, some in extension, some in the medium of time, some in the medium of mind. And there are possibilities of other kinds of mediums beyond these. This conceptual aid (as differentiated from a tool) is actually one of the implications of this theory. By taking space to mean the mediums in which existence takes place one has a general description of any level of space. Empirical space is defined by the entities it contains. Mathematical space will be defined in Chapter III. But the conceptualizing demanded of the reader in this theory will be aided by conceiving of space as generally referring to the mediums in which existence takes place.

There is a particular difficulty regarding the meaning of this theory for those who see it in terms of Scholastic philosophy. The idea of space in that philosophy is limited to the three dimensional while it is not in this theory. From the Scholastic point of view any reference to higher spaces appears to be an analogical use of the idea of space. This is precisely not its meaning in this theory. The basic meaning of space for this theory is one defined by mathematics. There it refers to a structural relationship of which line, surface and extension are only three of an infinite number of examples. This structural meaning of space is univocally applied both to various levels of dimensionality and to both abstract and existing space. The structural meaning is the same whether one space, four space or eight space is referred to. It is also the same whether the abstract space of mathematics is in question or an existing level of reality which bears this structure. Because space is used in this univocal and general way, both its level of dimensionality and reality or abstractness will be specified or implied in each case. It may be seen then that in Scholastic philosophy space is the empirical space of three dimensions while here it is a more abstract structural definition of which empirical three space is a single example. This structural definition is the subject of Chapter III.

This basic difference may be broadened to include other ideas. The space of Scholastic philosophy is said to be a quantitive concept, while a division of abstract or real things according to dimensionality in this theory is a non-quantitative division. For instance, quantity in Scholastic philosophy "means a thing divisible into parts which are in it and each of which is capable of existing as an individual"[7]. Reality can be divided in this theory according to the dimensional structure which is in it, thereby fulfilling the first part of the definition. But in such a division each part cannot exist as an individual. This is a general rule to be used in Chapter V, i.e., four space per se does not exist separately from either three space which it contains or five space which contains it. Although three space, four space, and so forth can be spoken of separately, they cannot exist as individuals apart from other spaces. Most certainly they cannot exist separately from the spaces they contain which make up an essential part of their nature. As an example, time, or successive movement

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7 (D.) Mercier, Manual of Modern Scholastic Philosophy, Trans. by T. Parker, and S. Parker, Vol. I, St. Louis, Herder, 1950, p. 84.

in Scholastic philosophy is closely related to extension, but it is not tied to the same space scheme. But in this theory time (or space-time) has no existence except in relation to three dimensional extension, and extension has no existence separate from two dimensionality and so on. This idea will be clearer in the general development, but it may be borne in mind that whatever kind of division into levels of space this may be, it is not a quantitative division according to the definition of Scholastic philosophy. The non-quantitative nature of this division into levels of space, and the general structural meaning of space should serve as a basis for a distinction between the ideas expressed here and the related ideas in Scholastic philosophy.

Summary:

In this introduction the fundamental question of the nature of mind defined as it is experiences has been set as the problem of this work. The basic hypothesis that mind has the nature of levels of hyperspace has been set up. Support for the hypothesis will be found by a thesis structure which attempts to show the identity of objects and operations in levels of hyperspace.to those in levels of mind. The speculative nature of this work has been underlined and its main conceptual tools defined. The

necessity for the reader to take an active part in enlarging his conceptions of space has been indicated.

Now it is possible to undertake the development of the theory first by finding what others have done with this problem.

CHAPTER I

PRESENT CONCEPTIONS OF THE NATURE OF MIND

> Yet it would be worth while, sometime, for the general historian of science to tell us just what happens when science foregoes the concern with the teeming richness and immediacy of personal experience.
>
> G. Murphy, An Historical Introduction to Modern Psychology, p. 209.

As a preliminary to a new theoretical solution to a problem it is wise to examine the present state of knowledge on the topic. The question of the nature of mind is a quite old one, many capable thinkers having attempted to work it out. It is the purpose here to gain a general view of these conceptions of mind since they make up the historical and contemporary conceptual background to this new idea. This theory does not grow out of an adoption of these conceptions. Relativity Theory and studies in psi phenomena were its stimulus, while dimension theory is its basis of development. Although this theory does not grow directly out of any of these conceptions, they form the ideational backdrop which gives this work greater meaning in relation to the history of ideas.

So great is the literature on this subject that it is manifestly impossible to present all that has been said. Since 1900 there have been written at least one thousand books and articles in this area. Existing records of works

since the time of the early Greeks may well include over ten thousand pieces. Selection will be necessary. In this selection an attempt will be made to survey both the major historical and present positions together with some lesser known works of the last twenty years or so. The latter rounds out the contemporary picture.

The most common presentations of all the views on the nature of mind either present them in their historical order, as examples of an abstract order such as monist and dualistic theories, or in their logical order as types of interaction between mind and body. The historical ordering of ideas is of little value unless one is studying the formation of one idea out of the previous ones, a matter not to be considered here. A kind of logical ordering will be used instead of an abstract philosophical one because this logical ordering will present an idea at least as important as the theories themselves. The order will be structured by the various ways man could solve this problem given his inadequate data. The important idea is that this is not an academic problem. These theories represent the fruits of man attempting to solve the whole problem as to what he is and what he will become. To treat them as dry abstractions is to entirely miss the meaning of this plethora of theories. Here man is attempting to discover himself and his value in the order of things.

It is extremely easy to criticize. In a few lines a whole philosophical position may be put down as destroyed. But it should be clear at the outset that a few lines are not sufficient either to describe all the denotations and connotations of a postion, nor is it a sufficient basis on which to reject a complex system of ideas. So besides selecting theories, it will only be possible to touch on the main features of each theory.

The naive setting up of each theory and destroying it in turn until only the absolutely perfect system remains will be avoided. It will be more instructive to the understanding to see in these solutions the dynamic situation of man facing a problem with insufficient data. Any solution will represent something of the nature of man and of the problem. In this development it is then hoped the reader will learn two things, 1) how man has been forced into these various and conflicting solutions by his limited knowledge, and more importantly, 2) to learn further of the meaning and significance of the problem to this creature who has been working on it in one way or another since his beginning.

In terms of contemporary knowledge and ideas the problem of the nature of mind appears to be this: the physical world is well mapped out, perhaps because it is more readily accessible to controlled observation; it is possible to describe it as process or even as essence, in some sense,

in the modern formulations of nuclear physics. The mental world is not so well or fundamentally known, so it comes to be judged in terms of the physical, the more certain thing. Had the mental been worked out first, then it would become the criterion, and the place of the physical world would be in dispute. Men would ask, "Isn't the physical only a function of the mental world?" Perhaps only a few radicals would dare assert its existence independent of the mental. But from the way knowledge developed the physical is now the criterion and the relation of mind to it becomes the question. The problem is usually seen as the relation of mind to body. It will be noticed that in this formulation of the problem, a transition has already been made between the nature of mind to the nature of the mind body relationship. The nature of mind itself is a more direct question, which quite possibly because of the way man's knowledge developed, is usually answered in the indirect terms of the mind body relationship. Also some will notice that even to use the idea of mind versus body is to fall in line with an exaggerated distinction made by Descartes. Discovered truths may later alter the meaning of the distinction which is usually seen and stated in these terms.

In contemporary terms, then man was faced with realities whose relationship he wished to understand. He experienced a world of events and the question arose

concerning the relationship of his experience to the things outside of himself which he experienced. Because the course of events from the world to their effect in the body could be traced, the problem reduced to one between experience and the body, or mind and body. Man's equipment for solving the problem is his intellect and his painfully accumulated and limited data. With this limited data what are the possible solutions to his problem?

To begin with, it is an extremely difficult problem, which as yet has no generally accepted solution. In view of this it would not be unreasonable for man despairing for a solution to look around for reasons to believe a solution may never be found. Johnson for instance classifies it as a spurious problem because of its very nature[1]. A problem is said to be spurious in science when no solution can be found. This makes its existence depend on outcome. There are a few interrelated bases for considering this problem unsolvable. Forty years ago the usual answer would have been, since the mind of another person may never be

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1 H.M. Johnson, "Are Psychophysical Problems Genuine or Spurious", American Journal of Psychology, Vol. 58, 1945, p. 189-211.

objectively known, and one's own mind is insufficient on which to establish laws, then mind itself cannot be studied. After much dispute it became generally agreed that introspective reports were unreliable. But since then techniques have been developed for getting around simple reports of introspection such as the Bernreuter Personality Inventory. For instance in the Minnesota Multiphasic Personality Inventory, when a person hits too many items on the lie scale, the test is not immediately discarded because his introspection is reported falsely, but rather the view is that he is accurately reporting (unknown to himself) a rigid, moralistic adaptation. Projective tests are even more apparently getting around the necessity for accurate introspection by causing a person to reveal himself in ways unknown to him. In these tests and in a general dynamic interpretation of behavior the state and structure of the inner life appears to be validly inferred according to experimental evidence. As long as man is learning about mental life, it appears a little early to say that "what it is" or "what its relationship to body may be" can never be known. Because all the facts are not available, it may be an unsolvable problem. It appears too early for despair.

This same general answer may be applicable to all those who despair of the adequacy of experimental means as

does Weiss[2], since experimentation itself in psychology is reaching higher and higher levels of complexity and adequacy, as exemplified by recent experiments on psychoanalytic concepts[3].

Still, since experimentation has not solved the problem, man might justifiably look for other means. Loewenberg has made a plea for the use of dialectical method in the Socratic-Platonic sense[4]. Until man's problem is solved, any approach offering the possibility of a solution must be considered. But to say one is more valid than another seems premature until one yields an accepted answer. Since science is changing in its scope and means, and no philosophy has won the field, both need be granted a hearing. Some may argue that a solution has already been offered but none has as yet enough evidence to make it generally accepted. As to the philosophical how of the problem, Mackay has

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2 P. Weiss, "Cosmic Behaviorism", Philosophical Review, Vol. 51, 1942, p. 345-356.

3 M. Slobin and L. Dombrose, "Measurement of Impulses, Ego and Super Ego", American Psychologist, Vol. 6, 1951, p. 340.

4 J. Loewenberg, "The Discernment of Mind", University of California Publications in Philosophy, Vol. 19, 1936, p. 87-112. (PA 11:2603) Those works which could not be cited in the original will also be referred to by their volume and entry number in the Psychological Abstracts as has been done here.

pointed out the value of the use of analogy in its solution[5]. The psychophysical parallelism solution, for instance, is based on an analogy.

Besides those who assert it is an unsolvable problem, or one not solvable by science or philosophy, there will be those who assert it is not a problem at all, or that it is one that shouldn't be solved. Feigl, for instance feels the mind body dualism is an artifact of language and does not reflect a problem in reality[6]. On the other hand Gaviola raises a fundamental issue when he asserts that mind is of a different essence than matter and can not be related to it[7]. It then becomes necessary to prove they are two different essences, and that essences cannot be related. It will be seen later that the theory to be developed here shows the exact and interdependent relation between essentially different genera of essences.

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5 D.S. Mackay, "The Analogy of Mind", University of California Publications in Philosophy, Vol. 19, 1936, p. 63-84. (PA 11:2064)

6 H. Feigl, "Logical Analysis of the Psychophysical Problem", Philosophy of Science, Vol. 1, 1934, p. 420-445

7 E. Gaviola, "The Impossibility of Interaction Between Mind and Matter", Philosophy of Science, Vol. 3, 1936, p. 133-142.

These are a few of the ways in which the problem is thought of as unsolvable. There are four general kinds of solutions that have been proposed. They are, 1) to reduce mind to matter, 2) to oppose it to matter, 3) to reduce matter to mind, and 4) to keep the two in a substantial union. These positions will form the successive section headings.

1. Only Matter Exists

So far man's rejections of the problem as a problem or as one admitting of solution have been briefly examined. These questions are not actually settled but only indicated by this brief exposition. Granted now that it is a valid problem with a possibility of a solution, how can man accomplish it? Since the material world is so certain and well mapped out, and brain the organ of mind is part of it, it is not unreasonable to seek in the material world, or more specifically in the brain, some explanation for mind. This equating of mind with the physical can take place in several ways.

Mind can be seen as actually a special kind of aggregate of nuclear particles[8,9]. Haldane proposed that it may be part of the wave-like aspect of matter[10]. Most commonly mind is seen as being the physical action of the nervous system itself as by Boring[11], or at the synapse as in the psychonic theory of consciousness[12], or as some other aspect of nervous system functioning[13]. Freud and others who tend to regard mind as an evolutionary advance in tissue complexity also belong to this group.

Wiener's modern day analogizing between mind and machines implies mind is merely a complex physical apparatus[14], and has led to various promises that a mind will be

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8 P. Bousfield and R. Bousfield, The Mind and Its Mechanism, N.Y., Dutton, 1927, p. v-244. (PA 1:1696)

9 M. Peucesco, Mouvement et pensee, Paris, Alcan, 1927, p. 940. (PA 2:1455)

10 J.B.S. Haldane, "Quantum Mechanics as a Basis For Philosophy", Philosophy of Science, Vol. 1, 1933, p. 78-98. (PA 8:1432)

11 E.G. Boring, The Physical Dimensions of Consciousness, N.Y., Century, 1933, p. 251. (PA 7:2168)

12 W. Marston, "The Psychonic Theory of Consciousness", Journal of Abnormal and Social Psychology, Vol. 21, 1926, p. 161-169.

13 O. Reiser, "Consciousness, Chronaxy, and Nerve Fiber Radiation", Psyche, Vol. 30, 1927, p. 43-51. (PA 2:2674)

14 N. Wiener, Cybernetics, N.Y., Wiley, 1948, p. 194.

built some day[15].

Besides seeing mind as an aspect of nuclear physics, mechanics, or neurology, it may be explained physically in behavior terms. That is, the motor phenomena associated with the manifestation of mind are taken to be its real substance[16]. The whole school of molecular behaviorism belongs in this category.

All of these theories have the common property of seeing the solution of the nature of mind as lying in the properties of matter, whether it be in special nuclear particles, waves, nerves, or in organized tissues. The holders of these views must either deny the existence of consciousness or see it simply as an aspect of organized matter. Theories of this sort tend to deny that self experience has any qualities which are not purely those of physical processes. Some of the authors cited, though, maintain the somewhat ambivalent position of saying mind is matter, but continue to think of it as having properties that could not be bestowed by matter. This ambivalence arises from the

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15 A. Turing, "Computing Machines and Intelligence", Mind, Vol. 59, 1950, p. 433-460. (PA 25:2887)

16 H. Langfield, "Consciousness and Motor Response", Psychological Review, Vol. 34, 1927, p. 1-9.

necessity of either showing that the properties of the postulated material basis of mind adequately describe all the properties of mind, or to deny some of the characteristics of mind given in experience. They often fail to accomplish either of these. Behaviorism in its equating of mind to explicit and implicit muscular responses together with its supporting experimental evidence is probably the strongest of these materialistic monist positions.

As a solution to the nature of mind these theories have the common strength of being able to point to relatively objective phenomena as their source of explanation. They need no vague constructs or abstractions; they have something objective to rely upon. They have a common weakness of tending to deny the qualities of the thing they hope to explain, mental experience itself. This is a serious and fundamental failing. They sacrifice an adequate attainment of their end for material objectivity. They all appear to capitalize on the prestige of the natural sciences of physics and biology. Since in these views mind is simply matter in action, and this matter is governed by the laws of physics, these theories tend to deny any self determinism to man. Logically they lead to the rather amazing conclusion that the human mind has had no real influence on the history of man. As a solution these theories represent man's tendency to explain the subjective by a descent into the concrete and

correspondingly they have their own particular strengths and weaknesses.

2. Mind Versus Matter

In this next group of theories man tries to retain both mind and matter as ultimates. By so doing he has the awkward task of relating them to each other. The title expresses the resulting lack of substantial unity.

As a step in the continuum between the previous section and this one, there are a great many writers who conceive and accept mind in its experience aspects but feel it ultimately is nothing more than cerebral action. For instance, Krech speaks of motor neurological systems in which previous neural patterns persist[17]. Similarly Cobb[18], and Troland[19], conceive of mind as experienced but theoretically base it purely in neural functioning. Gestalt psychology in general belongs in this group.

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17 D. Krech, "Dynamic Systems, Psychological Fields, and Hypothetical Constructs", Psychological Review, Vol. 57, 1950, p. 283-290 and p. 345-361.

18 S. Cobb, Foundations of Neuropsychiatry, Baltimore, Williams and Wilkins, 1948, p. 89-101.

19 L. Troland, The Principles of Psychophysiology, Vol. 3, N.Y., Van Nostrand, 1932, p. xxiv-446. (PA 6:2619)

Samuel Alexander's well known work could be listed as materialistic in result, but it was not in aim[20]. As with those above he accepts mind in its experience aspects, but theoretically he equates it to space-time. Intrapsychic space and time are seen as identical with physical space-time, quality is the space-time configuration, even universals exist in space-time. For every major advance in physics there appears to be a theory of mind born directly out of it. This is the result when a pressing problem is faced with inadequate data. Anything new is capitalized on as a possible explanation. Alexander's theory represents the most mature attempt to use space-time as the vehicle of mind, but there is in it a serious failure to note the limitations inherent in space-time as will be seen in the next chapter.

There are many writers who set up both mind and matter as really having separate existence, but plead ignorance as to how they interact. McDougall[21] and Baldwin[22] are examples of this position. Or they separate them and do not make their relation clear. Emergent evolution

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20 S. Alexander, Space Time and Diety, London, Macmillan, 1920, 2 Vols., p. xxviii-347 and p. xiii-437.

21 W. McDougall, Outline of Psychology, N.Y., Scribners, 1923, p. 35-37.

22 J. Baldwin, Handbook of Psychology, N.Y., Holt, 1890, p. 2-7.

which supports the separateness of mind and body belongs here[23]. Descartes' interactionism at the pineal gland is a weak interactionism. Pratt is a modern example of interactionism[24]. Interactionism in general suffers from the difficulty of stating the details of the transition from the level of matter to mind. To simply assert there is such a transition is hardly enough.

Another solution, since details of the interaction are not clear, is to see the two phenomena of mind and body running on parallel courses but consisting of two separate kinds of reality which are coordinated in their changes. Modern statements of this psychophysical parallelism are uncommon, but Hartley is an historical representative and Morgan[25] is a more recent example.

There are two other general ways of stating the relation between these parallel series. Modern proponents of this position are again rare. Geulincx and Malebranche set God as mediating between these two orders. Leibnitz postulated a pre-established harmony between them.

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23 O. Reiser, "Consciousness as a New Dimension", Psyche, London, Vol. 14, 1943, p. 165-176. (PA 9:4004)

24 J. Pratt, "The Present Status of the Mind Body Problem", Philosophical Review, Vol. 45, 1936, p. 144-166. (PA 1:1257)

25 C. Morgan, "Influence and Reference: A Biological Approach to Philosophical Problems", Monist, Vol. 36, 1926, p. 535-560. (PA 1:1257)

These are the conventionally mentioned solutions. There are two others mentioned in the literature which keep both mind and matter and explain their relation in unusual ways. Strong sees in matter a sleeping sentience or potentiality for consciousness which becomes manifest when matter reaches a certain complexity of organization[26]. This is close to emergent evolution. Kaiser postulates a non-phenomenal causality as the basis of mind which would provide separate basis for mind in the material world[27].

This is a brief resumé of theories that tend to hold to both realities without making a substantial union of them. The earliest ones cited form a transition from materialism by holding to mind as experienced but making it an aspect of nervous tissue or of the physical space-time world. As has been seen, by holding to both realitites one can then plead ignorance as to their relationship, or one can hold to both while tending to say the real answer is in the properties of organized matter. One can say the two interact without exactly showing how, or one can make the

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26 C. Strong, "The Sensory-Motor Theory of Awareness", Journal of Philosophy, Vol. 36, 1939, p. 393-405.

27 C. Kaiser, "The Continuity of Change II. The Theory of Perception", Journal of Philosophy, Vol. 33, 1936, p. 645-656.

two a parallel series of events with no interaction, with God mediating between them, or set both series in a pre-established harmony. The two can also be kept separate by postulating a special basis for the phenomena of mind such as sleeping sentience in matter or a non-phenomenal causality.

All these solutions have the strength of keeping both kinds of reality, mind and matter, though some tend to deny the former. Their weakness lies in attempting to explain the relationship. Strict parallelism and pre-established harmony get around the question as to how the two orders interact. But there is a need to establish means of demonstrating such a parallelism. Most of these mind versus matter positions have the value of not winning a solution by denying one of the realities involved. Section four will take up other solutions which hold to both realities while linking the two in some kind of unity. Most of the solutions here tend to pull the two realities apart as in parallelism. When they link them, the explanatory details regarding the link are weak as in interactionism. These solutions represent man solving his problem by keeping the two as separate realities and trying to show a relation between them. They are not a distinct class of solutions but are part of the continuum beginning with those that deny the existence of mind.

3. Only Mind Exists

Of course another way of solving the relation between two orders of reality besides denying the existence of mind is to deny matter's existence. Actually this would appear to be a stronger kind of solution than one that denies mind since man's own experience is more immediate and certain than the external things experienced.

Most of the examples of proponents of the idealist position are historical; one thinks of the names of Plato, Berkeley, Hegal, Hume, Fichte, and Mach. Blanchard is a modern proponent of idealism who views the idea as an early stage in an evolutionary sequence of attaining a trancendent end[28]. Barrett maintains the priority of mind in the order of things so that the social and material are aspects of that order[29]. Steiner even goes beyond mind and points to the spiritual hierarchies in the universe as the real source and meaning of things[30].

Idealistic positions in general have both the advantage and disadvantage of setting up a position which cannot

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28 B. Blanchard, The Nature of Thought, London, Allen and Unwin, 1939, 2 Vols., p. 654 and p. 542. (PA 14;3303)

29 C. Barrett, "The Objectivity of Mind", Journal of Philosophy, Vol. 31, 1934, p. 169-179.

30 R. Steiner, Peniero umano e pensiero cosmico, Bari, Laterza, 1931, p. vii-97. (PA 6:3043)

be experimentally verified. In fact as regards the world of scientific explanations, idealism appears to express an entirely different order of explanation. One of its strengths lies in keeping close to the quality and immediacy of experience itself. But a common weakness in this position is failure to explain the persistence and consistency of inferences of something outside experience. As a monism compared to materialistic monism, it at least has the advantage of ascribing to man a certain dignity and supremacy.

4. Mind and Matter As a Unity

The three previous solutions of the nature of mind have relegated it to matter, opposed it to matter, or rejected matter. It is possible to retain both orders of reality without opposition. The relatively new science of psychosomatic medicine does this. Yet as with Franz Alexander the psychosomaticists tend to simply state there is a unity of the two without explaining the nature of the unity[31,32]. Since nearly all of the theories of the nature

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31 F. Alexander, Psychosomatic Medicine, N.Y., Norton, 1950, p. 36.

32 W. Barlow, "The Mind-Body Relationship", British Journal of Physical Medicine, Vol. II, 1948, p. 74-80, (PA 23:2005)

of mind being proposed at this time are materialistic, the mind-body unity, even if it isn't explicit, is an important divergent trend. Because of the findings in this new branch of medicine, physicians and others concerned are actually beginning to think in terms of mind-body unity.

There are several kinds of theories which assert in one way or another that mind and body are simply two aspects of the same underlying entity. The philosophical theories of Schelling, Fries, Clifford, Taine, Bain, Spencer and Hoffding are examples. Wundt's conditionalism which makes mind the condition of the body is a type of double aspect theory[33]. Prince asserts they are the same thing apprehended in two ways[34]. Dewey and the school of functionalism take the standpoint of action within which the body is the means and mind its fruit[35]. Such a view may be said to either not attempt to answer the mind-body question or to seriously neglect important aspects of the problem. Myers solves the problem by identifying vital

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33 W. Wundt, Outlines of Psychology, (Trans. C. Judd), Leipsig, Englemann, 1902, p. 356.

34 M. Prince, "Why the Body Has a Mind and the Survival of Consciousness After Death", Mind, Vol. 37, 1928, p. 1-20.

35 J. Dewey, "Body and Mind", Mental Hygiene, Vol. 12, 1928, p. 1-17.

force with mind and deriving the same force from matter so that organized matter is given a mind[36]. For every major position on this question someone will find support in modern physics. Kennedy uses the idea in theoretical physics that matter and energy are forms of the same reality to explain mind and body[37]. Matter is equated with body and energy with mind, so that mind and body are two aspects of the same reality in this way. Most of the double aspect solutions seem to neglect problems regarding the essential realities involved.

Scholastic philosophy gives one of the most complex and subtle solutions to this problem. In its solution mind and body are retained as two different kinds of reality joined in a substantial union. While assigning to the brain and physiological processes a physical reality and to higher mental processes a different kind of reality, the two are seen in a union which adheres to the facts of neurophysiology and psychology. The solution of Scholastic philosophy is perhaps one of the best worked out of all these theories,

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36 C. Myers, The Absurdity of Any Mind-Body Relation, London, Oxford Univ. Press, 1932, p. 27. (PA 8:2406)

37 F. Kennedy, "The Interrelationship of Mind and Body", Philosophy, London, Vol. 15, 1940, p. 417-428.

both in details and in implications. Although its end result is remarkably similar to the theory to be proposed, the structure of Scholastic philosophy and this theory cannot be compared without a drastic change in the meaning of space and dimension as used in that philosophy.

5. Evaluation of the Existing Theories of Mind

This description of the theories of mind has been hurried and sketchy. The reason for this is that the literature on this subject is too vast, and most philosophies and scientific theories are too complex to present them adequately in a few lines. For that reason the evaluation has been somewhat neutral up to this point. Now it is possible to unite all these scattered ideas into a single picture and show where man stands on the question of mind.

The main thing to note is that as a scientific problem there is no real solution to the question. Most scientists implicitly believe mind will reduce to the neurochemical processes of the brain. In fact, many such as Krech, the social psychologist, and Stanley Cobb, the neuro-psychiatrist, feel that very nearly enough is known now to reduce mind to brain. Psychosomatic medicine is a contrary trend which accords a genuine reality and unity to mind and body, but it has as yet no real theoretical framework.

While science is accumulating facts and generally theorizing in the direction of materialism, philosophy has already come forth with many and varied solutions. But in terms of science none is generally established. Apparently philosophy has exhausted the full range of possibilities for a solution. New philosophical theories can be seen as slight variants on the old. The point is that if philosophy in one of its many disputant branches has given a theory close to what is true, philosophers are not agreed on it, and science has not yet verified it experimentally.

Meanwhile, while philosophy may have spoken of all the possibilities by now, and science continues to accumulate facts and theorize in the direction of the facts (materialism and psychosomatic unity), there is a curious group of theories that are born directly out of new developments in physics. They extend all the way from early theories of muscular action as spirits moving in tubes in the muscles, down to Wiener's Cybernetics, Alexander's space-time as mind, and Myers's matter-force relation as body and mind. These theories are curious because they, better than the others, show man's endeavor to solve a problem with inadequate knowledge. Every new major physical finding is capitalized as an explanation of mind. Criticism of these efforts seems almost improper in this

situation where there is such a desperate need for a solution and none has made itself known.

If one thing can be learned from the few theories touched upon here and the many thousands of others that could not be included, it is that this is an old problem--and this is a major problem. Why should man persist so long in this query? What does it matter what mind is or how it is related to the body? It matters a great deal to inquiring man, for he is attempting to find his place in the scheme of things and simultaneously to find what that scheme is. Between monistic materialism and monistic idealism there is all the difference in the world--not as they stand as dry systems, but in relation to the meaning and value of man's life.

If this is an old, vital problem as yet unsolved in science and confused by the many philosophies, is there enough knowledge now to solve it? Until recently (1930 or so), the answer apparently was no. Now it may be yes. As a step toward discovering the needed data for a solution of the problem it will first be necessary to examine the knowledge of man to see where in general mind could be in the natural order and where it cannot possibly be. This is the task of the next chapter.

Summary:

This chapter represents the various theories of the nature of mind which form the conceptual background of the present work. The theme running through the chapter is that of man attempting to solve a basic problem with inadequate data. A great many historical and contemporary types of solutions were briefly described extending from negating mind to negating matter, to seeing mind and matter as opposed or as a unity. The general conclusion was reached that this is an old, vital problem with no generally accepted solution.

CHAPTER II

INADEQUACY OF THE PRESENT CONCEPT OF A FOUR DIMENSIONAL UNIVERSE TO EXPLAIN MIND

> All such sign-meaning associations are successive rather than simultaneous, the sign having the role of a stimulus, in modern terminology, and the meaning the role of a response. Because of constant use, however, and because of predominant interest in the meaning, we are scarcely aware of the sign but seem to ourselves to actually see distance, as we even seem to hear the meanings of words spoken in everyday conversation.
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> R.S. Woodworth, Contemporary Schools of Psychology, p. 42.

As a first step toward assigning mind a position in the natural order it is possible to show with reasonable certainty where it is not in that order. This is more than merely the negative side of the exposition though. By showing the limitations of the physical, the nature of both the mental and the physical will be clearer. Most of contemporary theorizing regarding the nature of mind, for instance, involves basic misconceptions which permit the construction of a physical theory of mind. So here, while delimiting where mind can be in the natural order, the first step will be taken towards clarifying what mind itself is.

What are the possible categories of existence in which mind could fit? Somewhat arbitrarily three will be chosen which should cover all possible cases. Mind could

be a part or an aspect of the four dimensional physical world. If not there, it could be a part of higher spaces beyond the four dimensional. If not in either of these two, it must be in a category of existence which is neither physical nor hyperspatial. It is then either in the four space order, beyond it but part of the same order, or it belongs to some other kind of existence. The first two categories are specific; that is, one can test whether mind is part of four space or of a higher space. Four space is so specific as to readily admit of a test. Higher space is quite broad, since it can be extended to infinite dimensionality, but it too can be tested. The last category of other kinds of existence could include an infinite number of kinds, which could neither be conceived nor formulated in any exact structure. The category of other kinds of existence could best be demonstrated by eliminating the possibility of the first two.

The value of dividing the possible kinds of places for mind in the natural order in this fashion is that by testing out the first two, which are testable, the nature of mind may be approached. By this means the general whereabouts of mind in the order of things can be found. The greatest doubt will remain only if the first two are completely eliminated, since 'other kinds' might include anything else. But in the examination to follow only the

first can be eliminated as a possibility. The second comprises the rest of this work and bears a good deal of probability. The third category need not be invoked.

The first category involves the question whether mind can exist in the physical world. To keep the question on the level of the existence of mind in the physical world makes it exceedingly difficult, if not impossible, to answer since the properties of the physical are still being discovered. If it is not in those properties today, may it not be tomorrow? The question becomes answerable if one finds the essential and basic structure of the physical, a structure that will remain the same regardless of new data from the physical sciences or even new data from theoretical physics. Although it is doubtful that anything can be shown to be absolutely and finally true in science, it is possible to eliminate most of the likelyhood of error. The question is then rephrased to whether mind can exist in the physical world as defined by its essential structure. In order to answer the question it will be necessary to examine that structure.

To Aristotle and more clearly to Newton the structure of the physical world included two distinct kinds of mediums in which existence took place. One is three dimensional space or extension. The second is time, a separate kind of absolute. Every physical thing Newton ever observed

involved both the mediums of three space and time. Every physical event that has ever occurred has involved both of these. Yet in man's conception of the world they were kept apart. On the whole man's thinking today, including that of many physicists, continues to keep these apart. So the physical world is seen as having two basically different kinds of mediums of existence.

Due primarily to the genius of one man the relation between these two mediums is now known. Relativity Theory has linked space and time into a real, four dimensional space of space-time. Einstein's relativity theory is still not generally known primarily because it involves more than new data; it involves a new conception of the physical world. J.W.N. Sullivan says this of the theory,

> The extraordinary lack of comprehension with which the scientific world at first greeted it was due not to its technical difficulties, but to the unfamiliarity of the outlook it assumed. It seemed to be the product of an alien mind[1].

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1 J.W.N. Sullivan, The Limitations of Science, London, Chatto and Windus, 1933, p. 268-269.

This theory is confirmed by all the data of Newtonian physics, and in addition by several crucial experimental observations which can not be explained by that physics. It is now generally accepted into the body of science, especially in its essentials. Certain lesser aspects such as the idea of curved space are not yet experimentally confirmed nor fully accepted. The aspects referred to here are confirmed experimentally and are more basic in the theory.

H. Weyl, one of the earliest to see the meaning of the new conceptions, describes this structure of the physical.

> ...The scene of action of reality is not a three dimensional Euclidean space but rather a four dimensional world, in which space and time are linked together indissolubly. However deep the chasm may be that separates the intuitive nature of space from that of time in our experience, nothing of this qualitative difference enters into the objective world which physics endeavors to crystalize out of direct experience. It is a four dimensional continuum, which is neither "time" nor "space"[2].

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2 H. Weyl, Space-Time-Matter, London, Methuen, 1922, p. 217.

The idea of four dimensional space may be conceived of as an abstract part of the province of mathematics. But as soon as it is applied to existing things, it refers specifically to the physical. That is, it is quite accurate to say that any existing four space entity is physical, conversely that any existing physical object is a four space entity. Existing four dimensional space and the physical world are identical. This could be rigorously demonstrated in several ways. For one it could be shown that any point in a physical object has four coordinates, three of space, x, y, and z, and one of time, t.

Or it could be demonstrated by showing the equivalence of mass and energy, since mass is physical and energy is four dimensional. Energy is a four space entity because it involves an extended thing in temporal change, or it always has the four coordinates x, y, z, and t. Energy and mass are now known to be equivalent as in the famous formula -

$$E = mc^2$$

where E is energy, m is mass, and c is a constant--the velocity of light.

Or to quote Einstein and Infeld,

> Classical physics introduced two substances; matter and energy. The first had weight, but the second was weightless. In classical physics we had two conservation laws: one for matter, the other for energy. We have already asked whether modern physics still holds this view of two substances and the two conservation laws. The answer is "no". According to the theory of relativity there is no essential distinction between mass and energy. Energy has mass and mass represents energy. Instead of two conservation laws we have only one, that of mass-energy[3].

What all this means is this. Whereas before there were two absolutes for the physical world, three-space and time, there is now one, space-time. More fundamentally, the old three-space or extension was thought to be physically real whereas now it is seen as not. Only a four dimensional or space-time thing has physical reality. For instance, a self-subsisting, stationary rock apparently need not be thought to involve time and could be taken to represent a self-subsisting three-space. Yet in taking all matter apart physicists have found it to always involve movement of its 'particles' and movement of 'particles' is a space-time thing. Moreover space-time is such an

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3 A. Einstein and L. Infeld, The Evolution of Physics, N.Y., Simon and Schuster, 1938, p.208.

essential part of matter that if one removes it, matter is simultaneously removed. For instance, one can take the space-time out of matter by stopping all the movements of its 'particles'. Yet since the energy in the matter is this movement, one would be setting energy equal to zero; and by the formula above mass equals zero. Not only would the 'particles' of it cease to move, but they would also cease to exist as matter. All of the data of physics points toward a space-time continuum or four space as the essential structure of the physical universe.

The older physics had a number of elements such as mass, inertia, gravitation, heat, acceleration, and so forth. Modern physics has substituted for all this, one formula relating to one'substance'—space-time. All of the older elements are aspects or properties of this substance. Newton was describing phenomena. The physics of today is very close to knowing its nature.

Everything physically, materially existing is a four space entity. Every existing four space entity is a material thing. All of the properties of physical things reduce to those of existing four space. Now that the structure of the physical is known, it is possible to see what kind of phenomena is generally possible in it and what is not possible. General sweeping conclusions can now be reached which were not possible as long as the

physical was thought of as naively observed phenomena, since on the naive level one could never be certain as to what the next moment might reveal regarding matter.

Science strongly implies the dimensional size of the universe is four dimensional, and that is all. What can this physical, four space universe include? The immediate conclusion is that it includes only those things all of whose properties are reducible to those of four space. Not only does it include extension in movement and abstract surface, line, and point which are aspects of extension, but it includes nothing else which is not basically and totally reducible to four space! It is important to gain insight into the real limitations in such a universe. It is a cold, purposeless, conglomeration of things moving. The beauty of the rose is a mass of wave lengths of light. A symphony is a briefly enduring number of compressions in a gas. Man is a localized set of space-time changes. The love between two individuals is the increased probability of a decrease in the space-time interval between two localized sets of space-time changes. Moreover past or future have no reality for the extension in movement can be at only one point at a time. Free will and life after death are

unspeakable. Samuel Alexander[4] and others have attempted to find in modern physics all the special powers of man such as his mind. But the world of modern physics is much like the old world of colliding balls of the materialists, only better defined.

Conceive of a world which is nothing but centers of movement rearranging themselves, one in which all that is real is concentrated totally in the present position of these movements. That is the physical world. As long as the conceptual scope of things is limited to four dimensions of space, in no conceivable way can it include anything not totally made up of these centers of movement. Things happening describes it. The order in things happening may be there, but it will remain unknown for there is no intellect in such a world. It is admittedly difficult to fully conceive what it means to have a universe limited to four dimensions, because man has so persistently projected his own qualities into the material world and has made so many attempts to link mind to this vast

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4 Samuel Alexander, Space Time and Deity, London, Macmillan, 1920, 2 Vols., p. xxviii-347 and p. xiii-437.

conglomeration of centers of activity. Our concepts of the physical world are actually badly contaminated with the mind it cannot possibly contain. A purified concept of the physical as space-time will not be easily attained for it is outside man's experience, just as the whole physical world is outside that experience. Bertrand Russell is accurately describing what man must be if the universe is limited to four dimensions,

> That man is the product of causes which had no prevision of the end they were achieving; that his origin, his growth, his hopes and fears, his loves and beliefs, are but the accidental collocation of atoms; that no fire, no heroism, no intensity of thought and feeling, can preserve an individual life beyond the grave; that all the labours of all the ages, all the devotion, all the inspiration, all the noonday brightness of human genius, are destined to extinction in the vast death of the solar system, and that the whole temple of Man's achievement must inevitably be buried beneath the debris of a universe in ruins--all these things, if not quite beyond dispute, are yet so nearly certain, that no philosophy which rejects them can hope to stand[5].

It is possible to make the behavior of man look remarkably like the operations of a complex space-time machine which is the body. From the aspect of behavior

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5 B. Russell, quoted by J.W.N. Sullivan, op. cit., p. 211.

man could possibly be reduced to space-time. But man's experience of himself and the things about him--experience as experienced--cannot be reduced to space-time. Experience has a quality which is distinctly different from the physical world which can in no way reflect on itself, conceive itself, judge itself, or will itself. From the aspect of experience, mind is somewhere outside space-time. This is an argument resting upon conceiving clearly what experience and the physical are and intuitively seeing a distinct difference. It is possible to prove a distinct difference, but that proof will only be sketched here. The total width of being or reality in a space-time world is at t_x, a moment of space-time which is an infinitesimal part of the time continuum. The 'particle' is at one point in the space-time continuum at a time. The total of real existing being in a space-time world is on a razor edge now. In space-time terms experience has the essential difference of being broader than the razor edge. Experience here includes all psychic activities; it is mind viewing itself as the totality of activities it encompasses. My experience of this sheet of paper spreads and includes what is was a moment ago. It can spread even to years of time to include, while I view this paper, its meaning in terms of where it was obtained (in a basement), how obtained (stolen), and what has happened since then.

The bare perception of this paper could be limited to the razor edge now. But the meaning of this paper which is real here and now is at least the perception of it in relation to an apperceptive mass, that mass has a spread in time not possible in a space-time world. Going beyond perceptions and memories to abstract ideas, dynamic strivings, exercise of the will, and to self knowledge, the difference between mind and space-time becomes clearer. This accidental collocation of atoms cannot reflect on a pattern of action and then take it up. Least of all they cannot know themselves. The idea of experience involving a spread of time not possible in four space will be taken up later at greater length. Actually bare perception is the area of mind closest to the physical world while the other higher aspects of mind are more apparently not reducible to space-time. The experiencing quality of perception most differentiates it from the physical--that experiencing quality when examined in its structure will be seen to involve a spread in time not possible in space-time.

Another way of showing a difference between space-time and mind is in the secondary qualities. Space-time includes wave lengths of light but no colors. There are compressions in a gas in four space but no sounds whatever, In spite of tremendous explosions in that world, it is deathly silent. There are gases of such and such

composition in that world, but there are no odors. There are solutions of salts but no taste. These secondary qualities, real enough to any man, are experience qualities totally absent in space-time.

If it is impossible to find yellows and greens as they are experienced in space-time, consider the worse plight of the physicist who would look for yellow and green in the abstract--detached from all objects. A man may conceive of such abstract colors as has already been done here. In the world of space-time all things are in particular instances of them; they are more nearly here than there, but never nowhere in particular. Things in the abstract realm of ideas and dynamic tendencies may be said to involve a space spread or a lack of particularization which is not possible in space-time.

All these instances of mind not being totally reducible to space-time emphasize either the experience quality of mind or its time or space spread. If these do not suffice to show the essential difference between mind and four space, an important body of work can be cited which shows an aspect of mind so unrelated to the physical as to be a serious point of controversy as to how it could possibly be true. J.B. Rhine of Duke University pioneered in the experimental study of extra-sensory processes which,

until his work, were little more than speculative rumors[6]. Now after twenty-one years of research, all mathematical and methodological criticism have been fully answered and the evidence for ESP has become so overwhelming as to mark disbelievers as simply persons unacquainted with the literature or unable to be moved by any evidence. This evidence is recorded in detail principally in the Journal of Parapsychology, and in the Proceedings of the American and British Societies for Psychical Research[7]. There is no longer any real question as to whether ESP exists. Workers in parapsychology are turning their attention to find the nature of the process by finding its relation to the personality structure of the percipient[8,9]. To give some idea of the kind of evidence for ESP, the results

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6 J.B. Rhine, New Frontiers of the Mind, N.Y., Farrar and Rhinehart, 1937, p. 111-275.

7 Unfortunately this literature is not available. Citations will be from my own notes or from the Psychological Abstracts for which the volume and entry number will be appended.

8 G. Schmeidler, "Personality Correlates of ESP As Shown by Rorschach Studies", Journal of Parapsychology, Vol. 13, 1949, p. 23-31. (PA 24:526)

9 B. Humphrey, "ESP Score Level Predicted By A Combination of Measures of Personality", Journal of Parapsychology, Vol. 14, 1950, p. 193-206. (PA 25:5997)

of a study on precognition will be cited. The experimenter, S.G. Soal, an English mathematician, lectured vigorously against the possibility of ESP[10]. He had conducted an extensive well controlled experiment without apparently demonstrating ESP. In the experiments a percipient recorded his impression as to which card various agents were concentrating on in another room. The cards were chosen completely at random. The whole procedure was observed by several competant judges. Between the agent and percipient all possibility of sensory communication had been eliminated. Arguing further against sensory contact between them is the fact that the final results show the percipient was reacting to the card that had not yet been selected. When it was suggested to examine the data for precognition of the yet unselected card (+1)

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10 S.G. Soal, "Fresh Light on Card Guessing; Some New Effects", Proceedings of the Society for Psychical Research, London, Vol. 46, 1940, p. 152-198

the results were as follows:

> Statistically the precognitive (+ 1) results on the whole series are highly significant. Including every single experiment between the dates 24/1/41 and 6/1/43 at which an Agent was present, we have a total of 11,378 (+ 1) precognitive trials. This total includes tests in both "telepathy" and "clarivoyance" and tests at all rates of calling with all Agents; i.e. we include those conditions which consistently led to negative results as well as conditions which conduced to success. The number of (+ 1) successes on this grand total is 2,890 compared with an expectation of 2,308.7 by Steven's method. We have thus an excess of (+ 1) hits amounting to 581.83 and equivalent to 13.6 Standard Deviations, with odds of more than 10^{35} to 1 against chance[11].

This is not a particularly unusual finding. But such a low chance level is practically never even approached in all the other commonly accepted findings in scientific knowledge. Extra-sensory perception may be taken as an established phenomena beyond all reasonable doubt. There are great masses of experiments which have incorporated in their design and in the statistical evaluation of the results safeguards against every criticism. It is of interest here because it is one of the best established (statistically) of all mental phenomena and is, at the

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11 S.G. Soal and K.M. Goldney, "Experiments in Precognitive Telepathy", Proceedings of the Society for Psychical Research, London, Vol. 47, 1942, p. 36.

same time, clearly one transcending space-time. The findings may be generalized by saying that neither the space nor the time difference between the agent and the percipient have been shown to have any effect on the success of the results. For instance ESP has been found to operate over a distance of 4,000 miles[12], and precognition for a period of ten days[13]. Distance has a distinct bearing on all energy exchange relationships in space-time. Also an event that has not yet occurred can have no influence on the present state of affairs in space-time. ESP is an example of a mental phenomena that has been shown experimentally to transcend both space and time.

In these several ways mind can not be reduced to a four dimensional space. Of the three possible places for mind in nature, in four space, beyond four space, and in another category of existence, the first can be eliminated as a possibility. Wherever mind fits into nature it does not appear to fit in four space or into the physical universe. Man's four dimensional universe contains

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12 E. Mahan, and J.B. Rhine, "A Second Zagreb-Durham ESP Experiment", Journal of Parapsychology, 1947, Vol. LI, p. 244-253.

13 B. Humphrey, and J.B. Rhine, "A Confirmatory Study of Salience in Precognition Tests", Journal of Parapsychology, Vol. 6, 1942, p. 190-219.

nothing more than centers of movement, and this is fundamentally too limited a structure for mind. Mind would seem to be somewhere outside of the physical, four space universe.

Summary:

Mind could fit into only three places in nature, in four space, beyond four space, or in another category of existence. Modern physics was cited to show that the essential structure of the physical universe is that of space-time. The general nature of entities possible in such a space was shown. Mind was shown to be excluded from the barren and limited world of space-time since the latter cannot include the various kinds of experience as experience, nor does it have the time spread or lack of particularization of the higher levels of mind, nor the secondary qualities. Lastly experiments which appear to have established the existence of the various forms of extra-sensory perception, a mental phenomena, were cited. Since extra-sensory perception transcends both space and time, it is experimental evidence that mind is somewhere outside of space-time.

Since mind is not in the first four dimensions of space, its nature is to be found either in higher space, or in a separate category of existence. The likelihood of the former can now be shown.

CHAPTER III

DEVELOPMENT OF THE MATHEMATICAL FOUNDATION OF THE THEORY IN SPACE OF GREATER THAN FOUR DIMENSIONS

> Whereas nature doth not admit of more than three dimensions...it may justly seem very improper to talk of a solid ...drawn into a fourth, fifth, sixth, or further dimension...Nor can our fansie imagine how there should be a fourth local dimension beyond the three.
> J. Wallis, Algebra, 1685.

An examination of mind in general, and certain mental phenomena in particular, makes it appear that the present four dimensional framework of reality is inadequate to contain mind.

The theory to be presented here arises out of the idea that mind exists, and yet does not appear to exist in a four dimensional universe. Therefore, it may exist in a space of greater dimensionality. This theory proposes that there is a relationship of identity between mental phenomena on the one hand, and existence in hyperspace on the other. Before the identity can be shown, it is necessary to develop the mathematical basis of spaces of higher dimensionality. Thereafter the spaces can be described in experiential terms and compared to the experience of mind.

'Space' and 'dimension' are concepts that have been used in senses varying from the loosest to the most rigorous, in application to realms from formal physics to imagination and spiritualism. In science these concepts

have a restricted range of meanings. Most basically, in terms of structure, they belong to the proper domain of mathematics; and in mathematics they appear in more than one context. With mathematics supplying the basic framework, these conceptions of space and the related idea of dimension have been found to describe the physical universe. Space and dimension are not then, in terms of science, concepts to be loosely applied to various analogous situations; but are conceptions arising out of a rigorous mathematical framework. It is possible to set up an arbitrary definition of dimension and space and develop its consequences. This has been done many times[1]. But then it is not valid to assert or imply that the higher spaces so described form a continuous series with ordinary four dimensional space. Our ordinary space is rigorously defined in a mathematical framework which describes all of physical space. If one is to conceive of a higher space with the same existential reality as ordinary space, and forming a logical series with it, then one must base it on

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1 Charles M. Perry, Toward a Dimensional Realism, Norman, Oklahoma, University of Oklahoma Press, 1939, p. ix-180.

the mathematical framework for ordinary space.

Since this is primarily a work in psychology which borrows from mathematics, there is a need to safeguard against the dangers any scientist runs into when he steps beyond his field. Lewin defines the problem between psychology and mathematics as one of realizing that pure mathematics is an abstract approach to operations which in psychology are empirical and factual[2]. It is necessary that the abstract mathematical structure fit the empirical data. In general, to borrow from one science for another, it is necessary to understand the total relationship between the two areas. The elements borrowed must be seen in their original meanings and definitions. The authoritativeness of the thing borrowed must be assessed. For instance, in borrowing from psychology the error is often made of asserting or implying that Freud's doctrine represents the considered opinion of psychologists in general, which is not true. Lastly, the thing borrowed must be relevant to tha matter to which it is applied. In borrowing elements

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2 Kurt Lewin, Principles of Topological Psychology, N.Y., McGraw-Hill, 1936, p. 59.

of one science for another it is then necessary to, 1) understand the relationship of the two areas, 2) the borrowed must be obtained in the context of its original meanings, 3) the authority for the borrowed must be assessed and 4) the borrowed must be relevant to the matter to which it is applied.

This theory borrows from mathematics. It may be seen as part of a general trend whereby, with the advance of knowledge, compartments lose their distinction and diversitites become related. The dangers of ranging beyond one's field are great but it is necessary to the natural development of knowledge. The dangers simply have to be borne in mind and safeguarded against. The first point of danger above, the relationship of the two areas, will be taken up immediately. Points two and three, obtaining the borrowed in its original context of meaning and with assessed authority, will form the remainder of the chapter. Point four, the question of relevancy of the mathematics developed here to psychology will, implicitly or explicitly, form the whole succeeding work.

1. The Relationship of Mathematics to Experience

It is not the purpose here to exhaustively delineate the relationship between mathematics and experience. What is intended is a broad enough view of the two so as to give

a more understandable basis to the synthesis attempted in this theory.

The word experience, above, is used rather than the term psychology because the relationship of psychology to mathematics is part of the more basic issue of the relationship of this formal system of symbolic manipulations to human experience in general. The whole question of this relationship, as broadly conceived, has been a subject of some debate among mathematicians. Some prefer to conceive of their work as purely formal, detached from the world of events. Others view mathematics as deriving from experience and valid in so far as affirmed in experience. Kattsoff[3], like Russell, Whitehead, and other prominent writers in the field, classifies the philosophies of mathematics into the metamathematical and the epistemological. The metamathematicians (also called formalists) are those who see mathematics as a formal body of operations in which internal consistency is the ultimate criterion of validity. This position is prominently represented by Hilbert, who

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3 L.O. Kattsoff, A Philosophy of Mathematics, Iowa State College Press, 1948, p. 2.

felt all bodies of mathematics should be based on explicit postulates, and that the whole system must be shown consistent with these postulates. Metamathematics sees applied mathematics as a straying from the basic purpose of exploring mathematics as a pure structure. This theory, in so far as it relates a basic structure to experience, is not metamathematical.

In contrast to the metamathematical purists, there are a number of schools of thought holding that mathematics is at its basis derived from experience, or takes meaning in relation to experience. Kattsoff calls this the epistemological position while others use the term intuitional. Brouwer's intuitionalism is a prominent example of this position. By intuitionalism is not meant any special way of obtaining knowledge, but that the verity of mathematical knowledge is known directly to the experiencing organism. This emphasis on the experiencing organism leads to questions of the existence of the mathematical truths in experience, which is a question outside of the scope of the formalist position. Also in its concern with the relationship of mathematics to experience, it seeks out the general applications of the science and its relation to other sciences.

Metamathematics asks the question, is it logical or self-consistent? Epistemologists ask the question, is

it objective; that is, does it fit with objective experience? The philosophy of metamathematics is critical while that of the epistemologists is speculative. To the metamathematicians an instance of the practical application of mathematics is merely a convenience for the person who uses it, but nothing of the mathematical structure of reality is thereby asserted. For the epistemologists an application is an affirmation of the expected, since for them reality has a mathematical structure in which eventually all valid mathematics may be found.

The view of the epistemologists is gaining in strength although there will always be formalists and good arguments for the formalist position. The work of Russell[4], Jorgenson[5], and Russell and Whitehead[6], and others has fairly well established an essential relationship between logic and mathematics, thereby relating mathematics to rational experience. Burington lists five types of

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4 B. Russell, Introduction to Mathematical Philosophy, London, Allen and Unwin, 1924, p. viii-208.

5 J. Jorgenson, Treatise of Formal Logic, Trans. W. Worster, London, Oxford University Press, 1931, p. 211.

6 B. Russell and A. N. Whitehead, Principia Mathematica, 2nd Ed., Cambridge University Press, 1950, 3 Vols., p. xlvi-674, p. xxxi-742, p. viii-491.

activities in applied (epistemological) mathematics[7], The first is the type this theory falls into, "Problems involving the formulation of a general mathematical structure and theory for a particular situation or field F being made the field of study." The examples in this category are those which have given so much prominence to the epistemologist's view that reality has a mathematical structure. Examples are Newton's theory of gravitation and mechanics, Maxwell's theory of electromagnetism, Einstein's relativity, Planck, Heisenberg, Schroedinger, Dirac, and vonNeumann's quantum theory and wave mechanics, and current nuclear theory.

Mathematics itself is not a fountainhead of pure truth, so that to relate a body of ideas to mathematics is not to make it true. Anyone who has studied the varied attempts of mathematicians to define their own science or its objects[8], or considers the fallen idols such as Euclid's postulate of parallel lines sees that mathematics only approaches truth. Synonymity with mathematics does not

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7 R.S. Burington, "On the Nature of Applied Mathematics" in American Mathematical Monthly, Vol. 56, 1949, p. 225.

8 Kattsoff, op. cit., p. 16-23.

make a body of ideas true. Ultimately the ideas and their mathematical extensions must be tested against verifiable experience.

The essential implication in a theory such as this, which links mathematics with experience, is to hypothesize the mathematical structure of that experience. That is, the further implications of the body of mathematics, beyond those explicitly developed, continues to apply to further realms of that experience. Once the two have been hypothetically related, the conclusion is that further extensions of that experience or of the mathematics continues to be applicable to the other. The structure of the two is seen as identical throughout their extent. This is the essential value of hypothesizing a relation between the two. Otherwise, were only that part of the mathematics which had been explicitly related to experience valid, there would be no need to study anything but the experience. If an hypothesized relation between mathematics and experience is true, then one has in the conventional manipulations of the mathematics a powerful tool for exploring truths in the area of experience to which it is related. It might be difficult or impossible to get at areas of experience otherwise. The hypothesis that mind exists in such and such dimensions of real space has value in that, if the relationship is true (or parsimonious

throughout its extent, since we may never know its ultimate truth), one then has added a powerful tool by which the nebulous and somewhat subjective nature of mind may be explored. Further implications also may be drawn, such as, by such a union as this an ultimate aspect of a large portion of reality is being described. These further implications will be treated in the last chapter. The main functional value of such a union is as a means of making further discoveries.

Kattsoff sums up;

> In the last analysis, then a (mathematical) theory is true if its relations with the rest of reality are definitely established. This is best done by showing its applicability to at least one other realm. It is a well known fact that a system is most easily shown consistent if its terms can be interpreted. Ultimately the consistency of sets of postulates (i.e. systems) is referred to the rationality (consistency) of reality. The true significance of mathematics is grasped only in its relations to the rest of nature[9].

In summary, mathematicians are divided on the question of the relation of mathematics to reality. There are those who view mathematics as a thing in itself, not to be related to experience. And there are those who view

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9 Ibid., p. 248. Brackets [ ] are the present author's.

the science as deriving from or ultimately embedded in experience. The present work, like all of applied mathematics, belongs to the latter or epistemological outlook. The ultimate test of validity of such a work as this lies in verifiable experience. Its functional value is in its providing a means for further discovery.

2. Development of the Mathematical Basis of the Theory

Having seen the general relation between the area borrowed from, and the area for which it is borrowed, it remains now to develop the thing borrowed in its original meanings, and to show its authority.

For the present the dimensional basis of the theory will be shown in its naked form, as a mathematical entity. This is how mathematicians do it. It is best at this point to avoid confusion between the space of physics, the space of everyday life, with this space of the mathematicians. An abstract framework is presented here. Space in the Mathematics Dictionary is defined as;

> 1) a three dimensional region
> 2) any set or accumulation of things, the members being called elements or points and usually assumed to satisfy a set of postulates of some kind.

and dimension;

> Refers to those properties called length, area, and volume... Technically a configuration has 1, 2, 3, or in general n dimensions when the equation describing it analytically contains 1, 2, 3, or n essential constants. A space is said to have n dimensions when n numbers (coordinates) are necessary to fix the position of a point in the space[10].

The first part of each of these definitions is the more popular, or one might say, physical notion. The second is the technical mathematical meaning which relates to operations but not intentionally to real things. When mathematicians describe dimension they are working most immediately with an operation of defined characteristics. Since this is what they mean, it will be the sense in which the mathematics of the theory is developed here. In the definitions to follow elements which everyone has experienced, lines, points, surfaces, and so forth will appear; but that they are encountered in experience is an extraneous circumstance for the present. This is intentionally the realm of only consistent operations.

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10 Glenn James and Robert C. James, Mathematics Dictionary, N.Y., Van Nostrand, 1949, p. 332 and p. 109.

What has mathematics to say of space and dimension? It has a great deal to say in several different contexts. The classic treatment finds space in two broad areas in mathematics, geometry and topology. In geometry dimension is treated by analytical or combinatorial methods. In topology several definitions have been shown inadequate, and one stands out as the accepted statement. Going beyond conventional treatment, there is also a definition in mathematical logic and an unusual one in group theory. All of these will be developed here because they comprise a complete picture of the mathematics of dimension theory. Some areas will be deëmphasized for reasons which will become apparent when the area is developed. Each of these different areas may be translated into the others. They speak of the same thing in different ways. The course of development, then, will be from geometry (analytic and combinatorial), to topology, to mathematical logic, and to group theory.

Geometry will be seen to provide descriptions of mathematical entities in higher space which, by their nature are almost impossible to translate into terms of experience and will thereby be rejected. Topology will provide the most authoritative statement which will be the mathematical criterion used to determine the dimensional validity of future speculations. Mathematical logic will provide a similar definition from another source. Group

theory will reinforce the validity of certain later speculations. No proofs will be given, instead authorities for the statements will be cited.

A. A Brief History of the Important Errors Made in Dimension Theory

It appears that the earliest origins of dimension theory were intuitive interpretations of man's personal experience with the objects of the world through the senses of sight and touch especially[11]. Solids were the palpable realities which formed the origin of the concept of dimension. By the time of the Greeks, geometry had arisen out of abstracting from the solid the concept of surfaces and lines. They then had some conception of dimensionality in which the one dimensional was part of the two dimensional, which was in turn part of the three dimensional. Time was placed in various kinds of special categories related to solids, but was not conceived of as dimensional until Einstein's Relativity Theory linked the two in a space-time continuum.

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11 D.M.Y. Sommerville, An Introduction to the Geometry of N Dimensions, N.Y., Dutton, (1929), p. 1.

The history of dimension theory had a long slow start, especially regarding practical application, since it is only in the twentieth century that a fourth dimension has been added to man's conception of reality. As early as Ptolemy there had been speculations on a n dimensional mathematics though[12]. In Descartes' time more serious attempts were made which continue to the present day. This work is still confined for the most part to a small class of mathematicians and philosophers. While other scientists have only of late begun to extend their conception of the universe to a fourth dimension, mathematicians have made a brief exploration of the whole range of dimension theory and have looked upon, in symbolic form, different kinds of infinite dimensionalities.

Present conceptions of the mathematical nature of dimensions were arrived at laboriously after several false starts. The nature of these failures is important since it delimits the nature of dimension. Three main errors will be treated here. Two of these failed on technical

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12 Florian Cajori, A History of Mathematics, N.Y., Macmillan, 1926, p. 306.

grounds, and the other was a failure in practical application.

An early formal attempt at setting up a definition of the nature of dimensions was based on the intuitive notion of a difference in quantity between lines, surfaces and solids[13]. That is, it was felt that a surface contains more points than a line and less than does a solid. The ideas of more and less were justly applied to finite sets[14], while surfaces contain infinitely many lines and the lines infinitely many points. George Cantor eliminated the possibility of using the concept of different multitudes of points to differentiate dimensions[15]. His work demonstrated that different infinities (i.e. all rational numbers, all irrational numbers, etc.) are of different sizes. They could be measured by establishing a 1:1 correspondence between their elements. When he showed a straight line segment, a square, and a cube contain equally many points,

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13 W. Hurewicz and H. Wallman, Dimension Theory, Princeton, Princeton University, 1941, p. 4.

14 "Set--a number of particular things, as the set of numbers between three and five, the set of points on a segment of a line, or within a circle". James and James, op. cit., p. 322.

15 George Cantor, Contributions to the Founding of the Theory of Transfinite Numbers, Trans. by P. Jourdain, Chicago, Open Court, 1911, p. ix-211.

he demonstrated the invalidity of using 'quantity of points' as the key to dimensions.

The second attempt to arrive at the nature of dimensions involves the concept of continuous mapping. It was felt the difference, for instance, between a one dimensional and a two dimensional entity was that a line could be traversed by a continuously moving point; while such a point could not 'map' or traverse a square. When Peano found that a continuously moving point could traverse a square or a solid cube, while it could not traverse some one dimensional objects, he showed continuous mapping did not define the nature of dimensions[16].

These were the two theoretical attempts which failed to arrive at the nature of dimensions. The last failure, a practical one, is one still frequently found described in the literature as defining the essential characteristics of dimensions. In fact the definition of dimension quoted from the Mathematics Dictionary, above contains it.

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16 G. Peano, Formulaire de mathematiques, Turin, Bocca, 1894-1908, 5 Vols. in 3, Vol. I, p. vii-144.

It is the conception of the dimensionality of space as the least number of parameters or coordinates necessary to define the position of a point in that space. That two parameters are necessary for a surface and three for a solid is apparent. But from there on adding parameters gives little definition of what kind of entity is arrived at. The idea of parameter itself can be shown to be of uncertain value when applied to some complex spaces. The concept has embedded in it more definitive properties of dimensions which will be seen later in topology. The use of parameter as a guide to the nature of dimensions has led to some confusion of phase space with real space. For instance, five fishes in a bowl of water require sixteen parameters to describe their state at any moment, for each of them three parameters of space to define their location in the bowl and one of time. No one would agree that they exist in sixteen dimensional space though. The notion of parameters, while not of help in arriving inductively at the nature of higher dimensions, contains truths that will be found in other contexts.

In this brief survey, which orients the mathematical presentation here in its historical perspective, it has been seen that the idea of dimensions has grown slowly out of sense experience. Two relatively mature attempts to characterize dimensions have been shown in error and one

other has shown failure in practical application. It remains to see the contemporary mathematical presentation of dimensions, first in geometry.

B. The Geometry of N Dimensions[17]

The geometry of n dimensions may be conceived as the extension of ordinary plane and solid geometry into higher dimensions. The concept of dimension in geometry has arisen as an accepted aspect of the equations involved. It has not appeared clearly necessary to geometricians that they define or try to arrive at the nature of dimensionality such as the topologists and the mathematical logicians have done. As examples, Todd, without any attempt at rigor, defines dimension as the freedom of a linear system[18]. Similarly Sommerville simply defines it as the degrees of freedom of a system[19]. Geometry (projective and analytic) then does not make a clear attempt to arrive at the nature of dimensionality, but uses it more as an accepted tool. For this reason and because of the nature of geometrical

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17 The n is a symbolic element for which any number 1, 2, 3,...n can be substituted.

18 J.A. Todd, Projective and Analytical Geometry, London, Pitman, 1947, p. 174.

19 Sommerville, op. cit., p. 174.

descriptions of things, projective and analytic geometry will provide an approach to dimensionality, but not one of particular value to this work. It is necessary to examine this description to see why it is not of value.

The projective and the analytic approach in geometry are two separate but related ways of handling the material. Analytical geometricians at first conceived of geometrical figures as the basic entities and the algebraic formulas which satisfied the figures as lesser equivalents. Over the course of time the geometrical figures came to be regarded as merely the visualization of the formulas. The value of x is visualized as a point on a line; x, y as a point in a plane, and x, y, z as a point in space. N dimensionality in these terms becomes the number of parameters x, y, z,...n needed to locate a point in n space. The concept of dimensionality as defined by parameters does not provide a rigorous definition of the nature of dimensions though.

Since an equation in analytical geometry is most often 'represented' by a figure in a plane, or at best a solid, an equation of four, five, six or more parameters can not be intuitionally known for what it represents geometrically. The algebraic language is quite adequate for n dimensional space, but beyond three dimensional representation the language ceases to be useful for

visualization. A point in n dimensional space is simply defined by a set of n real numbers x_1, x_2, x_3, $x_4 \ldots x_n$. A 'hyperplane' of n dimensions is the set of points satisfied by an n parameter linear equation. But the equation does not appear to provide any means of coming to know what such a hyperplane is like when encountered in experience. Analytical geometry is then a part of mathematics which approaches higher space in terms of the algebraic equations of figures in that space, but thereby does not appear to provide a means of visualizing the entities represented beyond three dimensional solids[20]. Notice analytical geometry's description of a five dimensional cube. A five dimensional cube with edge two, sides parallel to the coordinate planes, and center at the origin, is the totality of points x_1, x_2, x_3, x_4, x_5, for which[21]

$|x_1| \leq 1$, $|x_2| \leq 1$, $|x_3| \leq 1$, $|x_4| \leq 1$, $|x_5| \leq 1$,[22]. Such a

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20 At best four dimensional figures can be visualized in space-time relativity terms.

21 R. Courant and H. Robbins, What Is Mathematics?, London, Oxford University Press, 1941, p. 230. The word 'simultaneously' is omitted since a five dimensional figure is a moving one, and the word invalidates their description of the figure.

22 $|x|$ means the absolute value of x.
$\leq$ means equal to or less than.

formulation gives no idea as to what a five dimensional cube looks like.

In projective geometry a higher dimensional figure is 'projected into' a lower dimensional area, or is described in terms of figures of lower dimensionality. For instance, a three dimensional cube with its vertices numbered one through eight may be described in two dimensional terms by its six planes with the corners bearing the identifying figures. Or a three dimensional cube may be described as made up of six squares, twelve line segments and eight vertices with three segments at each vertex.

A four dimensional cube is then found, by the mathematics of projective geometry, to be one"bound by eight three dimensional cubes, each identified with a 'neighbor' along a two dimensional face". It has "sixteen vertices, in each of which four of the thirty-two straight edges meet"[23]. Such a figure cannot be visualized. A cube in five space is even less visualizable in terms of this kind of description.

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23 Courant and Robbins, Ibid., p. 232.

In general, analytical geometry, while it may be said to deal with entities in higher space, conceives of them in terms of algebraic equations. Similarly projective geometry deals with them in terms of the lower dimensional geometric figures involved. These are valid approaches to higher space in terms of which entities may be conceived. But any description of entities which is to be related to experienced mental phenomena must be in terms more readily apprehended than algebraic formulas or a summation of one, two, and three dimensional components.

Then too, in topology will be found a more rigorous description of the nature of dimensions than is found in analytical or projective geometry. Topology's sudden rise to prominence in mathematics is due primarily to its being a more fundamental approach to the nature of mathematical entities.

C. The Topology of N Dimensions

What is topology? Also called analysis situs, it is more than a branch of mathematics. It is a study of mathematical relationships in such primary terms that basic

elemental structure can be delineated[24,25]. The best known branch of mathematics in everyday use is metrics, or the measurement of things in terms of arithmetic. Less known is projective mathematics treated in the previous section. Not commonly known, topology is the study of the properties of geometrical figures that persist when the figures are transformed without regard to their metric or projective properties. The most spectacular examples of topology are deformations or 'rubber sheet geometry'. If a figure is drawn on a rubber sheet which is stretched or compressed without breaking it, the topological properties of that figure remain the same while the metric and projective properties have changed considerably. A ring may be stretched, bent, or tied in knots, and as long as it is not broken it is topologically equivalent. A square, circle, and irregular polygon are equivalent figures topologically since they are each plane figures which define a simple inside and an outside. A sphere and a cube similarly are equivalent figures topologically. A strict definition of

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24 Philip Franklin, "What is Topology?", Philosophy of Science, Vol. 2, 1935, p. 39-47.

25 W.L. Ayres, "Some Elementary Aspects of Topology", American Mathematical Monthly, Vol. 45, 1938, p. 88-92.

topological transformation is the following:

> A topological transformation of one geometrical figure A into another figure A' is given by any correspondence between the points p of A and the points p' of A' which has the following two properties.
> 1. The correspondence is biunique. This means that to each point p of A corresponds just one point p' of A' and conversely.
> 2. The correspondence is continuous in both directions. This means if we take any two points p, q of A and move p so that the distance between it and q approaches zero, then the distance between the corresponding points p', q' of A' will also approach zero, and conversely.
>
> Any property of a geometrical figure A that holds as well for every figure into which A may be transformed by a topological transformation is called a topological property of A and topology is the branch of geometry which deals only with the topological properties of figures[26].

Topology by its nature permits the study of the essential mathematical properties of a thing divorced from its metric and projective accidents. Because of this it has succeeded in giving the most penetrating characterization of space and dimension that can be found in mathematics. The study of space and dimension as a mathematical entity is the proper domain of topology[27]. Projective and combinatorial geometry draw pictures of things in

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26 Courant and Robbins, op. cit., p. 241.

27 S. Lefschetz, "The Structure of Mathematics", American Scientist, Vol. 38, 1950, p. 106-111.

various spaces, whereas topology describes the essential nature of the spaces.

Poincare in 1912 called attention to the need for a deeper analysis of dimension and set forth an early topological definition[28]. He observed that a line is one dimensional because two points on it may be separated by a point, while separation of two points on a plane requires a line, and so forth. From this he arrived at a definition of a space as n dimensional if any two points may be separated by removing an (n-1) dimensional subset. Brouwer constructed on this intuitive definition a more rigorous one[29]. Independently of Brouwer and of each other, Menger and Urysohn in 1922 recreated Brouwer's concept. The main authoritative works on dimension theory today are those of Menger, and Hurewicz and Wallman. The definition of dimension used in all these works, and the one to which others may be reduced[30] is that following. Since its formulation in the early twenties it has become the foundation of one of the central branches of topology.

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28 Poincare, (No title), Review de metaphysique et de morale, 1912, p. 406, quoted by Hurewicz and Wallman, op. cit., p. 3.

29 K. Brouwer, "Uber den naturlichen Dimensionsbegriff", Journal fur Mathematik, Vol. 142, 1913, p. 146-152, quoted by Hurewicz and Wallman, op. cit., p. 4.

30 Hurewicz and Wallman, op. cit., p. 6-8.

It is:

> a) the empty set has dimension -1.
> b) the dimension of a space is the least integer n for which every point has arbitrarily small neighborhoods whose boundaries have dimension less than n[31,32].

This is the definition of the mathematical nature of dimensions which will be used as the mathematical criteria for the dimensional validity of hypothesized higher spaces. It is necessary to explain the concepts involved in it.

It will be remembered a <u>set</u> is a number of particular things such as the numbers between ten and thirty or the number of lines in a surface. The set of zero-dimensionality is a finite number of points which then has the characteristic that the region of space it occupies can be made as small as desired and no points of the set will be included in the boundary. The empty set contains no points and may be set at dimensionality -1. A set S is of dimension zero if it is not of dimension -1 (that is, if it has at least one point) and if each boundary of S has dimensionality -1 (that is, contains no points of S). The empty set and dimension zero are of use in the definition of dimension to

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31 Ibid., p. 4 and 24.

32 Karl Menger, <u>Dimensiontheorie</u>, Leipzig, Teubner, 1928, p. 80.

make it complete, but are of no use in the applications to be made of dimension in this theory. The -1 or zero-dimension set could only be used in practical application to a realm without existence or to a point existence.

For the more important b. part of the definition it is necessary to understand neighborhood and boundary. A set N is a neighborhood if each point of N is the center of an arbitrarily small sphere all of whose points belong to N. Therefore the interior of a cube is a neighborhood while its surface faces are not. The neighborhood of a surface is all those centers of arbitrarily small circles all of whose points lie on the surface. It may be seen that the neighborhood is always of dimension n for any object of n dimensionality.

The boundary of a neighborhood N is the set of all points which are centers of spheres only part of whose points are in the neighborhood N. The boundary of a cube is then its faces. It may be seen that just as the faces of the three dimensional cube are two dimensional, the boundary of any figure of n dimensions is always of less than n dimensions. Hence the b. part of the definition, "the dimension of a space is the least integer n for which every point has arbitrary small neighborhoods whose boundaries have dimension less than n", equals n-1. This will be true for all spaces developed in this theory. Only in unusual kinds of

spaces does it have any other value.

A recursive definition of dimension can be built up from the concept of -1 and zero-dimensionality. In it set S is of dimension 1 if it is not of dimension -1 or zero, and if each point in S can be enclosed within an arbitrarily small region of zero-dimension. This can be carried into a higher dimension n with each boundary equal to one less than that of the neighborhood.

An extensive mathematics of dimension theory has been built on this concept of the nature of mathematical space, but the lag between theoretical mathematics and translation of it into experience terms is so great that little more than this definition is needed to build the rest of the theory presented here.

D. The Mathematical Logic of n Dimensions

The definition of dimension given above in topology is the most generally accepted, but dimension and space are entities which can be arrived at by several avenues. In order to show the relevance and validity of the logical approach Bertrand Russell's work in this area will be briefly cited. It may be recalled that Russell, Boole, Whitehead and others have demonstrated the continuity between mathematics and logic. In fact a purely logical attempt to construct the nature of higher dimensions of space could be entirely valid, but the basic mathematical

structure has been cited in order to have a broader basis for the development of the theory, and to be in accord with the majority of opinion.

In the area of mathematical logic, Russell defines dimension in terms of serial relations[33].

> Let there be some series u_n whose terms are all themselves serial relations. If x_{n-1} be any term of u_n, and x_{n-2} any term of the field of x_{n-1}, let x_{n-2} be again a serial relation, and so on. Proceeding to x_4, x_3, etc., let x_1, however obtained, be always a relation generating a simple series, Then all the terms x_{n-1} belonging to the field of any serial relation x_n, form an n-dimensional series. Or to give the definition which starts from the terms: let u_n be a class of terms, any one of which, x_n say, belongs to the field of some serial relation, x_{n-1} say, which itself belongs to a definite class u_{n-1} of serial relations. Let each term x_n in general belong to the field of only one serial relation x_{n-1}...Let u_{n-1} lead

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33 "series--the indicated sum of a finite or ordered infinite set of terms." James and James, op. cit., p. 319.

> to a new class u_{n-2} of serial relations, in exactly the way in which u_n led to u_{n-1}. Let this proceed until we reach a class u_1, and let u_1 be a simple series. Then u_n is a series of n dimensions[34].

The two parts of the definition are equivalent to each other. The first is phrased in the serial terms x_{n-1}, etc. The second part is phrased in the classes of terms u_n of which x_{n-1} is a term. The definition has the general form, let there be a class of terms each of which is a series, of which each again is a series, and so on down to the limiting x_1 or the one dimensional series. Then the class is n dimensional. An entity of any dimension is made up of a series of next lower dimensional entities. Conversely, a lower dimensional entity arranged in a series forms a class of the next higher dimensionality.

This type of definition has been criticised by Menger along the lines of the findings of Cantor and Peano

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[34] Bertrand Russell, Principles of Mathematics, 2nd Ed., London, Norton, 1937, p. 375. The subscripts in the first four sentences have been reversed from Russell's original statement so as to make their meaning uniform throughout the definition and conform to the rest of this work. As originally stated, he had confusingly made u_1 an n dimensional series and u_n a one dimensional series. Then the meanings were the opposite for the second part of the definition.

mentioned earlier[35]. He would say, for instance, the cube can be considered as a class of points and not of the subclasses of planes, then lines, and then points. O_r in Russell's terms that the series x_3 can be seen as made up only of the series x_1. Russell on the same page asserted the possibility of such a transformation. Yet in the second part of this definition he had included a clause which guards against this when he says, "Let each term x_n in general belong to the field of only one serial relation x_{n-1}..." By this clause he makes it invalid to omit the intermediate steps in this recursive definition. By the definition then the three space cube x_3 is the class of the two space series x_2, which in turn is the class of the one space series x_1.

The topological definition and that of mathematical logic are speaking of essentially the same thing. Topology uses neighborhood as the x_n class and the boundaries and neighborhoods building downward as the successive x series down to the limiting x_1 series. The zero dimension series

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35 Karl Menger, "What is Dimension", American Mathematical Monthly, Vol. 50, 1943, p. 3.

and the minus one dimension series in topology are limiting refinements which can have little practical application. Though Russell's definition was stated as building downward from x_n, it can be seen as describing the relations of the x series built in either direction, just as does the definition of Menger, Urysohn and Brouwer. Their neighborhood to boundary relation describes the same dimensional step to step relation as does Russell's series n to series n-1. This is equivalent to topology's relationship of the n dimensional neighborhood to the n-1 dimensional boundary. It is quite probable that mathematical logic could be shown to provide as rigorous a definition of dimension as does topology.

In surveying projective geometry, topology and then mathematical logic there is some return to the experience quality of this thing studied. In fact mathematical logic provides a definition so close to experience that when it comes to a practical application of dimension theory to spaces of five, six and seven dimensions, it will be the most useful, while topology will remain the ultimate criterion of accuracy.

The last body of mathematics to be studied, group theory, will be the furthest from experience quality. So far, in fact, that in some sense it may be said that in group theory even mathematicians do not know what they are

doing.

E. Group Theory and Dimension Theory

Geometry, topology, and mathematical logic provided different kinds of description of dimension and space. Geometry, as it were, pictured entities in higher space in terms of algebraic equations or as 'composed' of two and three dimensional entities. Topology arrived at the most accepted definition of the real nature of dimensions, and hence of higher space. Mathematical logic was seen to provide practically the same definition as that provided by topology. One might say that a classical survey of the mathematics of dimension must include the first two areas above, and perhaps when broadly conceived, even mathematical logic.

In an obscure corner of mathematics there is a fourth area that describes dimension in its own unusual way. That is group theory. In any classical or ordinary definition of the nature of dimensions group theory would probably not be mentioned since it is not well known that this mathematics describes our real space. Group theory will not provide another definition of the nature of dimensions in general. It is far too abstract for that. It probably is the most powerful tool for approaching dimension theory in science. But the limited knowledge of the meaning

of this mathematics when applied to space will result in its supplying only a lone, valuable bit of data, and not a general definition of dimension as did topology and mathematical logic.

A group, formally defined, is a set of finite or infinite elements, termed operatives, for which the product of any two equals a member of the group, i.e. A B = C, where A, B and C are operatives in the group[36]. Product here does not necessarily mean the multiplying of A by B, but it means operation A is followed by operation B. A multiplication table, or better a matrice, forms a group since the product of any row by a column yields a member of the group at the point of intersection of the row and column. In fact any group can be arranged in such a table.

Basically group theory is a body of mathematics which not only works with abstract entities such as the x, y, z of algebra, but the very operations involved in the manipulations of these entities is unknown. In group theory one deals with unknown in unknown ways. A group

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36 Walter Ledermann, Introduction to the Theory of Finite Groups, Edinburgh, Oliver and Boyd, 1949, p. 2.

of operatives looks together in a definite pattern. Operatives in a group are manipulated within the bounds of the pattern. In the world of events there are groups of changes which have a certain kind of structure. If that structure is characterized by the pattern of a group, the mathematics of that group may be applied to that phenomena. Until a group is applied to a body of events the operations referred to in the pattern are unknown. In this sense it is said that in group theory unknowns are handled in unknown ways. There are a number of special terms describing properties of different groups such idempotency, non-overlap, exhaustive, spectral set, and so forth, which need not be taken up.

Thus far in this chapter, what has been delineated lies in the realm of mathematics. By dimension was meant the mathematical nature of dimension. Whether or not it applied to real space has not yet been shown. In investigating the group of interest here the development steps beyond mathematics into physics, beyond formal knowledge into applied knowledge, for the group to be studied is of interest because it has already been related to real space.

The group of interest here contains sixteen operatives. Eddington, who has done the most work with this group, has termed it the group of E operatives. Dirac in 1928 made the first important application of the group when

he showed that its pattern characterized the operations of electrons. In his Relativity Theory of Protons and Electrons and more fully in his Fundamental Theory, Eddington used the E group to link together the macroscopic Relativity Theory of Einstein to microscopic quantum mechanics. Eddington's fundamental assumption was that in nature there are equivalent sixteen fold frames of operations which can be appropriately represented by the set of E operatives[37]. More specifically he identified the E operatives with dimensional operations of real space[38].

In this extensively developed application of the E group, Eddington showed that the E operatives fit the pattern of dimensioning in real space. He shows the first three operatives in their relations are equivalent to operations in the first, second and third dimensions of space, and that the value of $\sqrt{1}$ of these operatives refers to space-like changes. The fourth operative has value of $\sqrt{-1}$ which he identifies with time-like changes. For instance, if one were to go two yards in one direction (first dimension), three yards perpendicular to that (second dimension),

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37 Arthur Eddington, Relativity Theory of Protons and Electrons, London, Cambridge University Press, 1936, p. 32.

38 Arthur Eddington, Fundamental Theory, London Cambridge University Press, 1948, p. 113-129.

four yards perpendicular to the second (third dimension) and five yards 'perpendicular' to the third (a four dimensional space-time change); using E operatives one would have gone $(2E_1 + 3E_2 + 4E_3 + 5E_4)^2 = \sqrt{4}$, or two time yards[39] from the point of origin. Minkowski's 1908 formula for four space changes gives the same results[40].

The proof of the identity of these operatives and the dimensions of space rests on the authority of Eddington's extensive work. With these rather simply manipulable E operatives he has been able to inductively arrive at all of the principal physical constants of the universe. The bit of data useful to this work is that E_5, the operator for the fifth dimension of space also has a $\sqrt{-1}$ value. In terms of Eddington's work this means that just as in going from three to four dimensions there is a time-like change (as contrasted with a space-like one), there is again a time-like change in going from four to five space[41].

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39 A time yard is the length of time it takes light to travel a yard.

40 Arthur Eddington, New Pathways in Science, London Cambridge University Press, 1935, p. 274-275.

41 Arthur Eddington, Fundamental Theory, London Cambridge University Press, 1948, p. 125-127. E_5 here is equivalent to Eddington's E_{05}.

The E operatives could be of much greater use to this theory than to simply indicate that five dimensional space involves a time-like rather than a space-like transformation, but group theory is so abstract and remote from intuitive experience as to make its application difficult. There are other relationships between E_5, five space, and Einstein's space curvature which cannot be taken up, both for lack of space and lack of development in certain areas of science.

It was the time-like change in going from a four dimensional to a five dimensional object which led Eddington to speak of a five dimensional thing as involving three dimensions of space and two time dimensions. He promptly rejected such an entity as inconceivable[42]. It will be described in its conceptual qualities in the next chapter.

Eddington's use of group theory is essentially a different kind of approach to higher space than that to be made here. The value of group theory to this work is that

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42 Ibid., p. 126.

it leads to essentially the same conclusion which will be arrived at by a different route, that the generation of five dimensional space involves a time-like change.

3. The Relationship of This Mathematics to Real Space

The mathematics presented thus far, except for group theory, is a formal body of knowledge. The spaces described have no necessary relationship to this space in which man exists. The space they describe might be termed ideal or formal space. Since this theory identifies the operations of mind with operations in certain levels of higher, real, existent space, it is necessary to show that these borrowed mathematical guides (topology, mathematical logic, and group theory) apply to this real space of existence. This may be done briefly and simply. By making the application of the mathematics to reality a separate and explicit step, mathematics as a formal, 'metamathematical' body of knowledge is not confused with applied mathematics. By making this a step, the formal knowledge and its application are seen as they should be--distinct but related.

In Chapter II the general conception of the physical universe as a four dimensional space-time continuum was discussed. This is the real, physical space to which this mathematics must be related. Towards that end it is

necessary to make clear a matter not taken up in the mathematics thus far. That is the general kinds of spaces possible, and the related meaning of Euclidean and non-Euclidean spaces.

In order to have any constancy or certainty at all, a space must permit free mobility. That is, abstractly conceived, there must be the possibility of translating entities without altering at least some of their basic properties. It will be recalled that even in topology where an entity may be 'twisted' and 'bent', certain basic relations remained between the thing and what it was translated into. All the spaces that can be conceived as having this property of free mobility (technically--homotopic transformation) may be classified as Euclidean or non-Euclidean[43].

Euclidean space is that defined by Euclid's definitions, axioms, and postulates. Such a space may be simply conceived of as 'plane space' or 'flat space', technically termed homaloidal. For many centuries Euclid's postulates

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43 This is not, to my knowledge, proven anywhere; but it may be accepted as probably true. The assertion clarifies the notion of the total range of kinds of spaces possible while it is not a necessary part of the assertions to follow.

were thought to be ultimate mathematical truths. An attack on the validity of these was reacted to as though it were an attack on the validity of reason. Mathematicians made a great many attempts to independently establish the validity of the postulates, or to derive the postulates from the axioms. The postulate of the unique parallel--that through any point not on a given line one and only one line can be drawn parallel to a given line--remained uncertain. The several proofs that appeared to establish its validity contained faulty reasoning, or contained the assumption in the postulate that what was true for a segment was true for the line throughout an infinite length. This postulate stood out as independent of the others, and as only uncertainly true[44].

The work of Gauss, Bolyai, and Labachevsky established the self-consistency (a formal evidence for validity) of a mathematics in which such lines defined above are not parallel throughout their length. The difference between acceptance and non-acceptance of this postulate, or others, is the difference between Euclidean geometry and space and

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44 J.W. Young, Fundamental Conceptions of Algebra and Geometry, N.Y., Macmillan, 1917, p. 26.

the non-Euclidean. By departing from Euclid's axiomatic and postulational basis, consistent and mathematically valid new kinds of geometry and space may be set up.

There are then three general kinds of mathematical space; that without free mobility, Euclidean, and non-Euclidean. Of the infinite number of possible non-Euclidean spaces, two are well developed. They are Lobatchevskian space with negative curvature and Riemannian or positive curved space. Positive and negative curvature need not be defined here. Suffice it to say that the work that culminated in Einstein's Relativity Theory appears to indicate that real space is non-Euclidean-Riemannian curved space.

Until recent times, space had been conceived to be Euclidean. Newton's mechanics, which define in its context an ordinary, three-space, is based on Euclidean geometry. Up to a distance of a million miles or so his mechanics is an accurate description of phenomena in physical space. Only with astronomical distances have Einstein's non-Euclidean geometry of space been shown to be more accurate than deductions based on plane space. The differences have been minute but generally in favor of Relativity Theory. For distances less than the astronomical, Euclidean conceptions of space are quite accurate, and are generally accepted and used. The point is that

the mathematics developed here describes Euclidean space[45,46,47]. It might be thought better to base this work on the Einsteinian space conception. Euclidean space is used for several reasons. A practical reason is that non-Euclidean-Riemannian space is not developed as fully as the Euclidean in a way that will permit an application such as in this theory. For instance, there is no developed Riemannian topology of n dimensions. Also, Euclidean space is suitable for terrestrial distances and phenomena. An objection could be that even if applicable to terrestrial four space distances, it is not necessarily adequate for an application to 'distances' in space higher than four space such as dealt with in this theory. That four space, Euclidean-based formulas will appear to be applicable to mental phenomena may be taken as evidence for the validity of the Euclidean basis. Also, as in the improvement over classical mechanics by use of a non-Euclidean geometry, it may be possible some time to improve the conceptions here by a non-Euclidean geometry--should it ever be developed

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45 Hurcewicz, op.cit., p. 9.

46 Russell, Principles of Mathematics, op. cit., p. 374.

47 Eddington, Fundamental Theory, op. cit., p. 107, and p. 125.

adequately. Lastly 'plane space' was used since Einstein's Riemannian space is not firmly established. Eddington, for instance, feels the 'curvature' is simply a device for accounting for fluctuation in the distribution of particles[48,49].

For these various reasons Euclidean mathematics has been used. Because the mathematics is Euclidean, it fits a real Newtonian space which may be considered to be the accepted real space for distances less than the astronomical. Since this mathematics describes the essential nature of dimensions, and fits the real accepted space of four dimensions, it would seem to be the appropriate tool to describe the nature of real higher spaces should they exist. They do exist in mathematics. The acceptance of their real phenomenal existence depends on an application such as this of mathematics to experience.

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48 Eddington, Relativity Theory of Electrons and Protons, op. cit., p. 256.

49 Eddington, Fundamental Theory, op. cit., p. 5.

Summary:

Since this theory identifies real space with mind, it was necessary to define that space. Since the structure of space is mathematical, it was necessary to borrow from that science. All that mathematics has to say of dimensions was studied under the heading of geometry, topology, mathematical logic, and group theory. Geometry was seen as inadequate for the practical purpose here. Topology provided the most rigorous and accepted definition while mathematical logic supplied a similar one. Group theory in application provided a description of the essential transformation involved in five dimensional space. Lastly this mathematics was related to real Newtonian space, and would thereby appear to be the appropriate tool for the exploration of real higher space. Now it is possible to examine the nature of this higher space and see if and where it fits phenomenal reality.

CHAPTER IV

THE IDENTITY OF THE OPERATIONS OF MIND TO THOSE IN CERTAIN LEVELS OF HYPERSPACE

> With the help of...theories we try to find our way through the maze of observed facts, to order and understand the world of our sense impressions. We want the observed facts to follow logically from our concept of reality. Without the belief that it is possible to grasp the reality with our theoretical constructions, without the belief in the inner harmony of our world, there could be no science.
>
> A. Einstein and L. Infeld,
> The Evolution of Physics, p. 312.

The mathematical foundations have been layed. With them as a basis it is possible to describe the nature of higher spaces and to show the possible identity of operations or entities in those spaces to mind itself.

The mathematical foundation stones, the topological definition of dimension in terms of neighborhood and boundary, the mathematical logic definition as series of a series, and the two time values of the E_5 operator have little meaning in relation to the objects of daily life as they stand. They must be developed and applied before the nature of higher space will become apparent. It appears that this work of developing in experience terms the nature of entities in higher space has never been done before, so the task now ranges beyond that of simply borrowing.

In the first section of this chapter the topology and mathematical logic of dimensions will be linked together to show how they are a related approach to the description

of higher space. A first application of this approach will be to see how it describes ordinary three space and even arrives at a four space identical to Einstein's space-time. The three succeeding sections of this chapter will develop successively five, six, and seven space. Each description of the higher space will be examined and found to fit the mathematical criterion. In each instance the operations possible in the space will appear to be those of certain levels of mind itself.

1. The Mathematical Development of Real Four Space

The best accepted description of the essential characteristic of dimensions in Euclidean space was given by topology[1]. It will be recalled that the dimension of a space is, "the least integer n for which every point has arbitrarily small neighborhoods whose boundaries have dimension less than n...". This definition describes the neighborhood n in terms of its boundary which is less than n. But it is the neighborhood itself that is of interest here. How can this definition be used to arrive

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1 See Chapter III, Section 2C.

at a description of the neighborhood?

It can be done in this way. If any n space entity is separated into two regions--u and v, a boundary between u and v is created. A region of boundary in space n is created. This region of boundary in u or v is also the boundary of all the points it contains. The dimensionality of the region of boundary will also be the dimensionality of the points it contains. By the topological definition the boundaries of the points in the n space are of n-1 dimension so the dimensionality of the boundary region is n-1. Thus it is established that any separation of an n space entity into two regions u and v creates a boundary region of n-1 dimensionality. In effect this step permits of thinking in terms of boundary regions instead of points alone.

Now the important key to the nature of a neighborhood is that <u>any</u> boundary region is of n-1 dimensionality. What must the neighborhood be then? The neighborhood must be a series of n-1 dimensional elements for only such a series will permit of discovering an n-1 boundary along <u>any</u> region of separation. If the n dimensional neighborhood is a series of n-1 dimensional elements, does it conform to the original topological definition? It does, since points in this series (regions of boundary as a region of points) will have boundaries of dimension n-1.

What in effect has been accomplished is to yield from the original definition of topology, which only described a neighbhrhood in terms of its boundary, an assertion of what the neighborhood itself is. This assertion also fits quite well with the definition of mathematical logic in which the n dimensional entity is a series of n-1 dimensional elements. Out of an elaboration of the meaning of the topological definition, and its consonance with the mathematical logic definition, these two basic mathematical elements can now be used to generate spaces. First as an example of what can be done with these definitions they will be used to generate ordinary three space and Relativity's space-time.

The basic element on which the rest will be built is a point which has been defined as zero-dimensional. A series of points generates a line which is a one space. The neighborhood of this one space has a dimensionality of one. Any point in it will have a boundary of zero dimensions, since the one space is a series of zero space entities. One space is then a line. Without adding special conditions to this generation the line may be either straight or curved.

How is two space arrived at? A two space is generated by a series of one space entities, or lines. It is known in geometry, and it is intuitively grasped that

this series of lines generates a surface. Since the lines may or may not be curved the surface is not necessarily a plane one. The neighborhood of the two space will be two dimensional and the boundary, since it is a series of lines, will be a line or a one space entity. Topology and mathematical logic areagain satisfied, and a two space which is grasped intuitively as a surface has been developed from the mathematical formula.

The three dimensional space, similarly, is a series of two space surfaces. The three space entity which is this series of surfaces is the solid of mathematics which corresponds to the extension of the physical solid in man's experience. Again, because the very pattern of generating these dimensional entities satisfies the requirements of topology and mathematical logic, the entity generated is truly three dimensional as defined by these two mathematics. Only the extensional characteristic of physical solids is three dimensional, however. Matter itself so involves energy (four space) that matter with zero energy has zero mass and does not exist.

Since, by some labor, a formula has been reached which will permit a valid description of higher dimensional entities, it is now possible to take the step that required about twenty centuries of thought. According to the logical pattern presented by mathematics, substantiated by

man's three space experience, and adopted as the basis of this work, a four space is a series of three space entities. The three space entity is the extension of a solid so the four space entity is a series of mathematical solids. Where in the world of phenomena may such a thing be found? The only example of it is an entity with extension undergoing change. More commonly, the series of solids is a moving body. For example, when a book falls from a table to the floor what has been described is an ordered series of solids. It will be recalled that the idea of order is contained in the earlier definition of a series. The falling book is an ordered series of solids. It is also a moving body, and one that describes a time--the time required to go from the table to the floor. This time is quite unlike Newton's absolute time, for the implication is that the four space time does not exist separately from the series of solids. Without the series of solids there is no four space. If there is a four space, there is contained in it the series of solids that generate it. The mathematical formula used here of necessity leads to a space and time that are inseparable. This is essentially

the conclusion of Relativity Theory as regards space and time.

> In the pre-relativity physics space and time were separate entities. The Newtonian mechanics was relative with respect to the space of reference, so that, e.g. the statement that two non-simultaneous events happened at the same place had no objective meaning (that is, independent of the space of reference). But this relativity had no role in building up the theory. One spoke of points of space, as of instants of time, as if they were absolute realities. It was not observed that the true element of the space-time specification was the event specified by the four numbers x_1, x_2, x_3, t. The conception of something happening was always that of a four dimensional continuum; but the recognition of this was obscured by the absolute character of the pre-relativity time. Upon giving up the hypothesis of the absolute character of time, particularly that of simultaneity, the four dimensionality of the space-time concept was immediately recognized. It is neither the point in space, nor the instant in time, at which something happens that has physical reality, but only the event itself. There is no absolute (independent of the space of reference) relation in space, and no absolute relation in time between two events, but there is an absolute (independent of the space of reference) relation in space and time...[2]

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2 Albert Einstein, The Meaning of Relativity, 3rd Ed., Princeton University Press, 1950, p. 30.

Later on Einstein reiterates in this way:

> Just as it was necessary from the Newtonian standpoint to make both the statements, tempus est absolutum, spatium est absolutum, so from the standpoint of the special theory of relativity we must say, continuum spatii et temporis est absolutum. In this latter statement absolutum means not only "physically real" but also "independent in its physical properties, having a physical effect, but not itself influenced by physical conditions"3.

This property of having a physical effect but not being influenced by the physical gets at the fact that dimension theory describes the principles of things of which the real examples of spatial entities from life are examples bearing the principles, but not being the principles.

By these quotations, then, the description of four space arrived at by the use of the topology-mathematical logic appears consonant with the latest conceptions of physics regarding the nature of space and time. Having done all that is possible to demonstrate the validity of this tool by its mathematical derivation and its accurate description of the known four dimensions of the space of

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3 Ibid, p. 55.

man's existence, it remains to explore what this tool has to say of higher spaces.

2. Five Dimensional Space and Alpha Mind

A formula has been developed for describing the nature of spaces while adhering to basic mathematical requirements and the findings of physics. The formula has been shown to generate ordinary four space including the findings of Relativity Theory. It is now possible to use it to arrive at a conception of the nature of things in five space. After the formula has been applied, the description of the five space must, going back to the basic criterion, accord with topology. The description must be adequate to relate it to the world of events. Lastly, the datum of group theory regarding the nature of five space must be arrived at even by this independent approach. These three will be demonstrated in order.

A four space entity is a moving solid or an event. By the terms of the formula imposed by mathematics, the five space entity must be a series of events. This description of it must fit with the requirements imposed by topology. First, five must be the least integer possible to describe this entity. In effect, by building up to higher dimensions in successive steps the requirement of the least integer is adhered to. By making the integer for the space

generated by the four series simply one integer greater, it becomes the least integer. The space generated could not be less than a five space since it will be seen to have properties different from those possible in a four or lesser dimensional space. Five is the least integer then.

Next, by setting the neighborhood as five dimensional, the boundary of any arbitrary point in that space must be less than five dimensional, and hence is satisfied by a four dimensional boundary. That the boundary is four dimensional may be seen by separating the series of events into two series at any point in the series. The new boundary will be an event since the series is a series of events. The description of the five dimensional entity as a series of events is then seen to satisfy the requirements of topology, and by the way it was arrived at, the requirements of mathematical logic. That is, by making the five space the field of a four space series, which is made up of three space series...to the simple one space, the requirements of mathematical logic have been adhered to.

It is possible to conceive of this entity now. The mathematics of the real four space of physics describes a five space entity as a series of events. Is there anything in the phenomenal world that corresponds to this description? At first one might conceive of a series of events out in the world as such a series. This would be a mistake

which can be shown in several ways. The series of events out there, things happening, is defined by physics as four dimensional space-time. Then again in terms of the logic of the development here, any cut in things happening should have a four space boundary. A book falls. One takes a cut in the continuum formed by the falling book. Wherever the cut is made the boundary of it is a three space book and not an event. In fact that is how things happening out there were generated, by a series of solids. Events in the physical world are always four dimensional.

This five space series of events is a different kind of entity. Conceive of an ordered series of events arranged along a line. Since events have a time date, and the series is ordered, in relation to any now some events will be in the now, some will be old and before the now, and some will be not yet or after the now. This is a five space because its boundaries are events and not simply a solid as with four space. All of these different time dated events lumped together into a single entity are the five space entity. There is only one known place in phenomenal reality where one can find such a lumping together of events and that is in mind. Let the phrase alpha mind be the designation of the level of mind referred to. To call it passive mind or by any other term would appear to bring in more implications than are desired.

Because aspects of mind never linked together before under one term are to be linked here, let the term alpha mind apply to those aspects of mind that will be described as a five space.

Figure 2. will aid in visualizing a five space. Along AB is ranged the series of events symbolized by the solids S_1, S_2, ... moving along the arrows. T_1, T_2,... are time dates of the event formed by the solid S moving along the arrow. Arbitrarily T_3 corresponds to the now of the physical world. T_1 and T_2 have old time dates and are in the past history of the four space world of physics. Even though they are no longer existent in the now physical world they have five space existence in the now as does a man's memory of those events. The T_3 event happening in the physical world has a five space existence as in sensory consciousness. The event T_4 being after the now corresponds to a precognition of events that have no physical existence yet. The validity of conceiving of alpha mind as a real five space entity may be shown most clearly in three steps, corresponding to past, present, and future in the diagram.

Taking a series of events all with time dates before the now, it is hypothesized such a series finds existence only in memory. For the present it will be necessary to let memory stand for the unconscious storage of memories as they exist before they are recalled. Conscious recall

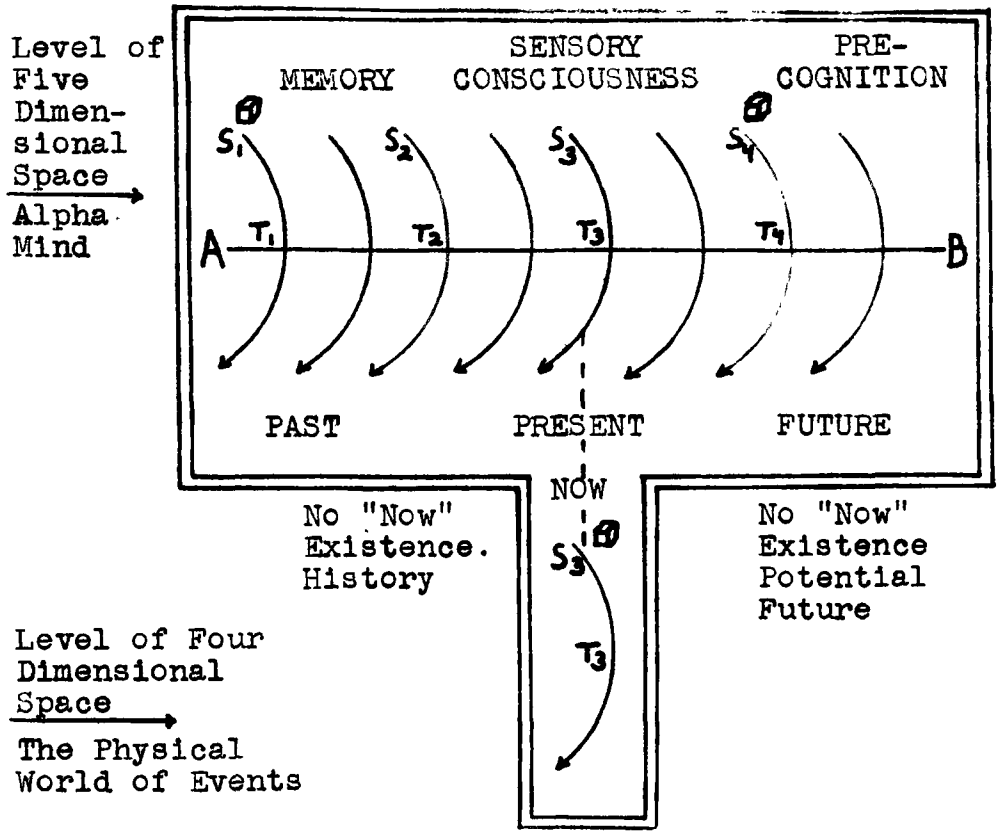

Figure 2. Schematic representation of four and five space. AB, a series of moving solids S_1, S_2, S_3, S_4... with time dates T_1, T_2, T_3, T_4... T_3 is the now of the physical world and the moving solid S_3 exists in both four and five space. T_1 and T_2 are dated before the now and hence are in the past and correspond to specific memories. T_4 is dated after the now and hence is in the future--corresponding to precognition. Existence at any moment T_3 is represented as bounded by the double line.

will be treated separately. Because a man can recall past events they may be said to have some kind of existence before they are recalled. It is this kind of existence that is considered now. Consider the time dated series of memories stored by an individual reaching from his childhood to the present. These memories are events in the life of the individual. Somewhere along this series there remains the broken, treasured toy. Not only the toy is there but the setting of the loss, the events leading up to it, and the reactions of the individual are still there. Somewhere along this person's series of memories is the complex setting and his reactions to a balmy summer night ten years ago. Meanwhile, in the world of physics--the four space world, the toy has long since disappeared; and no one would argue that the summer night still exists. The physicist must say they might have been at one time, but they are not now. But to the individual who experienced these things, somehow, somewhere, they still are. This is the difference between four space and five space. These stored memories are a series of events, all having some kind of existence, all with different time dates.

In all of the world known to man only memory, and as will be seen later, consciousness and precognition--the three aspects of alpha mind--have the characteristics of five space. All other series of events such as recorded

history and various symbolic representations of the past are based on mind. The history book is not history. It is only paper with marks on it until mind sees it as representing the past in present symbols. One immediately looks about for some means by which the past event can be made real in the present without resorting to memory. For instance, would not a photograph of a past scene do that? One might even say the memory is merely a storage file of photographs--a four space kind of entity. Even a photograph is not the same as five space existence. To physics it is only a concatenation of points on a surface reflecting such and such wave lengths (having black and white dots). Only to a mind with memory of a past does it represent the past. It only represents the past, too. The kind of five space existence spoken of here has actual possession of the past. That is literally a vital difference.

The truth of this matter is so simple as to make it in some sense difficult to demonstrate. As an example, one could operationally define the difference between closed book and open book. Then taking a book, flipping the pages, glimpsing print, diagrams, and illustrations, and hearing the pages turn, one could return it to the state, closed book. A physicist will confirm that the book then has closed book existence. In fact he could burn it and

pulverize the ashes so that it could not again have exactly the same open book existence. He can then pronounce it has not, and cannot have, the same open book existence. Then in memory one could flip the pages, glimpse illustrations, and hear the pages turn, and then pronounce, "You may be correct in your realm, but somewhere in mine it has open book existence just as before." That is to say, the series of events (flipped pages), part of a larger series of events (individual's stored memories) continues to exist even though the time dates are before the now. This before the now series is one example of five space existence. Because it is a series of events, any region of boundary in it will be an event (a four space element). The series makes up a new entity (memory of alpha mind) which has the characteristics of a five space. An article by Oppenheimer deals with similar ideas in which memory is presented as different in these same space and time qualities from the physical[4].

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4 O. Oppenheimer, "'I' and Time: A Study In Memory", Psychological Review, Vol. 54, 1947, p. 222-228.

These are events before an arbitrary now which is defined by the local state of affairs of the physical world. Part of this series of events which is a five dimensional entity (alpha mind) will be dated in the new. These are dated T_3 in Figure 2. Present perception and introspective awareness of responses are both dated in the now. These will be subsumed under the general heading of consciousness. It is a little more difficult to demonstrate that the events in consciousness also comprise a series of events, albeit a short series. The reason for this is that consciousness itself is quite different from unconscious stored memories and requires the development of three ideas, differentiation in five space and the relation of consciousness to the unconscious and the mind body relationship. This will require extensive development later. For the present it will be possible to give some indication of the relationship of five space to consciousness. But without development of the three ideas above the demonstration will be an indication of what might be true rather than anything as clear as the relation of memory to five space.

The problem is this. In order to conceive of consciousness as a five space entity it too must comprise a series of events. It could easily be conceived of as a unitary action similar to the four space falling body rather than forming a series of events. Suppose for a moment that

consciousness were unitary. By that is meant that it is something changing with the point of change being an infinite fraction of the series of states of consciousness. A close analogy would be a photoelectric cell. Such a cell reacts linearly to a certain state of affairs. Light fed into it keeps it in one state. Sudden absence of light causes it to change its state and close a switch. The cell is a linear reaction to a state of affairs.

The simple truth is that were consciousness a linear reaction to a state of affairs such as this none of our acts would have meaning to us. The photoelectric cell remains as it is with light, and closes a switch without light. It would seem that whatever the state of the cell a moment ago or what it will be in a moment hence has no bearing on its state now. As long as it is in operating condition, whether it reacted to none or to ten periods of darkness in the last minute has no bearing on its state now. Were consciousness linear, were it tied to a linear change of the physical now, it would be like the photo-electric cell and not make adjustments to what was, but only to what is. The meaning of a thing to an individual spreads out and involves what it was, and what it may become. A man holds a revolver in his hand. It may have been just captured from a man who wished to kill him. It may belong to a good friend who prides himself on his

marksmanship. It may have been unexpectedly found in his drawer. The physical gun stimulus is the same. But the meaning in each case is tied to what the gun was or might be and extends beyond its simple nowness. This question of meaning then relates the nature of consciousness to a series of events.

Consciousness is the counterpart of the traveling four space now. The things happening in the four space world have an existence in five space. And this existence appears to be consciousness itself since it also involves the things happening now in the physical world in the perception of outside things moving, and in the perception of the state of the body and the muscular responses. In Figure 2. the T_3 event in four space has a five space existence also in consciousness. The quality of consciousness, since it involves meanings arising out of continuing to exist past events in five space, is a five space quality. A photoelectric cell kind of consciousness would involve no meanings or relatedness of events. This essential characteristic of consciousness is its five space kind of existence.

It is not surprising that sense consciousness is difficult to separate from the things happening world of physics for in a broader perspective it will be seen to be the area of mind closest to the world of physics. In fact

it may be defined as that region of an existing five space entity which has the same time date as the world of physics.

So far events in the five space series with time date before the now (memory) and in the now (consciousness) have been taken up. Figure 2. includes events in that series which are after the now, or precognition in alpha mind. Events after the now are only potentially existent in the world of physics. They are the 'unpredictable future'. Their inclusion in the diagramatic representation of a five space raises some of the most important questions and implications of this work, perhaps of more long range importance than postulating a real dimensional space structure to mind.

If a five space entity is a series of events, does it include in this moment any events that have not yet occurred in the world of physics? The answer would appear to be it does. What would lead one to think it does not? The higher spaces constructed here of necessity have been built up from notions of what lower spaces are like. This is necessary to a practical, visualizable, application of dimension theory. But it is not a necessary aspect of dimensions themselves. They are not made from lower dimensions. Notice that Russell's definition built downward from a higher dimension to the simple one space. Also note that topology states the relation between dimensions and not

that one is built from the other. The fact is dimension theory describes the necessary relations between spaces. Only incidentally does it show the relation by building downward as did Russell, or building upward as is done in the practical application here.

Dimension theory applied to real spaces means that five space entities will have one sort of existence and four space entities another sort, and there will be a necessary kind of relationship between these spaces. The relationship is basically mathematical. A five space turns out to be a series of events. A series of events dated before the now can be seen to have five space properties, and apparently to exist in the form of memory. A five space including events in the now and stretching back into the before now can be seen to have five space properties, and apparently exist in the form of consciousness. Because it is the relation between spaces, and not the building of one from another that is true of a dimension theory, a series of events after the now in the future also satisfies the requirements of a five space. The field of five space is a series of events, whatever their time date. To postulate the existence of five space as a real component of this world is to postulate the five dimensional existence of future events, events that have not yet had existence in the world of physics.

It will be recalled that in Chapter II extra-sensory perception, which is well demonstrated empirically, was cited as evidence that the world cannot be of only a four dimensional extent. In enlarging that world to five dimensions a sound basis for the possibility of precognition is automatically layed. This theory of mind then also provides a basis for a hitherto unexplained mental phenomenon--precognition, by the same structure that appears to explain memory and consciousness.

That events which have not taken place yet have existence in five space appears to argue for a deterministic fatalism. In the larger view of the complete theory this apparent fatalism will disappear.

Having briefly seen the implications in the range of five space from before the now to after the now, it is possible to systematize the nature of a five space transformation. In four space an entity undergoes change in time. Some changes, like those in a stone, are quite slow. The upper limit of the speed of change, according to Relativity Theory, is roughly 186,000 miles per second--the speed of light. An entity in four space at this moment is what it never has been before and what it will never be

again[5]. All of the existence in the physical world is of this transitory sort. As it were, the physicist must deal with things as they pass by.

The same phenomena in five space undergo their changes and yet every part of the continuum of changew remains indefinitely. This is what memory is. The essential transformation in going from four space to five space is a time change. The first three dimensions of space give an entity extension, size, bulk. This is a space-like change. In going from the three to a four space the thing moves, it has temporal existence (really spatial-temporal). This is a time-like change. In going from a four space to a five space the essential transformation is from a thing moving, to a thing 'moving and staying as it was'. This time-like transformation in five space of the thing moving and staying in all the parts of its movement is the essential characteristic of a five space entity. In generating an entity out of a series of events the events remain.

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5 Barring the exact repetition of the field of probability distribution, which with more than a few atoms approaches the impossible.

It will be recalled group theory contributed a datum regarding five space. Eddington said a five space entity would have five parameters, three are space-like and two are time-like. A point in the five space described here has these same parameters. Take a point on the flipped page of the book that was visualized. Three space-like parameters locate a point on the page of the book. One time parameter dates the page along the course of its movement. These are the four parameters of ordinary space. The fifth time-like parameter locates that point on the page at the end of the series of events that have transpired and been stored in the memory since then. This new fifth time-like parameter is psychic time. The development here not only accords with topology and mathematical logic, but it also independently arrives at the finding of group theory.

Note one last point about five space. By considering the series of events before, in, and after the now the total range of five space was described. A five space series can also be quite brief, including only a few events. The memory of the summer evening is a five space entity for it includes at least some events with different time dates. Short segments of five space also have the characteristics of that space; alpha mind may be described in terms of short segments. Looking through the range of alpha mind

from memory to sensory consciousness, and precognition, that level of mind may be characterized as experiences of events. A mental event, something happened to a person, he passively experiences or experienced it, is a short segment description of alpha mind.

Before examining higher spaces it would be well to see what has not been explained in addition to what has been. Alpha mind developed out of five space theory has memory, perhaps consciousness, and a potential for precognition. There is no will, no abstracting power, no recalled memories, no dreams, and no self-reflection. The relationship of mind to body and consciousness to the unconscious are unexplained. All these have yet to be explained. Alpha mind is quite limited in its possible range of functions. It is the level of passively experienced mental events.

3. Six Dimensional Space and Beta Mind

In the treatment of five space a first view of that region was presented. This was checked against the mathematical criteria, and the kind of existence possible in that space was identified with a level of mental operations, alpha mind. Perhaps more questions were raised than were solved, but a general idea of the nature of that region was arrived at. The same will be done for six space. The mathematical formula will continue to form the basis for the

description of this higher region. The kind of existence in this region will be related to any like existence in the real world. The validity of the description will be checked against the mathematical formula. Again it will be possible to arrive at a general conception of the kind of existence posited by the mathematics of six space. Again it may well be that more questions are raised than are answered, but this is not a deterent to any search. Later interrelationships of these regions will depend on these general conceptions.

Just as n space is series of n-1 spaces, and a neighborhood n is a region of n-1 boundaries, six space is a series of five spaces. As a series of five spaces any boundary will be five dimensional while the series as an entity is a six space.

In order to relate the description of this higher region to the real world the five space entity is taken as a mental event determined in its accidents. Six space is then an entity which is a series of mental events. In like manner memory is a series of spatial-temporal events, space-time a series of solids, a solid is a series of planes, a plane a series of lines, and a line a series of points. In an approach to the description of this region three simplifications will be introduced. To immediately conceive of all the implications in this series of mental

events would hardly be possible without these simplifications.

Alpha mind includes events before, in and after the now. The first simplification will be to take only those mental events before and in the now, memories and perceptions, while leaving out precognitions. Second, the description of this region will not be related to consciousness yet. So, in so far as this region is mental, it may for the present be thought of an unconscious or at least not specifically conscious.

The third simplification will be to use short, simplified series. Any range of five space entities greater in number than the reciprocal of infinity can be conceived of as a series. For instance, in the previous discussion of the flipped pages of a book and a summer evening, a short four space series was used. Not only short series, but also special simple classes of series will be used. Later it will be possible to relate these simplified classes to the total six space and to see not only the general nature of six space but the relation of these simple classes to it. These three simplifications will then be introduced. Only memory and perception five space entities will be used. Six space will not yet be related to consciousness. To aid conceptualization simple classes of five space series will be introduced.

All these steps are necessary if the development is not to plunge immediately into matters too complex for conceptualization.

These simple classes will fall into two broad categories which are two major aspects of alpha mind. All that exists in alpha mind or five space may be seen under the aspects object-like or experience-like. Object-like are those mental events which are perceptions and memories of things in the world encountered through sense experience. A chair that is seen and felt then becomes an object-like five space entity. By experience-like is meant a more inclusive situation which has occurred to an individual and exists as a memory and perception. It may include groups of objects interacting, and the fact of interaction or something happening is the key to the experience-like. Object-like and experience-like are merely two aspects of alpha mind which are not mutually exclusive.

The first series of mental events will be, according to the introduced simplifications, not specifically related to consciousness, include events in and before the now and will be object-like. In fact it will be the simple class of similar object-like mental events, e.g. the series composed of all trees that have been percieved. The equivalent to this in six space must be something that includes all the trees in the percieved series. Yet in including

all of them it cannot be exactly any of them. Its nature must be structured by that of the trees. The common and basic features of trees in the series must make up its basic nature. While the accidental features common to only this and that tree must determine its nature only slightly. Being based primarily on the basic features and little on the accidents it is a kind of entity representative of trees. In the world of experience such a representation is found in the idea tree. The idea tree is the representative of all the perceived trees having their essential common features and little containing their incidental features.

In fact the relation between the idea tree and perceived trees is that between five and six space. The idea tree is the entitative representative of the series of perceived trees, $tree_1$, $tree_2$, $tree_3 \ldots tree_n$, which the individual possesses as experienced entities. The boundaries are five spatial (perceived trees) and the neighborhood a six space (entitative of the series, trees).

Going beyond the limiting example it is possible to see that in general objects in the abstract, ideal form stand in relation to objects perceived as does six space (beta mind) to five space (alpha mind).

It will be recalled it was asserted before that one space is not made out of another but simply exists in a

certain relationship to the other. The five space has one kind of nature while the six space has another. There is a necessary relationship between them, but one is not strictly speaking causally made from the other. The transformation in kind of existence in going from the one space to the other is essentially a dimensional transformation and corresponds here to the mysterious process of abstraction[6]. That is, the idea tree is simply the beta mind equivalent to the trees experienced. What may be described as the process of abstraction is the dimensional transformation between alpha and beta mind or between five and six space.

More complex than a simple class of similar objects would be the class of object-object existence. By this is meant considering classes in which objects are linked together which bear a consistent relationship such as large to small, within to without, A part of B, and so on. The beta mind equivalent of such simple alpha mind series is 'possible conceptions of cognitive relations'. Without

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6 W. Edgar Vinacke, "The Investigation of Concept Formation", Psychological Bulletin, Vol. 48, 1951, p. 1-31, especially p. 6 and 7.

rigorously demonstrating the point, cognitive relations may be seen to stand in relation to object-object classes as does abstract existence to perceived object existence.

Table I.- lists the alpha and beta mind equivalents for various simple classes of objects and experiences. Further on there are listed more comprehensive categories and last, the most comprehensive. The table is not complete nor are the classes and categories mutually exclusive. It serves merely as a suggestive guide.

Similarly further beta equivalents may be studied for the experience aspect of alpha mind. Each one will not be proved to be a six space equivalent as this would extend the development too much. After a number of simplified classes of six space existence are seen it will be possible to link them together and form a true picture of six space.

Consider the simple class of similar acts which have been performed by the individual and exist as memories. A series of similar acts such as writing on paper generates a beta equivalent. Similar to the tree example above, the beta equivalent must represent all the individual instances of writing. The basic similarities in the acts will be basic to the nature of the beta equivalent and the accidents will not. The beta equivalent must be an entitative representative of the common and basic features of the acts writing on paper. This entitative representative

Table I. - A suggestive representation of equivalents between alpha and beta levels of mind. They are listed in order of increasing complexity from simple classes, to broad categories, to the inclusive description.

	Alpha Mind Five Dimensional Space	Beta Mind Six Dimensional Space
Simple Classes		
I Classes of similar objects and object relations.		
1.	Sense experience of objects of external world.	Objects in abstract symbolic existence.
2.	Object to object existence (large to small, within to without, etc.).	Conceptions of cognitive relations.
II Classes of similar experiences.		
1.	Acts	Habits
2.	Positive satisfactions.	Desires, interests, adience tendencies.
3.	Negative satisfactions.	Dislikes, fears, abient tendencies.
4.	Total bodily experiences.	Abstract conception of body image.
5.	Interactive social experiences.	Ego tendencies.
6.	Early conduct experiences.	Super-ego tendencies.
Broad Categories		
I Object category		Abstract ideas and relations.
II Experience category		Attitudes, needs, dynamic tendencies.
All Inclusive Description		
	Field of five dimensional mental events.	Field of six dimensional mental representations (intellectual and dynamic).

corresponds to the writing style of an individual or the writing habits of the individual. Habit in general is the entitative representative of individual similar acts. Since the acts appear to exist in five space, and habit is the entity representing the series of these five space entities, habit would appear to be a six space entity or a beta mind equivalent.

Another simple class under the experience aspect of alpha mind is the class of similar positive satisfactions. Let a positive satisfaction be a mental event which led to a psychophysical satisfaction[7]. The series of similar positive satisfactions has the entitative equivalent of desires, interests, likes, wishes, or general adience tendencies. For instance the series of satisfactions found with the theater has the beta equivalent of interest in the theater. Similarly negative satisfactions have the equivalent of fears, or abient tendencies. Total bodily experiences have the equivalent of the abstract concept of the body image. The series of interactive social experiences

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7 The 'physical' of psychophysical may be included here since it exists as a five space entity also. See Class II, No. 4 in Table I.

have the beta equivalent of ego tendencies. The early conduct experiences are equivalent to super-ego or conscience in six space. The dynamic, moving toward quality of these beta equivalents may have been noticed. Since the generating series is one of acts or 'doing somethings', this aspect of alpha mind has its entitative representation in a dynamic tendency, just as a habit is a tendency to repeat a certain pattern of action, and an interest is a tendency toward certain situations.

Part of this class simplification is the necessity of conceiving of similar kinds of entities in series. But having digressed for the sake of exposition into this over simplification, it is possible now to see six space more complexly so that similar five space entities are no longer necessary. For instance, consider the series of mental events in general under their object-like aspect. The beta mind equivalent of this series is the field of abstract ideas and relations. The series of experienced objects generates an entity which bears the essential features or patterns of those experiences and less of their accidents. The entitative representative bearing the essential features of object experience is thought, which exists at the beta level of mind.

The broad experience category of five dimensional mental events must also be considered. As with the object

aspect, it is no longer necessary to conceive of classes of similar experiences. The series of alpha level experiences in general would appear to generate the field of dynamic tendencies. That there is a definite relationship between the life experiences of an individual and the individual's dynamic tendencies as described here, is one of the most general conclusions of dynamic psychology. These tendencies can be conceived to be the entitative representatives of individual experiences. It is not simply the sum of those series of lifetime experiences.

Even by dividing five space mental events into subcategories of objects and experiences the nature of six space has been simplified. The broadest conception of six space is as a series of five space entities which are already defined as mental events. Acutally all of the simple classes and categories described heretofore are all existent in that space. A series of alpha level entities may be comprised of anything from a few mental events to all possible. In this light the previous simplifications may be seen to be valid, but since they are simplifications of a six space they do not give the most general picture possible. Each of these simplifications was selected because in man's knowledge he has already abstracted out those same classes of existence in six space just as he has

abstracted out three kinds of five space; memory, perception and precognitive knowledge. It may be possible to describe all existence in five space by these three conceptions, but the classes and categories in Table I.- are not all those possible in six space. One may see that if out of the great range of alpha mind experiences any few are a six space series, how it is possible to conceive of a great many kinds of such series.

The all inclusive description of a six space involves a conception of all these kinds of series. As a whole it is the equivalent of the total of five space mental events (in and before the now) in series. This inclusive description of six space is the field of mental representations (intellectual and dynamic). Just as subclasses included the intellectual and dynamic, the field is a fusion of both of these kinds of tendencies. Only as ways of viewing beta mind can the dynamic and intellectual be separated. They are intimately fused in six space conceived of as a whole. These dynamic tendencies do not necessarily involve conscious choice, but rather they are any tendency toward one pattern of action rather than another. If this is will, it is blind will.

In higher spaces existence is of necessity removed from the simple and discrete world of physics. This necessarily subjective description already is related to

the mathematical criteria. Based on the possible validity of the five space description, a six space must be a series of five space entities. By considering series of mental objects and experiences five space entities were used. Each of the simple classes of six space entities or the inclusive description of that space may be seen as generated from the five space series. Because six space is comparatively distant from the simple, objective world of things, it has not been as possible to describe six space as explicitly as simpler spaces. The nature of six space is not irrefutably established here, but it would appear to be the space which is the field of intellectual and dynamic representatives of mental events.

One might question the validity of describing six space in terms of five space existence. The simple fact is that the validity of the description of six space then depends on 1) that of the five space description and 2) the mathematical validity of the relation between the hypothesized entities in five and six space. At the level of six space the limitation in the available conceptual tools makes an appearance. But it may be possible and profitable to go one step further.

4. Seven Dimensional Space and Gamma Mind

The upper dimensional reaches of this theory have now been attained. It will become apparent that the nature of things in seven space, following the progression developed from lower spaces, is exceedingly abstract and difficult to conceive. Correspondingly, eight space can be described as a series, but a conception of its entitative nature is not possible at this time.

According to the basic formula, if six space is the field of intellectual and emotional tendencies, a seven space entity is a series of such tendencies. For simplification again one can consider intellectual and emotional tendencies separately as long as it is borne in mind that this is a simplification. Also, again consciousness will not be specifically related to this area even though it will become apparent that at least some of the processes described are normally conscious.

At the beta level one has the field of abstract relations and ideas which are themselves based on

apprehension of objects and object relations[8]. These logical relations and abstract ideas can be seen grouped in larger and more inclusive classes of abstract ideas, but they remain only grouped abstractions. The seven space entity is a series of these abstractions. Each of these abstracts is an act of knowing as of this abstraction, of that relation, and so on. The unitary entity which is a series of acts of knowing is the more abstract apperception of the act of knowing itself. In six space one has the intellect knowing what something is in its abstract nature. A series of such abstract knowing acts is the entity mind apperceiving its own act of knowing, self reflection, self consciousness. As Mercier states it, "An act alone is knowable; a power can only be known through its activity"[9]. The power of mind knowing itself in its knowing act is the entity which is the series of knowing acts. The entity, mind knowing its knowing act, can be conceived to have a single act of knowing at any boundary region made in the entity. As entitative of a series of six

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8 Special acknowledgement is due to Cardinal Mercier, A Manual of Modern Scholastic Philosophy, St. Louis, Herder, 1950, especially Vol. 1, p. 237-283, for supplying a guide to relations in this highest region of rational life which is almost traditionally neglected by scientific psychology.

9 Ibid., p. 259.

space entities it is seven dimensional and has six dimensional boundaries, thereby adhering to the topological and mathematical logic criteria.

The other category of six space entities can be broadly described as dynamic tendencies toward an end. They are tendencies to select this end rather than that end. They may be described as blind acts of will. The seven space entity is entitative of a series of these entities. As a series they represent a great many possible tendencies to choose ends. The entity which is the series contains all of these various tendencies or choices. The unitary entity which represents this series of tendencies is the power of choosing an end. The power of choosing or free will is an entity which contains all the possible choices. It might be well to repeat the injunction that the higher space entity is not simply built up from the lower, but rather exists as an entity having a certain relation to the lower. Free will is not simply built up from the field of choice tendencies, but bears the relationship to that field as does seven space to six space. It is an entity (free will) which is the series of six space entities (all the possible tendencies). Free will bears a dimensional relationship to the field of dynamic tendencies, but it is not simply fashioned of those tendencies. Again, because the higher entity is conceived of as

consisting of a series of the lower dimensional entities the requirements of topology and mathematical logic are satisfied, and free will appears to exist in seven space.

Since abstract relations and tendencies are only aspects of six space, the corresponding seven space apprehension of the act of knowing and free will are aspects of seven space. A general description of gamma mind must be a conception of it as the entity which is the series of both intellectual and dynamic tendencies. The entity which is the series of these includes both apprehension of knowledge and free will. Gamma mind may be described as the field of self reflection, for to reflect on the self is to reflect on both the knowledge and tendencies in the self.

It is to be noted that the main feature added by seven space is selfhood which can lay hold of its knowledge and determine its acts. This may be taken as the most general description of the gamma level of which free will and apprehension of the act of knowing are only aspects. Selfhood is the entity which contains the field (series) of intellectual and dynamic tendencies. A boundary in selfhood may be abstractly conceived to consist of an act of knowing or tending toward something. Selfhood is all of these tendencies. It is the entity which embraces these tendencies.

The conceptual elements at this level are so abstract as to make comparison with neighborhoods and boundaries somewhat more impressionistic than exact as appears necessary at this dimensional level. Nevertheless in the development here it is possible to see, faintly perhaps, the same formula of topology and mathematical logic. Gamma mind still appears to be an entity which is the series of six space entities thereby satisfying the mathematical requirements.

An eight space would necessarily be a series of seven spaces, but a conception of it does not yet appear possible. The theoretical development here must stop at the level of seven space.

Table II.- is a summary description of all spaces mentioned in this work including some aspects of higher space which have been implied but not specifically taken up. On the left is the abstract designation of the dimensionality of the space. On the right are the kinds of real existence possible in that space.

Table II. - Summary descriptions of the nature of existence in spaces at dimensional levels from minus one to seven. Five, six and seven space are described generally and then under certain aspects. The descriptions in brackets under Rational Life are taken from Scholastic philosophy.

Dimension of Space	Description in Terms of Type of Existence Described			
	General Description	Rational Life	Will	Person as a Psychiatric Entity
7	Gamma Mind Selfhood	Apprehension of act of knowing and of knowledge, understanding (Passive intellect--essences and natures known).	Free Will	Person as self-determinative system, capable of insight.
6	Beta Mind Mental Representatives	Abstract relations and ideas (active intellect and universal abstract ideas).	Tendencies towards an end.	Person as a field of dynamic tendencies.
5	Alpha Mind Mental Events	Objects of thought (immagination and sense data).	Passively experienced events.	Person as a field of experiences.
4	Universe of material objects and events.			
3	Universe as a static extension. No material existence.			
2	Universe as a single plane. No material existence.			
1	Universe as a single line. No material existence.			
0	Universe as a single point. No material existence.			
-1	Perfect non-existence.			

Summary:

In this chapter the mathematical tools of topology and mathematical logic were linked together into a single formula of dimensional relations. This formula was shown to develop and describe the ordinary four space world as it is conceived of by modern geometry and physics. Five space was developed and appears to contain phenomena such as memory, sense perception, and precognition. Six space appears to be the region of intellectual and dynamic tendencies. The description of seven space appears to be a region of self-knowledge and self-determination.

In the next chapter a beginning will be made in integrating these various levels of functioning in order to fill out the aspects of mind which this brief survey of higher spaces has not yet touched upon.

CHAPTER V

THE FUNCTIONING OF MIND IN HYPERSPACE

> Our imagination always represents real space as having but three dimensions. We reach this intuitive space spontaneously; it seems to us so natural, so inevitable, that we have great difficulty in freeing ourselves from the domination of this image...But does experience exhaust the possibilities of real space? And can this space have no more than three dimensions? Nothing obliges us to believe that such is the case.
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> M.P. de Munnynck, "Space" in The Catholic Encyclopedia, Vol. 14, p. 168.

So far what has been accomplished is to show the possibility that three major levels of mind may be part of the phenomena occurring in three higher levels of space. The description of mind at this point is a static one split into three relatively detached strata. But mind is a dynamic, changing, interrelating entity. Can a dimension theory describe the dynamic interaction in mind? So far the structural outline of a house is standing. When completed will it be livable?

The very structure of a dimension theory must be adequate to describe mind as a functional entity. The first necessary step is to set down all the dimensional principles which must characterize the relations and processes in mind. These principles will be applied to yield in this chapter a somewhat simplified, linear picture of mind. The application will be in three steps; to explain the qualitative aspect of the conscious--unconscious

dichotomy, and then to explain between level relations within mind from higher to lower levels, and from lower to higher levels. The next chapter will continue this development to achieve a relatively complex picture of a dimension theory of mind as a dynamic entity.

1 Principles of Relations in Dimension Theory

In a dimension theory of mind all relations in mind must basically be dimensional. This is a simple consequence of hypothesizing that the structure of mind is that of higher space. This is an example of the limitations imposed by dimension theory so that it cannot be made to explain anything whatever. What is said to be dimensional must conform to dimensional principles even to its very roots. While this is a tremendous restriction on the possible kinds of relations in a theory of mind, it is an invaluable aid in structuring what a dimension theory of mind can explain.

Before these principles are set forth it would be well to briefly re-examine the content of the related, for this is fundamental to an understanding of the functional relations themselves. A clear characteristic of dimensional structure of ideas is that the content of different levels are unlike in some essential respect. To functionally relate these levels is to bring into relation with

each other entities which differ in some fundamental way. This difference is, of course, at basis a mathematical one. Each higher level adds a new parameter which is so closely tied to the nature of the entities in that level as to make them essentially different from those on any other level.

Applying dimension theory to reality one discovers quite different types or genera of existence on these different levels. A zero space is a world of one point. A one space is a timeless, formless world of one line. A point is a barrier in that world. A two space is a world of a single plane in which walls or boundaries are lines. There is no time or materiality. In such a world only the outline of a man appears. A three space world, while timeless and non-physical, is yet a world of extended forms with boundaries of planes. Man appears as the volume he occupies. To add another parameter is to enter a world of material realities and time relations. A boundary is a solid. Strictly speaking such a world does not contain man as a psychophysical entity, but contains only the body of man. To add another parameter is to enter a five space immaterial world akin to the physical in that events take place in it, but they remain in their taking place positions. A boundary is a space-time event. Man is enlarged to a psychophysical entity capable of memory and

sense consciousness, but he has no higher faculties. A six space is a world of ideas and dynamic tendencies. A boundary is a memory. Man can now conceive abstractly and respond, though both are automatic and not reflective or self determining. The last or seventh parameter changes the world to one in which ideas and tendencies can bend back upon, know, and determine themselves. Now a boundary is an idea or a tendency. Man appears as a self reflective, self determining, psychophysical entity.

Only to naive experience, which is accustomed to considering one or two levels more than any others (usually the third and fourth) do some of the changes between levels appear to be greater than others. In their structure the changes between any two levels are equally great. In all considerations of relations it is to be borne in mind that the character of things on different levels is always different in some essential respects.

This is the content of a dimension system. What relations are possible between these contents? Relation here is broadly conceived to mean any kind of comparing of one to another or translating of one into another. Because a dimension theory is structured in levels of different sorts of contents, there are two general kinds of relations possible. There are the relations between contents both on the same level (intralevel), and there

are relations between contents on different levels (interlevel). On a level they will be between like entities, and between levels they will be between unlike entities. For reference convenience the intralevel set of principles will be referred to as the L set and the interlevel principles as the M set.

The original definitions of space will be made to yield statements for all the possible kinds of relations they contain. These statements are not the work of the mathematicians but will be teased out of their work. They will cover all the principles of relations possible in a dimension theory. They are derived from the original definitions of Russell(Chapter III, Section 2D.) and Menger (Chapter III, Section 2C.), although Russell's definition will be the more apparent source. The two definitions are intimately related though, as developed in Chapter IV, Section 1. These principles of relations will be teased out of the original definitions, and they will form all the principles of relations possible in a dimension theory of mind.

Each level in dimension theory is formed of an ordered series of the next lower dimensional entities just as extension (level three) is formed of a series of surfaces (level two). In more general terms the n dimensional entity is formed of an ordered series of n-1 dimensional

entities. There are two general principles of relations on any particular level then. Principle L1; for any n dimensional entity, the n-1 dimensional components are in a given order. This may be illustrated by reference to a simple four space which contains a body moving in relation to a fixed point. The four space moving body (n above) is formed of an ordered series of solids (n-1 above). Considering the four dimensional event, the bodies which make it up are in a fixed order. That is, the body was at this point, then that point, and so on with the succeeding points. Principle L1, will be most useful in application to five space, but it will not be immediately applicable to six and seven space since our knowledge has not advanced to the point of being concerned with the order in tendencies and acts of will even though there must be an order at these levels. The first intralevel principle is concerned with the order of n-1 entities.

The second principle will be concerned with the number or range of n-1 entities. The order of the n-1 series and its range would seem to completely describe the series which makes up the n dimensional entity. Principle L2: is that n dimensional entities may be made up of n-1 dimensional series of different range or size. An illustration from a simple four space is that events (n above) may be formed of a long or short series of solids

(n-1 above), a four space one second or one year in width. Long or short are relative terms. The exact size of any series could be specified, but the application of dimension theory has not progressed to the point where such exactitude can be of use.

Principle L2. merely says the series may be of different lengths. As relative terms of lengths the words differentiated and undifferentiated will be used. That is, differentiated will be used to refer to an n dimensional entity made up of a relatively limited, restricted range of n-1 entities. Relative to it undifferentiated will refer to an n dimensional entity of a relatively great, unrestricted range up to and including all of the n-1 dimensional entities in series. Differentiated will never refer to a range of n-1 entities so limited (less than the reciprocal of infinity in extent) as to not make up an n dimensional entity. That is, differentiated will always refer to an n dimensional entity even when the range of n-1 entities is quite small. Differentiated and undifferentiated are merely relative terms for restricted or large range which will be used in conceptually comparing series of different sizes.

These are the two relatively simple intralevel L set of principles referring to the relation of order of parts, and the comparison of a large to a small series of

parts. Concerning interlevel relations, three general principles may be set forth. Principle M1: any n level of dimensionality is related to all other levels of dimensionality. This follows from the definitions which link an entity of n dimensionality to the n-1 dimensional series which makes it up, a series of n entities being an n+1 dimensional space. In this way the entities in any two levels are related, and hence all levels in general are related. Whatever level of space one considers, it is contained in a higher series and contains in itself all the successive lower series. In the example of the simple four space this may be seen to be true. The moving object (n above) is part of the five space which contains it, and in turn it contains in itself the solids, planes, lines, and points which make up the moving object. This general principle links together all spaces and the phenomena in those spaces into an indissoluble functional unity which is important when considering the implications of this dimension theory of mind.

Principle M1. could serve for a complete description of all interlevel relations except for the fact that in practical application the differential implications when going to a higher to a lower space, as against going from a lower to a higher space, are of great theoretical importance. So, there will be two other interlevel principles

concerned with higher to lower, and lower to higher relations.

Principle M2: is that in going from a higher to a lower level of dimensionality, given the entity in level n, those it contains in n-1 dimensional space down to the simplest series are structured. That is, since the higher series contains in itself the successive lower series, given the higher entity those it contains are determined. In the example of the simple four space, given the space-time event, the extensions, planes, and lines that make up that event are determined.

Principle M3: is that given the n-1 dimensional series the n dimensional entity would appear to be structured. Primarily this principle says that since the n entity is formed of an n-1 series, given the series of lower dimensional entities, the higher entity appears determined. An example from four space is that given the three space solids arranged in a series, the space-time event they form appears determined. Technically it should be possible to state this principle without the use of the cautionary word'appears', except for the possibility of misinterpreting the implication of the lower to higher relation were there no caution.

One of the reasons for the 'appears' is not the mathematical principle that given a series of n-1 dimensional

entities, mathematically speaking one cannot be certain an n dimensional entity exists[1]. The criterion here for the existence of the higher space is that certain phenomena exist which have the property of that space. The evidence for the higher space here is not simply that the lower series exists, but that there are real phenomena corresponding to the higher space itself.

The 'appears' in the above principle is a caution regarding the interpretation of lower to higher relations, a caution that will be explained in full in the final chapter on the implications of the theory. It is related to the question as to whether precognition means events are determined fatalistically. Even without the word 'appears' all three principles are true; they are part of a single structure of ideas which is the definition of space and dimension.

The principles of relations in dimension theory may be summarized. Regarding the content of the things related, it may be said that entities on different levels have

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1 B. Russell, Principles of Mathematics, 2nd Ed., London, Norton, 1937, p. 375.

essentially different properties. There are two general kinds of relations, L. intralevel, and M. interlevel. On a dimensional level the n-1 dimensional entities are in an ordered series (Principle L1.). There is also the relation of limited to large range of n-1 dimensional entities (Principle L2.) which ranges will be designated by the relative terms differentiated and undifferentiated. Between levels there are three principles. All levels are related (Principle M1.). Given an n dimensional entity the entities of lesser dimensionality it contains are determined (Principle M2.). Given an n dimensional series, the next highest dimensional entity it forms appears determined (Principle M3.). On a level there is the relation of order in the series and the relation of large to small series. Between levels one can say that all levels are related, the higher structures the lower, and the lower appears to structure the higher.

The main principles for a description of mind as it functions are those that relate levels. The intralevel relations are more nearly static aspects of functioning. Interlevel relations govern the more dynamic translating of one thing into another. In a dimension theory of mind these are <u>all</u> the possible principles of relations which must be adequate to describe <u>all</u> of the complex and varied relations in mind.

2. Relations Within Levels; Quality of Awareness

The first use of these principles will be concerned with intralevel relations of dimensionality. No dimensional distinction has yet been made between what is conscious or unconscious in these levels of mind. For instance, alpha mind contains a series of discrete events with old, present and even future time dates. Not all of these could be conscious at a given moment. Is there a dimensional relation corresponding to these two aspects of mind?

To begin with, what conscious and unconscious refer to is uncertain. Miller has devoted a whole book to the sixteen meanings of unconscious he has been able to discover in the literature[2]. Instead of setting up definitions and then showing a relation in this dimension theory to correspond to that defined, an attempt will be made to structure the only definition that can be made by this theory. Its adequacy or inadequacy in relation to the knowledge of the conscious and unconscious may then be seen.

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2 J.G. Miller, Unconsciousness, N.Y., Wiley, 1942, p. ix-329.

There are two general problems regarding what is conscious, that of the quality of the experience, and secondly the question as to what determines the content of consciousness. The problem of the quality, and that of the determination of content will be taken up separately to simplify the exposition. The qualitative aspect will be considered first, and the determination of contents will be part of the next chapter.

To be noted first is that whatever consciousness is linked to in this dimension theory, it will have essentially different qualities according to the dimensional level referred to. That is, according to the introduction to the principles of relations, the contents of separate levels is essentially different. The quality will be accordingly essentially different. At the alpha level the contents of consciousness will have the quality of events bearing particular accidents. In contrast to this the contents of the beta level can be no clearer than a purely abstract idea or a general tendency. Hence the quality will be without the accidental particularizations of the alpha level. At the gamma level the contents are the power to reflect on ideas and actions, not even having the particularization of those ideas or actions. The quality of consciousness must be essentially different at these various levels.

Since in general consciousness is what is sharp, clear, and standing apart from the rest, it must correspond to differentiation. Principle L2., which permits the distinguishing of brief and long series, would appear to be the only adequate one to correspond to it. In this case it would appear that what is ordinarily referred to as consciousness is differentiation in this structure of ideas, and undifferentiation would correspond to unconsciousness. Differentiation at the alpha level would correspond to a memory or the visualization of one or a few objects with particular accidents. At the beta level it corresponds to a singling out of an abstract idea or a dynamic tendency. Differentiation at the gamma level would contain an act of reflecting on an idea or tendency. Consciousness in dimension theory seems to correspond to a narrow segment of the series at any level, The unconscious or undifferentiated would refer to all the rest of the series. For instance, unconsciousness at the alpha level would refer to all of the rest of the series that is not differentiated.

Apparently this is in accord with the main import of most of the meanings of unconsciousness Miller has found in the literature. Of his sixteen meanings of unconscious, nine have the general implication of an undifferentiated

series[3]. Definition four when applied to the individual or his actions asserts they are undiscriminating. In response to a great undifferentiated mass of material the response would have to be undiscriminating, for only to something differentiated out of the series could a discriminating response be made. Definitions six, seven, eight, nine, eleven, thirteen, fourteen and sixteen assert the individual is unsensing, unnoticing, lacking insight, unremembering, unrecognizing, unable to communicate, ignoring, or unaware of discrimination. Each of these he applies both to the individual and to the individual's actions, emotions, needs and drives. These various meanings of unconscious refer to different contents, i.e. sense data, memories, insights, associations, language symbols, or to contents in general (unnoticing, ignoring, unaware of discrimination). The general meaning, though, is that the subject is not conscious of particular kinds of contents as differentiated. The other major definitions include the strictly behavioristic and the early

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3 Ibid., p. 21-44.

psychoanalytic. In general it would seem that an unconscious defined as undifferentiated mind on three levels corresponds closely to many of the meanings of unconscious in psychology.

Such a dimensional definition has important implications which need to be made explicit. Many theories of the unconscious, especially the early psychoanalytic[4], divide the conscious and unconscious as though they were separate regions. Under certain restrictions material passed from one to the other. Such an explanation is not possible here. If mind is identified with the contents of these levels, then these contents are all present in mind. Let us identify the presence of contents in this mind with the act of awareness. Awareness becomes that act of possessing or having present these contents. The implication is that this awareness, which is the simple act of possession by mind, can range from total differentiation to total undifferentiation. This is in accord with evidence and common experience, while it is an explanation of a basic problem in psychology.

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4 Sigmund Freud, New Introductory Lectures, N.Y., Norton, 1933, p. 102. "...the word unconscious has more and more been made to mean a mental province rather than a quality which mental things have".

By aware here is simply meant present within the region called mind. But by consciousness man appears to mean sharp, clear, differentiated and standing forth. In this sense man can be aware or conscious of only a limited memory or a limited tendency at a time. Differentiation appears to be the very criterion of consciousness. But this does not deny to the undifferentiated the general quality of presence in awareness. Of course its presence must be undefined, without particularizations, and without distinguishable marks since so much is present at once. It is undifferentiated, but present in awareness. A difficulty cited by A.N. Whitehead is an example.

> But the things apprehended as mental are always subject to the condition that we come to a stop when we attempt to explore ever higher grades of complexity in their realized relationships. We always find that we have thought of just this--whatever it may be--and of no more. There is a limitation which breaks off the finite concept from the higher grades of illimitable complexity[5].

The limitation is that of one's definition of consciousness. Whitehead thinks of it as discreteness standing forth or differentiation. In those terms illimitable complexity is

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5 A.N. Whitehead, Science and the Modern World, N.Y., Macmillan, 1927, p. 247.

certainly not available all at once. But it is possible to have illimitable complexity in awareness, if by awareness one does not mean discretely present and standing forth. The experiments of Hull and Smoke support this when they show it is possible for an individual to make discriminatory responses on the basis of a concept which they are unable to make discrete in consciousness[6,7]. They knew and were aware, but not discretely so. It would appear the conscious, preconscious, and unconscious are a scale of differentiation from sharp, to less sharp, to broad complexity.

Empirical experience supports this view of awareness in different grades of discreetness. When asked as to the source of one's enjoyment (a form of awareness) of a warm country scene of hills, pasture, stream and ambling cows, one can answer by attempting to communicate the experience in discrete terms. It is the warmth of the air, the light breeze, the deep greens, the soft sounds of leaves,

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6 C. Hull, "Quantitative Aspects of the Evolution of Concepts", Psychological Monographs, Vol. 28, No. 123, 1920, p. 1-85. cited by W. Vinacke, "The Investigation of Concept Formation", Psychological Bulletin, Vol. 38, 1951 p. 23.

7 K. Smoke, "An Objective Study of Concept Formation", Psychological Monographs, Vol. 42, No. 191, 1932, p. 1-46. cited by W. Vinacke, "The Investigation of Concept Formation", Psychological Bulletin, Vol. 38, 1951, p. 23.

and the planning of a restful day there. It is all these and more, all present to the experiencer's awareness at once. But so much is present that none stands out sharply from all the rest. One is aware, but diffusely so. Undifferentiated awareness has many names and forms. Broad aesthetic enjoyment, some mystical states, intuition, poetic and literary meaning are examples. "In a broad sense ... it is the sum of all former experiences...either sensory or reflective--which is involved in the attribution of meaning to any datum"[8] -- the definition of apperceptive mass. This mass is present and influential in awareness, but is not differentiated.

A psychology which sets what is undifferentiated at this moment as outside the scope of any kind of awareness is extremely limiting the meaning of events. What is real and operative is simply the stream of bits of things which become differentiated and then are lost in a moment. In such a psychology the enjoyment of a painting is a response to this bit of it, then that bit, and so on, but never a

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8 P. Harriman, "Apperception" in The New Dictionary of Psychology, N.Y., Philosophical Library, 1947, p. 31.

broad, vague response to many aspects and associations at once. One may then be inclined to broaden conscious to what one vaguely perceives, the preconscious. But the full, real meanings of things here and now is precisely the "sum of all former experiences--either sensory or reflective--which is involved in the attribution of meaning to any datum". The present meaning of events ranges in explicitness from what is differentiated, through the less differentiated to what is completely undifferentiated.

The identification of awareness in any degree with the presence of a content within these levels answers the basic question as to what explains the quality of consciousness. Mind is identified with these dimensional levels and their contents. The quality of knowing is then the act of presence of a content, say a memory, within mind. I know the memory because it is an active content of my mind. But knowing comes in shadings from sharp and clear to diffuse and general. The differentiation of this memory as a limited event is the consciousness (as discrete) of this event. One can possess, and is that sense, be aware of memories or ideas in general, which has been termed unconscious because it does not stand forth as differentiated. Yet the basic implication here is that one possesses the undifferentiated contents, and can be aware of them as undifferentiated. This is the apperceptive mass. It is what

gives the broadest meaning to events. This kind of theory provides a definite place for a broad intuition, poetic and aesthetic experience and complex but non-discrete awareness.

3. Relations Between Levels Within Mind

While the quality of states of awareness has been described, there is as yet no dimensional description of what determines that this and not that shall be differentiated or conscious at any one moment. The answer to this will be imbedded in a general exposition of functioning between levels of mind, which must take place in accordance with the M set of principles.

Principle M1. is the general statement that all dimensional levels are related to each other. Principle M2. gives the relations when going from a higher to a lower level, and Principle M3. in going from a lower to a higher level. In a theory which identifies mind with certain levels of hyperspace all transactions between levels of mind must accord with these simple principles. The within mind five, six and seven spaces will be the levels of present concern. The relation between four and five space, which is that between body and mind, will receive separate treatment. By developing each higher level out of the lower, the functional relation between them has been implied; but now it may be made more explicit.

Some preliminary remarks will circumvent the development of serious impediments to an understanding of these relations. In building a higher level out of the lower, it will seem at times that in a causal way the higher is made of the lower. Ideas of causal determination must be removed from the conceptions of interlevel relations, or it will be impossible to grasp their meaning. Causal determination, which implies succession in time and contiguity in space, is a four space physical concept. Though proper to a conception of four space, it will impede the understanding of relations between other spaces. For instance, things in five space in some sense are timeless for they do not come into being or disappear. They simply always are as they are. How then can the five space object be causally made out of a physical, time-bound thing? The concept of physical causality is not of the correct form to describe the relation.

Instead of the ideas of make, fashion, effect, cause, influence, or temporally determine, the idea of correspondence will be used. Borrowing from the original definitions of topology and mathematical logic (Sections C. and D., Chapter III), correspondence will be taken as the equivalence in Russell's definition between the series of n-1 dimensional

entities and the n dimensional entity which they make up[9]. That is, since the n dimensional entity is made up of a series of n-1 dimensional entities, they may be said to have a relation of correspondence. The phrase 'exact correspondence' will be used when the whole n-1 series is considered in relation to the n entity. Otherwise 'correspondence' will be used in the broader sense whenever any part of the n-1 series of the n entity is considered. Correspondence is a way of referring to what corresponds on a higher or lower level to what is on a given level without thinking of one being made out of the other causally.

Of the three interlevel principles, Ml., that all levels are related, is dimension theory's statement of the unity in these levels of mind and in mind-body. The above to below relation and the below to above relation are simply two aspects of a system which inseparably links all levels. This unity may be expressed two ways. As for location, all lower levels are contained within the higher level. As for relationship, no change can be effected at

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9 Correspondence is a little more difficult to see in Menger's definition. Since each point of dimension less than n is a little space of less than n, it is the equivalence between the neighborhood of these points and the n space. The meaning is substantially the same as in Russell's definition where the neighborhood of these less than n points is the n-1 series.

any level without having corresponding to it a different structure at all other levels. The levels of dimensionality are in effect levels of potential kinds of functioning within the unitary mind. The balance of this system is the correspondence that must exist between the levels. The self in the largest sense may be conceived of as a unitary reality showing itself on many levels at once, having an essentially different appearance on each level.

Principle M1., that all levels are related, is the essential statement of the unity which is necessarily studied here in its analyzed aspects. Principles M2., relations from higher to lower levels and M3., from lower to higher levels, are two broad aspects of this unitary, interlevel correspondence. In examining these two aspects separately it must be borne in mind that they must fit together into a unitary structure which is generally expressed in Principle M1. These two aspects, coming down from higher levels, and going up from lower levels, will be seen to correspond to two general psychological processes, creativity and learning. In going from a higher to a lower level one will be seen to be viewing mental function from the area of choice to the area of result of choice, a creative process. In going from a lower to a higher level one is progressing from a concrete object to a realization of its abstract attributes, a learning process. These are two

general aspects of mind functioning that lock in a corresponding unity. They will be considered separately and at length.

A. Simple Functioning From Higher to Lower Levels-Creativity

The unitary relatedness which is the dimensional structure may be viewed under the aspect of higher to lower level relations. Principle M2. states that in going from a higher to a lower level of dimensionality, given the entity in level n, those it contains in n-1 dimensional space down to the simplest series are structured. By applying this principle to the contents of mind in these three levels one obtains dimension theory's description of the functioning of mind as creating. Mind is creating or acting here in that the act of will (seven space) has corresponding to it a dynamic tendency (six space), to which corresponds an image, or a pattern of action of the body image (five space). The choice of will is translated into a set of particularized internal acts.

Applying Principle M2. to the contents of these dimensional levels one may say that given a differentiated choice of free will in seven space (the n entity in the principle), the corresponding six space, and five space entities are determined (n-1 and n-2 levels). What beta and alpha level entities correspond to the differentiated (conscious in that sense) act of will? They are precisely those which in developing the theory upward appeared to

structure the will. Building downward now they appear as lower level manifestations corresponding to the act of free will.

Here is an example. We are given the differentiated act of free will at the gamma level which consists of reflecting on and choosing a tendency. Given this act there will correspond to it at the beta level the dynamic tendency towards that end. At the alpha level there will be concrete, particularized visualization of a pattern of action. As will be seen in the next chapter, this alpha pattern of action may be translated into an actual motor response which is its corresponding content at the physical level. Hence, given the choice of will, there corresponds to it realities on various levels including the image and the physical act of carrying out the will.

This is a somewhat simplified picture of this functioning between levels. Not all actsoriginating in the inner region of man will be deliberate acts of will from the gamma level. It is possible for the functioning to be from the beta to the alpha level alone. When it does come from the beta level the will may be said to correspond to (participate in) the action of the dynamic tendency without deliberatively doing so. Examples of this beta to alpha process are hallucinations, spontaneous images, fantasies, and dreams. These are practically always the alpha

correspondents to a dynamic tendency which is not influenced by a deliberate act of will. But there are changes in will corresponding to these beta contents. That is, the will participates in these acts. The whole value of dreams and spontaneous images in clinical practice is that they are direct keys to the dynamic tendencies within the individual. They are imaginal particularizations or symbolizations of the dynamic tendencies on a higher level.

It may be seen that this creative process from the interior to the exterior of man may be initiated at various levels. But having been initiated, the alpha level will manifest some discrete correspondents to what exists on a higher level. These alpha correspondents are sense images. The sense images can be recalled memories or some rearrangement of sense impressions to correspond to the higher level entity. Symbols and imaginative constructions are just such rearrangements of sense data to correspond to the form at a higher level. Language itself is a part of the alpha memories and hence one kind of alpha particularization of a person's higher beta desires.

The contents on different levels are essentially different, and those at the alpha level are the most particularized in their accidents. Since this is so, the great importance of the alpha level in this creative process is that at the alpha level man may discover discrete,

particularized representations of higher aspects of himself. Gamma will and beta tendencies, even when differentiated, do not stand forth sharp and clear. They can, and have been at times entirely overlooked in science, i.e. in a psychology based on associations alone. Even though the alpha level particularizations cannot capture the experience quality of the higher levels, it can represent those levels. Man can realize those levels and communicate them to others by communicating these images (which include language) to others.

In summary, Principle M2., which fixes the lower level correspondents of a differentiation at any higher level, may be realized in the picture of functioning from higher or more interior levels of man. Given a gamma determination of will, there corresponds to it beta dynamic tendencies and alpha sense images. Given a differentiated beta tendency, there corresponds to it alpha sense images. These images may be a complex visualized pattern of action, they may be recalled memories, they may be imagination (reordered sense images), or they may be language images. This inner to outer functioning of mind in man is a realizing on the sense level of his higher aspects, and in that sense it is creativity.

The reader may be aware that other complex aspects of this functioning are yet to be taken up. This description

has not yet said what determines the level of origin of this creativity, what determines what shall be differentiated and hence conscious, what is conflict in this structure. These will be considered when the general picture of the downward and upward aspects of functioning is complete.

B. Simple Functioning From Lower to Higher Levels--Learning

The transition from higher to lower levels, or from inward to outward aspects of mind appears to be creativity. In such a transition higher acts or tendencies are translated into more discrete sensory level images. A transition from lower to higher levels is one from exterior to inner aspects of mind. It is a process which may be designated as learning in a broad sense, since in it sense data are translated into knowledge.

Principle M3. is the basis for such a transition. It states that given the lower level series the higher level entity appears determined. In application this means that given a series of alpha sense experiences, the corresponding beta abstract idea and dynamic tendency appears determined. Given the beta series of abstract ideas or tendencies the gamma reflection on these ideas or tendencies corresponds to it and appears determined in that sense. For instance, to learn the abstract concept of tree, one

must have sense experience of various trees and then abstract (alpha to beta level correspondence) from the experience, Corresponding to the beta abstract 'tree ideas' there is a gamma level reflection on the idea of tree.

Considering this dimensional structure from lower to higher levels, sense experience appears to determine the contents of the higher level. The world appears to determine man. Viewed from higher to lower levels, man appears to determine his world. Which is it? The word 'appears' has been held to because both are true. Now the opposite processes of creativity and learning may be put together into a more complex structure which includes both.

Summary:

Since to simply identify three levels of space with levels of mind presents only a static picture of mind, this chapter aimed at developing the early approaches to the functioning of mind in hyperspace. The basis of this functioning has to be dimensional. Five possible dimensional principles of relations were derived from the definition of space and were set forth clearly. One intra-level principle was developed as the basis for the qualitative distinction between the conscious and unconscious. The implications in this particular definition were clarified and substantiated. The general interlevel relatedness

was set forth as the unity of mind (and indirectly of mind-body). Higher to lower level functional relations were seen to be the process broadly designated as creativity while the lower to higher level relations were described as learning. With the dimensional basis for the quality of consciousness-unconsciousness exposed, together with the unity of relations between levels, and the settling of two aspects of this unity, creativity and learning, further functional relations may now be considered.

CHAPTER VI

FURTHER FUNCTIONING OF MIND IN HYPERSPACE

> But although the notion of a science dealing with a subject matter not directly observable must have seemed incomprehensible in the nineteenth century, when the present traditions of psychology were established, it does not follow that those traditions are appropriate for the twentieth century...In the new scientific era now beginning we venture to say psychology will modify rather than reject its earlier definition as the study of the psyche, and will study openly and without apology the problem of dynamic organization which always has been its chief concern.
>
> P. Lecky, Self-Consistency, A Theory Of Personality, p. 33.

The upward and downward aspects of this structure of relations are the groundwork of further aspects of a dimension theory of mind in operation. Both are true, and both participate in a general relatedness in which there must be perfect correspondence of contents at all levels. An economic, dynamic balance or equilibrium has been postulated for mind by a great number of psychologists. Whether or not correspondence is the same kind of balance, it is one inherent in the structure of this theory.

Mind is too complex to present in a work less than several volumes in length all of the dynamic, functional processes it embraces. In a work of this size the best that can be done is to describe the major lines of functioning which include as minor aspects all the other kinds of dynamic relations. These major lines may now be

delimited and studied.

The basic question is, what determines the contents of these levels. This will be answered by synthesizing all the separate ideas mentioned and implied before. Knowing the determination of contents one might wonder what determines the level of functioning. There will be several answers to this depending on what is meant by the question. Lastly, the determination of the momentary position of consciousness will be taken up. The determination of contents is the basic issue of interlevel functioning while the determination of the position of the line of consciousness is the basic intralevel functional relation. The level of functioning issue properly lies between these and includes aspects of both. These are the major lines of functioning within mind. These issues will lead into the problem of the mind body interaction, an extension of functioning down into its physical roots.

Lastly, since the implication of all this is to leave the bounds of the individual undetermined, this broad issue will be considered. The basic questions of the determination of contents, of levels of functioning, of the position of consciousness, and of the mind-body relation answer in a fundamental and general way all the problems of the functioning of mind. The last section on the bounds of the individual leads into the implications of

this theory, the subject of the next chapter.

1. Complex Functioning Within Mind

We may ask first what determines the contents of any level. This has already been answered in several other contexts but a summary picture may now be obtained. What, for instance, structures the events in the alpha level? If it is not shaped from above it is the entitative representative of sensory responses. Similarly for the higher level. If the beta tendency is not shaped from above by free will, it is the entitative representative of alpha experiences. At the gamma level there is the first possibility of real self determination, so that three things may influence the contents there. If there is any reality at the eight dimensional level it would have a bearing on the course of free will. Also the free will determines itself. Lastly it may be the entitative representative of the beta tendencies, in which case it may be said to participate unreflectively in the tendencies of the individual. In general the contents of each level either are determined by the higher level or are the entitative representative of the lower level. The only exception is the gamma level which has the additional power of self determination. This formulation in terms of, "if it is not this, it is that", may appear unsatisfactory. To say

the two correspond does not clear away the mystery even though it is true. If one must be given superiority over the other, the higher level determination is more real than determination by the lower level as will be seen in the last chapter.

The structuring of the beta level involves the whole problem of psychopathology for it embraces the making and unmaking of a man's dynamic tendencies. The general conclusion of dynamic psychology that one's personality trends, good or bad, normal or pathological, are fashioned by one's past experiences is the determination of the beta by the alpha series. Psychotherapy, the modification of these trends, is accomplished essentially by insight and self reflection--a gamma determination of the beta level. Conflict in this theory is then the opposition between what one's personality dynamics (imposed by experience) would lead one to do, and what one would choose if the matter were reflected on. Psychotherapy (outside of the relatively ineffective suggestive varieties) is the long process of training an individual in self reflective gamma level discovery and modification of his tendencies.

Knowing what determines the contents of the levels, one would like to know what determines at any moment on what level one is functioning? The immediate and simple answer is that one always functions at all levels. Yet

this is not an entirely satisfactory answer for functioning may have several meanings. If functioning is taken to include the undifferentiated, since the undifferentiated is always at all levels, functioning is always on all levels. These contents are dynamic in themselves in that the alpha level involves changes lined up, the beta level the tendencies in changes, and the gamma level the entitative determination of changes. The undifferentiated contents are dynamic, and therefore functioning in that sense is at all levels at once.

By functioning one may mean operating as differentiated, sharp, clear, and standing forth. This is an identifying of the region of functioning with consciousness or differentiation. The answer to the question as to what determines the level of differentiated functioning is again that differentiation occurs at all levels at once so that one functions at all levels at once. The truth of this and its relation to the dimensional structure may not be immediately clear.

For the moment let us suppose that there is a single and corresponding line of differentiation running through the three levels of mind. In a short while the actual determiners of this line will be shown. If there were a single line of differentiation, what would be the quality of the individual's experiencing of this line, which is his

line of consciousness? In chapter V, Section 2. it was shown that consciousness at different levels has essentially different qualities according to the properties of the levels. Then if a line of differentiation runs through these three levels, there will be three essentially different qualities to this line of consciousness. Its gamma aspect will include the power of self reflection and determination. Its beta aspect will be the entitative tendency in changes (both idea and dynamic tendency is subsumed under this idea). The alpha aspect will be a concrete image. The experiencing of this line of differentiation would have these three quite different levels of quality. The higher two will be vague and without particularization. The lowest will be concrete and bearing accidents.

To most persons only the alpha level particularization is taken as consciousness. Even if there were a line of differentiation running through the three levels, such a definition of consciousness would limit what one means by conscious experience of this line to differentiation at the alpha level. From the standpoint of this particular definition of consciousness, the question of what determines the level of one's functioning is translated into the question of what determines the signs appearing in alpha consciousness. This definition does not permit or conceive

of a consciousness of these higher levels themselves, so that level of conscious functioning becomes a question of signs of other levels appearing in sense consciousness. It is important to note that from this view one consciously deals only with the explicit signs of the higher levels--not with them themselves.

An alpha sign of the beta level would be any fantasy, image, or symbol which refers to an abstract idea or a dynamic tendency. Language symbols which refer to ideas and tendencies are such a sign. Language and other complex symbols which refer to choosing and deliberating are signs of gamma level operation. The important point is that if, as is usual, consciousness is made to refer to what is alpha differentiation here, these signs are the only conscious access to the higher levels. Any condition, such as brain damage or amentia, (this will be seen in the next section) which limits the complexity of symbolic constructs and signs of the higher aspects of mind, will limit apprehension of these aspects.

Not only are these signs the only means of conscious access to the higher aspects of self, but they are part of the very determination of the beta and gamma contents. Since there is correspondence between the levels, any advance in the signs of the higher levels will reflect an advance in conceptions in those levels. These alpha signs

may be learned and in the advance of the learning of them, in a sense, there is learning in the corresponding contents in the higher aspects of mind. Just as the awareness of free will, in an alpha differentiation definition of consciousness, depends on having symbolic constructs with which to represent it to one's self, the advancement in these constructs reflects or corresponds to an advancement in self conception at the gamma level.

In the view of this extremely limited definition of what man can be aware of, he only deals second hand with higher aspects of himself. Their autonomy appears strange and almost incomprehensible in relation to consciousness. Fantasies and signs come and go and man conceives himself (the conception is a gamma level operation) as having little or no control over them. This limited conception of the height to which conscious awareness extends is not actually valid. Differentiation or consciousness is a line extending through all the levels of mind. To limit it to the alpha level is to limit man's apprehension to second hand signs of higher aspects of himself. But to broaden the concept of awareness to beta and gamma awareness, no matter how unparticularized it is, is to gain a more reasonable picture of mind. In this picture awareness is equated with presence on a level. It comes in grades of sharpness extending from complete undifferentiation to complete

differentiation, consciousness being the differentiated line extending through the three levels and having three kinds of quality depending on the character of the levels.

The question as to what level or levels on which functioning takes place at any moment has been answered several ways. If by functioning the undifferentiated is included then one operates on all levels at any moment. If by functioning the line of differentiation running through the levels is included, the answer is the same. Since consciousness is usually limited to what is alpha differentiation here, levels of operation really refers to what signs one has of the higher aspects of mind at the sense level. These signs are important since they are in this definition of consciousness the only consciously apprehended aspects of the higher levels. They are not only the signs of beta and gamma mind, but they reflect the development of its contentual structuring. Lastly, the unreasonable limitation of a view of consciousness as being only alpha differentiation was briefly examined. In the structure of this theory there is no real means or necessity of so limiting the extent of the line of differentiation.

The determination of the contents of these levels, and the question of the level on which one functions has been examined. The last major question is what determines

the momentary position of the line of differentiation running through the three levels of mind. Whereas the quality of consciousness has been taken up already, now its positional determination can be settled. An answer to the question earlier would not have been understandable. Now it may be easily discovered and understood.

Let this line of differentiation running through the three levels of mind be termed the line of awareness so that it will not be confused with consciousness, usually conceived of as alpha differentiation. This line of awareness consists of the corresponding differentiated contents at the three higher levels of space. Let it even be extended downward into space-time, the physical world. What determines where it shall be? At one end of the line is, what may be referred to as, the present, differentiated state of self determination. Strictly speaking the will transcends time so that what is referred to here are whatever contents at the gamma level correspond to the now position of this line. This in itself would seem to place the line--free will or self determination fixing its own contents at any moment. The other end of the line of differentiation is anchored in the present position of the physical world. The now position of that world would here appear to determine the line.

Actually both are true, both are aspects of the general relatedness in Principle M1. Both the now position of the world and the present determination of the gamma level determine the location of this line of awareness. Both correspond to each other (through the intermediate five and six space levels). This is the fixing of the line of awareness of which consciousness as alpha differentiation is a part. The present state of the world (four space) influences the sense consciousness (five space), which has corresponding to it contents at the two higher levels (six and seven space). Conversely, free will determines its own differentiated content (seven space), which has a corresponding differentiation at the beta level, the alpha level (sense consciousness of the signs of self, language, etc.), and at the physical level (present material state of the brain). One is creation and the other is learning; both are aspects of a general relatedness. The position of the line of awareness has two corresponding determiners, self determination and the now position of the physical world.

2. The Mind-Body Relationship

Without dimension theory's description of the mind-body relation the mind it alludes to would appear to float in distant spaces, detached from the material world.

Instead, the structure of these ideas already contains the ties between the physical body and its mind. Most of the foregoing description of the functioning within mind had little or nothing to do with the material world. Now that functioning may be extended downward into four space to anchor mind in its relation to the physical world.

One of the tools to an understanding of the mind-body relation will be association by contiguity. It hasn't been developed until now because it wasn't particularly necessary or useful. Although association has been the keynote in some psychological structures, it is a limited aspect of this one. Principle L1. is the last one remaining that has not yet been applied. It is the basis of association by contiguity. It states that for any n dimensional entity the n-1 dimensional components are in a given order. Take the events in the alpha level. They are the n-1 components of the n entity which is alpha mind. What is their given order? They are in a time order. That is, if events ABCD are in that order in the series, then event B has a later time date than A, and an earlier date than C, and so on. The less the time date difference between two events the closer or more contiguous they are. Events of the same time date are of the same time date unit. If there is to be a differentiation in the alpha series, events of the same time date or close time date will tend

to be differentiated together. If one recalls events of date T_2, all the events of date T_2 will appear in consciousness while those close to date T_2 will tend to appear. That is, contiguous memories tend to be recalled (differentiated) together. Principle L1. when applied to the alpha level is the law of association by contiguity[1].

This association by contiguity has an important bearing on the relation of the five space alpha mind to the four space physical body. The next key to that relation is in the contents of alpha mind itself. At the alpha level one has the series of sensory responses, past and present, that are associated with the body. The series contains non-physical representations of the physical body and its physical milieu. The alpha series not only contains the body in its moment to moment changes, but it also contains the series of changing brain patterns. Just as the physical surroundings and the movements of the body are represented there, so are the physical changes within the body as in the changing brain patterns.

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1 The law of association by similarity need not be developed here. Briefly it involves a relating of different alpha entities because they have the same beta correspondent. The several other laws of association have a more doubtful status in psychology. See E. Hilgard, Theories of Learning, N.Y., Appelton-Century-Crofts, 1948, p. 57 and p. 146-154.

Since the brain pattern and the sensed sign it refers to have exactly the same time date the two are always associated. Through constant repetition of the association of the brain pattern with its sign, the pattern comes to have the meaning of the sign. This pattern has the qualities of the sign or object because alpha mind tends toward the object. As a five dimensional reality it contains the actual object. The brain pattern associated with the object changes as does the object, and hence has the meaning of the object.

Now the link between body and mind is complete; the person may be seen as a functioning entity involving at least the first seven dimensions of space. The physical world incorporates the first four dimensions of space. The body and brain are a part of that world. At a given moment let us say an individual has a physical sensory response to an object. In the physical world there is this sensory response and the object that structured it. In the world of five space there already existed this same object and its alpha sensory pattern as an undifferentiated part of

the alpha series[2]. The physical, sensory-neural pattern in the brain and the alpha brain pattern are in exact correspondence. The sensory-neural pattern differentiates the alpha pattern and the individual has sensory consciousness of its associated object.

The previous section referred to a line of differentiation running through from seven to five space, and extended down to four space. The four space end of this line of differentiation or awareness is the physical, sensory-neural pattern in the brain. The now state of the brain is the physical determiner of the location of this line of awareness. The brain does not translate the object from out there to within the mind. The object already has undifferentiated existence in alpha mind. The function of the brain is to give differentiation to mind by tying it to the razor edge now. The brain, being physical, must reflect the moving now. Its changes correspond to and give differentiation to the alpha neural pattern and its associated sign or object. The brain does not give reality

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2 The two are not associated until they have been actualized at the line of differentiation. Until that time, from the viewpoint of the physical world, they are only potentially real and not actually real, and hence not associable as are determined contents. The obscure question of potentiality versus actuality will be taken up at length in the last chapter. This is the last subtlety which must await the full laying out of relations in this fashion before its more dynamic sense can be readily seen.

to alpha mind. It simply stakes out the now pattern which gives sensory awareness to mind. The case is the same in Scholastic philosophy in which "Sensuous perception is a hyperphysical operation" that depends directly and intrinsically upon the material organ[3].

This structure of ideas may be further illustrated by showing the relations between will and its end result, the pattern of bodily response. The will determines its purpose and, running down the line of differentiation, there corresponds to it an end. At the alpha level there would correspond both the alpha differentiation of a visualized pattern of action and the alpha brain patterns associated with these actions. In the physical world the motor patterns appear in the brain and the body undertakes its action. In this way the will is translated into a physical act. The gamma choice may not be the kind to end in an act, but whether act or internal image is the end result, both will have a corresponding pattern of neural stimulation in the brain. The relations from the gamma

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3 (D.) Mercier, et al, A Manual of Modern Scholastic Philosophy, Trans. T.L. Parker and S.A. Parker, St. Louis, Herder, 1950, Vol. 1, p. 207.

to the alpha level are the same as before. The associated brain patterns have been found in the alpha level thereby permitting a translation of will into physical action.

If the reader has closely followed the reasoning up to this point, he may have some doubt regarding the validity of adding the brain pattern to the alpha series. Actually it is the end point of a long line of reasoning, a capstone demanded by this particular application of dimension theory to mind, and one when fitted in place, completing a structure fitting in detail with the data of experience.

First, will the structure of the alpha level permit the adding of this brain pattern to it? The answer is yes, but it may not be apparent if the implications of the early development of the alpha level are not remembered. The key idea is that the fifth dimension of space is not causally made of the series of four space entities. It simply has a structure which is related to four space as an ordered series of changes with different time dates is to a change in the physical world. Strictly speaking four space does not make the five space, nor five space the four. They are related (through correspondence of contents) but separate kinds of (levels of) reality. Five space contains all physical objects transformed by having two time parameters. Any physical object regardless of time date

has a corresponding content in five space. Hence to conceive of the physical brain pattern as being there is quite valid. In fact it is necessary, for no physical object can be arbitrarily excluded from having a corresponding content in five space.

If it is valid to point to the presence of the brain pattern as associated with its object or sign in five space, what are the implications of such an arrangement? The sensory-neural pattern then does not create the image in five space corresponding to it. It only functions to differentiate the image out of the undifferentiated series. The total object is contained in five space, but only those aspects of it associated with the brain pattern are differentiated or made conscious by that pattern. In this very real sense the brain is the lower end of the line of differentiation. It is the limited, physical aspect of alpha differentiation or sense consciousness.

This picture of the body-mind interaction does not conflict with the general findings of neurophysiology. In this theory the brain is 1) a basis for differentiated awareness, 2) closely related to alpha processes but not to the beta and gamma, and 3) is the reception center for afferent sensory stimulation and efferent motor responses. The literature is too vast to summarize, but the general agreement between this theory and neurophysiology may be

outlined.

Because the association between brain patterns and experiences is gradually built up and elaborated, a learned relation between a sense object and a brain pattern will develop in early life or at any time new brain areas take over the function of old ones.

The linking of specific patterns of alpha experience to specific brain patterns would lead one to expect localization of alpha processes in the brain. For instance, the occipital area is most immediately linked to the visual pathways so reception of visual stimuli may be localized there. Similarly those areas most immediately linked to the innervation of the motor neurones will be the local region for motor responsiveness. Ablation of the visual area will prohibit differentiation of visual images from the undifferentiated alpha series and the person will lose consciousness of sight. Correspondingly injury to other areas will affect the alpha sensory consciousness or responsiveness linked to that area. If neighboring nerves can indirectly receive stimuli then, through learning, the related function may be restored. If the brain, say in the occipital region, is stimulated one would have some kind of sensation of sight corresponding to whatever pattern was excited in that region of the brain.

This theory does make one particular demand on the neurophysiology of the brain. There should be localization of only the alpha functions in the brain. Beta and gamma functions in themselves should have no localization whatever in the brain. Only the alpha level is particularized enough to have immediate relations with the brain. Beta abstract ideas and dynamic tendencies in themselves have no accidental particularization. Neither has free will or self reflection. The alpha signs of these higher levels may be localized in the brain (as is especially true of language functions), but the processes in themselves of the beta and gamma levels should be impossible to find in the brain. Five space alpha mind has immediate ties to the four space brain, but six and seven space beta and gamma mind are related to the brain only through the alpha level.

It is difficult to find in the experimental findings of neurology a definitive statement on this score. Certainly all the agreed upon localizations in the brain are those of alpha processes[4]. But materialistic

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[4] S. Cobb, Foundations of Neuropsychiatry, Baltimore, Williams and Wilkins, 1948, p. 76-87, especially p. 81 and 82.

neurologists still hold out hope of finding selfhood, will, and abstract ideas in themselves in the brain; hopes now centering particularly on the frontal lobes. The finding of loss of intellect or of initiative in prefrontal lobotomy does not settle the matter for the higher faculties in themselves have to be distinguished from their alpha signs[5].

To prove the error of this theory neurologists would have to show abstract ideas, as abstractly apprehended, are in themselves affected by injuring the brain. Suppose, as is not unlikely, the frontal lobes mediate the more complex and subtle symbolic alpha functions. Destruction of these lobes, while not necessarily affecting will or abstract ideas, would then make alpha differentiation of the signs of the higher functions impossible. The individual would not only lose the means of symbolically conveying to others the state of his higher faculties, but he would also lose sensory awareness himself as to their state.

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5 Ibid., p. 82.

While his higher functions were unaffected he would not know for himself (in sensory consciousness) or less yet be able to convey to others in symbols the state of his higher functions. Not only does the theory demand that the processes at these levels cannot in themselves be localized, but they themselves are of such a nature as to make it appear impossible for neurologists to prove this conclusion of the theory to be wrong.

What happens when the brain is increasingly damaged and finally destroyed? Theoretically (and actually) the individual should progressively lose both sensory consciousness relating to the areas destroyed and the means of communicating to others (which communication is always through the physical brain) the inner state of his mind. With the brain gone the individual ceases to give any signs of mental activity to the physical world. This is precisely what is expected in a theory which assigns mental activity to a realm related to but essentially different from the physical. Absence of signs of mental activity with the brain destroyed is no basis whatever for assuming that the mind is destroyed. It simply cannot give signs of itself to the physical world.

There is one last finding in medicine that is in general support of this theory. Psychosomatic medicine is increasingly making it apparent that mind and body are not

just interdependent and interacting, but form some kind of functional unity. This unity expresses itself in this theory in correspondence between levels. An individual cannot have a dynamic conflict at the beta level without it having some correspondents at the alpha and even at the physical level (through brain innervations). The person becomes a reality showing itself in different ways on different levels.

3. Boundaries of the Individual

Having exposed the functioning of mind according to dimension theory both within the higher levels of space, and as tied to the physical, the main outline of the functioning of mind in hyperspace is complete. An important question remains to be answered for there are as yet no boundaries whatever between individual minds, or between a mind and existence in general in these levels of space. In the usual theories of mind, the mind of one individual is somehow bound to one brain and contains only the contents and elaborations of the sensory experience of that brain. In this theory these higher levels of space are higher levels of reality in which all individual minds participate. The question as to the boundaries of individuals will bring us home to some of the profound implications of this theory which does not simply explain mind. These implications

will be opened here and expanded further in the next chapter.

What would be the boundaries of the individual in a dimension theory of mind? There are two general answers to this depending upon what one conceives to be the individual. If mind as undifferentiated or unconscious is conceived of as being a real part of the individual, there are no boundaries whatever. If mind as differentiated and known to itself is conceived of as the real limits of the individual, there are real limiting boundaries in a dimension theory. We return again to the question as to what man can consider real. Ordinarily he conceives his own bounds as being pretty much just what he is, or can readily become consciously aware of. If the limits are so set, he is quite bounded. Our whole thinking is inclined toward conceiving of the mentally real only as that which is or can be differentiated--and often only differentiation at the sense level is referred to. First, consider the implications of this theory if the bounds of the individual are considered to be all that is undifferentiated in mind. This would mean that the individual is willing to accept as part of his own mind any part of these spaces. The undifferentiated includes even what is conscious at a moment since it will be undifferentiated in another moment. He would be accepting all the contents of these levels,

even those that cannot readily or will not become differentiated for him.

By discarding the criteria of what is conscious or potentially conscious as the limit of his mental self he would be including the total contents of these levels. To see that it is only necessary to recall the structure of these levels. They are higher planes of reality which have contents corresponding to all those below them. They are not built or formed by different individual perceptions and cogitations. Quite the reverse, individual perceptions and cogitations are differentiations within the contents of these levels. Taking as the bounds of the individual the limits of the undifferentiated, the individual's limits include all of the contents of any level. Therefore all individual minds have the same limits and undifferentiated contents.

This apparently paradoxical situation is precisely the basis for extra-sensory perception. The broad implication of ESP is that it is a phenomena in which the perceived (consciously known) object need not be present to the senses either in space or in time. The object may be distant in space and old or 'unborn' in time and yet be known in its determinations. It is this one phenomena which led to the original development of this theory. These higher levels contain the object that is both distant in time and

in place from any present point in space-time. Since this distant object is in these levels it is available or potentially knowable (differentiated) in an unrestrictive definition of the limits of an individual mind. This is perhaps the only theory of mind which gives a real basis to ESP, a phenomena that has as yet no adequate explanation.

Furthermore certain empirically discovered aspects of ESP are explained in this theory. Since the 'distant object' is present in the alpha level, it is present in mind defined as including all the undifferentiated. The process of coming to know the object, besides being that of differentiation, will be effected by the same influences as a recalling of any memory. Memory recall is the end result of the will, acting through the personality dynamics of the individual (beta mind), ending in a differentiation at the alpha level. The recall of memory is then effected by the dynamic structure of the individual. The negative effect of this structure is repression. Hence one would expect that ESP itself will be effected by the personality structure of the individual. There are a growing number of studies showing just this of which only that of

Eilbert and Schmeidler need be cited[6]. They found that ESP high scorers tended to be task oriented rather than ego involved, and to be more impunitive or intropunitive than extrapunitive. Ego involvement is a beta level phenomena (See Table I.-) and intropunitive-extrapunitive is the direction of dynamic tendencies.

Those who worked in ESP had no particular reason to expect it would function just like the operation of memory so that years later when the ESP curves were examined by Pratt and found to closely resemble memory curves there was some general surprise[7]. This again is in accordance with this theory since here it is a problem of differentiation at the alpha level and has to operate like the differentiation of memories under the influence of the higher levels. Because ESP is the process of differentiating the alpha level, just as in memory recall, it should and does bear the characteristics of memory recall. ESP turns out to be a process more like voluntary recall rather than any special kind of sense perception.

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6 L. Eilbert and G. Schmeidler, "A Study of Certain Psychological Factors in Relation to ESP Performance", Journal of Parapsychology, Vol. 14, 1950, p. 53-74.

7 J.G. Pratt, "The Meaning of Performance Curves In ESP and PK Test Data", Journal of Parapsychology, Vol. 13, 1949, p. 9-23.

The idea that ESP is a special form of sense perception is based on the common notion that the mind translates the object from 'out there' into its own chambers. That ESP is more like memory contradicts any 'special form of sense perception' as an explanation of ESP while it supports the explanation given in this theory. The proof that ESP exists, can transcend space and time, is under the influence of personality dynamics, and operates like memory, is about all that is possible in this area to substantiate this theory's explanation of ESP, and indirectly of mind itself of which ESP is a part.

Conceiving the individual mind as including the undifferentiated, there are no bounds between individuals and the 'recall' of distant events and the contents of other minds is potentially possible. But the more common view of the limits of mind see it as including only what is, was, or will be differentiated. For a content to be differentiated and stand forth sharp and clear in consciousness is taken as the sign of its reality. In such a view of the individual there are in effect boundaries between individual minds in this theory. Individual limits in this sense answers the question as to why ESP is not a more common phenomena if it involves 'simple memory-like recall'.

The bodies of different individuals are distinctly separated. Corresponding to these bodies and brains there are aggregates of contents in five, six and seven space. Both as the alpha, beta and gamma experiences appear to be built up out of the experience of a single material organism (learning), and as they are reflected in an individual and distinct organism (creativity), this aggregate of experience is different from the experience of other individuals.

Moreover the reason why this aggregate of experience tends to remain separate reverts again to the question as to what causes differentiation or conscious awareness. Briefly, since these experiences are associated with one's abstract body image at the beta level (See Table I.-), part of which associations are discrete brain configurations at the alpha level, these experiences are more readily differentiated in consciousness than those not so associated. Differentiation at its lower end requires that a pattern of nerve excitations appear in the brain, and those experiences which are associated with such a pattern more readily appear in consciousness than those not so associated. Even though the data is available in the unconscious, it only becomes known to the individual when it is differentiated; differentiation generally depends upon association of the content with a brain pattern at the alpha level or with the

body image at the beta level. This accounts for the infrequency of ESP since the 'sensed object' in that phenomena is not associated with a particular brain pattern. It also accounts for the primal repression of psychoanalysis, the so-called repression of contents that have never been in consciousness and are therefore not associated with the body image or a brain configuration[8].

To bring the 'distant object' into association with the body image, or with a specific neural pattern requires an act of will to which corresponds the 'distant object' as part of the body image. The process has to act through the beta tendencies and hence is limited and distorted by them. Even then it cannot be differentiated unless there corresponds to the configuration of the object some alpha configuration of the brain.

Using consciousness as the criteria of mental reality there are definite boundaries to the individual in dimension theory. The usual concept of mind is of this kind and does not include all the undifferentiated; so in

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8 W. Healy, A. Bronner, and A. Bowers, The Structure and Meaning of Psychoanalysis, N.Y., Knopf, 1931, p. 218-227.

terms of the usual concepts of individuality there are definite boundaries between individuals in hyperspace. On the whole the individual is bound within the limits of his experience and its corresponding elaborations at higher levels. But potentially it is possible to escape these limits as is sometimes done in ESP. The potentiality for this escape is evidence for unbounded individuality.

Summary:

The groundwork in the previous chapter has been elaborated upon in this one to present a more complete picture of the functioning of mind. Three fundamental matters were taken up in turn; the determination of the contents of any level, the problem of levels of functioning, and the determination of the line of awareness. The determination of the line of awareness is the basic problem to intralevel functioning. The determination of the contents of any level is the basic problem of interlevel functioning. The question of level of functioning fits between these and contains aspects of both. The lower end of the line of awareness is the brain pattern itself; so the exposition led into dimension theory's explanation of the mind-body relation. These circumscribe all the basic keys to a functional picture of mind. Lastly, because the bounds of the individual is an important problem in a theory with this

structure, this matter was taken up. It was found that the individual may be conceived as bounded or unbounded depending upon one's conception regarding what may be taken as the real contents of an individual's mind. A natural explanation for ESP was found in dimension theory's explanation of the individual's limits. This last section rouses some of the basic implications of this theory which are the subject of the next chapter.

CHAPTER VII

IMPLICATIONS AND CONCLUSIONS

> Now in determining whether we can have a special science of immaterial beings, the questions which are all-important are, are we in a position to give a definition of what immaterial being is? And have we any special principles that apply to this kind of being and to it alone, whereby to construct a science.
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> Cardinal Mercier, A Manual of Modern Scholastic Philosophy, Vol. 1, p. 419.

For what purpose is a theory? Is it to present in a network of subtle relations and neat explanations the reduction of a complex phenomena? This is its means to an end, but not the end itself. A theory is the structure reputed to lie within the phenomena, a structure whose purpose it is to enable man to understand and develop his knowledge of the phenomena. Moreover since the thing 'explained' in this instance is a large part of reality, it is an attempt to understand and place ourselves in the scheme of things. So far the bare analytical structure of this theory and its immediate relations to mind have been set forth. But there are meanings, values, and broad implications in it which are the outer extensions of the theory. Without some glimpse of these the exposition would always be only half completed.

The heart of the theory is extremely simple. It is the mathematical definition of space. Even the first

half of Russell's definition is more complicated than it need be to express the simple heart of this structure. The form of this work, relating a mathematical structure to a segment of reality, is one becoming more common in science as science advances beyond classification. Einstein's Relativity Theory is a notable example of a work in this pattern.

That this particular part of mathematics should appear successful in explaining both the physical universe (four space formulas are at the heart of modern physics) and mind too, has a distinct implication in itself. In Chapter II 'other categories of existence' beyond the spatial was mentioned as a possibility. If the category of space is that basic to both the physical and the mental, there may not be any other categories. If this theory is true, all of existence may have a dimensional structure. Before the reader gives a hasty assent or dissent as regards this possibility he should consider what is a dimensional structure. The author for one is uncertain as to whether it is purely mathematical. As shown in the introduction it is non-quantitative in the Scholastic-Aristotelian sense. It could look mathematical and yet be of a form adequate to contain relations in the third degree of abstraction. In any event a too hasty identification of this structure with mathematics alone is to be guarded

against. Its possible adequacy to describe both the physical and the mental may imply that it, in some way and from some aspect, is the structure of all of existence.

Were this true reality might be 'something' manifesting in different levels or genera of reality, in each level according to its limiting nature. Only an infinitely high level would be without limits. Man has conceived and perhaps intuited an order in nature for a long time. He suspected order but did not generally know its form. Could dimensionality be its form? If this is the key to the order, man would have made a tremendous advance in working out the nature of reality. If this is the key, things really are ordered in a strict, logical way. Moreover reality would be too vast for man (acting as a scientist) to do more than work out its lowest levels and dimly apprehend the structure of the rest. A general implication of this work is that mind is part of the fundamental properties of the universe and is borne out of the fundamental and natural structure of existence, which is that of levels of dimensionality.

This simple heart, a series, each term of which is a series, and so on, when applied to reality yields in the first four simple dimensions the whole of the physical universe. Three more simple dimensions may yield the mind of man. But these seven dimensions are only the beginnings

of the dimensional series. It is quite conceivable that the universe is infinite in dimensionality. Seven is a small number compared to the infinite. Yet in seven is almost all man knows of.

Could the seven dimensions be the limit of real space? $N_o$thing compels us to think so. In fact the implication of this structure would make it appear invalid to so limit the dimensional extent of the universe. For given a series of seven space entities, an eight dimensional space would appear to necessarily exist from the definition of space. Successively this would appear to be true on up to a space of infinite dimensionality. This can be seen another way. It has been stressed several times that a higher space is not causally made out of the lower, it simply bears a fixed relation to it. This is true through all space. That anything at all is real in any level of space implies the real existence of all the rest of the levels of space. Phenomena appearing in the bottom seven dimensions would appear to be the lower order correspondents of an infinite space, and the lower order evidence of its existence. Certainly any existing content at the infinite level, since it completely transcends space, time, and all other limitations we can conceive of, would have as a distant correspondent the world just as we have it now in the bottom seven dimensions. This is Principle M2. applied

to the case of infinite dimensionality. While all this may not prove the existence of infinite dimensionality, there is nothing here making it impossible; and the implication at least is that it is quite possible. What would it be like? One can get some appreciation of it by reconsidering how much is possible in seven levels. No doubt it could never be understood in its own nature for this would require having direct experiance in that level. Since each level transcends the limitations of the lower levels it may only be approached negatively by conceiving of a level in which all limitations of any conceivable kind are removed.

Our understanding of the seventh level is clumsy and incomplete enough without attempting more, but at least this dimensional structure may be the key to higher levels of existence. The reader may be interested in an impressionistic approach to the eighth level. In its structure it would appear to be an entity which is made of a series of acts of self reflection on will and ideas. My individual impression, for which no evidence can be shown, is that at level eight one finds pure creativity which gives to any particular content the quality of relatedness to everything else. In it events attain a unity of meaning. It may possibly be found in certain experiences that have been termed mystical.

It is quite within the realm of possibility that higher spaces may be explored by symbolic logic and a description given of the relations possible in those spaces. This could be done without attempting to present a 'direct experiential' picture of those spaces as was necessary in this theory. That is, higher spaces may be explored abstractly but not very well 'experientially'.

Looking back over these bottom seven dimensions one gets the impression that in the middle of them (four space) there is hard, solid reality while all that comes before or after is evanescent in comparison. There are immaterial lines, surfaces, extensions, then suddenly solid reality, and then again images, tendencies and self reflection. This odd solid lump (the physical world) in the midst of the series is only solid to naive experience. This is

what a physicist has to say of it:

> The external world of physics has become a world of shadows. In removing our illusions we have removed the substance, for indeed we have seen that substance is one of the greatest of our illusions.
>
> In the world of physics we watch a shadow graph performance of the drama of physical life. The shadow of my elbow rests on the shadow table as the shadow ink flows over the shadow paper. It is all symbolic, and as a symbol the physicist leaves it. Then comes the alchemist mind who transmutes the symbols. The sparsely spread nuclei of electric force becomes a tangible solid; this restless agitation becomes the warmth of summer...The frank realization that physical science is concerned with a world of shadows is one of the most significant of recent advances[1].

In addition the transition from three to four to five space is not as great as it might at first seem. In three space one has the shape, in four space the shape moving, and in five space the shape moving and staying in its moving positions. As the introductory quote to Chapter II indicates, the object in the world (four space) and the perception of the object (five space) are so nearly alike as to lead one to confuse the two. The solid lump in the series is not so solid and the transition from three to four and five space is not so great.

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1 A. Eddington, The Nature of the Physical World, London, Macmillan, 1928, p. xiv.

Though not so different from the material world, alpha, beta and gamma levels of mind are different enough to render them immortal. These three levels are non-material (i.e. non-four dimensional) and in themselves alpha, and correspondingly the higher levels transcend the time limitation on the physical world. The physical body and anything else material is bound to the edge of now and can never recover its past. It must change with time. The addition of the second time parameter in five space puts it just beyond this limitation of the physical world. In this theory the mind of man would appear to be immortal. But without the brain (the lower end of the line of differentiation) there must be some difficulty in making differentiation at the alpha level.

The quote at the beginning of this chapter sets up the requirements for a special science of the immaterial. If this theory is true those requirements may be satisfied. We may have a strict definition of the immaterial, and special principles that apply to the immaterial alone.

L. von Bertalanffy advocates the development of a General System Theory which is a new scientific discipline dealing with the logico-mathematical principles of systems in general. These general principles would be applicable to the various sciences, relating them as on different

levels or strata of reality. He says,

> Reality, in the modern conception, appears as a tremendous hierarchical order of organized entities, leading, in a superposition of many levels, from physical and chemical to biological and sociological systems. Unity of Science it (sic is?) granted, not by a utopian reduction of all sciences to physics and chemistry, but by the structural uniformities of the different levels of reality[2].

A dimension theory may be the natural mathematical-logical system which orders and relates scientific knowledge by dealing with the inherent structure of the levels of reality. It would bring to psychology the possibility of exact laws and give to psychology its own realm; one essentially different from the physical but bearing an exact relation to the physical sciences. There would even be a proper place in such a system for a 'science' of theology. If this is the structure of reality, it is possible to place all of man's knowledge, scientific, philosophical, and religious in their proper places in this structure without distorting or reducing the knowledge in any of these areas.

It would seem that dimension theory has the important property of being able to deal with genera or levels of

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2 L. von Bertalanffy, "An Outline of General System Theory", British Journal For the Philosophy of Science, Vol. 1, 1950, p. 164.

reality. It can describe essentially different kinds of realities while bringing them into an exact relationship with one another. Most theoretical structures are locked within one level of reality, most often the physical, and all things are treated as reduced to that level. Mind becomes the firing of neurones. Religion becomes the wishful fantasy of this mass of firing neurones. Exact relations between the material and immaterial were heretofore absent in scientific theories, but may now be a real possibility in a dimensional structure.

Not only can the material and immaterial be related, but so can the actual and the potential. Let the actual be defined as determined being, and the potential as determinable being. This line of awareness, to which so many explanations had to be related, is the line of actuality in this theory. What has not been or is not in this line is potential, determinable. In terms of the actual and the potential we may again voyage through spaces and gain a more dynamic view of their relationships. In Table II.- the kind of existence possible in various spaces was listed. The first three dimensions of space were described as a universe of a line, a plane and extension, without material existence. A universe of a line is timeless. What is potential to its static actuality is the two dimensional plane containing the line, in which the line may be thought of as obtaining

room for translation. What is potential to the static plane universe is the actual three dimensional solid containing the plane, in which the plane is translated. What is potential to a solid is the actual four dimensional space-time in which the solid may be translated. What is potential to this here and now space-time world is actual in five space in which space-time is translated. That is why events which have not yet happened in space-time can only have five dimensional existence. What is potential to alpha sense imagery is actual in six space. That is, what will be one's alpha imagery in a moment is an actual part of the beta entity which contains it. What is potential to a now beta tendency is actual in seven space. That is, what one's tendency will be in a moment is contained within (determined by) the higher free will act containing it.

In general, what is potential to this point of actuality on one level is actual in the next higher level. Yet this itself is a potential having its actuality in the higher level, and so on. Generalizing, what is potential to the universe of dimensionality is actual in infinite space. This may have a familiar ring to a theologian. This is a conception of things similar to J.W. Dunne's serial order, for he too was implicitly dealing with a

dimensional structure[3]. Looking up into higher spaces one chases after the actuality of the future in higher and higher levels not finding a solution until the highest level is reached. Precognition of future events is just such an ascending view. The future of the physical world finds its actuality at the alpha level which makes precognition look like a proof of fate.

Yet one can also look down from higher levels in a dimensional series. Instead of successive evidences for the existence of fatalistic determinism one finds indeterminism. For instance, only in a view looking up from a lower space does the alpha series seem to contain past, present, and future in a determined order. Looking down from the beta level, future perceptions are determined by the beta tendencies. More clearly than that, the future beta tendencies are determined by gamma free will which in turn determines the future alpha images. Looking down in the series things seem to be determinable, looking up they are fixed in the higher level. To grasp the full meaning

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3 J.W. Dunne, The Serial Universe, London, Faber and Faber, 1934, p. 1-240.

of a dimensional structure it is necessary to conceive of both views, the ascending and the descending. Either view without the other is a serious limitation on one's conception of the structure and implications of the theory. Both are true. The contents determined by both cannot conflict because of the principle of correspondence. But the ascending view, from any level, will have the quality of what is meant by fate. The descending view will have the quality of free determination.

One might like to know which view is truer. Actually both are ture, but the looking up view is the more limited. The view looking down from the higher levels contains a greater scope of reality and is more valid in that sense.

In the course of the development of ideas in this theory these two views were not entirely separated. Perhaps apologies are in order, but it seems that a lively and complex picture of this dimensional structure is only possible after it has been layed out in a somewhat static fashion by building up from the known spaces and the commonly held ideas into the less known and less understood. Having achieved the unknown country by narrow paths, then the panoramic view becomes possible. To guard the reader against error due to the lack ofa complete, dynamic, interrelated picture combining the ascending and descending views, cryptic injunctions with little explanation have been

entered in three places in the thesis. When the alpha series was first described as the series of past, present, and future events the reader was warned that this is not a proof of fate. One can see now that the apparent 'fate' is removed by simply taking a larger view and looking down from a higher space. When the looking-up Principle M3. (given the lower level series, the higher level entity 'appears' determined) was set forth, the appears was added to guard against reading fate into it. One could conceive, for instance, of the present beta entity as always determined simply by the past alpha memories. Now one can see that this is not entirely justified because the same beta entity more truly is determined from above. Lastly, the future alpha image was said to not yet be associated with a brain pattern. Seeing the future alpha series as containing all one will experience lined up would make a future image appear to be already present in the alpha series with its associated brain pattern. In that case conscious 'recall' of a future event should be a simple and common occurrence. It is not because only from a four space view of things is the above true. From the more comprehensive higher space view the future image and its brain pattern are subject to the determination of higher levels of mind.

The actual to potential, and the related ascending and descending views, give this theory a most subtle and

complex aspect which is not soon mastered by the understanding. There are other aspects of it, such as an explanation for psychokinesis and the larger issue of the place of mind in the determination of the order of nature, which will be passed by so as to not burden the reader.

Besides the more general implications and values of the theory it has special values within the limited domain of psychology. The main one is that it may show the logical and exact structure of mind itself. The exact nature of mind would be known. Out of this a number of values follow. The theory could serve as a theoretical framework which orders and relates the varied and heterogeneous data of psychology. Exact laws of the operation of mind could be developed. Subjective phenomena could be translated into exact formulas. The psychodynamics of mind could be settled once and for all. Lapan's calculus of behavior could be developed[4]. In finally coming to grips with the nature of its subject matter psychology could become a lawful science like physics and yet retain mind

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4 A. Lapan, "Toward A Calculus of Behavior", Journal of General Psychology, Vol. 42, 1950, p. 333-347.

as mind without continually attempting to reduce it to physics.

In relation to dynamics the theory is in a particularly favorable position. The history of dynamics would be too much to trace out here, but it may be outlined. Probably the earliest dynamic formulations were those that explained behavior as the result of supernatural influences. The next stage was that of classifying the aspects of behavior to produce a static picture. Dynamics were an implied but not an actual functional part of the picture. Many philosophical classifications of mental phenomena are examples of this stage. Next science came along and tended to study probabilistically limited, static aspects of mind. Freud personified interacting regions and forces in mind and created a real, though not necessarily an accurate, dynamic picture of mind. Present dynamic psychology is a mixture of these two last trends.

This theory presents a field-like dynamic picture so complex that quite certainly, in order to facilitate understanding, many of the dynamic attributes of this picture have been distorted in limited and somewhat static concepts such as tendency, act of self determination, and so on. For instance, ideas and tendencies are so interlinked at the beta level as to require a somewhat artificial separation of them as aspects of a single phenomenon. All

the way through the exposition of the idea has been hampered and somewhat distorted by attempting to translate it into words. Over and over again delicate and subtle time relations have had to be crudely depicted. To grasp the real dynamic relations in and the meanings of the beta and gamma levels the reader has to literally recreate them in his own mind when following the train of thought. In regard to dynamic interaction, the structure of the theory is quite adequate to depict a subtle, field picture of dynamic relations, one so complexly interlocked as to almost inevitably be distorted by words.

These in brief are the main implications and values of the theory. Before the conclusions are taken up they may be summarized. In a work of this character it is especially necessary to point out its implications. A general implication is that mind is part of the structure of existence; and that, since this structure may be adequate to describe the physical and the mental, it may be the structure of all of existence. Were this true the nature of higher spaces becomes an important issue. Intuitively eight dimensional space seems like some mystical experiences in its properties. Infinite dimensional space is an implied possibility. In the bottom seven dimensions the physical seems to stand out as a solid lump; but it only has this character in naive

experience, not in modern physics. Another implication is that mind is immortal. A real science of the immaterial is possible. The structure of the theory may make a unification of knowledge possible since it can deal with genera or levels of reality, and actual to potential relations. The implications in the double aspects of the ascending and descending views of spaces were cited implying a settlement, among other things, of the fate-free will issue. In psychology the theory could serve as the structure of an exact science of mind. It could bring the multiple and far reaching benefits of a general scientific solution of the nature of mind.

1. Conclusions

The theory and its major implications have been described. Now the conclusions can be settled upon. Can the hypothesis be accepted or should it be rejected?

To begin with, what would be the basis of the acceptance or rejection? It cannot be whether or not this theory fits with any preconceived idea as to the nature of mind or the dimensional extent of reality. As a work of science any hypothesis that admits of a test merits a hearing. The basis for acceptance or rejection is the weight of empirical evidence. An hypothesis need not be the usual or the expected. It only has to be testable. It stands or falls on the evidence.

To judge whether or not the hypothesis may be accepted it will be stated again, and then the facts in favor of it and against it will be summarized. The basic hypothesis of this work is that levels of mind exist in, and are part of the kinds of events that are natural to a real (existing) space of five, six, and seven dimensions.

There are various kinds of evidence in favor of the hypothesis. In Chapter II the improbability that mind is contained within the structure of the physical universe was shown. Mind would then appear to be either in higher space or in some other category of existence.

The main grounds for accepting the hypothesis is that the structure of space, as defined by several areas of mathematics, when applied to the world of phenomena appears to describe mind. Further, the principles of relations in the mathematical definition of space seem to describe mind as a functional entity. The quality of consciousness was adequately defined in the dimension theory, as was the meaning of the conscious-unconscious dichotomy, and the determination of the position of the line of awareness. The theory appears adequate to describe the functional acts such as the acquisition of knowledge and the translation of will into internal or external acts. The mind-body relation was described.

Further, the theory seems to account adequately for the experimentally established phenomena of extra-sensory perception which has no other adequate explanation. This phenomena is mental and in general would appear to demand a hyperphysical explanation. Also the theory seems adequate to explain such phenomena as ego operation, psychopathology, therapy, habits, and so forth, even though these aspects of mind were not developed at great length.

There are also several grounds for not accepting the hypothesis. Perhaps the main one is that this work is more of an outline of the structure and functioning of mind. It has not been shown to fit in with every empirically and experimentally established mental phenomena. This would be a tremendous task for the science of psychology has long ago passed the point where one man could even know all the data. Still the theory could be compared for its adequacy with the main findings of psychology.

Second, the theory could well be criticized on the grounds that the theoretical structure itself is not clear and consistent in all respects. Much further elaboration of the relations between these spaces is needed and also, perhaps, a closer tying in of this elaboration to the mathematical formulas themselves.

Third, before the theory may be established in science it must do more than fit with all the data of

psychology and be consistent in itself. These two would lead to its acceptance as only plausible and parsimonious. To be fully accepted predictions from it that are unlikely in other views of mind would have to be experimentally confirmed. It would have to explain phenomena that would have no explanation on any other basis. This latter may already have been done with extra-sensory perception.

It would appear that the grounds for accepting or for rejecting the hypothesis, which is the basis of the whole theory, are not adequate either to completely accept or reject the hypothesis. The theory is plausible in many respects; it explains mind in some respects; it explains some hitherto unexplained phenomena, so immediate rejection of it would seem unwise. But the three criticisms outlined are also sufficient to militate against a full acceptance of the theory as valid at this time. The conclusion that the theory may neither be fully accepted nor fully rejected at this time appears the most warranted.

Outside of the question of evidence and adequacy of explanation mind itself is too gigantic, varied, dynamic and subtle a thing to admit of facile explanation. Even the 'main findings' of psychology are far from clear and in some respects they become less clear with the further piling up of data. At best this work can be only an extended outline of what may lie behind the data.

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This work is representative of the mind-body unity that is being discovered in science.

Alexander, Samuel, Space Time and Deity, London, Macmillan, 1920, 2Vols. xii-437 and xxviii-347 pages.
A space-time theory of the nature of mind is presented here.

Barbado, M., Introduction de la psychologie experimentale, Trans. by P. Mazoyer, Paris, Lethielleux, 1931, 502 pages.
The book was useful for its complete outline of theories of the mind-body relationship.

Bell, E.T., The Development of Mathematics, N.Y., Mc Graw-Hill, 1945, xiii-637 pages.
The work is an historical survey which places dimension theory in a context of historical changes and development.

Burington, R., "On The Nature of Applied Mathematics", American Mathematical Monthly, Vol.56, 1949, p. 221-242.
The work analyzes the nature of applied mathematics, thereby forming a partial guide to those making an application of mathematics.

Cajori, Florian, A History of Mathematics, N.Y., Macmillan, 1926, viii-514 pages.
This historical survey places dimension theory in a context of historical development.

Cobb, Stanley, Foundations Of Neuropsychiatry, Baltimore, Williams and Wilkins, 1948, xi-260 pages.
This is a good summary of the neurophysiology of the brain and also represents the materialistic view of the nature of mind.

Collingwood, R.G., The Idea of Nature, London, Oxford University, 1945, viii-183 pages.
In this are presented the theories of nature from the ancients to the present. It is useful for background and orientation.

Dunne, J.W., The Serial Universe, London, Faber and Faber, 1934, 240 pages.
This speculative work explores many of the qualities of a dimensional structure.

Eddington, Arthur. The Nature of the Physical World, London, Macmillan, 1928, xvii-361 pages.
Eddington's work is of especial value to this theory since ultimately he sees the physical world as dependent on mind and thereby he encourages a conceptual linking of the two.

, Relativity Theory of Protons and Electrons, London, Cambridge University, 1936, vii-336 pages.
He presents the basic structure linking the macro and microscopic in the theory of the universe. It contributed to the knowledge of five spaces.

, Fundamental Theory, London, Cambridge University, 1948, viii-292.
The link between this theory and modern physics is embedded in this work.

Gilbert, C. and J. Schleidler, "A Study of Certain Psychological Factors in Relation To ESP Performance", Journal of Parapsychology, Vol. 14, 1950, pp. 53-74.
This is an example of the many current studies which are finding a relation between personality of the perceiver and his success in ESP.

Einstein, Albert, The Meaning of Relativity, 3rd Ed., Princeton, Princeton University, 1950, 150 pages.
The work interprets Relativity Theory and describes the accepted characteristics of four space.

Einstein, Albert, and L. Infeld, The Evolution of Physics, N.Y., Simon and Schuster, 1938, x-319 pages.
They survey the physics which forms the starting point of the theory.

Hilgard, Ernest, Theories of Learning, N.Y. Appleton-Century-Crofts, 1948, viii-409 pages.
This survey of theories of learning was of especial value in relation to the various kinds of association now identified in psychology.

Humphrey, B., and J.B. Rhine, "A Confirmatory Study of Salience in Precognition Tests", Journal of Parapsychology Vol. 6, 1942, p. 190-219.
This is an example of a study supporting the hypothesis that ESP processes are not affected by the time distance between the perceiver and the perceived.

Hurewicz, W., and Henry Wallman, Dimension Theory, Princeton, Princeton University, 1941, 165 pages.
This is the most recent, complete, and authoritative work in the area of dimension theory.

Kattsoff, Louis O., A Philosophy of Mathematics, Ames Iowa, Iowa State College, 1948, ix-226 pages.
He presents a general survey of the structure of mathematics which is valuable especially for its relation to philosophy and human experience.

Ledermann, Walter, Introduction to the Theory of Finite Groups, Edinburgh, Oliver and Boyd, 1949, viii-152 pages.
The general background and meaning of the E group may be found here.

Lefschetz, S., "The Structure of Mathematics", American Scientist, Vol. 38, 1950, p. 106-111.
This work provides a survey of the areas within mathematics thereby aiding in locating the special domain of dimension theory within the larger region.

Lewin, Kurt, Principles of Topological Psychology, N.Y., Mc Graw-Hill, 1936, xv-231 pages.
Lewin's work is related to this theory in that it has a similar outlook, encounters similar problems, and uses the same area of mathematics.

Lindvorsky, Johannes, Theoretical Psychology, St. Louis, Herder, 1932, xi-145 pages.
This is an attempt to formulate the general laws of psychic contents and processes from the view of empirical experience. It is useful as a first approximation to the nature of those contents and processes.

Lorentz, H.A., The Einstein Theory of Relativity, N.Y., Brentano, 1920, 64 pages.
This is a presentation of Relativity Theory which is useful in relating this theory to the universe of physics.

Mahan, E., and J.B. Rhine, "A Second Zagreb-Durham ESP Experiment", Journal of Parapsychology, Vol. 11, 1947, p. 244-253.
This is one of many experiments supporting the hypothesis that ESP is not affected by distance.

Menger, Karl, Dimensionstheorie, Leipzig, Teubner, 1928, 318 pages.
Menger's is one of the earliest of the authoritative works in what is now recognized as the topology of space.

Miller, J.G., Unconsciousness, N.Y., Wiley, 1942, vi-329 pages.
This detailed examination of the meanings assigned to consciousness and unconsciousness aided the relating of these concepts in this theory to the commonly accepted meanings.

Nys, D., La notion d'espace, Bruxelles, Sand, 1922, 446 pages.
This is a survey of the theories and properties of space whose value is partly limited by the absence of the modern view of four space.

Oppenheimer, Oscar, "I and Time: A Study in Memory", Psychological Review, Vol. 54, 1947, p. 222-228.
This is a related speculative work which points out the time and spaceless characteristics of mind.

Pratt, J.G., et al, Extra-Sensory Perception After 60 Years, N.Y., Holt, 1940, xiv-433 pages.
This is a survey of the findings in ESP up to 1940 enabling one to arrive at a general view of the validity and implications of these studies.

Russell, Bertrand, Principles of Mathematics, London, Norton, 1937, xxxix-534 pages.
The work is a thorough treatment of mathematical logic, contributing important notions on dimensionality.

Sullivan, J.W.N., The Limitations of Science, London, Chatto and Windus, 1933, v-307 pages.
This broad survey of science was of especial value in relation to the limitations of modern physics.

Uspenskii, P.D., Tertium Organum, Trans. by N. Bessaraboff and C. Bragdon, N.Y., Knopf, 1945, xv-306 pages.

It contains one of the few speculative accounts of the properties of higher spaces and was a stimulant in the development of the theory.

von Bertalanffy, Ludwig, "An Outline of General System Theory", British Journal for the Philosophy of Science, Vol. 1, 1950, p. 134-165.

The work has a broad perspective in science and represents a new potential development which may be partly realized in this theory.

Whitehead, Alfred North, Science and the Modern World, N.Y. Macmillan, 1927, xi-296 pages.

Whitehead surveys the history and meanings of science. The work was of value as a conceptual stimulant.

APPENDICE

AN ABSTRACT OF

A Dimension Theory Of
The Nature Of Mind

A root problem in psychology and in science in general is that of the nature of mind. In this work a theory is set forth which may be a solution to that problem. Underlying the work is the hypothesis that mind exists in, and is a part of the kinds of events that are natural to a real space of five, six, and seven dimensions. This hypothesis can be tested by developing the functional properties and contents of these spaces and then comparing them to levels of mind. The conceptual tools were defined and the necessity for the reader's interiorizing new concepts of space was stressed.

As a preliminary to a theoretical and speculative solution to the problem of the nature of mind the various existing theories of mind were set forth. Since the physical world is so well knownmost of the theories of mind become a question of the relation of mind to the physicsl. These theories may be divided into monistic materialism, monistic idealism, dualism, and substantial unity. It is apparent that the nature of mind is an ancient problem for which there is as yet no adequate scientific solution.

A first step in discovering mind in the order of nature is to show it does not exist in four space. It was demonstrated that existing four space and the physical are identical. Further, mind was shown to be unlike the physical in its experienced quality, its time spread, its lack of particularization at the level of abstract ideas, and in the secondary qualities. Lastly the experimental findings in parapsychology were cited to show that a mental phenomenon (ESP) which transcends space and time has apparently been established. All this makes it unlikely that mind exists within four space.

To define the properties of higher spaces it was necessary to learn the basic mathematical definitions of space. These were set forth by geometry, topology, mathematical logic, and group theory. Topology and mathematical logic describe the most authoritative and practically applicable definitions.

When applied to reality these definitions were found to describe the first three spaces of a line, surface and a solid. The four space they describe was shown to have the properties of Relativity's space-time. The fifth dimension they would describe as an entity which is a series of events. This was identified with alpha mind which compriees events with the dates past (memory), present (sense consciousness), and future (precognition). In application

the formulas describe six space so that it appears to comprise a dynamic field of abstract ideas and tendencies which was called beta mind. Seven space is described as a region which appears to contain self reflection on ideas and actions which was identified with gamma mind.

Since these spaces comprise a description of mind as in three isolated regions of space, it was necessary to see if a dimension theory could describe mind as a dynamic entity. Out of the definitions of space five principles were described, two concerned with intralevel relations and three with interlevel relations. One intralevel principle dealing with differentiation and undifferentiation was found to characterize and give new meanings to the quality of awareness and what has been termed conscious and unconscious. One interlevel principle gives a general relatedness to all the levels both of mind and of mind-body. The principle which views this relatedness from higher to lower levels was seen to describe a process which might generally be described as creativity. The principle governing lower to higher level relatedness appears to describe the learning process.

After this development, it was possible to solve the main problems of the functioning of mind; the determinants of the contents of any level, the problem of level of functioning, and the determinants of the position of the

line of awareness. It was found that in this theory functioning is on all levels at once unless one limits mind to the level of the senses. The line of awareness (consciousness in a broad sense) was found to be fixed by both will and the physical world. The lower end of this line of awareness is the brain itself. The theory was found to give an exact description of the mind-body relation which accords with the data of neurophysiology. The bounds of the individual in hyperspace were examined, and it was found he is bounded or unbounded depending upon what is taken as a real possession of his mind. In this this there was found the theory's explanation of ESP.

The applicability of the concept of space to the mental and the physical implies that the levels or genera of all of existence are those of space itself, and that mind is part of the fundamental structure of the universe. Besides a universe of infinite dimensionality, the theory also implies mind is immortal and could constitute a basis of a science of the immaterial. It links the material and the immaterial, the actual and the potential. In psychology the theory could bring the benefits of a general scientific solution of the nature of mind. Although the theory is an adequate explanation of much of mental life, because further extension and testing is necessary, it was concluded the theory may neither be fully accepted nor rejected at this time.