

A CYBERNETIC DEVELOPMENT OF EPISTEMOLOGY AND OBSERVATION,
APPLIED TO OBJECTS IN SPACE AND TIME (AS SEEN IN ARCHITECTURE).

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ABSTRACT

This Thesis proposes a new epistemological ontology which has two peculiar characteristics: Objects in its Universe are formulated as being self-observers (i.e. reflexive); and the nature of observation of Objects by others is shown to contain the logic for computing relationships between Objects in the Universe.

This Universe is non-hierarchical, and permits of mutually contradictory beliefs about its Objects to be simultaneously held by different observers.

The logic by which observers construct hierarchies in the Universe is shown to need only one variable in order to operate, and to operate from the oscillatory nature of the self-observing Objects producing a sense of local time in both observer, and observed Objects; the times of which must temporarily come together for observations to be made.

Using these notions of Objects and observations, a means, based on the potential for observers to construct hierarchies, is found for analysing arguments, and (potentially) for the improvement of computer performance.

A way is described for the representation of observations of Objects to be made, and a conversational idiom is established to account for communication between different observers.

The views put forward in this Thesis are demonstrated by various experiments, stories, and references.

THESIS MOTTO

". . .if you could finish it. . .you could rest. . .sleep. . .not before. . .oh I know. . .the ones I've finished. . .thousands and one. . .all I ever did. . .in my life. . .with my life. . .saying to myself. . .finish this one. . .its the right one. . .then rest . . .sleep. . .no more stories. . .no more words. . .and finished it. . .and not the right one. . ."

Samuel Beckett (*14).

PREFACE

When I set out on these investigations, I did not realise that I had been carrying them out already for ten years, nor did I realise that I would be carrying through such a general and broad-based piece of work. Nothing was further from my mind than the formulation of a philosophical system. Nevertheless, this work has grown itself, and I have, to the best of my ability, notated it.

The recent origins of this work are in the attempt to provide a means (by "dimensioning models") of preventing the drawing of false analogies, and the construction of arguments in which the levels shift, erroneously. From this grew a general theory of model/object relationships, which, introducing the object, insisted on an examination of the qualities of an object that can be modelled. And from these two, the role of the observer, making the model, became critical, as did the way in which he could express his model making. Thus, a small work mushroomed into something rather larger.

Undoubtedly, many of the types of view expressed here relate to my experience in studying and teaching architecture: indeed, the stated aim of the work is to examine certain aspects of space and time in architecture. The concept developed here of a Behaviour (B^0) can be clearly related to difficulties in defining complex architectural objects, such as cities. Conversely, Awareness (A^0) can be tied in to experiences of psychological overload and break-down. And the whole idea of the type of linguistic representation put forward here ties into problems experienced in expressing spatial experiences.

But equally, many of the ideas I can trace back to earlier works. The first clear statement I can find stems back four years, and is a piece of music "Tune into Memories of You"[®],
[®] in the Appendices

in which musicians interpret a common tune by playing simultaneously what each of them considers to be an appropriate accompaniment to that tune. In this case the tune is an Object with an Essence, and the accompaniment is the observer's attributed behaviour. But long before that, I can find stories which refer to this sort of Universe; not that, at that time, I saw it at all clearly - this is all post-rationalisation.

I account for this because I believe that the Universe I propose in this Thesis is to many rather strange, at first sight, and so I wish it to be known that it has basically grown itself (with me being essentially unaware of what was happening), over a long time-span. And, while I worked on it, I was still unaware of where the Thesis was going: new areas to look into, new questions, new ideas, kept on presenting themselves, and then making answers. Indeed, at an earlier stage, I had proposed putting in the text that was thus produced, (the real Experiment of this Thesis), as the main body of work, since it shows not only the conclusions, but also the cybernetic work method (including some necessary revisions of parts for which, when I was writing them, I could find no appropriate terms) by which the Thesis came into being.

However, in the end, a more conventional consideration for the reader over-rode this idea (although the text may be examined by anyone who wishes), and the only survivor from that text to appear here is the collection of stories which try to describe the qualities of this Universe in a more immediate form than the more philosophical text which is the main theoretical part of this work.

Having thus apologised and accounted for this thesis, and before moving on to acknowledge the substantial and much appreciated help I have received in its growth, I should like only to reflect that, in writing this, I feel that as with the pupil in Reps' (*88) book, I have been learning to clap one hand.

ACKNOWLEDGEMENTS

Because of the length of time during which it seems to me that this work has been developing, I find it impossible to acknowledge the help and inspiration I have received, with few exceptions, other than generally.

I should like to thank all those from whom I have learnt. That I cannot enumerate you does not reduce my gratitude, which is shown continuously to me by the way your sparks have made this work.

I would like to thank the people who have helped me prepare this work itself:

My wife, Tuulikki Leskinen, who has generously suffered and put up with a great amount during its composition and given me continuous encouragement and sympathy.

Betty Foxworthy and Hilary Lowday who have typed the text in various forms - an appalling task.

The Science Research Council who funded my three years research at Brunel University, where this work assembled itself.

My Supervisor, Professor Gordon Pask, who has been for many years a valued critic and has taught me to formulate and insist.

My fellow student Dionyssius Kallikourdis who has unravelled many mysterious and valuable texts for me.

My friend Richard Bunt, with whom I have talked about this work, more and more valuably, for many years.

My colleague Annetta Pedretti, who has helped me discover and develop parts of what I was trying to say, has noticed the holes, and has shown some uses.

Samuel Beckett, whose novels and plays I have re-read during the writing of this piece; and who seems to me either to have formed, or to reflect several of my thoughts.

Finally, perhaps I can express the hope that this work may help make some sense of the world, to those who try to make sense of it, and that this will be particularly so for Severi, my son.

If sparks I have collected from you have gone wrong, the misfire has been in my head, not yours.

Ranulph Glanville

15th September, 1973 to

14th February, 1975

London, Helsinki, Lemlax, Spetisbury

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REFERENCE MARKS AND NUMBERING SYSTEMS USED IN THE TEXT
(EXCLUDING TECHNICAL TERMS IN THE GLOSSARY)

Bibliographic references in this text are denoted by an asterisk* followed by a number, in brackets one step above the line (i.e. (*144)). The references will be found in the Bibliography listed in numerical order, with the number preceded by an asterisk. They have been so arranged that they are in author, then title, alphabetical order. A certain number of late additions, however, appear in the later numbers, out of this order. The alphabetical ordering is the reason for the bibliographic reference numbers in the text not being in numerical sequence.

Footnotes in the text are denoted by a raised at[@] or plus⁺ sign, and appear at the foot of the page on which they appear.

Statements in the Main Text are preceded by reference numbers(similar in form to those used by Wittgenstein). These have two purposes - they give a unique reference to each statement, and they highlight the form of the argument.

If a reference number in the Main Text is preceded by a single apostrophe ', there is a corresponding number in the Explanatory Text, expounding on that statement. This may be found by looking under the same number in the Explanatory Text (in which all reference numbers are preceded by a double apostrophe ", which denotes that the statement belongs in the Explanatory, not the Main Text).

It is intended that both the Main Text and Explanatory Text can be read alone, or together (though in the case of the Explanatory Text, terms are assumed and are not described). The Main Text contains no bibliographic, or other, references (but the Explanatory Text does).

TERMINOLOGY

Like Humberto Maturana^(*65), I have defined neither my terminology nor my formulations, at the outset. Instead, I have given labels and used them in a number of contexts. You, as a reading observer, can deduce from these Label-Objects the Objects' behaviour, and thus you will generate meanings for them.[@]

In this, I am being consistent with the general theory here propounded - a theory of Essence and observer. To define a Label-Object would be for me to tell you a behaviour I know, and not to tell you what is.

No behaviour can make up the Essence of the Label-Object, which is for itself only.

Some readers of various drafts have objected to some of these terms I have used. For instance, the terms "know" and "observe" are disliked, since they are applied to all Objects (inanimate as well as animate). I can only ask that readers so upset, should bear with the terms used: they are the best I could find, and seem to me, in spite of objections, to be appropriate. If the reader can find better terms, please change them - and let me know the improved ones.

[@] There is, however, a Glossary which may be consulted if meanings do not become clear.

INTRODUCTION

INTRODUCTION

This Thesis relates to two separate and distinct fields. It consists of an application of a Systems Approach to problems in both of these fields, each of which can be interpreted as being within the cybernetic domain.

These two fields may be described (in the common sensical context) as "Architecture" and "Language". The relationship between the two of them arises from the need to find a means by which the perception of some architectural topic (e.g. the locational structure of a city) can be represented. This involves the establishment of a system of Object relationships and qualities that can permit of the expression, simultaneously, by two different observers, of entirely different and contradictory descriptions of the topic, without the topic being considered to be absurd as a result of this incongruence. It also involves the description of a means by which each observation can be expressed in terms of a common Language, in such a way that these different observations may be communicated and modified, while allowing the essential difference between both them, and the observers' views of the languages they are using. Thus, the examination of the two fields, "Architecture" and "Language", also involves the formulation of an epistemological theory of ontology, based on observations of common Objects being essentially different; and the justification of such a formulation on an experiential (and hence epistemological) basis. The normal approach to both "Architecture" and "Language" does not permit such incongruence, and therefore, a new approach has had to be introduced, one of the characteristics of which is that it is non-hierarchical, and in this manner, permissive of containing its own description. It is not subject to the findings of Gödel^(*46) (that systems may not be assumed to be simultaneously complete and consistent), largely because it

relegates the concepts consistent and complete to the personal hierarchy building of each observer (for which a method of mapping is proposed), allowing that inconsistencies are part of the complete system.

In its non-hierarchical structure, the system may be seen as being a theory of an anarchic Universe, in which ordering is the personal domain of each observer, but in which each observer can communicate his own perceptions of his own hierarchies to others, thus allowing the arrangement of social and consensus orderings. In this respect, it echos the dominant architectural philosophy of the 1960's, that of the highly serviced environment allowing personal mobility, of plug-in and do-it-yourself, and of flexibility that was forcefully put forward in the original issues of the Archigram group's magazine^(*6), given theoretical substance by Banham ("The Architecture of the Well-Tempered Environment"^(*11)), and actually practiced most effectively by Cedric Price. The architectural climate has since shifted away from such playful expressions of the idea, into a realm of political activity based on a more realistic and socially conscious attempt to solve problems, but the idea still survives and has coloured all architectural thinking, as in for instance Pawley's "Garbage Housing"^(*83).

Both "Architecture" and "Language" have been subjected, as fields, to examinations using the Systems Approach, before this attempt. But the limitations that such attempts as have been made put on themselves have meant that they have not been of much use in this context.

In the case of "Architecture", the initial application of a Systems Approach was long delayed. As Gordon Pask^(*80) has pointed out on innumerable occasions in lectures and conversations, there is some considerable similarity between "Architecture" and cybernetics. However, it was not until Alexander published his epoch making article "A City is not a Tree"^(*2) that the

strictly non-interactive form of architectural descriptions became clear, and people, lead initially by Alexander himself, began to examine (primarily) the City as a system, ("Notes on the Synthesis of Form"(*4) and "From a Set of Forces to a Form"(*3); and then the research of for instance, the Cambridge Land Use Centre, McLoughlin's "Urban and Regional Planning"(*68), Chadwick's "A Systems View of Planning"(*25), and my own "Tapiola is a Paper Tiger . . . Expose yourselves . . . It's Legal"(*43), culminating in Broadbent's erudite summarising in "Design in Architecture"(*20).

Paralleling this, there was a development of interest in the possibility of using the computer in architecture, an interest that was brought to real prominence in the conference held in York on the subject in 1972(*113), at which various architectural computers from all over the world gathered. Much of the work discussed there was banal, showing a remarkable lack of understanding of the nature of the problem descriptions being utilised (e.g. non-consideration of Bremmerman's Constant - see Ashby(*7)), or assuming the perfect outcome to a problem by means of the union of sets of properties (how do you, to use Pask's(*79) term, "sanitise" these sets, to exclude any incongruences?), but some was of considerable interest. In particular, the development by Negroponte(*75)(*76)(*77) at M.I.T. of a machine that could interpret drawings, was a significant step for both "Architecture" and A.I. work (summarised in "Hunch"(*74) and "The Architecture Machine"(*73), amongst others). Nevertheless, this work was closely tied into the semi-lattice approach of Alexander(*2), and was furthermore concerned with the establishment of unique conversations, rather than for the formulation of a means of allowing simultaneously existing contradictory descriptions, as was also Abel's(*1) work using the computer as an interface in a Kelly Grid extension technique allowing the regulation of discussions between architects and clients, a piece of work epitomising

the other apparently fruitful approach to the computer and "Architecture" union.

Thus, the application of the Systems Approach to the field of "Architecture" was not relevant to the approach of this work: and indeed, such attempts as have been made to allow people to express their views, have been done with the specific purpose of reducing the discrepancies between such descriptions, rather than encouraging them. The whole development of the concept "Neighbourhood" is an extension of the administrative convenience of "Zoning", in which people's understanding of local space is tied together to provide a limited physical area in which a group of people will co-incide as much as possible (i.e. a ghetto). And the more recent attempts by Urban Geographers (e.g. Gould and White's "Mental Maps"(*45)) to provide means for measuring locational preferences in people have concentrated quite explicitly on providing descriptions of group views of area desirabilities, ignoring the characteristics of the personal preferences of each subject. In other words, the views of people are aggregated by a coarse grained geographical distinction, according to the location of each subject, and are then represented as a map of percentage preference for other areas.

In the area of "Language", the Systems Approach has a much longer history. Indeed, one of the earliest examples of a Systems Approach must be that of de Saussure in his "Course on General Linguistics"(*93) (see later).

The field of "Language" I have divided into five areas, according to the approaches they show to "Language": Syntactic, Semantic; Semiotic; Logical and Psychological; and Artificial Theories of Language. I shall summarise the approaches taken in each of these five areas rather briefly: they are well accounted for elsewhere.

In the case of syntax, the general linguistic developments this century were rather un-systemmic until Chomsky's

"Syntactic Structures"(*28) was published in the mid 50's. Previous work had either been "behaviourist" (that is, concerned with a one-directional S.-R. process, as exemplified, unfairly, by Bloomfield(*19) and Skinner(*97)), or had been very mechanistic (the traditional view of a descriptive grammar operating on many levels from phonemic to clausal). Chomsky introduced a systemic approach to linguistics, in that he managed to demonstrate that it was possible to consider linguistic structures as being not merely analytical, but also transformative and generative. In so doing, he took the position that a grammar does not only account for the form of a language and its comprehension, it also gives rise to those things that are utterable. He developed this view, later, into progressively less "linguistic" and more "social and political" work(*27). Since his revolutionary (and somewhat cross-disciplinary) approach was first unveiled, the examination of syntax has remained essentially in the field of systemic studies, and has spawned a massive research program in (and indeed the term) psycho-linguistics.

By a similar yard-stick, semantics has not really developed, at least in the more directly linguistic fields[®]. By its nature, semantics is somewhat lexicographical and hence circular in form: and in this respect, it has always been systemic. Nevertheless, it seems that semantics has not given full consideration to this circular characteristic, and hence has found it difficult to turn the form to its own advantage. Certainly, progress has been made, but there must be some doubts as to the success of an area which neglects its own form, and which confines itself to the examination (no matter how successful) of cross-cultural parts, and the mechanics of relationship of only its parts: in this semantics, of course, does not follow the cybernetic paradigm.

[®] General semantics - an altogether different field - has.

In some respect this failure may be accounted for by the development of semiotics, an area often confused (by mathematicians in particular) with semantics, but in reality one which has far more chance of producing useful results. The origins of this area are in de Saussure's "Course in General Linguistics"(*93) (in which de Saussure coins the term "Semiology", meaning the science of signs, and proposes its initial operational principles. "Semiology" has been generally replaced by the Americanised term "Semiotics", but the essential intentions are the same). De Saussure's formulation of the interdependence of the signifier and the signified within the sign, his insistence on the importance of the temporal context within which a sign rests to give it a full meaning, and his rejection of the symbolic nature of the sign, place him in the forefront of early systemic thinkers. Indeed, the whole of semiotics is riddled with systemic thinking, and with some astonishing parallels and near parallels with cybernetic statements: e.g. Hjelmslev's continuous scale change in Glossematics(*52)(*53) (although he did initially subscribe to an atomic unit, which later became a logical unit for signification) and Stafford Beer's(*16)(*17) insistence that all viable systems are parts of other viable systems, and contain viable systems. So much so, that the field might well be considered a model for much cybernetic investigation. Furthermore, the self-referential nature of semiotic systems closely relates to the "standard" cybernetic form (see Bunt(*22)).

Psycho-linguistics is a peculiar subject that has only really been considered self-contained since Chomsky's early publications, a sequitor of which appeared to be that there was, in the human brain, a structure onto which a common meta-deep-structure, which all linguistic systems shared could be mapped, one to one (see "Language and Mind"(*26)). Not that the field was previously non-existent, as Piaget's(*86) early work on the

acquisition of linguistic skills shows, but its earlier existence had been confined primarily to the study of either psychology or linguistics. The establishment of this inter-dependence between psychology and linguistics had been most clearly stated before the mid 30's in terms of philosophy, where, following Ogden and Richard's formulation of Frege's^(*38) examinations (presented as his triangle), the whole field seemed for an instant to be purely an examination of the logic of psycho-linguistics, even after Wittgenstein, in his "Tractatus Logico-Philosophicus"^(*108), in capping the achievements of earlier researchers, had temporarily killed off the subject. Indeed, it may be that linguistic philosophy is to psycholinguistics as semiotics is to semantics: in that linguistic philosophy and semiotics are both concerned with the logical requirements for, relatively, a language system or a meaning, to exist, whereas psycholinguistics and semantics are concerned with the actualities of existence of languages (communicating) and meanings (communicating) (see Houston^(*54) and Greene^(*47)).

In contrast with these primarily analytical views of language, the artificial language area (about which one need say little) is synthetic: it concerns itself with parts of the other various areas, especially syntax and (usually unconsciously) semiotics. Its intention is to find a mapping between natural language and the coding that a machine can understand and act on in a given context, so that conversation with such machines is less painfully unfluent for the human conversant. The only reason for including the area within this cursory summary, is that its success in modelling human language (especially in terms of Winnograd's^(*105) and Winston's^(*107) work) manages to confirm some of the work of especially Chomsky^(*28) and Hjelmslev^{(*52)(*53)}. In this respect, it confirms, by means of an interactive experiment, the interactive nature of each of these systems.

As we can see from these summaries, the Systems Approach has had a profound influence of the examination of "Language": indeed, one might even say that the study of "Language" has had a profound effect on the Systems Approach. And yet, the approach is again not of any great help in the terms of this Thesis, for, with the exception of the preliminary assumption of de Saussure (of the arbitrary connection), the work is not concerned with the relationship of the signifier and the signified. And even when these two components are assembled together, the approach is usually to consider the nature of the whole, not of their interdependence. One might suspect that this would be covered in the field of Psycholinguistics (or in Linguistic Philosophy), but it appears not be the case; even Whorf's^(*102) research into the relationship between the richness of North American Indian vocabulary and fire risk does not clearly make a statement about the relationship between the Object and that which describes it. My own "Some Parallels between the Formal Structure of Finnish Language and Finnish Architecture"^(*42) comes closer to making a statement about this relationship (considered as a psychological system), while the real statements of Linguistic Philosophy, essentially avoid the question altogether, by stating that using a Language, the Object itself cannot be examined, merely some representation of it.

Furthermore, the differentiation of the "Language" from the Object, that is the establishment of a hierarchy of two levels of essentially different types of entity, works both against our statement of a non-hierarchical Universe, and a logic of a semiotic system. For, semiotics is the study of the minimum requirements for a sign to exist, and not the study of the nature of the sign's own existence. And the establishment of a separate level for signs is also the prescription of the distinction between the levels of existence of both sign and Object. Whereas, the insistence that the observer of an Object and of a Language

finds some relationship between these two (the Language being thus an Object like any other Object), which will be made in this thesis, removes this difficulty. In this way, Occam's[®] requirement is satisfied, and there is no longer any need to assume as Wittgenstein^(*108), for instance, does, that there is a one-to-one relationship between the Object and its signifier, making up a sign function. And the experiential truth that, depending on who you are, and where you happen to be, almost anything may stand for almost anything else (i.e. that an analogy can be drawn within one's own mind), is more easily accounted for than the assumption of either the simultaneous two level existence, or the level transference of Objects.

The argument so far, then, is that the approaches to "Architecture", even those which are basically cybernetic, do not manage to encompass the concerns of this investigation, and that the same is essentially true for "Language" investigations, no matter which area of that field one examines, and that there is therefore a need to instigate a different framework within which such work can be situated.

In recording this argument, we should still check over the means that are currently used for the expression of spatial constructions, in order to verify that they too suffer the same short-comings as the approaches to "Architecture" and "Language" are claimed to suffer. And in doing this, we need not restrict ourselves exclusively to architectural examples, for there have been a few attempts to explain similarly complex topics, such as sculpture, which may have some relevance.

The traditional method of representing space is a metric means: that is, a representation is made using an agreed measure of length. This results in the standard architect's drawings of plan, section and elevation, together with the projections, axonometric, isometric, and perspective. In this form of[®] i.e. that the simpler solution, or the solution which accounts for more, is better.

representation, only those aspects of space that can be considered as Euclidean are represented, and a special skill is needed to "read" the drawings thus produced. But there are clear examples where this type of representation fails quite completely to represent what is significant in some spatial experience, as is shown in Piaget's work with small children ("The Child's Conception of Space"(*85)), and as is also shown in the maps of spatial schemata included in Gould and White's "Mental Maps"(*45), as well as in this Thesis. The realisation that spatial experiences are not only metric is clearly shown in the refurbishing of a fixed space that Interior Decorators practice. This type of metric representation is also that used by cartographers, and the changing form of maps of the same landscape highlights the refinements made in means of measuring using this technique. The use of a metric is, of course, a sensible means for communicating information about a space: it is a common means of representation, which can be interpreted by each observer to give a picture of a spatial experience: but it is not a representation of that unique experience, because it represents the interpretation of the yard-stick: indeed, one might say that it is the interpretation of the metric's experience of the space!

There have, however, been other means of representing spatial experiences: the work of Wilmott and Young ("Family and Kinship in East London"(*104)) used one means, a combination of words and maps, to establish the already mentioned concept of "Neighbourhood", as a social entity: but, again, this is the representation of a social, rather than an individual, experience. A similar method, to express locationally generated views (not even social ones) was used by Gould and White.

Nevertheless, there is, inherent in some of this work, the opportunity for each individual to express his own personal experience of the space concerned (his own spatial schemata), if only a "Language", and an appreciation of the nature of the type

of Object, and Object-observer relationship, can be discovered; that is, if a common means of expression can be found without too strong a set of consensus restrictions, allowing comparable but different and personal expressions.

Perhaps the nearest approach to this aim has been made by Laurie Thomas^(*100), in his work on extended reciprocal Kelly Grid^(*56) techniques (non-verbal as well as verbal), at St. Martin's School of Art. In this case, a common language of criticism was established with a small group of sculpture students, using each other's work as examples. The trouble with this approach, however, (apart from the time needed to establish the language) is that it is essentially private, and furthermore it does involve a certain consensus agreement.

Thus, there does appear to be a real and genuine need, for the establishment of a description of these Objects, Object-observer relationships, and Languages that have been pointed to, and which it is the intention of this Thesis to present. For any "consensus" description, and the use of any non-personal metric, avoids permitting the expression of any of the contradictory statements that we all know exist in individual descriptions of Objects, and thus in individual realities.

It might appear that the recently developed techniques for dealing with statistical information in such a way that the very hard and fast classes are softened (Zadeh's Fuzzy Set Theory^(*109), and its various extensions and applications) could be exploited to resolve this problem. But that would be to completely misunderstand both the character of Fuzzy Sets and Fuzzy Algorithms, and the requirements we are setting up. Fuzzification is a process which recognises that the insistence on a small number of classes is bound, with humans making choices between them, to be inadequate in the sense that I may find something "more or less good" (when I have only the choice "good/bad"), or when I find

something "good" in some contexts, but not in all, or when I really cannot decide which class something fits in ("don't know"). This is not an attempt to avoid making a general statement, nor is it an attempt to avoid a consensus view: it tries solely to make the information contained within such a consensus view more realistic and relevant. On the other hand, our intention is to allow the statement of an individual experience in some communicable form. Thus, we intend to maintain the quality of each observation at the expense of the consensus view, while a Fuzzy Theory tries to re-generate a general behaviour from a consensus view, thus failing to make real individual views, but describing their range of possibilities.

As a result of these general shortcomings in "Architecture" and "Language", the existing formulations being either incapable of sustaining the type of contradictions that exist between different individual views, or too complex to use easily, and having tried some preliminary experiments to verify these shortcomings, I decided that it was necessary to put forward a description of a theoretical philosophy which would permit the type of Universe we wish to postulate to exist, and which would also permit the type of expression we are demanding to be made.

This Thesis therefore consists of two main components:

Firstly, a philosophy capable of sustaining the type of experience and description about which we have talked in this introduction, and;

Secondly, some exploratory experiments that demonstrate the usefulness of this philosophy, and its success at handling the requirements we have set up for it to account for.

However, by themselves, these two components would not provide a clear enough picture of the implications of this philosophy. And therefore, this format has been extended, for the philosophy proposed as the theoretical base from which such

descriptions can be made, appears to have much more general qualities than might be expected from its roots in "Architecture" and "Language", and seems to generate some techniques that may have quite general applications. For these reasons, the somewhat curt derivation and statement of the philosophy is elaborated by a second text (using the same referential framework), in which the relationship of the philosophy to other people's work, and its reflection of common experiences, is explored.

This content is further elaborated by the inclusion of a set of six Short Stories illustrating the nature of this Universe, a Conclusion, which is intended to summarise the general lessons to be learnt from this work, and point to further areas of possible development, Appendices (recapitulating the particular techniques that emerge from the philosophy), a Glossary of main terms used, and a Bibliographical reference.

MAIN TEXT

- '0. 0, In order to know something exists we must be able to observe it.
- 0. 0,1 If we cannot observe it, we cannot know it exists.
 We cannot necessarily affirm its non-existence, either.
- '0. 0,2 If we do not know an Object exists, we can usefully say nothing about it.
- 0. 0,3 A Thesis says things about Objects.
- 0. 0,31 If we cannot say things about Objects, we have nothing to say.
- '0. 0,32 If we have nothing to say, we should not try to speak.
- 0. 0,41 We state our Universe, thus, as being a Universe of observation.
- 0. 0,42 We are not concerned with other possible Universes.
- '0. 1, For an Object to exist in our Universe, it must be observable.
- '0. 1,1 The Universe contains only observable Objects.

1. 0, The least imaginable conditions in which an Object can know anything are when it is the only Object it knows in the Universe.
1. 0,1 To know it is in the Universe, it must observe itself.
- '1. 0,2 Unless an Object can observe itself, it cannot know it is in the Universe.
1. 0,3 If it cannot know it is in the Universe, it cannot know anything of the Universe as being of that Universe.
- '1. 0,4 If an Object knows some other Object exist, it must also know it exists, itself.
1. 0,5 All Objects in the Universe are self-observers.
- '1. 1, In order to observe itself, an Object must have both itself to make the observation, and a means of making the observation.
1. 1,11 Call the Object O_a .
- '1. 1,12 Call the means of making the observation the Model Facility X_a .^e
1. 1,13 The small subscript indicates the specific Object referred to. O_a is Object a , O_b is Object b . O_a and O_b are both Objects and are both different. X_a is the Model Facility of Object a .
1. 2, The Object only knows it has an existence, and therefore only has an existence we can discuss, because it observes itself.
1. 2,1 The Object exists by virtue of its own self-observation.
- '1. 2,2 The Object observes itself through its Model Facility: its observation is,
- $(X_a)O_a$.
- where the brackets () denote an observational operation being made on that which the brackets contain.

^e The Model Facility's further properties will be investigated later.

- '1. 2,3 In the Universe of observation, the Object is what it observes itself to be,

$$\langle O_a \rangle = [(X_a)O_a],$$

Where the brackets $\langle \rangle$ denote the commonness of name of the stated Object, the brackets $[]$ the observation, and the equal sign $=$ the being of observation.

That is to say, that the denoted Object is to the observer, that which the observer observes with the co-operation of that part of the Object observed called the Model Facility.

1. 2,4 This is the basic formulation for existence, in the Universe.

1. 3, In observing itself, an Object has recourse to nothing that is not of its self.

1. 3,1 Self-observation is therefore private.

- '1. 3,11 Self-observation is what the Object, and only the Object, observes itself as.

- '1. 3,12 The Object, being what the Object observes, calls itself the Essence,

$$\langle O_a \rangle = [(X_a)O_a] \Rightarrow E_a,$$

Where the arrowed equal sign \Rightarrow indicates that which is given rise to by the observer, as his observation of the Object[®].

1. 3,2 The Object is observed by itself privately, and is its Essence, to itself. No other Object can see

[®] It should be noted that for any observer's observations, the various bracketings and equal-signs are essentially the same: that is, the normal equal-sign \approx could be used, and the bracket forms omitted. This is because, for the observer concerned, the Object is the behaviour (or Essence) is the act of observation, etc.

its Essence.

- '1. 4, Every Object, observing itself, has an Essence.
Without an Essence, there would be no Object,

$$\langle O_a \rangle = [(X_a)O_a] \Rightarrow E_a,$$

$$\langle O_b \rangle = [(X_b)O_b] \Rightarrow E_b.$$
1. 4,1 In order for an Object to observe any other Object, it must first observe itself, to know it exists, and thus to know it can make the observation.
1. 4,2 In order for an Object to be observed by any other Object, it must first observe itself, to exist for the other Object to observe.
- '1. 5, An (externally) observing Object can observe another Object, but it cannot observe the other Object's Essence.
1. 5,1 The means for observation is the observed Object's Model Facility (which the Object used to observe itself).
- '1. 5,2 The observation that one Object makes of another is called the observed Object's behaviour. The behaviour is what the external observer believes the Object to be,

$$B_a \Leftarrow [(X_a)O_b] = \langle O_a \rangle.$$
1. 6, The observing Object cannot see the observed Object's Essence, but can infer that it must have one.
- '1. 6,1 The Model Facility is common to all observations, and maintains the specificity of reference of observations to the observed Object.
1. 6,2 The observation is the observer's view of the Object through the Model Facility, which is, to the observer, the Object.
1. 7, All Objects are self-observers.

1. 7,1 All Objects may be observed by^e other Objects.
1. 7,2 All Objects may observe^e other Objects.
1. 7,3 When an Object is observing, it is called an observer.
This is a difference of role. The Object's view of
itself may be re-written to show the observing role,

$$\langle O_a \rangle = E_a \Leftarrow [(X_a)P_a] = [(X_a)O_a].$$
- '1. 7,4 The behaviour attributed to an Object by an observer
may be re-written,

$$\langle O_a \rangle = B_a \Leftarrow [(X_a)P_b].$$
1. 7,5 These are forms for all Objects.
1. 8, The Model Facility makes observation possible, and
maintains specificity.
1. 8,1 Objects may observe each other.
1. 8,11 The result of one observation of an Object by an
external observer is a behaviour.
- '1. 8,12 The result of many observations of an Object by external
observers is the Object's Behaviour,

$$\langle O_a \rangle = B_a^\circ \Leftarrow \sum_{b, (1!n)} [(X_a)P_b].$$
- '1. 9, The Object is its Essence and is its behaviour and is
its Behaviour,

$$\langle O_a \rangle = E_a,$$

$$\langle O_a \rangle = B_a,$$

$$\langle O_a \rangle = B_a^\circ.$$
1. 9,11 The Essence is private, in that it is observed by the
Object itself.
1. 9,12 The behaviour is public, in that it is observed by an
—external observer.

^e But need not.

1. 9,2 The Object, to be in our Universe, must be observed.
- '1. 9,3 There is a hierarchy in observations: there must be self-observation for there to be external observations, in both Object and observer.
1. 9,4 The observer, too, is an Object,

$$\langle O_b \rangle = E_b \Leftarrow [(X_b)P_b].$$
- 1.10,1 All inhabitants of our Universe are Objects. The Model Facility makes them observable. The observer observes them. The observation is the Object, and is its existence for the observer.
- 1.10,2 The observer's view of the Universe is his view.

2. 0, The observer is an Object in the Universe.
2. 0,1 The observer observes himself, and that makes him an Object in the Universe,

$$\langle O_b \rangle = E_b \Leftarrow [(X_b)P_b].$$
2. 0,11 Because the observer observes himself, he can exist to be observed by others,

$$\langle O_b \rangle = B_b \Leftarrow [(X_b)P_a].$$
- '2. 0,12 Because the observer observes himself, he can exist to observe others,

$$\langle O_a \rangle = B_a \Leftarrow [(X_a)P_b].$$
2. 1,1 When an observer makes an observation, he attributes a behaviour to an Object.
- '2. 1,2 There is another way to look at this. When an observer makes an observation, he creates for himself an awareness,

$$A_a \Leftarrow [(X_b)P_a] \Rightarrow B_b.$$
- '2. 1,3 To every awareness there is a related behaviour, which differs only in role.
2. 2,1 For the observer, the awareness is what he believes the Object of his observation to be.
2. 2,2 For the observer an awareness is also part of himself.
2. 2,3 The observer exists on two levels.
- '2. 2,41 The observer's self-observation is his Essence, and is private.
2. 2,42 The observer's observation is his awareness, and is public.
2. 2,5 The observer makes an awareness through the Model Facility of the Object being observed.
- '2. 2,6 The sum of many of the observer's awarenesses is his Awareness,

$$\langle O_a \rangle = A_a^o \Leftarrow \sum_{b,(1:n)} [(X_b)P_a].$$

2. 3, The sum of all Behaviours and all Awarenesses in the Universe is the same. Only the distribution differs.

2. 3,11 In a Universe, for example, of only 3 Objects (all of which can observe), the following self-observations are possible,

$$\langle O_a \rangle = E_a \Leftarrow [(X_a)P_a],$$

$$\langle O_b \rangle = E_b \Leftarrow [(X_b)P_b],$$

$$\langle O_c \rangle = E_c \Leftarrow [(X_c)P_c].$$

2. 3,12 The following external observations are possible,

$$\langle O_a \rangle = B_a \Leftarrow [(X_a)P_b] \Rightarrow A_b,$$

$$\langle O_a \rangle = B_a \Leftarrow [(X_a)P_c] \Rightarrow A_c,$$

$$\langle O_b \rangle = B_b \Leftarrow [(X_b)P_a] \Rightarrow A_a,$$

$$\langle O_b \rangle = B_b \Leftarrow [(X_b)P_c] \Rightarrow A_c,$$

$$\langle O_c \rangle = B_c \Leftarrow [(X_c)P_a] \Rightarrow A_a,$$

$$\langle O_c \rangle = B_c \Leftarrow [(X_c)P_b] \Rightarrow A_b.$$

2. 3,21 The Behaviours of the Objects are,

$$B_a^\circ \Leftarrow [(X_a)P_b] + [(X_a)P_c],$$

$$B_b^\circ \Leftarrow [(X_b)P_a] + [(X_b)P_c],$$

$$B_c^\circ \Leftarrow [(X_c)P_a] + [(X_c)P_b],$$

Where the addition sign + signifies both (a logical form will be developed later).

2. 3,22 The Awarenesses of the Objects are,

$$A_a^\circ \Leftarrow [(X_b)P_a] + [(X_c)P_a],$$

$$A_b^\circ \Leftarrow [(X_a)P_b] + [(X_c)P_b],$$

$$A_c^\circ \Leftarrow [(X_a)P_c] + [(X_b)P_c].$$

2. 3,3 The individual awarenesses and behaviours are the same. Their method of summation together makes the difference between the Behaviours and the Awarenesses.

2. 4, All observers in our Universe are Objects. The Model Facility of observed Objects makes them observable. The observer attributes to Objects behaviours that are, he believes, the Objects. These behaviours are the observer's awarenesses.
- '2. 4,1 The observer's view of the Universe is his Awareness.

3. 0, The Model Facility is that in an Object which makes it observable.
- '3. 0,11 The Model Facility in an Object is not the Object itself, but must be present as a necessary part of the Object, for the Object to exist.
3. 0,12 The Model Facility may be an Object, too. Then it will have its own Model Facility in it, to make it observable,
- $$\langle O_a \rangle = X_a = [(X_a) P_a] = [(X_a) X_a] \Rightarrow E_a.$$
3. 0,13 This Model Facility Object is not the same as the Model Facility, which is a part of an Object.
3. 0,14 Within the Model Facility Object, there is a Model Facility of the Model Facility Object.
- '3. 0,15 The Model Facility Object can stand as a surrogate for the Model Facility in our Universe, being of nothing but the Model Facility.
3. 0,2 The Universe of observation consists of Objects.
3. 0,3 The Model Facility is not an Object. It cannot be discussed, but it can be inferred as necessary, and its necessity may be examined.
3. 1, The Model Facility is that part of an Object which makes the knowing existence of the Object possible.
- '3. 1,1 The Model Facility permits observation. The observation made through it is the Object, in the observer's belief. The observation of the Object through it is not a Model, but is the Essence or a behaviour.
- '3. 1,2 The Model Facility is that within an Object which gives the Object integrity; permits its form to continue; maintains it.
3. 1,3 The Model Facility is thus a calculus with an interpretation, though which an observer, projecting his

views, can see that of the Object to which his views relate.

3. 1,4 The Model Facility regulates the projected views: if an observer's observation does not take account of the Model Facility, the observation will be false in that the Object cannot sustain it.
- '3. 1,41 The meaning of cannot sustain it is shown thus: if an observer predicts that an Object can do something, and that Object cannot do this something, the prediction is "untrue", and the observation from which the prediction was made was a "false" observation, for it lead to an "impossible" behaviour.
3. 1,42 In this case, the observation was made without proper regard for the Model Facility: or, without proper regard for the calculus with an interpretation that is the Model Facility.
3. 1,5 This is the structure of the Model Facility.
- '3. 1,6 In this structure lies "meaning". An observation made without proper regard for the Model Facility is meaningless, that made with proper regard for it is meaningful.
3. 2, All observations of an Object are made through its Model Facility.
3. 2,1 The Object exists by virtue of its own self-observation through its own Model Facility.
3. 2,21 An observation needs an observer as well as an Object's Model Facility,
- $$(X_a)P_b.$$
3. 2,3 Each observer is Unique and has its own Essence,
- $$P_b = [(X_b)P_b] \Rightarrow E_b,$$
- $$\langle P_c \rangle = [(X_c)P_c] \Rightarrow E_c.$$

3. 2,31 Each observer's observation of the Object is, thus, different,
- $$\langle O_a \rangle = B_a \Leftarrow [(X_a) P_b],$$
- $$\langle O_a \rangle = B_a \Leftarrow [(X_a) P_c].$$
3. 2,4 Each observation is nevertheless made through the same Model Facility.
- '3. 2,41 Each observation of an Object is thus related, through the commonness to all observations of the Model Facility.
3. 2,5 Each observation, being different, is of the same Object.
3. 2,51 The Object can thus be a topic of conversation since it can be held in common to different observations.
3. 3, For an observation to have Meaning, it must be related to the Object of observation.
3. 3,1 The Model Facility is that which allows the Object to be observed.
3. 3,11 The Model Facility is that which permits observations of the Object to be held in common.
3. 3,12 The Model Facility thus makes observations relevant.
3. 3,2 The Model Facility is thus the location of potential Meaning.
- '3. 3,21 The action of an observer observing on the Model Facility creates Meaning.
3. 4, Insofar as the Model Facility makes all observations of the Object relevant to the Object, it has a structure.
3. 4,1 The structure is the location of potential Meaning.
3. 4,11 The observation made with this structure (with proper regard for the Model Facility), is a Meaning.
3. 5, The structure of the Model Facility prevents observations of other Objects being confused with observations of the Object of observation.

3. 5,1 The Model Facility affects the observations made of the Object through it,

$$\langle O_a \rangle = [(X_a)P_b].$$
3. 6, The observer has, similarly, his own Model Facility,

$$P_a = [(X_a)P_a].$$
3. 6,1 The observer's Model Facility has a structure, which, when observed, gives Meaning to the observer's observation.
3. 6,11 The observer observing himself is thus prevented from making irrelevant observations of himself.
3. 7, The observer observes the Object,

$$\langle O_a \rangle = B_a \Leftarrow [(X_a)P_b].$$
3. 7,1 The observer and the Object both have Model Facilities which ensure the relevance of observations,

$$\langle O_a \rangle = [(X_a)P_a],$$

$$P_b = [(X_b)P_b].$$
3. 7,11 Since an observation of an Object involves both the Object's Model Facility, and an observer (who exists by virtue of his own Model Facility), there is an interdependence between these two Model Facilities,

$$\langle O_a \rangle = B_a \Leftarrow [(X_a)P_b] = [(X_a)[(X_b)P_b]].$$
3. 7,12 All observations are therefore interactive.
3. 7,21 The Model Facility of the observer affects what the observer believes the Object to be (the Object's behaviour): as does the Object's Model Facility,

$$P_b = [(X_b)P_b],$$

$$\langle O_a \rangle = B_a \Leftarrow [(X_a)[(X_b)P_b]].$$
3. 7,22 The Model Facility of the Object affects what the observer believes the Object to be (the observer's awareness): as does the observer's Model Facility.

3. 7,23 The Model Facilities of both Object and observer thus affect the behaviour and awareness made by the observation,

$$B_a \leftarrow [(X_a)[(X_b)P_b]] \Rightarrow A_b.$$

3. 7,24 The Model Facilities of both Object and observer thus affect the Object's and the observer's existence on the public level,

$$\langle O_a \rangle = B_a,$$

$$-P_b = A_b.$$

3. 8, All Model Facilities in our Universe are necessary parts of Objects. They are not Objects, but they can become Objects. Model Facilities affect observer and Object in an observation. Model Facilities make observations relevant. The structure of a Model Facility, which makes observations relevant, is the source of the Object's potential Meaning.

4. 0, There are two levels of existence.
4. 0,1 Any Object in our Universe must be observable.
4. 0,11 If an Object is not observable it does not exist (in the Universe).
4. 0,12 In order to allow observation, all Objects have a Model Facility through which observations are made.
4. 0,2 The Model Facility is available to all observers.
- '4. 0,31 When an observation is made through the Model Facility by the Object itself, the observation is private,
- $$\langle O_a \rangle = E_a \leftarrow [(X_a) P_a].$$
4. 0,32 This observation gives rise to the Essence.
- '4. 0,33 When an observation is made through the Model Facility by another observer, the observation is public,
- $$\langle O_a \rangle = B_a \leftarrow [(X_a) P_b] \Rightarrow A_b.$$
4. 0,34 This observation gives rise to a behaviour, of the Object, and an awareness of the observer.
4. 0,41 Many behaviours give rise to the Behaviour.
- '4. 0,42 Many awarenesses give rise to the Awareness.
- '4. 0,43 Public and Private are two different levels of existence.
4. 0,44 The Essence is Private. The existence of the Essence is implicit in any other observation, since the Object must exist for itself, to exist for other observers. There is thus a priority of existences: the Essence is implicit in both behaviours and awareness; behaviours and awarenesses are only potential in the Essence.
4. 0,45 The behaviour and awareness, and the Behaviour and Awareness are Public.
4. 0,5 The term "Public" is chosen because any Public

observation calls for a reference to an Object other than that being observed.

- '4. 1, There is a priority in these levels of existence.
 4. 1,1 For an Object to exist it must be observed.
 4. 1,11 It cannot be observed by any other Object unless it has a means for being observed.
 4. 1,12 The Object must exist before it is observed by another Object.
 4. 1,13 The Object must therefore first observe itself.
 '4. 1,14 The making of its own self-observation must be through the means for being observed.
 4. 1,2 This means must be in the self.
 4. 1,21 This means is called the Model Facility.
 '4. 1,3 Until the Object observes itself, it cannot exist,

$$\langle O_a \rangle = [(X_a)O_a].$$

4. 1,31 Self-observation is existence, (in this Universe).

4. 1,32 Existence makes external observations possible,

$$\begin{aligned} S_a \quad \langle O_a \rangle &= [(X_a)O_a], \\ (s+1)_a \quad B_a &\leftarrow [(X_a)P_b], \end{aligned}$$

Where the letter **S** denotes a moment in time at which an observation is being made, and the subscript **a** denotes that Object to which the time belongs.

4. 1,4 Observations must be made through the Model Facility, which is of the Object itself.
 4. 1,41 No external observation can be made before there is self-observation.
 4. 1,5 Public existence depends on private existence being already established.
 4. 1,51 Similarly, observation of others depends on observation of self being already established,

$$\begin{aligned} S_a \quad \langle O_b \rangle &= P_b \leftarrow [(X_b)P_b], \\ (s+1)_a \quad \langle O_a \rangle &= B_a \leftarrow [(X_a)P_b]. \end{aligned}$$

4. 2, Existence is through self-observation. Without self-observation no external observation can be made. Private existence precedes Public existence.

5. 0, There is a sense of time inherent in this Universe.
5. 0,1 It has already appeared in the notion of priority.
5. 0,21 An Object must have an Essence in order to have a
behaviour.
5. 0,22 An observer must have an Essence in order to have an
awareness.
5. 0,3 Thus, time is a constituent of our Universe.
5. 1, An Object observes itself.
5. 1,1 In its self-observation it maintains its self,
cyclically.
5. 1,11 This is an oscillation.
5. 1,2 Oscillators necessarily imply a time sense in them-
selves.
5. 1,21 The observation of the self by the self involves the
Object making its own time sense.
5. 1,22 There must be the possibility of a change, between the
Object (being what it observes itself as), and the
Object's observation of itself, for self observation
to occur,

$$\langle O_a \rangle = [(X_a)P_a]$$

5. 1,23 Thus, the sense of time in this oscillator consists
in the change of role within the Object (being either
in the role of observed or of observer), which can be
represented,

$$s_a \quad \langle \quad \rangle = [(X_a)P_a]$$

$$s'_a \quad \langle O_a \rangle = [(X_a) \quad]$$

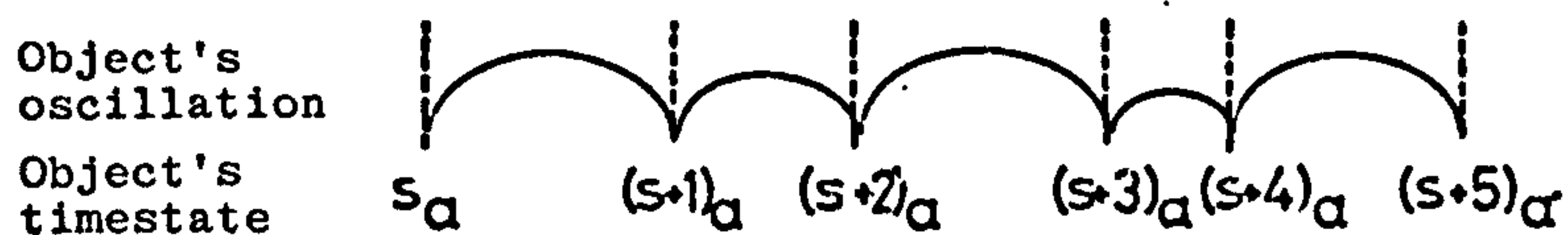
Where s' is the second half of the cycle beginning at
 s , $(s+1)'$ is the second half of the cycle beginning
at $(s+1)$, etc.

5. 1,24 These two states are normally compressed into the
one statement,

$$\langle O_a \rangle = [(X_a)P_a]$$

5. 1,25 Without these two states, (the half-cycles of the oscillator), the Object cannot be a self-observer. For this reason, the whole statement is made, and a change in time state is normally represented over one complete oscillation. That is why the statement in 5. 1,23 was made at S and S' , and not at S and $(S+1)$.

5. 1,26 A complete oscillation for any Object can be represented as an arc, with comparative lengths representing comparative time spans in a Reference Time (which is a convenience to allow expression of the comparison). Thus, for the Object O_a ,



5. 1,27 The different length of the drawn cycle is a comparative measure, and only means something to the external observer using a Reference Time. To the Object itself, the length of each cycle is the same, being the time needed by the Object in itself to change its role, and change back again. To the Object itself, there is only the difference between its time state as one cycle following another.

5. 1,3 Change involves a "before" and an "after".

5. 1,4 Time is a basic component for the operation of our Universe. It is inherent in our Object.

5. 1,5 The output of our oscillating Object would be, if we could observe it, a tape of an infinite regress.

5. 2, The dependence of this time is on the Object only, and on no other Object than that of which it is a function.

5. 2,1 Each Object is unique.

5. 2,2 Each Object has its unique time.

5. 2,21 Time is local and belongs to the specific Object of which it is part.
5. 2,3 Reference Time and General Time are not a necessity, (except for convenient comparison). That each Object has its own local time is.
5. 3, An observation requires the observer and the Model Facility of the Object being observed.
5. 3,1 The Model Facility allows access to the Object by the observer.
5. 3,2 All Objects have their own times.
5. 3,3 For an observation to take place, both Object roles must be present.
5. 3,31 In being present, they construct the Object, at the level of either the Essence or the behaviour.
5. 3,4 If the observer and the Object are the same, they have the same time. The observation is of the Essence,

$$\langle O_a \rangle = E_a \Leftarrow [(X_a) P_a]$$
5. 3,5 The Essence is the Object. Each Object has a time.
5. 4, The observer and the Model Facility are part of the Object.
5. 4,1 The observer and the Model Facility have the same time as the Object.
5. 4,2 The observer and the Model Facility make an Object possible.
5. 4,3 When the observer is not the same as the Object, the observation is a behaviour,

$$\langle O_a \rangle = B_a \Leftarrow [(X_a) P_b]$$
5. 4,4 All Objects have a time.
5. 4,5 The Object is the behaviour.
5. 4,51 The Object has a time.
5. 5, The observer is an Object,

$$\langle O_b \rangle = [(X_b) P_b]$$

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5. 5,11 The observer has its own time.
5. 5,12 The observer must connect to the time of the Object of observation.
5. 5,2 The times of the observer and the Object of observation connect. This is a correlation (of time[ⓐ]).
5. 6, Each Object has its own time. .
5. 6,1 The times of the observer and the Object of observation correlate.
5. 6,2 When the observer is not observing the Object of observation, its own time does not correlate.
5. 6,3 There is correlation during observation.
5. 7, Observation is made through the Model Facility and is the Essence or the behaviour,
- $$[(X_a)P_a] \Rightarrow E_a = \langle O_a \rangle = B_a \Leftarrow [(X_a)P_b].$$
5. 7,1 An Object must observe itself, to be observable by any other Object,
- $$\langle O_a \rangle = E_a \Leftarrow [(X_a)P_a],$$
- $$P_b = E_b \Leftarrow [(X_b)P_b].$$
5. 7,2 The Model Facility is the means by which all observations are made by all observers.
5. 7,21 The Object's Model Facility is common to all observations.
5. 7,3 The behaviour of an Object correlates with the Essence of the observer observing it.
5. 7,31 The Object observes itself, and correlates with itself.

[ⓐ] - The word "correlate" is used in its Dictionary, rather than its statistical, sense.

5. 7,4 The Model Facility of both observations is the same, and is the means for correlation.
5. 7,41 In order for both observers (the Object itself and the external observer), to observe through the same Model Facility, it must be there for both of them.
5. 7,5 There is only one Model Facility in the Object.
5. 7,6 If both observers want the same Model Facility to observe the same Object, and one observation is necessary to the other, the other must correlate with the one.
5. 7,61 The observer's time correlates with the time of the observed behaviour, which correlates with the Object's own self-observing time.
5. 8,1 We can summarise the correlation of observer and observed roles.
5. 8,11 For the Object O_a itself,

$$\begin{array}{l}
 s_a \quad \leftarrow [(X_a)P_a], \\
 s'_a \quad \langle O_a \rangle = E_a \leftarrow [(X_a)], \\
 (s+1)_a \quad \leftarrow [(X_a)P_a], \\
 (s+1)'_a \quad \langle O_a \rangle = E_a \leftarrow [(X_a)], \\
 (s+2)_a \quad \leftarrow [(X_a)P_a],
 \end{array}$$

Where the heavy boundary indicates the boundary of a normal Object expression.

5. 8,12 At $s'_a, (s+1)'_a$, etc., the observer role is "vacant" in O_a and may be filled by another observer: thus at $(s+1)'_a, P_b$ may observe O_a giving it a behaviour,

$$\begin{array}{l}
 s_a \quad \leftarrow [(X_a)^{P_a}], \\
 s'_a \quad \langle O_a \rangle = E_a \leftarrow [(X_a) \quad], \\
 (s+1)_a \quad \leftarrow [(X_a)^{P_a}], \\
 (s+1)'_a \quad \langle O_a \rangle = E_a \leftarrow \boxed{[(X_a)^{P_b}] \Rightarrow} \\
 (s+2)_a \quad \leftarrow [(X_a)^{P_a}] \Rightarrow \boxed{B_a}.
 \end{array}$$

5. 8,13 For P_b to be able to observe O_a he must be in the role of Object to his own observation,

$$\begin{array}{l}
 s_b \quad \leftarrow \boxed{[(X_b)^{P_b}]}, \\
 s'_b \quad \langle O_b \rangle = E_b \leftarrow [(X_b) \quad], \\
 (s+1)_b \quad \leftarrow [(X_b)^{P_b}].
 \end{array}$$

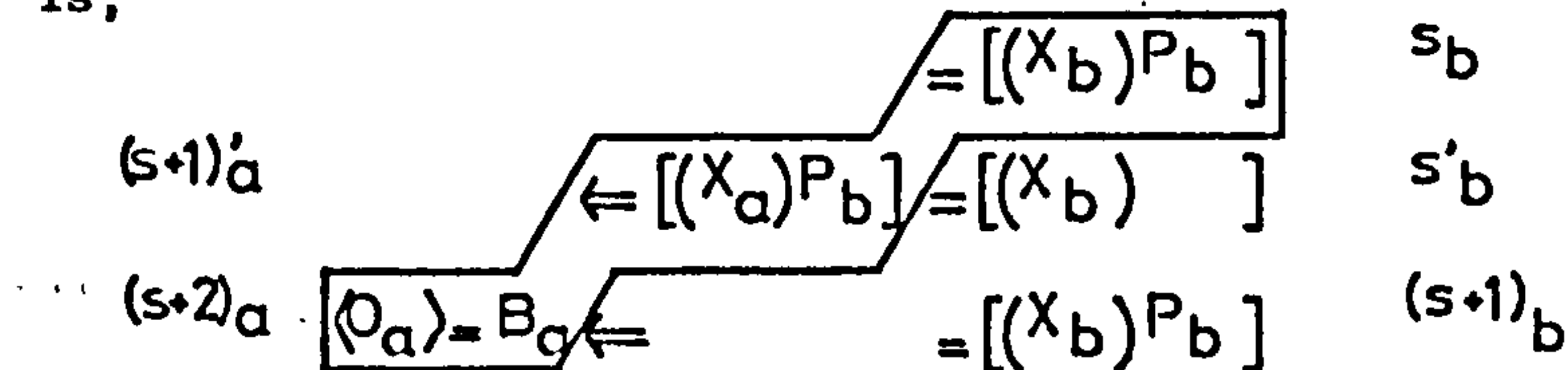
5. 8,14 For the observation of O_a by P_b at time $(s+1)'_a$ to take place, P_b must be in the role of Object of its observations (i.e. at time s'_b). Thus, the form of the observation at s'_b by P_b of O_a (giving only those parts that go into making the behaviour) will be,

$$\begin{array}{l}
 (s+1)_a \quad \leftarrow \boxed{[(X_a)^{P_a}]} \\
 (s+1)'_a \quad \langle O_a \rangle = E_a \leftarrow \boxed{[(X_a)^{P_b}] =} \quad s'_b \\
 (s+2)_a \quad \leftarrow [(X_a)^{P_a}] \Rightarrow \langle O_a \rangle \Rightarrow B_a \quad (s+1)_b
 \end{array}$$

5. 8,15 And the form of P_b 's self-observation will be,

$$\begin{array}{l}
 \leftarrow [(X_b)^{P_b}] \quad s_b \\
 \langle O_b \rangle = [(X_b) \quad] \quad s'_b \\
 = [(X_b)^{P_b}]. \quad (s+1)_b
 \end{array}$$

5. 8,16 Hence, a summary of the whole process of interaction is,



5. 8,2 Call the correlated times during which observations take place "shared time", and notate it with a subscript from each Object sharing a "shared time". Thus, if Object O_a is observed by observer P_b , their "shared time" can be notated,

$$s_{(a,b)}, (s+1)_{(a,b)}, \text{ etc..}$$

5. 9, The awareness of an observer is the same as the behaviour of the Object observed.

5. 9,1 The observer's time correlates with the behavioural observation.

5. 9,2 The observer's time correlates with the awareness observation.

5.10, In making observations, the unique, individual times of the Objects involved correlate.

5.10,1 The times only correlate when an observation is being made.

5.11, All Objects have their own times. Observation requires correlation between these times. No observation is possible without correlation. The times of public and private existence are the same.

6. 0, The observation made by any observer of any Object, whether public or private, is personal to that observer.
6. 0,1 No observation that can be made can be made except with an Object to be observed and an observer to observe it.
6. 0,2 All observations are made through the Model Facility of the Object being observed,

$$B_a \Leftarrow [(X_a)P_b] \Rightarrow A_b.$$
6. 0,3 There is nothing in an observation that is not of either the Object or the observer.
- '6. 0,4 No Essence can be experienced except by its own Object.
- '6. 0,5 No observation can be experienced except by its own Object of observation and observer.
6. 0,6 The behaviour and awareness are the observation as experienced by, respectively, the Object and the observer.
6. 0,7 No observation can be observed other than by the observer who observes it.
6. 1, All Objects can be observed.
6. 1,1 Communication is the transmission of an observation from one observer to another.
6. 1,12 An observation cannot be observed by any other observer than the observer who made it.
- '6. 1,13 Thus, communication by transmission of an observation itself is impossible.
- '6. 1,2 Representation is the making of one Object that stands for another.
6. 1,21 Representations must be Objects, otherwise they would not exist in our Universe.
6. 1,22 Representations, being Objects, can be observed.
6. 1,23 If an observation can be represented by another Object, it can be observed.

'6. 1,3 Communication can occur when observations are represented by Objects which are observed by other observers.

6. 2, There are two Objects which can be seen by the observer. Call one O_a , the other O_c ,

$$\langle O_a \rangle = E_a \Leftarrow [(X_a)P_a],$$

$$\langle O_c \rangle = E_c \Leftarrow [(X_c)P_c],$$

6. 2,1 The observer P_b observes the two Objects,

$$B_a \Leftarrow [(X_a)P_b] = \langle O_a \rangle,$$

$$B_c \Leftarrow [(X_c)P_b] = \langle O_c \rangle.$$

6. 2,2 If the observer observes both Objects as being the same, they are identical to him, for these observations,

$$[(X_a)P_b] \Rightarrow B_a \longleftrightarrow B_c \Leftarrow [(X_c)P_b],$$

$$\langle O_a \rangle = B_a \longleftrightarrow B_c = \langle O_c \rangle,$$

Where the bi-conditional \longleftrightarrow indicates that the behaviour of each Object to the common observer, appear to be the same. The origin of this computational ability (and of all other computation abilities used) will be covered later.

'6. 2,21 The two Objects are not identical; each Object has its own unique Essence,

$$\langle O_a \rangle = E_a \Leftarrow [(X_a)P_a],$$

$$\langle O_c \rangle = E_c \Leftarrow [(X_c)P_c].$$

6. 2,3 But for the observer, making these observations, the two Objects, that is, the two behaviours the observer believes are the two Objects, are the same.

6. 2,4 Thus, for the observer, one Object can stand for the other Object, as a surrogate.

6. 3, An observer cannot see the observation made by another observer,

$$[(X_a)P_b] \not\leftrightarrow [(X_a)P_d]$$

Where the negated bi-conditional $\not\leftrightarrow$ indicates that there is not an identity between the two expressions.

6. 3,1 Both observers can see the same Object, each attributing a behaviour,

$$\langle O_a \rangle - B_a \leftarrow [(X_a)P_b],$$

$$\langle O_a \rangle - B_a \leftarrow [(X_a)P_d].$$

6. 3,11 Both observers will observe the Object differently, and will believe they observe the Object.

6. 3,2 If one observer takes a second observable Object to stand for his observation of the first Object, the second observer may also be able to observe that Object,

$$B_{a(P_b)} \leftarrow [(X_a)P_b],$$

$$B_{c(P_b)} \leftarrow [(X_c)P_b],$$

$$\langle O_a \rangle - B_{a(P_b)} \longleftrightarrow B_{c(P_b)} - \langle O_c \rangle,$$

$$B_{a(P_d)} \leftarrow [(X_a)P_d],$$

$$B_{c(P_d)} \leftarrow [(X_c)P_d],$$

$$\langle O_a \rangle - B_{a(P_d)} \longleftrightarrow B_{c(P_d)} - \langle O_c \rangle.$$

Where the sub-subscripts (P_b) and (P_d) indicate the observer attributing the particular behaviour.

6. 3,21 By observing the two Objects, the one standing for the other, the second observer can understand what he believes the first observer to have observed.

6. 3,3 Thus, by use of a surrogate Object, Communication is possible.
6. 4, An observer can communicate to another observer by means of a surrogate Object.
- '6. 4,1 The other observer will construct a behaviour for both the Object and the surrogate Object, in order to make a picture of the observer's observation.
6. 4,11 There is no certainty that the second observer will understand anything similar to the observer's observation.
- '6. 5, In order for any Communication to take place with certainty, the second observer must represent the observation he makes of the first observer's observation.
6. 5,1 The first observer may then try and reconcile what he believes the second observer observed with what he observed initially.
- '6. 5,11 This is an error regulator.
6. 5,12 This is a conversational idiom.
6. 5,13 A conversation W_x consists, therefore, in three stages of representation.
6. 5,14 In the first stage the initial observer states his observation,
- $W_{x(s)}$ P_a 's view
6. 5,15 In the second stage the listening observer states his view of the initial observer's view,
- $W_{x(s+1)}$ P_b 's view of P_a 's view
6. 5,16 In the third stage the initial observer states his view of the listening observer's view of his own view,
- $W_{x(s+2)}$ P_a 's view of P_b 's view of P_a 's view

6. 5,17 Computing the error consists in finding the difference between W_{x_s} and $W_{x_{(s+2)}}$. If there is no difference, Communication is good. If there is a large difference, Communication is bad,

$$W_{x_s} \longleftrightarrow W_{x_{(s+2)}} \quad \text{good communication,}$$

$$W_{x_s} \not\longleftrightarrow W_{x_{(s+2)}} \quad \text{bad communication,}$$

The means for computing differences of this type are covered later.

6. 5,2 A full explanation of representation in a conversation is therefore, as below.

6. 5,21 To an Object O_a which is a topic of a conversation, the observer P_y attributes a behaviour and then uses another Object O_b to represent his observation.

This is,

$$\langle O_a \rangle = [(X_a)P_y] \Rightarrow B_a(P_y),$$

$$\langle O_b \rangle = [(X_b)P_y] \Rightarrow B_b(P_y),$$

$$B_a(P_y) \longleftrightarrow B_b(P_y).$$

$$\langle O_a \rangle \longleftrightarrow \langle O_b \rangle. \quad (\text{stage } W_{x_s}).$$

6. 5,22 The second observer attributes a behaviour to this surrogate Object, and represents the behaviour by another surrogate Object. This is,

$$\langle O_b \rangle = [(X_b)P_z] \Rightarrow B_b(P_z),$$

$$\langle O_c \rangle = [(X_c)P_z] \Rightarrow B_c(P_z),$$

$$B_b(P_z) \longleftrightarrow B_c(P_z),$$

$$\langle O_b \rangle \longleftrightarrow \langle O_c \rangle. \quad (\text{stage } W_{x_{(s+1)}}).$$

6. 5,23 The original observer attributes a behaviour to this other surrogate Object, and compares this behaviour to the behaviour he attributed to the initial Object.

This is,

$$\langle O_c \rangle = [(X_c)P_y] \Rightarrow B_c(P_y),$$

$$\langle O_d \rangle = [(X_d)P_y] \Rightarrow B_d(P_y),$$

$$B_c(P_y) \longleftrightarrow B_d(P_y),$$

$$\langle O_c \rangle \longleftrightarrow \langle O_d \rangle. \quad (\text{stage } W_{x(s+2)}).$$

6. 5,31 If there is no difference, the second observer is assumed to understand,

$$\langle O_a \rangle = B_a(P_y) \longleftrightarrow B_d(P_y) = \langle O_d \rangle.$$

6. 5,32 If there is a difference, a new surrogate must be found, either to re-express the original observation, or to express the difference,

$$\langle O_a \rangle = B_a(P_y) \longleftrightarrow B_d(P_y) = \langle O_d \rangle.$$

6. 6,1 A surrogate Object may be used to communicate an observation made by an observer of an Object. A surrogate Object is an Object in the Universe like any other Object, in the role of representing another Object.

6. 6,2 A conversation may be used as a check of the success of Communication between two observers.

7. 0, The observation, by an observer, of another Object, involves a correlation of times.
7. 0,1 The result of such an observation is a behaviour attributed to the Object by the observer, together with an awareness developed by the observer itself,
- $$\langle O_a \rangle = B_a \Leftarrow [(X_a) P_b] \Rightarrow A_b.$$
7. 1,1 All observations made in the Universe are made by Objects, of Objects.
7. 1,2 All Objects are self-observers.
7. 2, If one observer observes two separate Objects at the same time by his local clock, there will be two different behaviours attributed by it (one to each Object),

$$\langle O_a \rangle = B_a \Leftarrow [(X_a) P_b],$$

$$\langle O_c \rangle = B_a \Leftarrow [(X_c) P_b].$$

Where P_b is the observer.

7. 2,1 Each observed Object has its own time. Observations are only made with the correlation of the observer's and the Object's time.
7. 2,11 For the two observations B_a and B_c the shared times (i.e. the times of the observations) are shown as,

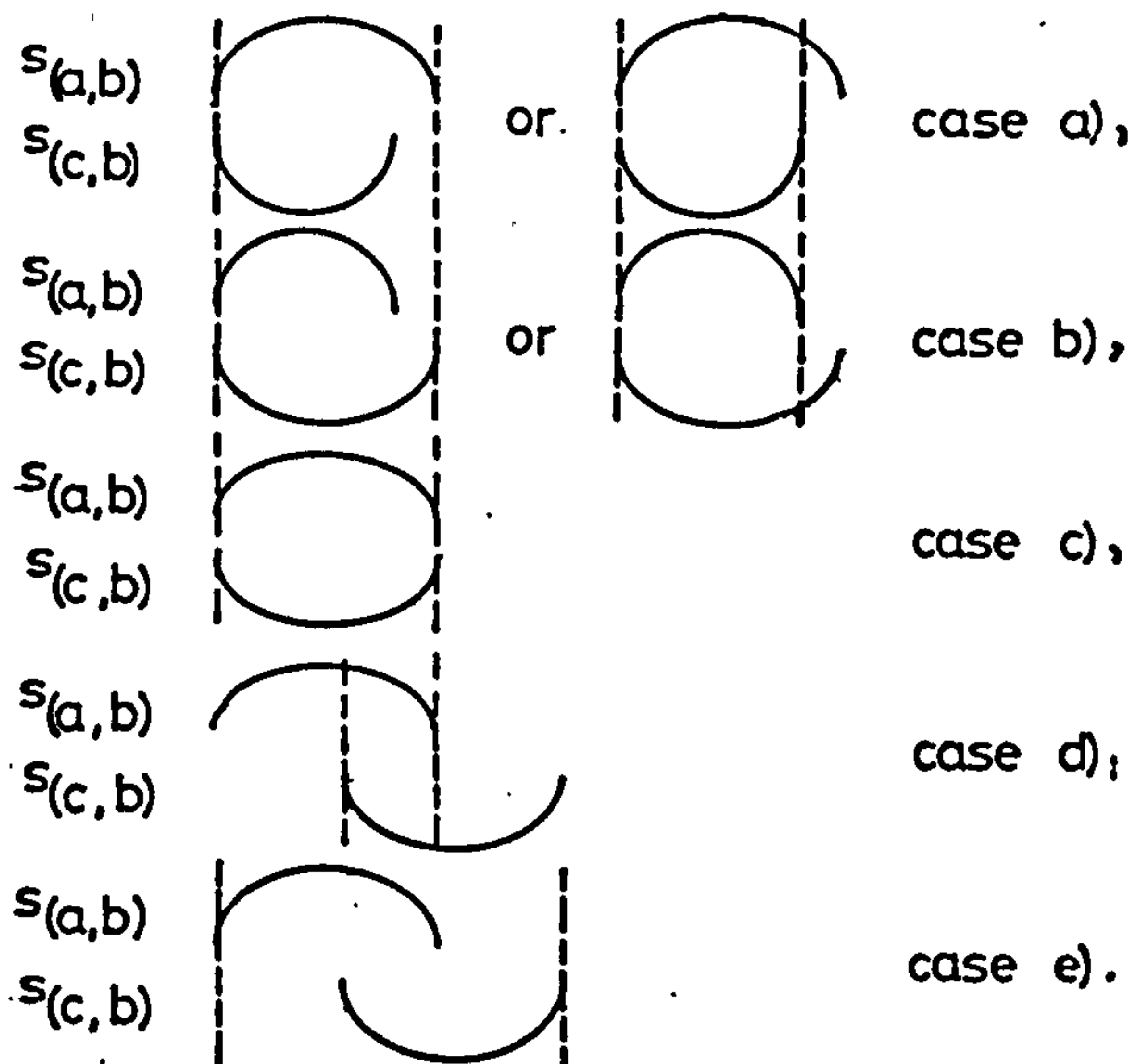
$$S_{(a,b)},$$

$$S_{(c,b)}.$$

Both of which have something in common (i.e. the local time of the observer, denoted by the b in the subscript).

7. 2,2 In terms of the local time of P_b , the observer, there are five ways in which these shared times may relate, while having something in common. Using the arc to

express the shared times, we have these possibilities,



Where the dotted bar lines $\|$ indicate the span over which the comparison is made.

- '7. 2,21 In case a, the observation made through local time $S(a,b)$ contains $S(c,b)$, that is, the behaviour of Object O_a contains the behaviour of Object O_c , attributed by the observer P_b . This is the form of implication,

$$\langle O_a \rangle = B_a \leftarrow B_c = \langle O_c \rangle.$$

- '7. 2,22 In case b, B_a is completely contained by B_c , giving the reverse implication to case a,

$$\langle O_a \rangle = B_a \rightarrow B_c = \langle O_c \rangle.$$

- '7. 2,23 In case c, B_a and B_c overlap, but neither is wholly contained in the comparison, giving a logical "and",

$$\langle O_a \rangle = B_a \leftrightarrow B_c = \langle O_c \rangle.$$

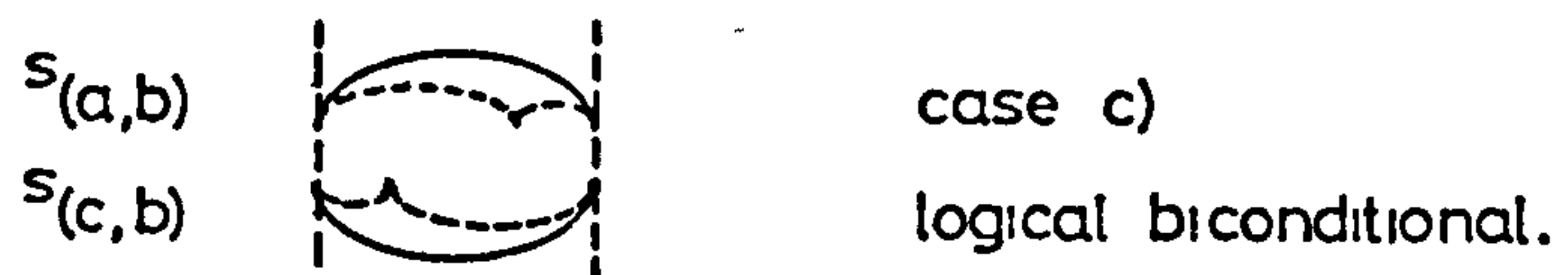
- '7. 2,24 In case d, B_a is completely contained by, and completely contains B_c , giving equality, or the biconditional,

$$\langle O_a \rangle = B_a \wedge B_c = \langle O_c \rangle.$$

- '7. 2,25 In case e, B_a and B_c overlap and they are both wholly contained in the comparison, giving a logical "inclusive or",

$$\langle O_a \rangle = B_a \vee B_c = \langle O_c \rangle.$$

7. 3, There is thus, in the necessary existence of each Object's local time, giving rise to the shared time of each observation, a computational logic in which implication in both senses (\longrightarrow and \longleftarrow), equality (\longleftrightarrow), and logical "and" (\wedge), and "inclusive or" (\vee), is already inherent. There is no negation, since comparisons can only be made when the observing Object can observe two other Objects during the same part of its local time.
7. 4,1 We have noted that implication is available in both senses. This means that cases a and b are the same computation with a different direction.
- '7. 4,11 Similarly, allowing a fracturing of the shared times of case c, we obtain,



Where the dotted arcs indicate the fractured times.

- '7. 4,12 This is effectively two implications operated successively in opposite directions. Thus the bi-conditional, \longleftrightarrow , can be treated as the implication, \longrightarrow , followed by the reverse, \longleftarrow , (or vice versa).
7. 4,13 Applying the same process to case d, we obtain,



In which the central section (at which the logical and operates) now takes the form of case c, and, by further fracturing can be treated as a pairing of implications, ($\longrightarrow \longleftarrow$). Each arc is, itself, fractured into two arcs, so that each of the little arcs is implied by the big arc, but only one little arc of which is involved in the computation.

7. 4,14 Finally, with case e, we obtain,



This is essentially the same as case d, except that all the little arcs are involved in the computation.

7. 5, In this way, we have established a computational logic that has only the operation "implication" (with a reversible direction).

7. 6, The computation of comparisons between observations made by one observer of two Objects may be executed by comparing the shared times against the observer's local clock. All these computations may be considered as being sequences of directional logical implications if a fracturing of the shared times is allowed.

- '8. 0, The finding of a relationship between observations of different Objects is the making of a Model.
- '8. 0,1 A Model exists in the Universe, and is therefore an Object.
8. 0,2 A Model is an Object placed in the role of a Model to another Object by an observer.
- '8. 0,3 By being placed in this role, an Object becomes a surrogate Object to another Object.
8. 0,4 A surrogate Object is used, together with that Object to which it is surrogate, to communicate an observer's view.
8. 0,5 The relationship is between the observations, that is, the behaviours,
- $$\langle O_a \rangle = B_a \Leftarrow [(X_a) P_b],$$
- $$\langle O_c \rangle = B_c \Leftarrow [(X_c) P_b],$$
- $$\langle O_a \rangle = B_a \longleftrightarrow B_c = \langle O_c \rangle.$$
8. 0,6 This relationship is one of identity.
- '8. 1, When the relationship is one of identity, the Model may be referred to as a Language, and may be denoted "L_{subscript}". A Language is a Model which is, in the view of the observer, identical to the Object,
- $$\langle O_a \rangle = B_a \Leftarrow [(X_a) P_b],$$
- $$\langle O_c \rangle = B_c \Leftarrow [(X_c) P_b] = L_c.$$
8. 2, There are three other relationships that may hold between two Objects.
8. 2,1 The first is containment or implication, in which one Object has all the qualities of the other, while the other does not have all the qualities of the one,
- $$\langle O_a \rangle = B_a \Leftarrow [(X_a) P_b],$$
- $$\langle O_c \rangle = B_c \Leftarrow [(X_c) P_b],$$
- $$\langle O_a \rangle = B_a \rightarrow B_c = \langle O_c \rangle.$$

8. 2,11 This relationship may operate in either direction.
It is clear that the converse is also possible (while not the same),

$$\langle O_a \rangle = B_a \leftarrow B_c = \langle O_c \rangle.$$

8. 2,2 The second relationship is logical "and", or sharing of a common area,

$$\langle O_a \rangle = B_a \Leftarrow [(X_a)P_b],$$

$$\langle O_c \rangle = B_c \Leftarrow [(X_c)P_b],$$

$$\langle O_a \rangle = B_a \wedge B_b = \langle O_b \rangle,$$

8. 2,21 Here, only a part of one Object is implied by the other. Calling this common part O_d , we have,

$$\langle O_a \rangle = B_a \Leftarrow [(X_a)P_b],$$

$$\langle O_c \rangle = B_c \Leftarrow [(X_c)P_b],$$

$$\langle O_d \rangle = B_d \Leftarrow [(X_d)P_b],$$

$$\langle O_a \rangle = B_a \leftarrow B_d = \langle O_d \rangle,$$

$$\langle O_c \rangle = B_c \leftarrow B_d = \langle O_d \rangle,$$

$$B_d \leftrightarrow B_d.$$

8. 2,22 Thus, the logical "and" can be seen as the sequential operation of two implications.

8. 3, The remaining relationship is summation, or the logical "or". Using O_d again to denote the common area,

$$\langle O_a \rangle = B_a \Leftarrow [(X_a)P_b],$$

$$\langle O_c \rangle = B_c \Leftarrow [(X_c)P_b],$$

$$\langle O_d \rangle = B_d \Leftarrow [(X_d)P_b],$$

$$\langle O_a \rangle = B_a \vee B_c = \langle O_c \rangle,$$

$$\langle O_a \rangle = B_a \rightarrow B_d = \langle O_d \rangle,$$

$$\langle O_c \rangle = B_c \rightarrow B_d = \langle O_d \rangle,$$

$$\langle O_d \rangle = B_d \leftrightarrow B_d = \langle O_d \rangle.$$

8. 4, The difference between the logical "and" and the logical "or" thus lies not in the logic, but in the direction of the implications.
8. 4,1 The whole logic is made up of a series of implications.
8. 4,2 The means by which these logical computations can take place is through the correlation of the observational times of the different Objects.
8. 5, Where an Object stands as surrogate for another Object, it is a Model of that Object.
8. 5,1 There is only one type of relation that exists between these two Objects, although the relation may exist in either direction, and may be applied several times. The relation is implication.
8. 5,11 Equality consists of two implications, opposite in direction, in which the change from Object O_a to the Model O_c is equalled but reversed in the change from the Model to the Object,

$$\langle O_a \rangle = B_a \longrightarrow B_c = \langle O_c \rangle,$$

$$\langle O_a \rangle = B_a \longleftarrow B_c = \langle O_c \rangle.$$

8. 5,12 Logical "and" consists of two implications, one each from the Object and the Model, to the area they share in common,

$$\langle O_a \rangle = B_a \longleftarrow B_d = \langle O_d \rangle,$$

$$\langle O_c \rangle = B_c \longleftarrow B_d = \langle O_d \rangle.$$

8. 5,13 Logical "or" consists of two implications, but in the reverse direction to Logical "and",

$$\langle O_a \rangle = B_a \longrightarrow B_d = \langle O_d \rangle,$$

$$\langle O_c \rangle = B_c \longrightarrow B_d = \langle O_d \rangle.$$

'8. 5,2 Using this one logical operation, together with its two directions, we can account for all our computations. There is no negation because if there is no relationship between observations of two Objects, one may not be surrogate to the other.

8. 6, Let us call the type of Model made by this operation, according to its direction of implication.

8. 6,1 If the implication is from the Object to the Model, we have,

$$\langle O_a \rangle = B_a \longrightarrow B_c = \langle O_c \rangle = M_c.$$

Where M denotes the role of an Object being surrogate to another Object.

8. 6,11 Put another way, with \tilde{M}_c representing this type of Model, which we call the Anti-Model, we have,

$$\begin{aligned} \langle O_a \rangle = B_a &\Leftarrow [(X_a) P_b], \\ \langle O_c \rangle = B_c &\Leftarrow [(X_c) P_b] = \tilde{M}_c(O_a). \end{aligned}$$

which means the same thing.

8. 6,2 If the implication is reversed, we have

$$\langle O_a \rangle = B_a \longleftarrow B_c = \langle O_c \rangle = M_c.$$

8. 6,22 Putting this another way, with M_c representing the Interior Modelling process, we have,

$$\begin{aligned} \langle O_a \rangle = B_a &\Leftarrow [(X_a) P_b]. \\ \langle O_c \rangle = B_c &\Leftarrow [(X_c) P_b] = M_c(O_a). \end{aligned}$$

8. 7, Thus, we use the expression Anti-Model \tilde{M} for a Model which contains the Object it Models, and the expression Interior Model M for a Model which is contained by the Object it Models.

8. 8, The computing of a relationship between the behaviour of two different Objects can lead to one Object being placed as surrogate to the other. The surrogate is called a Model; when the relationship is a bi-conditional, the Model is called a Language, when deduction an Interior Model, when inference an Anti-Model.

- 9. 0, A complex Object is an Object that stands for some other Objects, in some way, as observed by an observer.
- 9. 0,1 A Model[ⓐ] is an Object that stands for some other Object.
- 9. 0,2 A Model and the Object of which it is observed to be a Model are related by an observed area of commonness.
- 9. 0,3 A Model of a Model is also a Model of the Object of which the Model is a Model.
- 9. 0,31 A Model of a Model is thus a Model of two Objects: an Object, and another Object which is a Model of that Object.
- '9. 0,4 A transformation is a Model of a Model.
- 9. 0,41 Thus, a transformation is an Object which represents two other Objects and is a complex Object.
- 9. 1, Objects can be observed by an observer to relate together.
- 9. 1,1 The parts of Objects through which an observer sees them, are the Objects' Model Facilities.
- 9. 1,11 If Objects are observed by an observer to relate together, the relationship observed is in the observations of the Objects' Model Facilities making the behaviours the observer believes to be the Objects.
- '9. 1,2 The possible relationships between observations through the Model Facilities of observed Objects, as observed by the observer, are four, as already examined.

[ⓐ] The word "Model" is used in its Dictionary, rather than its Technical, sense.

9. 1,21 One observation through a Model Facility may share something in common with another in the observer's view,

$$[(X_a)P_z] \wedge [(X_b)P_z].$$

This is a logical "and".

9. 1,22 One observation through a Model Facility may contain another,

$$[(X_a)P_z] \rightarrow [(X_b)P_z].$$

This is a logical implication.

9. 1,23 One observation through a Model Facility may equal another,

$$[(X_a)P_z] \leftrightarrow [(X_b)P_z].$$

This is a logical equality.

9. 1,24 The possible connection by a logical "or" is compilation,

$$[(X_a)P_z] \vee [(X_b)P_z].$$

9. 1,25 These relationships reflect those between Object and Model, but with this difference: a Model is an Object surrogate to another Object while a complex Object is an Object which is the "result" of a computation between two other Objects (simples).
9. 2,1 Nothing in our Universe that is not an Object can be observed, and therefore exist.
9. 2,21 An observer gives behaviours to the two Objects.
9. 2,22 A commonness between these two behaviours can exist.
9. 2,3 The commonness is an observation made through the Model Facility of a complex Object. If it were not an Object, it would not exist in the Universe.

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9. 2,64 And the result of the "or" connection is,

$$\left\| \left\| B_a \leftarrow [(X_a)P_z] \right\| \vee \left\| [(X_b)P_z] \Rightarrow B_b \right\| \right\| \leftrightarrow \left\| B_c \leftarrow [(X_c)P_z] \right\| .$$

simple
simple
complex

9. 2,71 A complex Object stands for more than one other Object.

9. 2,72 A Model or Language stands for one other Object.

9. 3, A complex Object is an Object like any other Object in the Universe.

9. 3,1 The representation of an observation in the Universe is a surrogate Object.

9. 3,2 The representation of an observation of a complex Object must be by a surrogate Object.

9. 3,3 A complex Object exists, and is observed to be similar to, the simple Objects to which it is placed in the role of complex Object.

9. 3,4 The expression of this observation of the complex Object, is by a Model[®].

9. 4, A Model is an Object like any other Object in the Universe.

9. 4,1 If a relationship is seen by an observer to exist between the observations made of two Objects which are represented by a Model, the relationship may be represented by a Model.

9. 4,11 If the complex Object representation parallels the relationship between the simple Objects and the complex Object, in relating to the representations of the simple Objects, there is a complex Model.

9. 4,12 A Model representing a complex Object need not be a complex Model.

9. 4,13 A Model representing a complex Object will be a complex Model if it represents the simple-complex relationship observed between the Objects represented.

[®] In this context (9. 3,4 to 9. 6,) the term Model includes Anti-Model and Language (which are types of Model).

9. 5, Model Objects may be observed to have something in common.
9. 5,1 This commonness is embodied in a complex Model.
9. 5,2 A Model is an Object like any other Object in the Universe.
9. 5,21 A complex Model is an Object, like any other, in the role of complex Object, like any other complex Object.
9. 5,22 Since a Model is an Object in the role of representing another Object, a complex Model must represent some other Object.
9. 5,3 A complex Object demonstrates an observed similarity between two (or more) simple Objects.
9. 6, Objects which are observed by an observer to have similarities, have other Objects called complex Objects which also have the same similarities. Complex Objects are Objects in our Universe like any other Objects, put in the role of complex Object by the observer. The representation of a complex Object is a Model. If the Model representing the complex Object parallels the relationship to the Models representing the simple Objects, that Model is a complex Model. Languages can be related together by an observer.

- '10. 0, There are five basic forms of argument. They are Deduction, Induction, Abduction, Analogy and Identification.
10. 0,1 All arguments may be compounded from these five forms.
10. 1, All five forms may be derived from our form of implication.
10. 1,1 The form of a deduction from an Object to a Model is the form of an implication from the Model to the Object, or the form of an Interior Model,

$$\langle O_a \rangle = B_a \leftarrow M_c = \langle O_c \rangle.$$

10. 1,2 The form of an induction is, conversely, an implication from Object to Model, or an Anti-Model,

$$\langle O_a \rangle = B_a \rightarrow \tilde{M}_c = \langle O_c \rangle.$$

10. 1,3 The form of a tautology is the implication of a Model from an Object, and the implication of that same Object from the Model,

$$\langle O_a \rangle = B_a \rightarrow \tilde{M}_c = \langle O_c \rangle,$$

$$\langle O_c \rangle = \tilde{M}_c \rightarrow M_a = \langle O_a \rangle = B_a,$$

$$\langle O_a \rangle = B_a \leftrightarrow M_a = \langle O_a \rangle = B_a.$$

That is, an Anti-Model which is itself modelled by an Interior Model which is the same as the original Object.

- '10. 1,4 A tautology can also be achieved by the reversal of direction of implication,

$$\langle O_a \rangle = B_a \leftarrow M_c = \langle O_c \rangle,$$

$$\langle O_c \rangle = M_c \rightarrow \tilde{M}_a = \langle O_a \rangle = B_a,$$

$$\langle O_a \rangle = B_a \leftrightarrow \tilde{M}_a = \langle O_a \rangle = B_a.$$

10. 1,5 An abduction is a making of an hypothesis, and the creation of a new statement from that hypothesis. It is thus the construction of an Anti-Model from an Object, and the statement of an Interior Model of the Anti-Model which is not the same as the object,

$$\langle O_a \rangle = B_a \rightarrow \tilde{M}_c = \langle O_c \rangle,$$

$$\langle O_c \rangle = \tilde{M}_c \leftarrow M_d = \langle O_d \rangle = B_d.$$

Where O_d is abduced from O_a , or, more precisely, the behaviour of O_d as seen by the observer is abduced from the behaviour of O_a .

10. 1,6 An analogy is the converse of abduction, that is, it is the making of an Interior Model, then an Anti-Model which is not the same as the original Object,

$$\langle O_a \rangle = B_a \leftarrow M_c = \langle O_c \rangle,$$

$$\langle O_c \rangle = M_c \rightarrow \tilde{M}_d = \langle O_d \rangle = B_d.$$

Where O_d is analogous to O_a .

10. 2, Thus, all five forms of argument may be achieved by the operation of our Model making bi-directional implication.
10. 3, It will be noticed that the operation of an implication between an Object and a Model can be taken as the operation of a transformation on the Object, producing the Model (i.e. the transformed Object).
10. 4, If we wish to follow the various stages in a Modelling process, we may find the notation we have used (especially with respect to the similarity, or lack of similarity, between the Object and one of its Models) rather long-winded. It can be abbreviated to show the chain, read from left to right, using the forms M for Interior

Model, \tilde{M} for Anti-Model, and Q for the initial Object[@]. The difference between the Object and the Model can be shown by a marking of the Remainder (notated R). That which is omitted from the Object Q in making an Interior Model M is the Remainder R . Conversely, the Anti-Model adds in the Anti-Remainder \tilde{R} . An index is used for labelling purposes.

10. 4,1 Using this notation, we have the following,

10. 4,11

$$\underbrace{Q_1 \quad M_2}_{R_{1,2}} \quad \text{deduction.}$$

10. 4,12

$$\underbrace{Q_1 \quad \tilde{M}_2}_{\tilde{R}_{1,2}} \quad \text{induction.}$$

10. 4,13

$$\underbrace{Q_1 \quad M_2 \quad \tilde{M}_3}_{R_{1,2} \quad \tilde{R}_{2,3}} \quad \text{where } R_{1,2} \longleftrightarrow \tilde{R}_{2,3} \text{ tautology,}$$

$$\underbrace{Q_1 \quad \tilde{M}_2 \quad M_3}_{\tilde{R}_{1,2} \quad R_{2,3}} \quad \text{where } \tilde{R}_{1,2} \longleftrightarrow R_{2,3}.$$

[@] The notation is introduced to abbreviate and simplify the expressions. It should not be forgotten that we are, however, talking about one observer's computations carried out with the behaviours it attributes to the Objects.

10. 4,14

$$\begin{array}{c} \text{---} \text{O}_1 \quad \text{M}_2 \quad \text{M}_3 \\ \text{---} \quad \text{---} \quad \text{---} \\ \text{R}_{1,2} \quad \text{R}_{2,3} \end{array} \quad \text{where } \bar{\text{R}}_{1,2} \not\leftrightarrow \text{R}_{2,3} \text{ abduction.}$$

10. 4,15

$$\begin{array}{c} \text{O}_1 \quad \text{M}_2 \quad \bar{\text{M}}_3 \\ \text{---} \quad \text{---} \quad \text{---} \\ \text{R}_{1,2} \quad \bar{\text{R}}_{2,3} \end{array} \quad \text{where } \text{R}_{1,2} \not\leftrightarrow \bar{\text{R}}_{2,3} \text{ analogy.}$$

- '10. 5, Thus, the form of an argument may be deduced by comparing the Model, Object and Remainder.
10. 6, Thus, an initial Object can be re-constructed by the reversing of the process.
- '10. 7, Argument forms are the results of implications between the observed behaviours of different Objects, as seen by one observer. All five basic forms of argument may be constructed from this one operation, and thus the form of arguments can be understood from the Model types.

11. 0, A tautology is the statement of an identity, yet is shown in our logic as the result of two Modelling operations: two implications opposite in direction, but with the same Remainder and Anti-Remainder,

$$\begin{array}{c} Q_1 \quad \bar{M}_2 \quad M_3 \\ \hline \bar{R}_{1,2} \quad R_{2,3} \end{array} \quad \bar{R}_{1,2} \longleftrightarrow R_{2,3}'$$

$$Q_1 \longleftrightarrow M_3.$$

$$\begin{array}{c} Q_1 \quad M_2 \quad \bar{M}_3 \\ \hline R_{1,2} \quad \bar{R}_{2,3} \end{array} \quad R_{1,2} \longleftrightarrow \bar{R}_{2,3}'$$

$$Q_1 \longleftrightarrow \bar{M}_3.$$

11. 0,1 In making this identity, we are taking two opposite Modelling operations, and with the Remainder and Anti-Remainder being equal, we are cancelling the two steps against each other.
11. 1, In making an abduction or an analogy, in contrast, we cannot cancel the two steps, since the Remainder and Anti-Remainder are not the same. If the Remainder and Anti-Remainder were the same, the form of the argument would be the form of a tautology.
11. 1,1 In the case of an abduction, then, we have,

$$\begin{array}{c} Q_1 \quad \bar{M}_2 \quad M_3 \\ \hline \bar{R}_{1,2} \quad R_{2,3} \end{array} \quad \bar{R}_{1,2} \not\longleftrightarrow R_{2,3}'$$

$$Q_1 \not\longleftrightarrow M_3.$$

11. 1,2 In the case of an analogy we have,

$$\begin{array}{c} Q_1 \quad M_2 \quad \bar{M}_3 \\ \underbrace{\hspace{10em}} \\ R_{1,2} \quad \bar{R}_{2,3} \end{array} \quad R_{1,2} \leftarrow / \rightarrow \bar{R}_{2,3}'$$

$$Q_1 \leftarrow / \rightarrow \bar{M}_3.$$

11. 1,3 Thus, under the circumstances that the Remainder and Anti-Remainder are equal but opposite, two successive implications of opposite direction can be cancelled together.

11. 2, Let us call each implication a dimension^e of Modelling. It has direction which is shown by the Model form (Interior Model, Anti-Model).

11. 2,1 A tautology has no dimensions, since its two Modelling stages are opposite and the Remainder and Anti-Remainder are the same, e.g.,

$$\begin{array}{c} Q_1 \quad M_2 \quad \bar{M}_3 \\ \underbrace{\hspace{10em}} \\ R_{1,2} \quad \bar{R}_{2,3} \end{array} \quad R_{1,2} \longleftrightarrow \bar{R}_{2,3}'$$

$$Q_1$$

11. 2,2 By contrast, abduction has two dimension, firstly of Anti-Modelling, secondly of Interior Modelling,

$$\begin{array}{c} Q_1 \quad \bar{M}_2 \quad M_3 \\ \underbrace{\hspace{10em}} \\ R_{1,2} \quad R_{2,3} \end{array} \quad \bar{R}_{1,2} \leftarrow / \rightarrow R_{2,3}'$$

$$Q_1 \longrightarrow \bar{M}_2 \longleftarrow M_3.$$

^e Dimension is used in a sense analogous to that in which it is used by the Physicist and Engineer. The problem approached here is the starting point of this whole Thesis.

\tilde{M}_2 is the first Model dimension, M_3 is the second.
They cannot be cancelled.

11. 2,3 Similarly, analogy has two dimensions, but in the reverse order,

$$\begin{array}{c} \underbrace{O_1 \quad M_2 \quad \tilde{M}_3}_{R_{1,2} \quad \tilde{R}_{2,3}} \qquad R_{1,2} \not\leftrightarrow \tilde{R}_{2,3} \\ O_1 \longleftarrow M_2 \longrightarrow \tilde{M}_3 \end{array}$$

M_2 is the first Model dimension, \tilde{M}_3 is the second.
They cannot be cancelled.

'11. 3,1 If two Models of the same sense follow each other, they may also be cancelled. Obviously, an Interior Model of an Interior Model of an Object is an Interior Model of that Object,

$$\begin{array}{c} O_1 \longleftarrow M_2 \longleftarrow M_3 \\ O_1 \longleftarrow M_3 \end{array}$$

'11. 3,2 Similarly, an Anti-Model of an Anti-Model of an Object will be an Anti-Model of that Object,

$$\begin{array}{c} O_1 \longrightarrow \tilde{M}_2 \longrightarrow \tilde{M}_3 \\ O_1 \longrightarrow \tilde{M}_3 \end{array}$$

11. 3,3 The Remainder or Anti-Remainder does not affect the cancellation of one Model into another Model of the same sense.

- '11. 4, Thus, strings of Modelling processes may be cancelled into strings of simplified Model steps. These are called Model Dimensions.
- '11. 5, Using this technique of dimensioning, Modelling strings can be simplified, and analysed into their basic argument forms. From each pairing of final Dimensions, the form of the argument may be seen. Thus, keeping the Dimensions of a Modelling process is a way of keeping track of the argument set up, and is, with a record of the Remainders and Anti-Remainders, a means for ensuring the recreation of the original Object's behaviour, at some later time, by the observer, if the observer should wish to do this.

12. 0, The Object must observe itself before any other
observer can observe it.
12. 0,1 Nevertheless, its self-observation is private, and
cannot be seen by others.
12. 0,11 Thus, public existence is separate from private, but
depends on there being a private existence.
12. 0,21 Private existence allows existence in the Universe,
but does not allow others to know of the existence.
12. 0,22 Public existence is the knowing by others of the
existence of the Object.
12. 0,3 The progress of public existence is the Object's Life-
span.
12. 0,31 The first observation of the Object by an external
observer is its "birth". The last is its "death".
12. 0,32 There is no way of knowing "how long" an Object has
observed itself before an external observer observes
it.
12. 0,33 There is no way to know if an Object observes itself
after the last external observation.
12. 1, The Model Facility is that which permits observations
to be made of an Object.
12. 1,1 The Model Facility is that which makes sure observations
made of the same Object are made of the same Object.
12. 2,11 An observer observes the Object. The observation is
a behaviour.
12. 2,12 The Object observes itself. The observation is the
Essence.
12. 2,13 The Essence cannot be observed by the external observer.
12. 2,14 The Essence and the Behaviour are made through the same
Model Facility.
12. 2,2 As more observations are made by external observers,
the Behaviour increases.

12. 2,21 That which is the Behaviour cannot be the Essence.
12. 2,22 As the observations constituting the Behaviour increase, the remaining possibilities for the Essence, remaining unique, diminish.
12. 2,23 The Essence must be that which the Behaviour is not.
12. 3, As the Behaviour increases, the possibilities for the Essence diminish.
12. 3,1 Without the Essence, the Object cannot exist.
12. 3,2 The Object makes its own Essence through its Model Facility. Other Objects observe this Object through the same Model Facility and make its Behaviour.
12. 3,3 A behaviour cannot be the Essence.
- '12. 3,4 Ultimately, a behaviour must be attributed that is the same as the Essence, for there will be nothing else left.
12. 3,41 As this point is reached, the Object can no longer be externally observed.
12. 3,42 When the Object can no longer be externally observed, it is dead.
12. 3,43 The time during which the Object is externally observed is its Life-span.
- '12. 4, The same applies to the Awareness of the observer: as the Awareness increases, the observer's self-observation (Essence) is "threatened" the the observer's other observations.
- '12. 5, The increase of the Behaviour decreases the possibility of the Essence remaining private. If the Essence becomes public it is not the Essence. The Object becomes unobservable by external observers when the Essence is the only possible remaining behaviour of the Object. Once a behaviour has been attributed to the Object, its Life-span has begun, and it will gradually tend to the unobservable.

13. 0, In order to know something exists we must be able to observe it.
13. 0,1 If we cannot observe it, we cannot know it exists. We cannot necessarily affirm its non-existence, either.
13. 0,2 If we do not know an Object exists, we can usefully say nothing about it.
13. 0,3 A Thesis says things about Objects.
13. 0,31 If we cannot say things about Objects, we have nothing to say.
13. 0,32 If we have nothing to say, we should not try to speak.
13. 0,41 We state our Universe, thus, as being a Universe of observation.
- '13. 0,42 We are not concerned with other possible Universes.
13. 1, For an Object to exist in our Universe, it must be observable.
- '13. 1,1 The Universe contains only observable Objects.

EXPLANATORY TEXT

- "O. 0, The only way in which we can know things is by a personal experience of them: and that presupposes that we can, in some form and sense, observe that thing. This view is established by Laing, et al^(*60), and given wider context by Bannister and Fransella^(*12), in their presentation of Kelly's^(*56) Theory of Personal Constructs. Bannister and Fransella make the quite reasonable point that it is difficult to talk about any set of personal constructs, without assuming a personal interaction with the World, and thus, personal knowledge. This is, clearly, the underlying belief of the cognitive view of the World.
- "O. 0,2 The same view lies at the base of Existential philosophies (as colourfully depicted by, e.g. Sartre^(*92), in his novels): that is, we may only speak with authority about those things of which we have knowledge.
- "O. 0,32 The point thus becomes to eliminate those things of which we have no knowledge from any attempted discussion. This can be done by pairing the "unspeakable" with the "unknowable". The same sentiment is used by Wittgenstein^(*108) to terminate the discussion in his "Tractatus".
- "O. 1, This does not, in any way, deny the existence of other things than those of which we have experience, but it does insist that we can say nothing about them (not even that we cannot talk about them, which is the central paradoxical theme of much of Beckett's^(*110) work, especially "The Unnamable").
- "O. 1,1 In this way, we provide the "entry qualification" to our Universe: that the Universe contains only observable Objects.

"1. 0,2 Bishop Berkeley's views of our Universe (i.e. the view of the Idealist School as discussed in Passmore^(*112)) is the one that immediately springs to mind. His basic interest was in the means for keeping Objects in the Universe observed, and to this end, he invoked God. The series of Limericks shows the argument perhaps more clearly than any other statement:

There once was a man who said, "God
Must think it exceedingly odd
If he finds that this tree
Continues to be
When there's no one about in the Quad."

For which the Idealist answer was,

Dear Sir,

Your astonishment's odd:
I am always about in the Quad-
And that's why the tree
Continues to be,
Since observed by,

Yours faithfully,

God

However, the stance of this Thesis is slightly different, for we insist on the Objects in the Universe observing themselves (and hence being present in the Universe);

Dear God,

Why did you forget me?
I don't need another to see:
I don't need no bod
Around in the Quad:
I'm observing,

Yours faithfully,

Tree.[@]

[@] See the Appendices

Certain objections are normally set against this type of self-observing system: a complete description which is consistent, is necessary (as shown by von Foerster^(*37)), if an Object is to maintain itself in this manner. Yet Gödel^(*46) argued convincingly that it was doubtful if such a system could be assumed to exist. (The system put forward in this Thesis avoids this problem, as will be shown presently). However, Winnograd^(*106) has made such an Object (an algorithm for self-reproduction), albeit a rather simple Object, and Löffgren^(*64) has demonstrated a theoretical condition for complete self-reproduction.

- "1. 0,4 This self-observational quality has inherent in it a concept of priority (which will be covered in depth later): all Objects in our Universe have to be self-observers, in order to be in the Universe. Clearly, for any Object to observe any other (in the Universe), both Objects must already exist (otherwise they could not observe/be observed).
- "1. 1, However, this isolation of each Object, its self-dependence, means that the Universe is built up of separate entities, in the manner of Piaget's^(*85) child's Universe; each Object observes itself, regardless of the observations made of it by other Objects. That is, each Object is isolated, and, if it has any relationship with another Object, the relationship is secondary to the Object's isolated existence.
- "1. 1,12 The ability to observe the self is permitted through the incorporation in the self of the "Model Facility", in each Object (and it should be noted that this is a characteristic of all Objects in the Universe, and

not merely "intelligent" ones: it applies equally to electrons and to elephants. In this respect, this Thesis is an advance on von Foerster^(*36), who has come nearest to a similar formulation). The Model Facility within the Object is that which permits observations to be made - in this respect it is rather like a gate into a field - and thus provides a means for Lilly's^(*63) self-meta-programming to take place.

"1. 2,2' Thus, the Object contains, in itself, not only the Object (of observation), but also the observer, and the means for observation to take place (the Model Facility).

"1. 2,3 This is achieved by the cyclic form of the Object, for the Object observes itself, and is thus both observer and observed. This involvement of the observer in the realisation of the Object is a cognitive view of observation, and its relationship to that which is observed, (von Foerster^(*33)). In other words, we must observe in order to know, and our observing also forms that which we can know. The circularity of this form of observation of the self echos the specification for life put forward by Maturana^{(*65)(*120)}, and taken as an a priori by von Foerster^(*36), to the effect that life is that which sustains life. Other circular descriptive forms exist (the serpent eating its own tail is one of ancient lineage), and Ashby^(*8) has shown the need for this self-observational facility (the Model Facility) if any form of the necessary control to main stability is to exist in a system.

"1. 3,11 This explanation of the nature of the inhabitants of

the Universe leads to the understanding that Objects are essentially private, and therefore cannot be fully explained by any description. The Essence of the Object lies within the Object itself. Our common experience in consulting a dictionary (as with the feeling that we cannot see all), for example, shows us this: for if we keep on referring to each individual "meaning" in the dictionary, we will eventually end up looking up the original term we could not understand. This circularity of meanings is reflected in Pask's^(*79) proposition of a "Knowledge Entailment Net", and is also paralleled in the form of our Objects, with their inherent cyclicity, leading to the view of the Essence.

- "1. 3,12 The privacy of the Essence is an old philosophical concept, as in, for instance, Hegel^(*50).
- "1. 4, The inclusion of the Essence in the formulation of the Object, indicates the uniqueness of each Object, and, indeed, the already talked about privacy of each Object. This is a spatial distinction between Objects.
- "1. 5, A possible explanation of this Universe is the Solipsist's contention that the Universe is the construction of the observer. This argument would make the Essence of each Object basically irrelevant, but it has been well answered by von Foerster^(*37), who suggests that, if "I" observe an Object which "I" have supposedly invented, and that Object can converse with "me" (i.e. can form a "mental picture" of "me"), then it is difficult to know that it was not he who, in the first place, invented "me", so that "I" could invent him. If this is the case, there is no point

in accepting the Solipsistic argument, because it cannot lead us to any conclusions. This pragmatic dismissal of a point-of-view, as being "inefficient", is a very cybernetic stance.

- "1. 5,2 On the other hand, the statements of this Thesis do not, either, support the contentions of the archly contrasting Behaviourist School (as exemplified by Skinner^(*97)). The use we make of the term behaviour is a cognitive use, involving the interaction of both the observer and the observed. For this reason, many simultaneous (and possibly contradictory) descriptions of an Object can exist.[ⓐ]
- "1. 6,1 However, there are limits to the behaviours that can be attributed to the Objects, and these are limited by the Model Facility. This is how the Model Facility becomes the seat of "meaning" within the Object: and the observer attributing a behaviour to an Object must do so through the Model Facility. In this respect, the Model Facility resembles the means for operating at the L⁰ level in Pask's^(*82) paradigm.
- "1. 7,4 The attribution by an observer of a behaviour to an Object is, however, the Object, to that observer (at the time). For the observer (not being the Object) has only this view of the Object. The differentiation in the text is to show formations and roles. But it should be understood that the behaviour which an observer attributes to an Object is that Object, to that observer.
- "1. 8,12 Many observations (by many observers and/or at many

[ⓐ] This is essential to the intentions of this Thesis, and, for this reason, any description that dismisses this richness of views is contrary to our stated aims.

times) of an Object can exist, full of apparent contradictions, for they depend on the observer as well as the Object. Thus, although each individually attributed behaviour may be clear-cut, the combination will not be. At the moment, the techniques evolved for the handling of such loosely defined collections are not really appropriate to this concept.

Zadeh's^(*109) Fuzzy Sets are (as has been noted in the introduction) inapplicable because they fuzzify after the statements have been forced into a very tight and simple framework, and they are not capable of sustaining individual, and contradictory, views. Nevertheless, they are a better statistical technique than has previously been available, and the Behaviour does share something in common with a Fuzzy Set.

"1. 9, We have now derived three different ways of looking at our Objects, the Essence, the behaviour, and the Behaviour: each is, in its own way, the Object for the observer, and the Object is thus all three.

"1. 9,3 On the other hand, there is a priority in these views of the Object: the Behaviour assumes that there are already some behaviours, and a behaviour (as has been explained) assumes the Essence of both the Object being observed, and the Object observing.

"2. O,12 Observing involves the interaction of the two participants in the observation: the Object being observed is observed through the observer's connection with its Model Facility. Because of this, no observation can take place without this change in form: yet the Essence of the observed Object cannot be seen. This leads to an Uncertainty (which helps account for the different views held by different observers of the same Object), and reflects aspects of Heisenberg's^(*51) Principle, in that the Object as observed is not the Object as it observes itself[@]. For the external observer to observe the Object, involves the observer taking over the role of observer with the Object's own form, and producing the observer's view of the Object. There is thus, whenever an external observer observes the Object, a necessary change in the Information inherent in the Object. In the case of an atom, Heisenberg could talk about this as a photon, but there is no such physically measurable unit for epistemological "atoms".

[@] This analogy is perhaps a little farfetched, but it was of great help in the forming of this Thesis. The Uncertainty of Heisenberg's Principle comes from an observational problem in a space of reduced dimensions, and from the problem of significant energy transfer. Our Uncertainty comes also from the impossibility of seeing what is, but not because of energy transfers, which do not concern us. Rather, our Uncertainty comes from the very identity of the Object and the observer. Nevertheless, Heisenberg himself was not at all averse to pushing analogies like this, especially in relation to "indeterminate art forms".

- "2. 1,2 In participating in this observation, the observer makes a behaviour for the Object. However, this behaviour is equally a product of the observer as it is the product of the Object. The same observation could, then, be attributed to the observer: and when this is done, it is called an awareness.
- "2. 1,3 There is thus, a critical difference in roles. The observation is the same, but it can be related to the observer just as it can be related to the Object. Similarly, an Object in the Universe can be in the role of observing, just as well as it can be in the role of observed.
- "2. 2,41 And, as with a behaviour, so it is with the matter of priority in the awareness: for there to be an awareness, there must be an Essence, in both the Object, and the observer.
- "2. 2,6 The Awareness also bears a similarity to a Zadeh^(*109) Fuzzy Set, in the same way as a Behaviour. We are all aware, as a matter of Common Experience, how we can hold "inconsistent" and "contradictory views": to talk about the Awareness in the same way as we discussed the Behaviour seems therefore to be reasonable.
- "2. 4,1 In this way, the observer's Awareness becomes his view of the Universe: that is, an observer's Awareness is the sum of his views of the Universe, and is completely subjective. Even a set of observations of the Universe made by an "objective" observer would be uniquely and necessarily its own view, and would be thus subjective.

- "3. 0,11 The totality of an Object is vital: it needs not only that which is observed, and that which observes, but it also needs the means of observation. Without all three parts being present together, the Object does not exist in the Universe.
- "3. 0,15 In order, then, to consider the Model Facility as an Object[@] (which it is not: it is part of an Object), we must turn the Model Facility into an Object itself (otherwise we cannot talk about it, in this Universe). We therefore make a "Model Facility Object", by letting the means of observation both observe, and be observed by, itself. This deception would appear to be a possible means of accounting for the reproduction of organism (viz. Maturana^{(*65)(*120)}).
- "3. 1,2 From the foregoing, it is possible to discuss some of the properties of the Model Facility, to try and better understand its character. As with Andréka, Gergély and Nemeti^(*44), (in their characterisation) the Model Facility (which they refer to as a Calculus) is the in-built means by which a system calculates its own characteristics. In order to do this, the Calculus requires an interpretation in a syntactic plane, on a semantic domain. In our case the observer interprets what he sees through the Model Facility: The Model Facility structure is the syntactic plane, in which the semantic domain is operated on. In other words, the Model Facility is that through which relationships (in von Foerster's sense^(*36)) are computed.

[@] the (observed Object) and the observer have already been stated to be Objects, and can be formulated as such.

- "3. 1,41 The observer's observation through the Model Facility is thus regulated by the characteristics of the Model Facility. An inappropriately attributed behaviour can therefore be thought of as being "wrong". However, a "design intention" of our Universe is that contradicting behaviours should be attributable by various observers at various times, and so the concept "right" cannot be held in the normal form: for that is an "objective" overview, and an external observation. Fortunately, Turing's Test (as reported in George^(*40)) can be used in this context, allowing the "rightness" of attributed behaviours while the Object itself does not act in some contradictory manner (in the observer's view).
- "3. 1,6 Nevertheless, the structure of the Model Facility, locating, as it does, meaning, is the seat of Chomsky's^{(*26)(*28)} Deep Structure, for it is through this that the Object takes on its existence for each observer.
- "3. 2,41 And it is also because of the commonness of the Model Facility to all observations, that the Object may be named (and notated $\langle O_d \rangle$), as being the same Object in all views. Without this, the Object behaviours would have nothing in common, and we would not be able to assume any identity in an Object about which we speak.
- "3. 3,21 In this manner, Hjelmslev's^{(*52)(*53)} "Glosseme", or basic structural unit of meaning bearing, can be identified with the Model Facility, which is that which gives the Object a meaning, when observed. This is the "atomic" unit of meaning! but it cannot be, as Hjelmslev would have liked, examined for its

characteristic structures, because an observer's observation using a Model Facility, yields an Object. This view is in contradication, however, to de Saussure's^(*93) belief that the relationship between the signified and the signifier (being the two necessary parts of a sign) is arbitrary, because, in our case, there is a very clear structure in the Model Facility that participates in making the "appropriate" attributions that an observer may draw. In a certain respect, this view appears to have more in keeping with that of de Selby^(*95) who takes a more symbollic view of naming, suggesting that there is a necessary link between the Object and its name. It should be pointed out here that we are not usually talking on exactly the same plane as the works we have discussed: they are concerned explicitly with the representation of some Object, while we are talking of a pre-linguistic level, in which we observe the Object through its Model Facility, attributing to it an appropriate behaviour. However, later sections on representation will make the parallels clear on the overtly representational level.

"3. 7,11 It might appear that there is no way in which the observer can "form his view" of the Object (i.e. the Object might appear to be dominant in this explanation). But this is not the case, because the observer, being a self-observer, as well, is constantly reprogramming himself (in Lilly's^(*63) sense) through his own Model Facility. Thus, his ability to have a view of his own, depends on his own Model Facility, and there is thus an appreciable difference between

observations made, according to each observer's Model Facility. We would, of course, expect nothing else, and a considerable quantity of experimental work bears this out, for instance: Arbib^(*5), in general cybernetic approaches; Lettvin et al^(*62); in the field of physiology; Gregory^(*48), in perception and bionics; and Berger^(*18), in art.

"4. O,31 Observations may be made by any observer which cares to make them. That is to say, any observer may try and observe an Object by means of its Model Facility. This includes observers outside the Object itself, as well as the Object's own self-observation.

The observation which the Object makes of itself involves no reference to anything that is not a part of the Object. In this sense, it is a private observation, in that not only can only the Object itself make this observation, but there is no external reference that is involved in making it. It is not possible to be insistent about this, but it would appear that this self-observation is probably uncommunicable, and that this is why it is not possible to get an "accurate" picture of what any Object really is. This is, of course, an anti-objective view of the Universe: but then, so is the whole of this Thesis.

"4. O,33 On the other hand, an observation made of an Object by an external observer is a public observation, in the sense that it is made with a reference to something outside the Object itself (i.e. the external observer), and it is most definitely communicable (as we shall see).

Thus, there are two levels in this Universe: the private and the public.

This differentiation between the two levels is reflected in Ashby's^(*9) discussion of the predominance of the Black Box in his work. The Black Box cannot

be examined except from the point of view of its behaviour (measured as input/output correlation). This is how we arrived at the use of the term "behaviour" in describing the Object when observed by an external observer. What actually happens in the Black Box cannot be seen by an external observer (it is thus the Object's Essence), being private. Our interaction with this privacy is public, and is not the same as the private self-observation.

"4. O,42 Similarly, there is a differentiation to be made in the observer: the observations that are made of the self are private, while awarenesses are public, in that they involve a reference to some Object outside the observing Object's self.

"4. O,43 These two levels permeate, therefore, the whole Universe.

"4. 1, However, these two levels are not on an entirely equal footing, since one presupposes the other. Observations in this Universe have been shown to have certain pre-requisites: in order for an external observation to be made, we have shown, there must be already both an observer to make the observation, and an Object, of which the observation can be made. Both of these are, of course, Objects, else they would not inhabit our Universe. Yet, for an Object to exist in this Universe, it must be a self-observer. Self-observation is private, external observation is public, and self-observation must exist before any external observation can be made. Thus, an external observation presupposes self-observation by both the observer and the observed.

A sense of priority of this sort is, of course, not unusual. Pask's^(*78) theory fo intelligent functioning involves itself in precisely the same sort of suppositions, where a "m-individual" is the result of the representation of a "p-individual".

"4. 1,14 However, both these types of observation are made through the same Model Facility (if they were not, it would be difficult to insist that they were of the same "Object"), and it is this which is essential to the possibility of there being observations, and to the establishment of the two levels. In effect, the Model Facility acts as the description of the Object itself, needing the presence of an observer using it to establish an observation which is (to that observer) the Object. It is in this way that the problem of the complete and consistent Universe that Gödel^(*46) questioned is made irrelevant. Our Objects, containing the form of their own descriptions (their Model Facilities) do not need to refer externally to any other Object, in order to exist. Each is, as it were, its own axiomatic system, and needs no elaboration in the form of theories that may or may not be consistent and complete.

"4. 1,3 The circularity of form of the basic Object description, that of the Essence, is not itself unique: this form has been used by e.g. Maturana^{(*65)(*120)} (in his description of what life is), in order to get over the problem of a recursive definition, returning to some infinite nothingness, or some atomic axiom (and thus to Gödel's problem). Indeed, the form of circular definition is becoming more pervasive, no doubt because it does seem to avoid these problems.

"5. 1,2 The nature of an oscillator is to switch consecutively from one state to another, the switching on of one state being the trigger which will eventually switch on the other state (turning off the original state at the same time). In this switching, the oscillator actually generates a timesense of its own, based on the property of this state switching. (Andad nowadays we use this oscillatory motion, at an atomic level, to provide the yardstick against which we measure a consensus General Time). De Selby's^(*94) experiments with oscillators formed from Objects and their self-observations in mirrors, reflect most accurately the sense in which our Objects are oscillators, generating their own times.[ⓐ]

"5. 1,23 Thus, each oscillator has two half-cycles in its time unit: in our terms, that half when it is the observer observing, and that half when it is the Object being observed. This half-cycle delay in the making of an observation (i.e. between the receiving of a signal, and its transmission, or, in our terms, the making of the observation and the being observed) is a standard feature of almost all computational and automata theories, especially those which are based on some biological or neurophysiological understanding, e.g. McCulloch^(*67), George^(*39), Minsky^(*71) and Arbib^(*5), where the receiving of an impulse (in a neuron) always implies a delay in the transmission of the impulse by the same neuron. (The delay is not necessarily a half-cycle, because the neurologist is talking of the transmission along a chain. However, the functioning of most neurons can be described in terms of their own half-cycles:

[ⓐ] Although de Selby's times are reversed.

that is, the two halves are "being able to receive an impulse" and "being able to transmit an impulse". When viewed this way, a neuron is an oscillator, just as our Objects are).

"5. 1,5 As de Selby^(*94) originally noted, and Brown^(*21), Varela^(*114) and Günther^(*49) later reaffirmed, the output of an oscillator produces an Infinite Regress, of the sort discussed by Dunne^{(*30)(*31)}, in his paradox of the painter painting the World. But whereas Dunne has no method by which to handle this regress (except for mapping it onto another regress, which is (temporarily?) running parallel to the first, one time unit behind), the subtlety of the form that we give, here, to an Object, is that it is a machine that produces this regress (although we cannot observe the regress itself), and as such can be handled as an entity.

"5. 2,2 The generation of time, in our Universe, is, then, an inherent result of the actual formulation of a specification for Objects to exist in the Universe, and the production of time by each Object depends solely on the Object itself, and the changing roles it must assume, to be able to exist. Time is, therefore, local, being produced by each Object of itself. A General Time, of the sort we use for measuring and for synchronisation, is a construction of ours, rather than a general co-ordinating reference, basic to the Universe. Our common experience supports this view: for, even when referring to the reference clock of General Time, we have to say, often enough, "Oh! Is it really eight o'clock already?"

2

- "5. 4,2 Since time is local to each Object it follows that the observer and Model Facility parts of the Object synchronise into the Object's own time (this is how the Object's time is generated).
- "5. 5,2 Equally, the times of external observations must related to the times of the Objects being observed, at the moments of observations: otherwise, there would be no way in which the (external) observer could correlated with the time sense of the Object being observed, and thus observe the Object, in the way our formulation decrees. The correlation between the observer and that which is observed is another point which we have in common with Dunne^{(*30)(*31)}.
- "5. 8,12 Thus, the external observer, slipping into a vacant slot in the formulation of the Object which is being observed, can only observe during the half-cycle when that observational slot is vacant. This characteristic of observing has been argued by Petri^(*84) in his proposal for a temporally based system of computation. His computation is, in this respect, very similar to our observation. Dunne^{(*30)(*31)}, also depicted a similar means of observation, which he related to Heisenberg's^(*51) Uncertainty Principle, explaining that the minimum photon necessary for the making of an observation, could only be transmitted when there was this observational correlation of times, and that, in this time sense, lay the necessity of the incomplete observation.
- The correlation of these times (that of the observer and that of the observed) is familiar in the latch-on effect that occurs between independent physical oscillators running at similar (but not identical) frequencies.

"5. 10,1 It is important that the times of observer and observed only correlate when there is an observation being made, for, since this temporal correlation provides the means for making observations, and for computing relationships, a general correlation could imply a constant observation of all Objects by all other Objects, all the time! It could also be seen to imply an Object which was not like all other Objects in the Universe, a General Time which controlled all other Objects.

The same process of temporal correlation can if treated in this temporarily correlative way, account for memory (and that we do not remember everything all the time, or everything all at once). Miller's^(*69) somewhat naïve paper on the number of parallel data we can process in our brains at one time, suggests a physiological and psychological limit to the number of simultaneous observations one observer can make, at any one time on his local clock: and, although one may disagree with his detailed conclusions (i.e. 7 $\frac{1}{2}$ independent simultaneous data), one must agree that a type of limited parallel processing does appear to operate in the human brain's performance.

- "6. 0,4 The privacy of self-observation has already been established. Objects can observe themselves, and these observations, being only of the Objects' selves, are private.
- "6. 0,5 Equally, the observations made by external observers of Objects, are public, involving reference to an Object (observer) outside the Object being observed. However, this is not to say that the observation made on the public level of existence can be seen by any observer: for, in itself, each observation is made only by one observer, of one Object. Thus, each observation is unique, and, leading to a behaviour (and an awareness), it is made only of the observer and the Object.
- "6. 1,13 Thus, an observation cannot, in itself, be observed by any observer other than that which makes it, and observations cannot be transmitted. Yet, we can transmit messages, as we know from Common Experience, and so our theory should account for this. The necessity of our accounting for communication is further emphasised by the development of a whole Communication Theory (Shannon^(*96)), with which our theory has certain differences[@], as will be explained later.
- "6. 1,2 If we cannot transmit the observation (i.e. the behaviour) itself, we must find another means by which we can transmit our messages. If we suggest a second Object, which the observer observes to be similar to the first, we have a means for the communication of messages: for a second observer may also observe the two Objects, the one of which is similar to the other, and may thus compute a similarity. This second Object that stands for the first, is called a representation. In this respect, we

[@] because it has different concerns;

agree with Wittgenstein^(*108), when he talks of the non-observation of the Object itself, but the observation of a representation of that Object (which stands in an assumed one-to-one relationship with that Object). However, our agreement only extends to the communication of observations, not (as does Wittgenstein's) to the actual observations themselves.

- "6. 1,3 We therefore require the presence of some second Object, for which a behaviour can be constructed which is to the original observer similar to that of the original Object, in order for communication to be possible. This reflects Pask's^(*79) test for learning (i.e. the understood communication of behaviours) in a conversation, where the learner is required to construct an Object with a similar behaviour to the behaviour of the part of the system he is learning, in order to show he has understood the system. Pask refers to this as a Modelling Facility: but this should not be confused with our Model Facility.
- "6. 2,21 What we are communicating, therefore, is not the Object itself, but a similarity that we compute between the behaviours we attribute to two quite separate Objects. And in this construction of the behaviours must lie the means for the computing of similarities, for we have recourse, in our formulation, to no other things than the two Objects, and the common observer. (How this is done will be covered later).
- "6. 2,4 Communication is by observation of two Objects, one of which is surrogate (to use Negroponte's^{(*73)(*77)} word) to the other. This is rather like Turing's Test, (as recorded by George^(*40)) for intelligence: where if a communicating Object behaves as intelligent, it must be assumed to be intelligent!

"6. 4,1 However, pointing out some similarity between two Objects to a second observer (to whom the first observer wishes to communicate), does not mean that the second observer will make the same observations as the first: indeed, as we have already discussed, he cannot. But he will be able to observe the two Objects, attribute his own behaviours, and then compute a similarity between them.

"6. 5, Since the observations of the two communicating observers are not the same, the first observer needs more than to be able to transmit his message in order to be confident that he has communicated: but, if the second observer can transmit back to the first observer what he (the second observer) believes the first observer intended (by means of the same sort of surrogation), the first observer has the possibility of judging if the second has constructed a similar similarity to his own. This is known as a conversational idiom, and was initially developed by Laing^(*60), whose idea has been extended and justified by Pask^{(*79)(*82)}, through the extensive development of Rescher's^(*89) Logic of Commands.

"6. 5,11 The initial observer now has both his view of the Object, and the second observer's view of his view: and this is, of course, an error regulator, for he can act in order to correct the difference (if any) in these views. Ashby^{(*9)(*10)} has examined the means for such corrections to be applied, but this is not our concern here. What we have established is a conversational form that is similar to Miller et al.'s^(*70) TOTE unit. The presence of the TOTE unit (Test Operate Test Exit) here confirms Pask's^(*81) belief that it is not just a mechanism, but is an underlying form of cybernetic (and hence communicative) systems.

"6. 5,32 In this sense, we have come up with a theory of communication which, while not matching the formulation of Information Theory (and, particularly, as we shall see later, allowing for new and unpredictable outcomes in situations), does match the requirements of Wiener^(*103) for a cybernetic system.

- "7. 2, An observer must be able to attribute behaviours to several Objects at once, if it is to be able to transmit messages in the manner described. This is made possible by the oscillatory nature of its roles (observed/observer) in its self-observation. When, in its self-observation, it is observed, it can observe other Objects. The limits to the number of observations that can be made at once (maybe 7 ± 2 for humans - see Miller^(*69)) depends not on the nature of the process of observation, but the nature of the observer.
- "7. 2,2 Observations of Objects require the correlation of the times of the external observers and the Objects being observed. And it is in the relationships between these correlated times that we have an in-built means for the computation of similarities (and other logical relationships). The partial overlapping of observations (made at the same time in respect of the observer's half-cycle) gives a means for the inclusion of one observation within another. Thus our logical operators develop from the necessary times of observations, giving us a temporal logic (see Baer^(*111)). So, it is the behaviours, and not the Objects, which are related through the times of observations. In this way, of course, the observer is establishing his own hierarchy from a set of non-hierarchically organised Objects. In this respect, our Universe consists of a vastly large number of little isolated things, arranged non-hierarchically, and for which behaviours, being attributed by different observers, are non-predictive: another reflection of Wittgenstein^(*108).@
- "7. 2,21 Our means of combination, so gathered, account for the logical connectives of our Universe. Thus, the implication, for instance, from the Object "Light Green", infers the Object "Green",

@ Personally, I find this very depressing.

- "7. 2,22 or its reverse from the Object "Green" deduces the Object "Light Green".
- "7. 2,23 The logical operation "and" can be demonstrated by the Object "Green" and the Object "Box" combining to form "Green Box",
- "7. 2,24 while equality can be exemplified by the Object "Finnish" and the Object "The Language of the Finns".
- "7. 2,25 Finally the logical operation "inclusive or" can be shown in Object "Green Field" or Object "Green Plant" combining to "Green Field or Plant".
- "7. 4,11 However, all these operations can be "fractured" into a chain of implications (facing either direction), giving us but one logical operation facing in two directions. This fracturing is a descriptive convenience, and is not necessarily contained by our temporal logic which operates by the different possible relationships between two different observations.
- "7. 4,12 Nevertheless, this means of representing the relationships (especially reflecting the bi-conditional), matches the techniques of Günther^(*49), Löffgren^(*64), and Pask^(*78) in explaining a cyclic means of evading Gödel's^(*46) problem by making a Model of a Model of an Object which is the same as the Object itself.
- "7. 6, The notable peculiarity of this logical system is that it has only one relator (although this has two directions). Previously, Brown^(*21) had evolved a logic of two variables, based on the repeated crossing or the re-crossings of a line of distinction (although Varela^(*114) has recently shown a third variable of self-reference to be necessary to complete the system, which Patrick Welles is actually using in simulations at Columbia University). The reason for the need for only one variable would seem

to lie in the absence of the concept of negation, which is missing because a negation is not the computation of a similarity. A negation is being stated at any moment when two observations are not being made.

- "8. 0, Using this computational relator, we can make Models of Objects - but Models which are extremely abstract, since they are not concerned with detailed mappings between Objects and Models. This does not imply any contradiction with the work of, for instance, Klir^(*59), and Robinson^(*90) on Model Theories; our interest assumes the mappings of which they talk without investigating their classifications.
- "8. 0,1 Not that this implies any hierarchical structure - for a Model must be an Object just like any other Object, in order to inhabit the Universe.
- "8. 0,3 This role taking is very important: what it means is that the "real world" is at whatever Objects one wishes to place it, and any Model is equally real - but is placed in a relationships to an Object that reflects the observer's hierarchy, and thus appears, to the observer, not to be "real". Any Object with an Essence (i.e. any Object in the Universe), is, therefore, potentially in the "real world" of the observer. It is for the observer to choose those Objects that, at any one time, will be considered by him to be "real". In this way, the consideration of Models is essentially insignificant.
- "8. 1, Nevertheless, there is behind this a profound truth: that it is never the Object which is observed, and that any insistent representation of any objective form of reality is false: for the Object itself (i.e. its Essence) is never observed: instead, behaviours, attributed by the observers, are treated as a reality, and other behaviours which are also attributed by the observer are treated as supplementary, in that observer's view. This is reflected in Beckett's^(*15) "Dialogues with Georges Duthuit" ("There are many ways in which the thing I am trying in vain

to say, may be tried in vain to be said"). Nevertheless, there is not a total arbitrariness in the attribution of behaviours to Objects, for the "meaningfulness" of attributed behaviours is regulated by the Model Facility. In this respect, our Thesis is in agreement with Chomsky (*28) and Hjelmsley (*52)(*53), as opposed to de Saussure (*93)[ⓐ], for we assert that verifiably attributable behaviours (and their representations) rely on internal structures of the observer and the Objects observed.

"8. 5,2 This is how all Model and Language representations of any Object in the Universe may be made: by use of the one logical operation, with two senses of direction (i.e., implication).

[ⓐ] - although it appears that de Saussure's insistence on the arbitrariness of the relationships was itself rather arbitrary. He certainly never investigated this claim.

- "9. 0,4 A Model has something in common with the Object of which it is a Model, since it results from the computation of an implication between the behaviours observed by one observer of two Objects. In this way, a Model is, itself, a transformation of the Object. But, more normally, a Model is made, so that, by means of a Model being made of that Model, there is a transformation of the Object. In this, we echo Ashby^{(*8)(*9)}.
- "9. 1,2 Our means for computing these relationships between Objects and Model (and indeed between Object and Object), grows directly from the formulation of the nature of Objects in our Universe. This is a direct contrast with the work of most philosophers who invent a special class of inhabitants of their Universes, in order to account for these sorts of computations, called relationships. Wittgenstein^(*108), again, epitomises this stance, but he is not alone, developing, as he does, Frege's^(*38) division, and, himself, leading to Husserl's^(*55) distinction in his phenomenological view. Perhaps this is because these philosophers were concerned with a view that stems from logic and hence possible relationships between Objects, and their meanings, rather than a concern for the Object itself, from which a logic can be developed. In this way, perhaps it is the work of Russell^(*91), in his attempts to reduce the whole of mathematics to a set of logical functionings, which is the key to the approach of these philosophers. However that may be, it was obviously a valuable approach, resulting in a final clarification of the issue of the complete reduction of systems by Gödel^(*46).
- "9. 2,5 Nevertheless, there are relationships drawn between Objects, which result in the setting up, by the observer,

of hierarchies of Objects (which themselves are non-hierarchical). This is a cognitive process, executed by the observer, and is essential if there is to be any communication between different observers, of the observations they make.

"9. 2,61 The setting up of complex Objects (i.e. Objects that result from the logical operation on two simple Objects: or, rather, Objects for which a behaviour is attributed by an observer, which is computed by the observer as being the same as some area of overlap of the behaviours attributed by the observer to two other Objects, at the same time), which can be communicated to another observer, involves a sense of communication which is distinct from that of Shannon^(*96). For Shannon's description never allows the development of the previously unknown (i.e. the probabilities can never exceed one)^e. But, in our Universe, observers can continuously construct new complex Objects, each of which is itself a simple Object, like any other, but which is put in the role of complex. Further, as we have pointed out, Objects can have no certain predictions made about the behaviours that will in future be made of them, from those that have already been made. For this reason, one of the greatest weaknesses of probabilistic descriptions must be overcome, and it would appear that von Foerster's^{(*34)(*36)} suggestion of a measure of "Diversity" could be capable of this.

"9. 4,11 Since we insist on the equality of all Objects in our Universe, with only a structuring by the observer, we must re-affirm that, regardless of the role in which an observer places an Object, in building or representing his hierarchy, complex Object, Model, or complex Model, all the inhabitants of our Universe are simple Objects, in themselves, and are only put into their roles by the observer.

^e Hence, the Law of High Numbers.

"10. 0, There are five forms of argument in this scheme of logic. These are (as listed in Reichenbach^(*87)), deduction, induction, abduction, analogy and identification. This is not to say that there cannot be other logical operators, but they are not used in this system. Notable omissions are negation (since we observe overlaps between Objects to make computations negation is simply the lack of an observation), and the existential operator, \exists , which is used to make statements of existence. In a way, this existential operator is similar to our Object formulation: the form,

$$\exists x, (f)x.$$

is quite similar to our formulation,

$$O_a = [(X_a)O_a].$$

where \exists (together with,) corresponds to $=$, x corresponds to O_a , and (f) to (X_a) .

These five forms are, in themselves, not basic units, for induction and deduction are the same operation, (implication), applied in opposite directions, and the others can be taken as the application of chains of implications, in both directions.

"10. 1,4 The difference between the three argument forms that are made of chains of implications lies in two factors. Firstly, the difference between an abduction and an analogy, lies in the sequence of the implication directions: if the first implication is deductive, the form is an analogy, while if it is inductive, the form is an analogy. For a tautology, this sequence is irrelevant (i.e. a tautology can begin with either an induction[ⓐ] or a deduction). The difference between a tautology and, on the one hand, an analogy, or on the other, an abduction, lies in what is omitted and included

[ⓐ] Although an initial induction is easier, because none of the original character is obliterated.

in the two operations. If that which is included in one operation is the same as that which is omitted in the other operation, the form is a tautology. If not, it is an analogy or abduction.

The form of the tautology is a vital form, in any Model theory. For, while Models are not the same as the Objects for which they perform the Modelling role, whether the Model is (in our terms) an Interior or an Anti-Model, the Object must be able to be re-created by reversing the Modelling process. And the reversal of the process, together with the original process itself, is the form of a tautology. In this Thesis, the reversal of the process of making the Model, is called physiccisation, since Models are usually made, in order to execute some form of transformation of the Object, and, without physiccising the Object from the Model, the Object will not be transformed.

There is another way in which the tautology is of fundamental importance in this Universe. For, as we have pointed out, the circular form of definition (which we use to formulate an Object: tritely translated from the formulation as The Object is what it thinks the Object is . . .),

$$O_a = [(X_a)O_a].$$

is a nowadays common form used by, amongst others, Maturana^{(*65)(*120)}, Günther^(*46), von Foerster^(*36), and Löffgren^(*64). In particular, the tautological relationship of a system and its description, allows Gödel's^(*46) problem to be overcome, by making the Model of a Model of an Object identical to that Object. Pask^{(*79)(*82)}, in developing his Entailment Nets, makes extensive use of the tautological form (on a vast scale), related to this system and description arrangement.

"10. 4, In making an Interior Model from an Object, that which is omitted is called the Remainder. Conversely, making an Anti-Model, we include the Anti-Remainder. This Remainder (or Anti-Remainder: but we will refer in general only to the Remainder for the sake of simplicity) is made up of potentially two parts. There is the Information which is omitted (referred to as "I"), and the means by which that Information was omitted (referred to as the algorithm "f"). Thus, the Modelling process can be shown as,



$$Q \longleftrightarrow M(f)I$$

However, it is possible that, in certain circumstances, the Information is contained within the means of operation of the algorithm on the Model, i.e. the algorithm is reflexive,



$$Q \longleftrightarrow M(f)$$

The difference between these two cases is a difference of self-containedness, or reflexivity, and is paralleled in the assumptions of Semiotics and Linguistics (which is assumed to be a special branch of Semiotics, as well as a General Model). In general, the Semiotic approach to a system of meanings, assumes that there need be no external referent in the system, while the Linguistic assumption is of some sort of referent (see Bunt^(*22)). We will therefore refer to the two modelling systems, in order, as Linguistic and Semiotic, respectively. As

(facile) exemplars, we may cite the following two examples. Firstly, a Linguistic system in which Q is 4, M is 2, f is +, and I is 2:

$$Q \longleftrightarrow M(f)I$$

$$4 \longleftrightarrow 2(+)2$$

Secondly, a Semiotic system, in which Q is 4, M is 2, and f is square (2):

$$Q \longleftrightarrow M(f)$$

$$4 \longleftrightarrow 2^{(2)}$$

Notice how it is possible, even with Q and M the same, to find different ways of formulating f and I , depending on the need for a Linguistic or Semiotic system (although this may not always be possible): and notice also how the Semiotic system is a generative system, and uses far less storage; an understanding exploited by computer programmers (especially Jackson^(*115)) in reducing Memory storage requirements, and "kidding" computers that their memories are larger than they are.

- "10. 5, The omission or inclusion of the Remainder in making Models also identifies what sort of Modelling proceduree we are using (Interior or Anti-), and may thus be used to compute the form of an argument, by computing the difference between the Object and the Model, or looking to see if we are left with a Remainder or an Anti-Remainder.
- "10. 7, It is because of the simplicity of this computation of the form of arguments, involving only one type of logical operation, the direction of which can be interpreted from the type of the Remainder in a Modelling process, that this technique would seem to have a potential at the level of a direct application in computer technology.

Not only is it, apparently, very simple, but it is also very fast. Furthermore, because the computer can analyse the form of an argument being put to it, so simply, it would seem that there is the possibility of it developing an understanding of new terms when introduced in an argument, and hence of extending both its vocabulary and its understanding of its vocabulary. If this is so, it would seem that we have stumbled on, not only a method for mapping cognitive processes and arguments (which will be detailed later), but also a means to make more efficient and more "intelligent" (according to Turing's Test) the operation of our computers.

- "11. 1,2 In using the technique of measuring the Remainders in order to find the forms of arguments (i.e. do they cancel, are they Remainders or Anti-Remainders initially?), we highlight a common experience in techniques of measuring: that is, measurement by the comparison of Objects for their differences. And this provides us with a means for cancelling various parts of argument strings together.
- "11. 3,1 This technique of cancellation is, however, more simply introduced with the cancellation together of two consecutive Models of the same type: thus Interior Model followed by Interior Model gives Interior Model: this is a clear parallel to Brown's^(*21) law of crossing (that a crossing made once is the same as that crossing made again).
That this is so, is immediately clear, upon reflection: An Interior Model of an Interior Model of an Object must be entirely contained within the original Object, and the first Interior Model, of which it is an Interior Model, and must thus be an Interior Model of the Object, as well as of the Interior Model of which it is an Interior Model.
- "11. 3,2 Similarly, an Anti-Model of an Anti-Model of an Object, is an Anti-Model of that Object.
And cancellation of implications of opposite direction can occur when the Remainders are the same, giving a tautology, (as already explained), but analogies and abductions cannot be cancelled (if they could, you would lose the whole form of the argument).

- "11. 4, This is Model Dimensioning[ⓐ].
- "11. 5, This recording of the Model Dimensions of processes of making Models (and, indeed, of making complex Objects) leads to several things: firstly, it leads to an economy in the processes of Modelling, for chains of similar (and on occasion, contrary) Models may be adumbrated under one heading, and one stage, thus removing any extra steps that may have been included. Secondly, this record may be used to help make sure that the process of physicalisation is properly carried out, and that arguments are fought on similar levels. Thirdly, it allows a computer (or anyone else) to unravel the form of a long argument. Fourthly, it shows the means of building hierarchies used by some observer, and in this is a map of the cognitive process that that observer used (in this sense, it might fulfill the requirement set up by Cowan^(*29) for machines to act intelligently; and it clearly relates to the mapping of the development of grids of several Constructs as seen in Kelly^(*56)). It also refers back to the concept of a "reality", inasfar as it can demonstrate the construction of realities (in von Foerster's^(*33) sense) by

[ⓐ] The Dimensioning of Models, the correlation and adumbration of Models, also leads us to the conclusion that we have a non-hierarchical Universe: for, if some stages in hierarchical structures can be removed, where is the hierarchy - and at what level in the hierarchy are these Objects to be found? Our non-hierarchical Universe has produced a logic for the construction of (personal) hierarchies which is, in itself, essentially non-hierarchical and depends on a non-hierarchical ordering. One is tempted to say "Q.E.D."!

individuals, and it also shows that, in our non-hierarchic Universe, it is possible for individual observers to create hierarchies, and that, from their points of view, their starting points are their "real bases".

It has been the continuing concern of science to discover Models, for which the Dimensions are known, and in which the Remainder is designed so that material can be fed in, and the output of this process of physicalisation will be the "reality" of the world around us. In general, the fields of science manage this well enough: yet there are areas outside those normally thought of as sciences, where this attempt to provide means of physicallising Models is being tried. In particular, the work of Alexander^{(*2)(*3)(*4)}, Flemming^(*32), Glanville^{(*41)(*43)(*121)}, Klee^{(*57)(*58)} and Thompson^(*99) has attempted to deal with this problem, of re-creating a "reality" from a Model (i.e. of re-creating the Object from which the Model was made, from the Model itself). In these attempts, a record of the Remainder, and a set of Model Dimensions, is of the greatest importance.

- "12. 3,4 The number of descriptions of an Object made and communicated by different observers has a rather peculiar effect on the Object described: for, as the Behaviour increases, so the precision of understanding of the Object becomes less. Thus, we are left with the seemingly strange belief that, the more we describe Objects, the woollier they become. In this respect, our use of the dictionary is interesting, for the dictionary is an attempt to give one behaviour an authority over the others, and thus to limit the Behaviour. Hence, the need for Objects to "re-define" themselves.
- "12. 4, By the same token, the effect of a large number of awarenenses seem to be reflected in the need that humans have to "re-define" themselves, when they let their brains run wild, and they have too many influences on them at one time. If they do not do this, they "break-down" (usually quite literally, in a psychological sense), overburdened with awarenenses.
- "12. 5, The implication of this might seem to be that there can be no generous people: but this may not be the case, for a generous person, being one who assembles large numbers of awarenenses, might not break-down if his (unobservable to us) Essence was reflected outwards. However, this is all pure speculation, and is only intended as a passing thought.

- "13. 0,42 Cage^(*24) reports a debate between Dr. D. T. Suzuki, and a Hindu lady, on the nature of reality, and of the Universe that such a reality implied. After a long and heated argument, Dr. Suzuki and the lady left, arm in arm, and Dr. Suzuki, turning to the lady, said, "You know, that's why I like philosophy: nobody wins". This whole Thesis has only concerned itself with the one Universe. It is not the only one, and it is not argued that this is the only one; only that it seems to be a useful one to look into. But it does appear to have one interesting characteristic: it seems that, in permitting the erection of hierarchies by observers in the Universe, it may be able to contain many different Universes. It can certainly contain many different views of the City, at once, and without any conflict.
- "13. 1,1 As a parallel to this multiplicity of views of the City, Pirsig^(*116) discusses the nature of the multiplicity of views of a motorcycle, with reference to Kant's^(*117) extension of Hume's^(*118) Solipsistically based empiricism. Kant specifies the "a priori" internalised in the observer's mind, as that against which empirical knowledge is arranged. Our twist on this is to internalise each a priori to its own observation, but not (necessarily) for others, by making it a self-observer, which can also be observed by others. Thus Pirsig's "Zen and the Art of Motorcycle Maintenance" poses a problem of the multiplicity of views of the motorcycle (or the motorcycle's Zen), which we solve in a manner at once similar to, but different from, Kant.
- "13. 2, "Before studying Zen, Men are Men, and Mountains are Mountains.
While studying Zen, all is confused.

After studying Zen, Men are Men, and Mountains are Mountains.

The difference is that, in the former case, the feet were a little bit off the ground" (Cage(*23), Reps(*88)).

or,

"Before studying Cybernetics, Men are Men, and Mountains are Mountains.

While studying Cybernetics, all is confused.

After studying Cybernetics, Men are Men, and Mountains are Mountains.

The difference is that, in the former case, the feet were a little bit off the ground".

EXPERIMENT REPORTS

(London Knowledge Test)

(London Structure Test)

(Conceptual Space)

(Leadenhall Market)

FOREWORD TO THE EXPERIMENT REPORTS

The experiments reported on in the following sections were executed by the author, with the assistance of Annetta Pedretti (experiment three) and Tim Richardson[®] (experiment four). The subjects for the first three experiments were students in Grahame Shane's first year study unit (Urban Topics) at the Architectural Association School, London. The fourth experiment's subjects were clerks at Lloyds of London.

The results of the experiments were sets of drawings, some of which are included in each report. These drawings have been subjected to a coarse analysis, presented in (in general) simple tables, or summarising drawings.

The results have not been subjected to a rigorous statistical analysis: the form of the data makes this both difficult and irrelevant. Difficult because it is hard to count discrete units in freehand drawings. Irrelevant because the drawings themselves present the findings in the clearest possible way.

Many drawings have been re-drawn: the originals, drawn in pencil, would not print up properly. The re-drawing makes no difference to the main content (from the point of view of the experiments).

® Their work is included with their permission.

EXPERIMENT ONE: REPORT

REPRESENTATION OF THE BEHAVIOUR (B) OF AN OBJECT BY THE BEHAVIOUR (B) OF ANOTHER OBJECT, ACTING AS SURROGATE FOR THE FIRST OBJECT. (LONDON KNOWLEDGE TEST).

Aims of Test

There were two main aims for this test. The first was to persuade individual observers to attribute Behaviours to a common Object, and to represent these by behaviours attributed to another common Object. These behaviours may themselves be collected to form a Behaviour (B^Q), containing the contradictions that exist between the different observers' different views. Contained in this aim, was the intention that the observers should be shown that their attributed behaviours will be different, but that this is not important, since they can nevertheless represent their beliefs.

The second aim was to demonstrate a means for an approximate expression of the Object's own view of itself (its Essence) by the use of a formalised version of the Behaviour (B^O): unless this can be done, no inarticulate (and maybe no Object at all) Object can talk about itself, and it becomes very difficult to consider the Object in any generally agreed manner (without setting up the behaviours of both the Object and the Surrogate, for each observer, on each occasion: and then holding a conversation about these views until a consensus is reached). And, having set up this representation of the Object, to carry out an assessment of the "correctness" of the different views of the Object, based on the consensus view of the Behaviour. Contained in this aim, was the intention that the observers should realise that they could none of them have the Object's own self-view, and that they could survive an interaction with the Object in spite of this difference of view.

Origin of Aims

The origin of the aims of this experiment lies in the frequent arguments that arise amongst architects as to the exact location of places within the City. The ability of every person living in a City to use it, in spite of these differences in view, also needs to be expressed (i.e. not knowing where, for instance, Biggin Hill, is, will not prevent anyone getting there). In this way, it seemed that a form of expression that did show the different behaviours attributed, and a means of referring them to some standard picture of the Object itself, would be valuable.

Method: conditions

The Experiment was given to twenty-one students in the first year course at the Architectural Association School, in November 1973. These were all students who claimed to have a particular interest in Urban Problems. The students were given a blank form, and invited to locate the nineteen specified areas of London on an outline map of the G.L.C.[®] boundary, showing also the River Thames. The nineteen areas were chosen to mix well- and less well-known areas, and to take areas fairly randomly from those which constitute London.

The students were given fifteen minutes in which to locate the specified places, and were then shown an Ordnance Survey Map⁺, against which they could judge their results. At a later date, their results were measured more precisely by the author.

The students whose work is analysed here in detail were

[®] Greater London Council - the administrative London.

⁺ The official cartographic survey in the U.K.

part of a larger sample of one hundred and twenty students, a coarser analysis of whose work reveals no significant difference in results.

Method: Language, Object and question forms

In this test, both the Language and the Object, to which behaviours were to be attributed, were pointed to. The Object was said to be "the location of the following nineteen places which are within London", followed by a list of the places arranged alphabetically. The Language was pointed to by "marks made on this Map of the G.L.C. area, with the River Thames marked in". The question that the students were asked to answer was "where are the places to be located best represented on the map of London".

Thus, both the Object, to which the students were to attribute behaviours, and the Language in which they were to represent the behaviours by drawing comparisons between the behaviours of the Object, and the behaviours of the Language, were specified.

One might expect, specifying both the Object and the Language to which the students had to attribute behaviours, that there might be mis-match. That is, that students might not be able to attribute behaviours to the Object and/or the Language, or that they might not be able to draw a comparison.

That this was the case is shown by the results. Not one student was able to attempt to locate all nineteen places named. Within terms of this test, it is not possible to state that the perceptual difficulty was with either attributing the behaviour to the Object, or to the Language, nor is it possible to state that there were difficulties in drawing the comparison (or surrogating the Language Object to the Object itself).

Method: test methods and measurements

The test was set to the students in a group, all at the same time. The instructions were verbal and written: the list of places to locate came on the same form as the Language outline.

Results were measured initially by students themselves, from an Ordinance Survey Map. However, certain students allowed themselves some degree of licence in this, and a map showing the areas as 4 Km (nominal) diameter circles, and then as 8 Km circles, was produced by the author against which the Language representation was measured (by over-laying the correction map). The most generous interpretation of all the student representations was taken. The two scales were used to check on the refinement of the experimental checking.

This correction map is an interesting item. In order to show the difference in the different representations, it is only necessary to take one as being "correct", and demonstrating the others in its framework, or to map all representation together (this is the complete and articulate statement of the Behaviour attributed to the Object by the group of observers at that time). However, the use of a common referent was chosen instead. There is a very good reason for this: not one student located all nineteen places, so that not one student's map could be used as the referent. And the graphical difficulties of representing the full Behaviour (B^0) would be immense^⑥. It was therefore simpler to use one "artificial" referent, and this choice of tactic was further strengthened by the advantage that this has in allowing the difference between the best possible representation of the Object's

^⑥ i.e. to represent say twenty-one different represented locations for nineteen places would be extremely difficult (but see Experiment Four).

self-view, and the observer's view, to be seen. For, an Ordinance Survey-Map (which is what was used as the measure) is the result of a concensus operation making a very large Behaviour (B^0), accumulated over many years, by many observers, (almost all of whom manage to use the Language representation thus developed to represent the Object), which permits the expression of many attitudes, and which can be interpreted back by many observers into many attributed behaviours which can be related to the Object's behaviours; hence its authority.

Experimental data

The results of the experiment have been edited, and certain Language Objects are presented here as being in some way "typical" or "exceptional".

Firstly, the "correction" map is presented. This is derived, as has been stated, from the Ordinance Survey, and is considered the nearest approximation that the external observer can achieve to the Object's self-observation (although it is not this self-observation).

A further seven maps are presented. These are chosen to show the difference between substantially "correct", and substantially "incorrect" maps (although the most correct map probably only achieves its accuracy by means of graphical laziness), changes in degree of "correctness" depending on which scale (4 or 8 Km) was used (and thus showing the effect of the experimental checking's refinement), and, in the case of student f)⁺, the effect of allowing a shift in the marking sheet to the East of normal place; it could be argued that the increase in accuracy thus afforded to

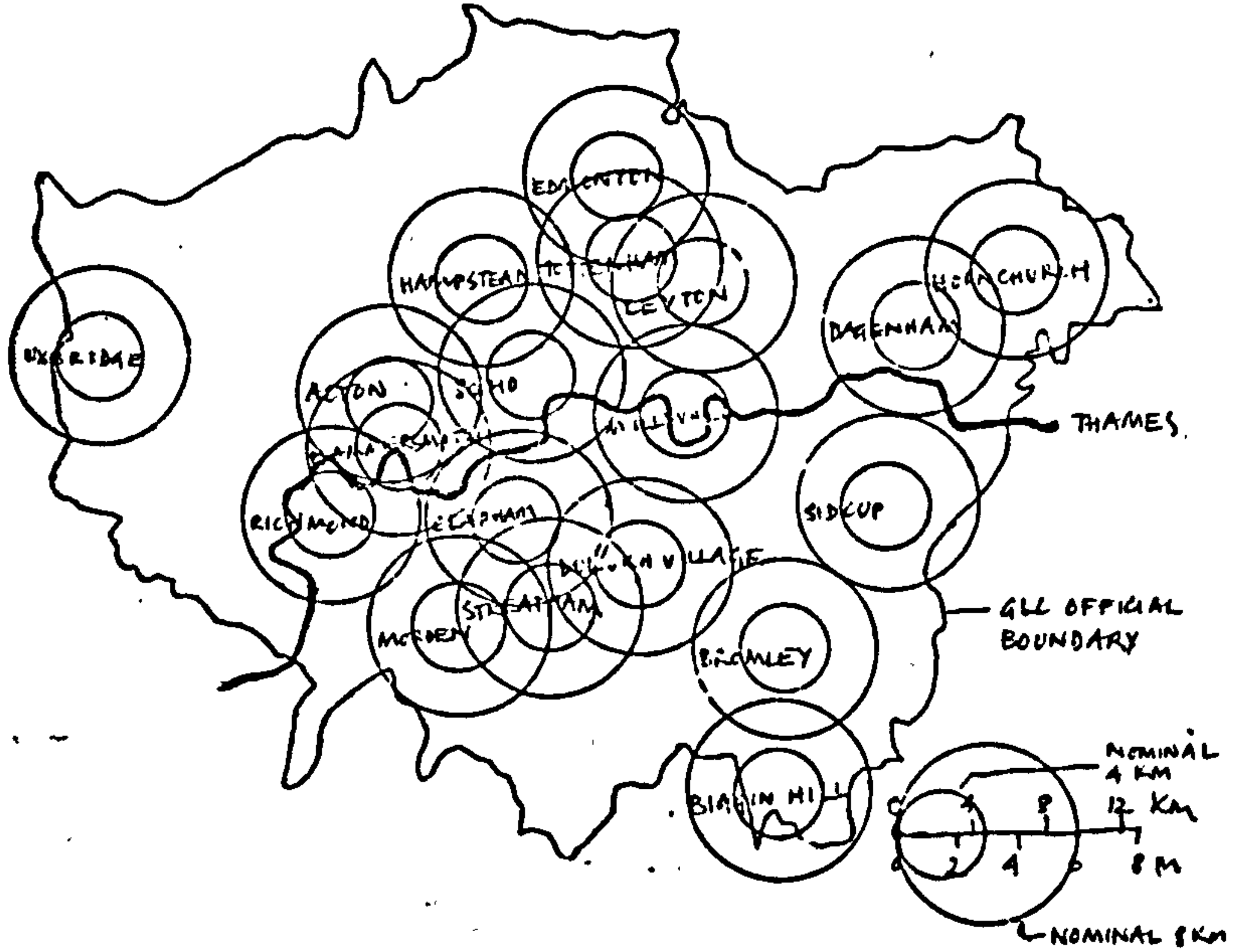
⁺ Student f) is also shown in the tables as student v). The reasons are explained in the tables.

student f) indicates that, in his case, there was a genuine difficulty in attributing behaviours to the Language (it's not a problem of observing the Object's behaviour).

Maps (See over)

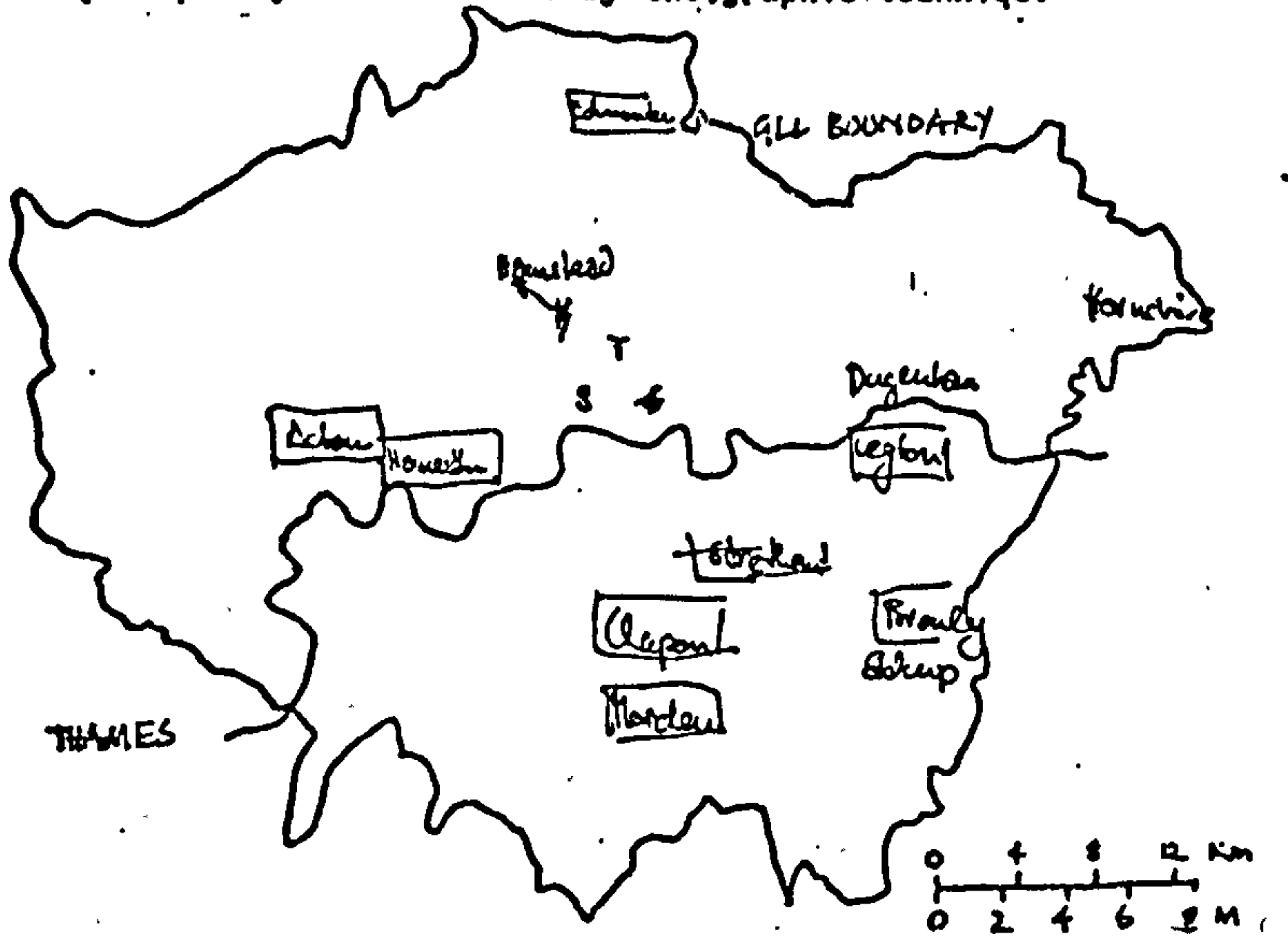
LONDON KNOWLEDGE

Measure Sheet (derived from Ordnance Survey Maps)



STUDENT (r)

Very high accuracy compared to places located (14 located: 6 accurate within 4km, 11 within 8km). This may be partly accounted for by the graphic technique.

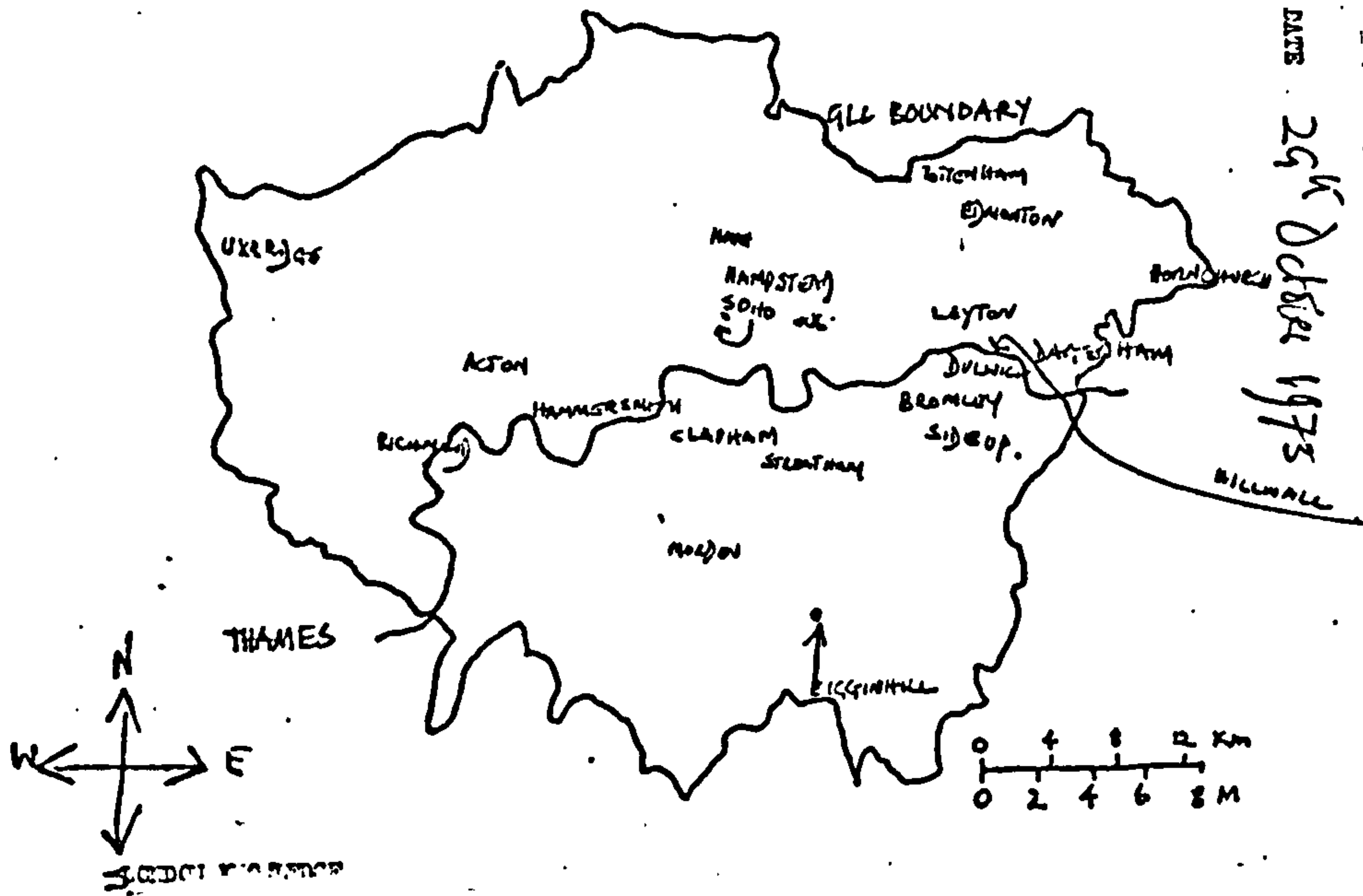


DATE 28/11

LONDON KNOWLEDGE
I used to live in Bethnal Green & Islington

STUDENT p)

Increase from 3 correct to 12 correct with scale change from 4 to 8km.



STUDENT c)

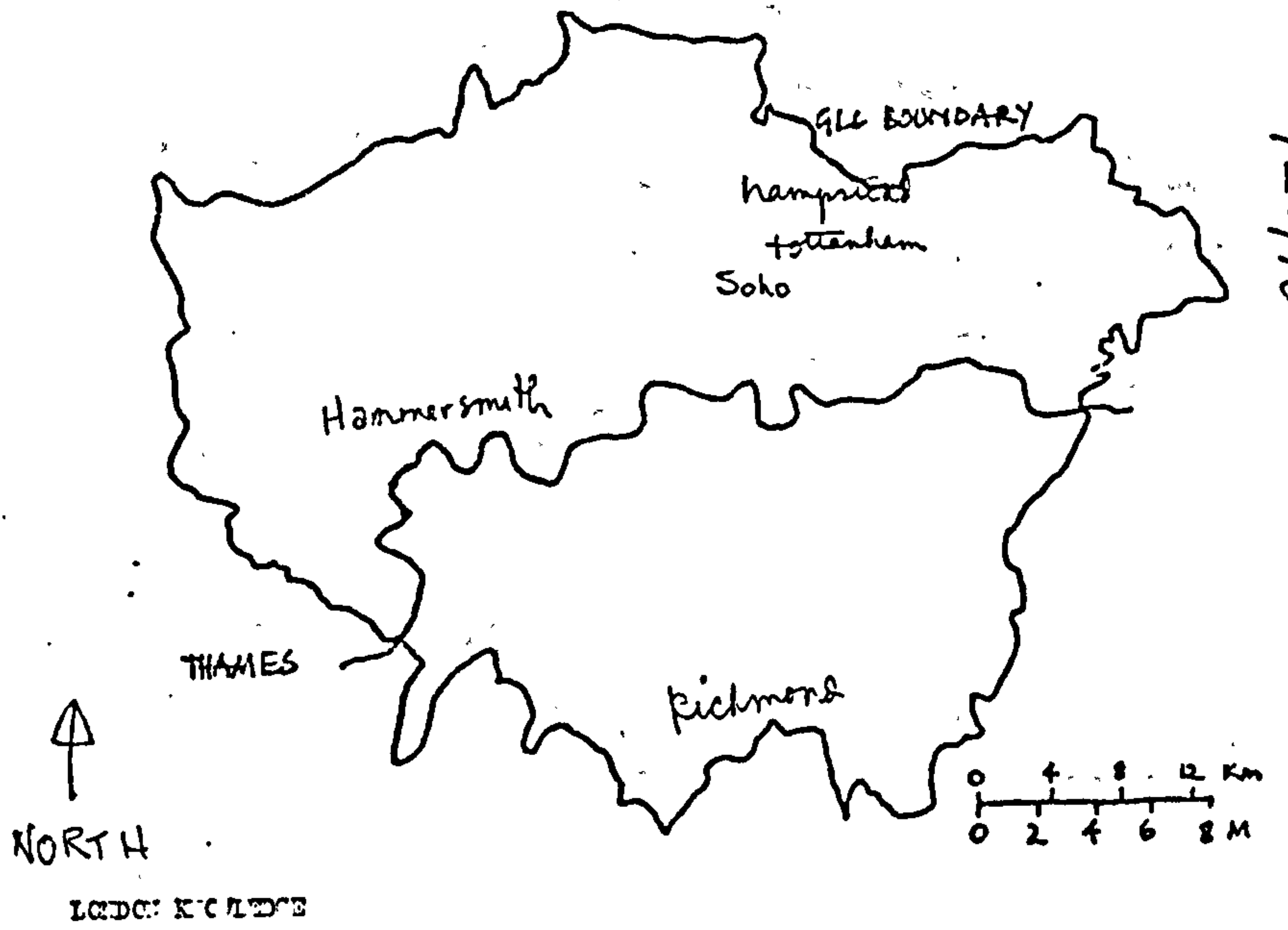
Places known correctly increases dramatically from 2 at 4km to 6 at 8km.



LONDON K.C. LONDON

STUDENT g)

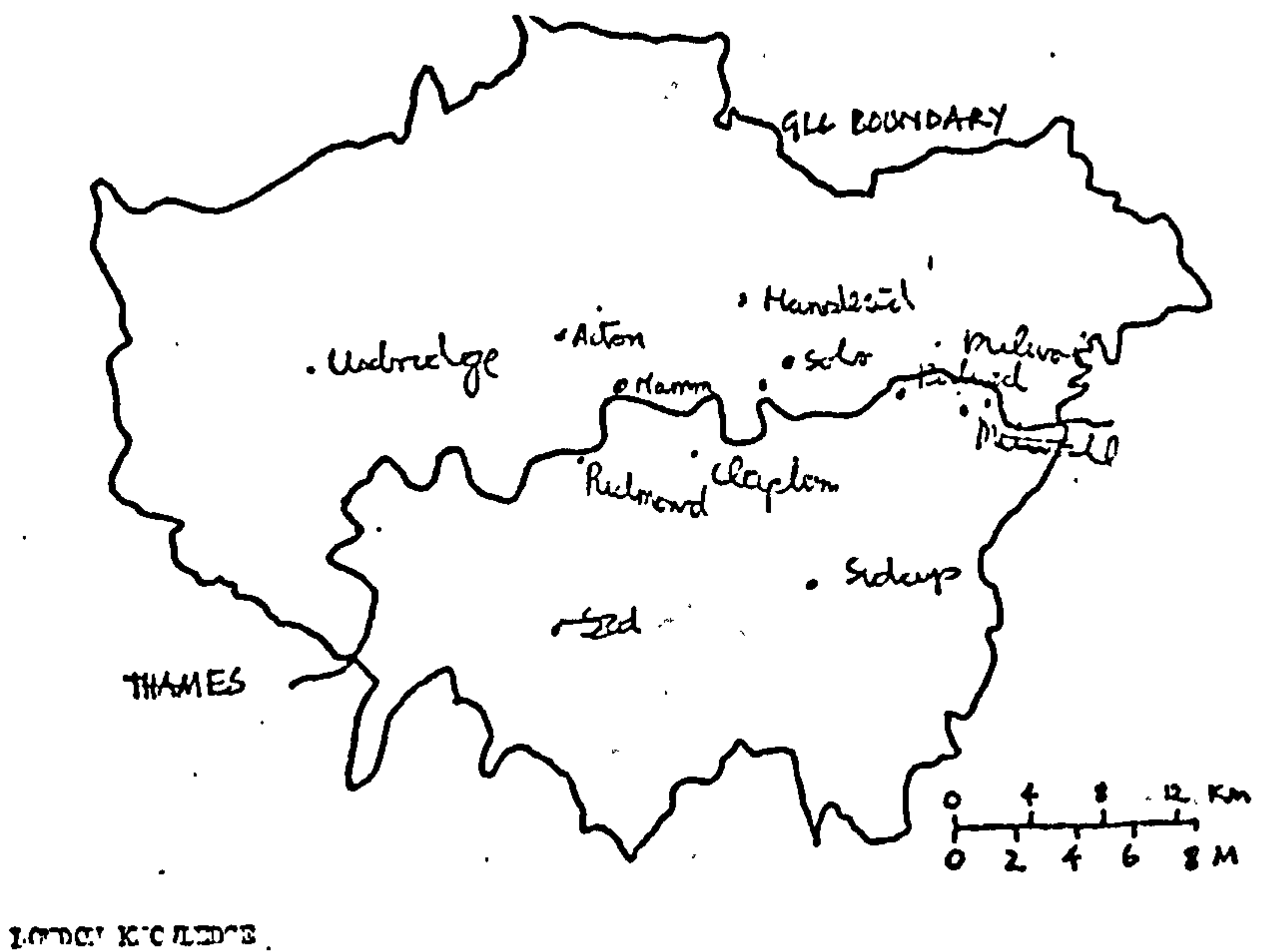
No change in accuracy with the change in scale from 4 to 8km.



DATE 10/29/73

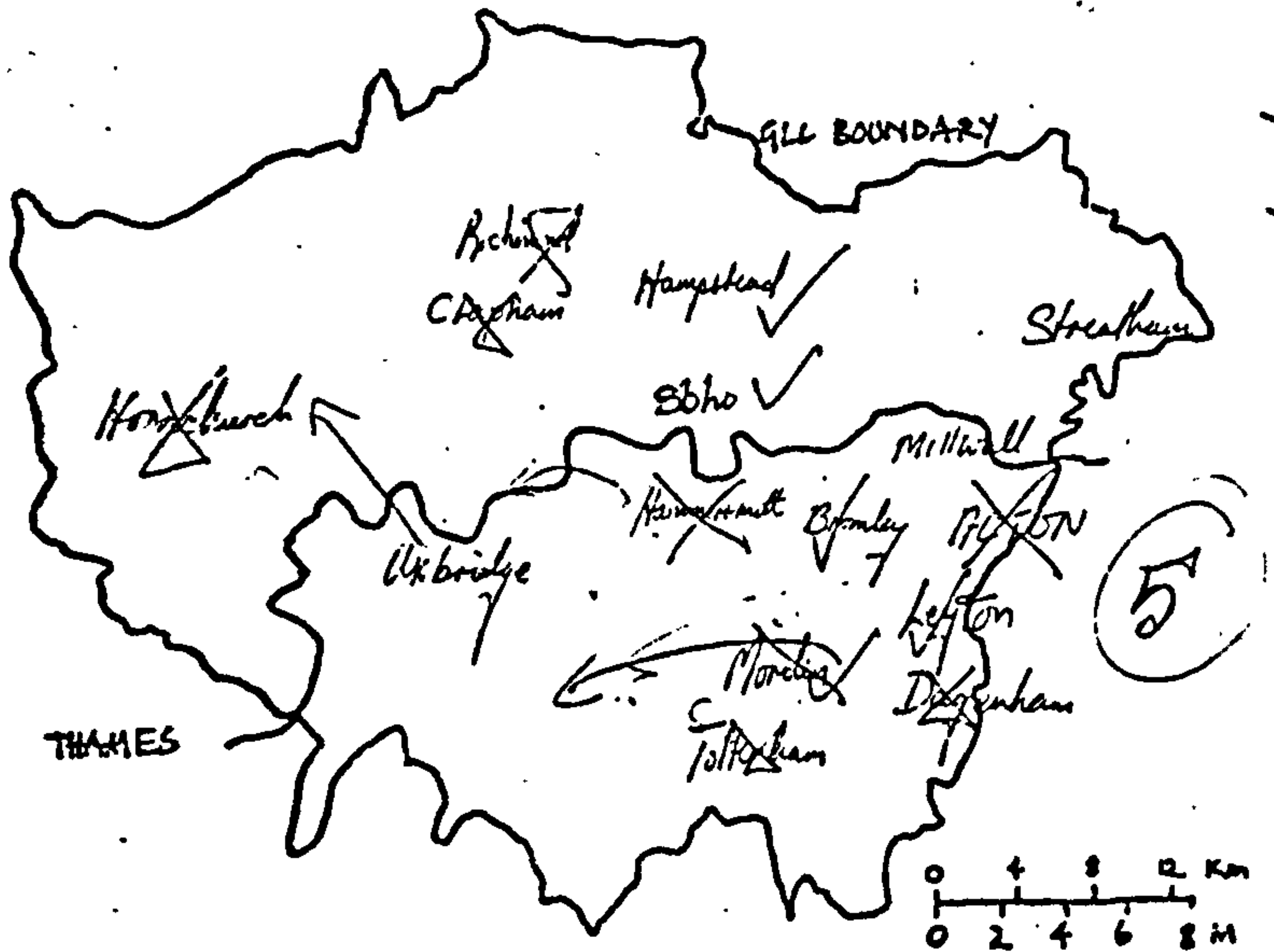
STUDENT f) (also known as STUDENT v))

An Eastward shift of the measure gives an increase from 0 places located to 7.



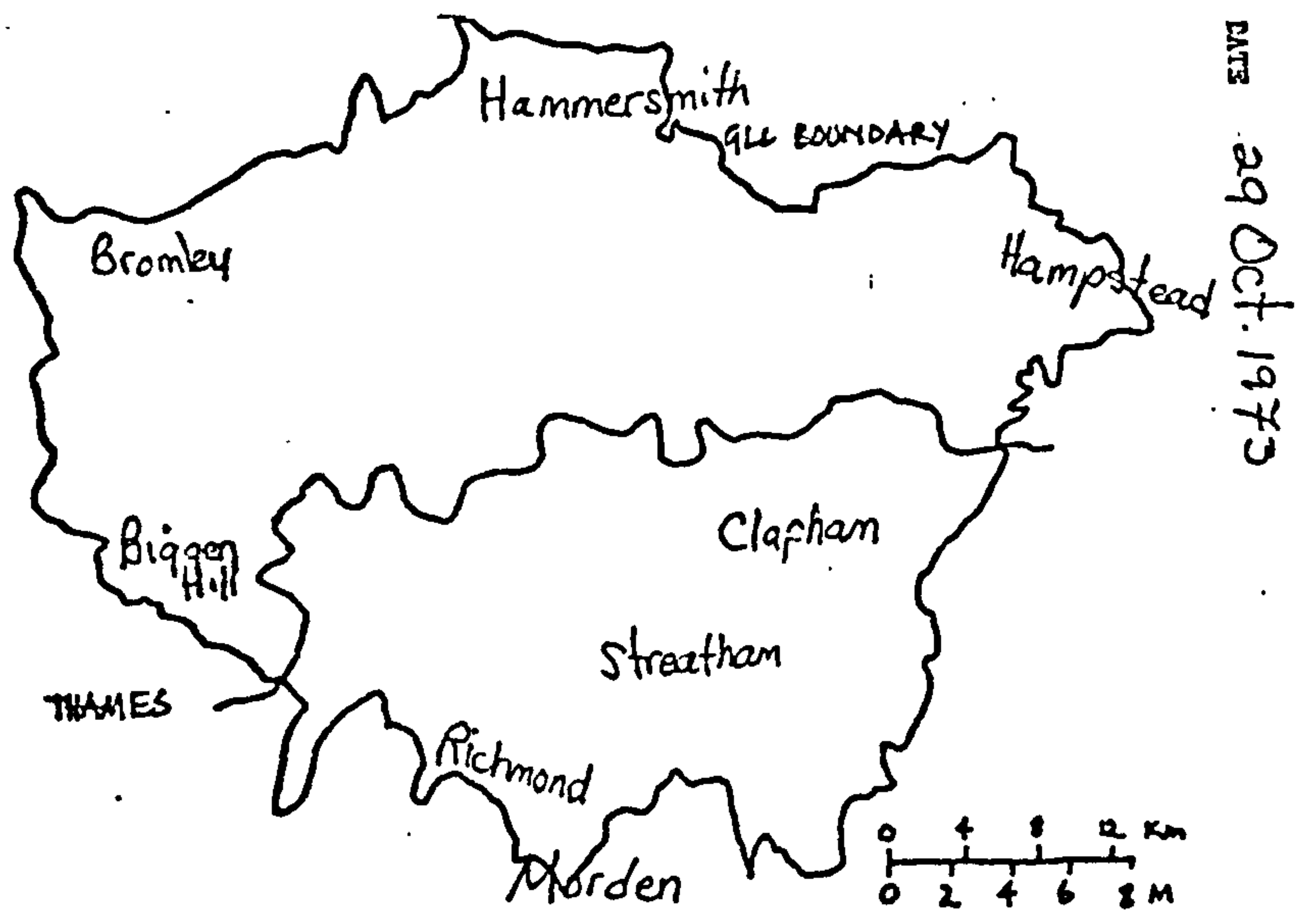
DATE 29 Oct 73

STUDENT a)
Very inaccurate at both 4 and 8km scales.



LEDCO K'C EDGE

STUDENT k)
Remarkable for the peripheral markings, and the extreme inaccuracy.



LEDCO K'C EDGE

Experimental Results

The results of the experiment carried out on the twenty-one students is shown in the following tables.

Table One shows the results by students. Each student is labelled (and those, samples of whose work appears have a cross by their reference letter). The student's success at representing the location of places is given on both scales, and taking both the total number of places named, and the total number of places located by each student as a denominator. The difference in these two denominators could be a type of confidence estimate[®]. However, this may be, the experiment does not clearly differentiate between confidence and "correctness", nor between the behaviour of the Object, and that of the Language (other tests do this). It is intended to make different points.

Table One (See Over)

[®] Relating to the observer's ability to either observe the Object, or to represent the Object's behaviour in the Language.

TABLE ONE

Table of test results (by students)

Student	No. of Places Located	No. within 4 Km	No. within 8 Km	% Places Located	% Correct 4 Km/ Total Places	% Correct 8 Km/ Total Places	% Correct 4 Km/ Places Located	% Correct 8 Km/ Places Located
a) ⁺	15	0	0	78.9	0.0	0.0	0.0	0.0
b)	18	4	6	94.7	21.0	31.6	22.2	33.3
c) ⁺	3	1	1	15.8	5.3	5.3	33.3	33.3
d)	14	2	3	73.7	10.5	15.7	14.3	21.4
e)	17	2	6	89.5	10.5	31.6	11.8	35.3
f) ^{+@}	10	0	0(7) [@]	52.6	0.0	0.0	0.0	0.0
g) ⁺	5	2	2	26.3	10.5	10.5	40.0	40.0
h)	12	2	5	63.1	10.5	26.3	16.7	41.7
i)	15	3	10	78.9	15.7	52.6	20.0	66.7
j)	3	1	2	15.8	5.3	10.5	33.3	66.7
k) ⁺	8	0	1	42.1	0.0	5.3	0.0	12.5
l)	15	6	7	78.9	31.6	36.8	40.0	46.7
m)	18	1	5	94.7	5.3	26.3	5.5	27.7
n)	7	0	2	36.8	0.0	10.5	0.0	28.6
o)	6	0	1	31.6	0.0	5.3	0.0	16.7
p) ⁺	18	3	12	94.7	15.7	63.2	16.7	66.7
q)	7	2	2	36.8	10.5	10.5	28.6	28.6
r) ⁺	14	6	11	73.6	31.6	57.9	42.9	78.6
s)	11	0	4	57.9	0.0	21.1	0.0	36.4
t)	5	1	2	26.3	5.3	10.5	20.0	40.0
u)	10	2	4	52.6	10.5	21.0	20.0	40.0
v) ^{+@}	10	0	7(0) [@]	52.6	0.0	36.8	0.0	70.0

⁺ student's work included as example.

[@] student f) is student v). In the case of v), an Eastwards distortion was allowed on the 8 Km measurements.

Table Two shows, by contrast, the data arranged by location asked for. In this, it reflects the Object's (and Language's) side, rather than that of the observer. It is clear that the behaviours attributed to the Object and Language are very different, from this table. The previous table showed that each observer's attribution of behaviours was different (in this, it showed a difference in the observer's awareness).

TABLE TWO

Table of Test results (by places)

	4 Km	8 Km	Marked	Unmarked
Acton	3	3 + 2 = 5	8	8
Bigginhill	1	1 + 4 = 5	7	9
Bromley	2	2 + 3 = 5	12	4
Clapham	3	3 + 5 = 8	7	6
Dagenham	3	3 + 5 = 8	5	8
Dulwich Village	2	2 + 6 = 8	3	10
Edmonton	1	1 + 4 = 5	6	10
Hammersmith	8	8 + 2 = 10	7	4
Hampstead	3	3 + 4 = 7	13	1
Hornchurch	3	3 + 6 = 9	5	7
Leyton	1	1 + 4 = 5	9	7
Millwall	0	0 + 2 = 2	10	9
Morden	3	3 + 2 = 5	9	7
Richmond	3	3 + 3 = 6	9	6
Sidcup	4	4 + 1 = 5	6	10
Soho	5	5 + 3 = 8	8	5
Streatham	1	1 + 5 = 6	8	7
Tottenham	2	2 + 5 = 7	9	5
Uxbridge	1	1 + 3 = 4	8	9

Results

The results of this experiment are shown in the following tables. Table Three is a table of the results by students;

TABLE THREE

Highest % places located	=	94.7	(students b, m, p)
Lowest % places located	=	15.8	(students c, j)
Highest % places correct (4 Km)	=	31.6	(students v, r)
Lowest % places correct (4 Km)	=	0.0	(students a, f [ⓐ] , k, n, o, s, v [ⓐ])
Highest % places correct (8 Km)	=	63.2	(student p)
Lowest % places correct (8 Km)	=	0.0	(students a, f [ⓐ])
Highest % correct 4 Km/places located	=	42.9	(student r)
Lowest % correct 4 Km/places located	=	0.0	(students a, f [ⓐ] , k, n, o, s, v [ⓐ])
Highest % correct 8 Km/places located	=	78.6	(student r)
Lowest % correct 8 Km/places located	=	0.0	(students a, f [ⓐ])

These results show clearly the difference in each student's expression of attributed behaviours, as a generalisation of the data in Table One, which itself is an ordering of the information submitted, in the form of a map, by each student. In doing this, Table Three shows the differences in student awarenesses, and also shows the way in which the measuring of "correctness" affects the understanding we (as the experimenter observing the statements of the students) have of the student's statements (i.e. some students seem to be much more "correct" given a larger measuring scale, and almost all gain by a measurement against the places they locate as opposed to those they are asked to locate). It also shows student attributed behaviours in comparison to the Behaviour of London through the use of the consensus representation of this Behaviour (and hence the Object's self-view).

[ⓐ] Students f) and v) are the same.

Table Four shows the results by places;

TABLE FOUR

Place most often correctly marked at 4 Km	=	Hammersmith	43.0%
Place most often correctly marked at 8 Km	=	Hammersmith	47.5%
Place most often incorrectly marked at 4 Km	=	Hampstead	62.0%
Place least often marked	=	Dulwich Village	} 47.5%
		Edmonton	
		Sidcup	

These results show the differences in the behaviours attributed to each of the places that the students were asked to locate. In this, it shows different behaviours attributed to the Object, and expressed through the Language. It also shows the effect of the measurement, and it expresses the different accuracy of place location against the general consensus Behaviour description. The results are quite amusing: Hammersmith (because of its Motorway and riverside locations?) is most accurately located - although the best increase in location is Dulwich Village (two at 4 Km to six at 8 Km = increase of 300%). Surprisingly, perhaps, Hampstead is most often inaccurately placed - although that may be because, its name being famous, students tried to locate it by guessing. The three joint least known places are perhaps less surprising (Dulwich Village, Edmonton and Sidcup), although Dulwich also appears as the "most improved" place in the change in measuring scale.

Conclusions

The main conclusions to be drawn from this experiment are that it is indeed possible to set up a situation in which, in spite of the Object and the Language being the same for all observers, it is possible to show that each observer represents his observation of the Object differently in terms of the Language. In this way, the aims of the experiment have been fully realised. The participating students, on being shown the test results were astonished at the "Inaccuracy" of their views. Nevertheless, they have all survived (and continue to survive) in the "alien" environment, about which they know so little.

EXPERIMENT TWO: REPORT

REPRESENTATION OF THE BEHAVIOUR (B) OF AN OBJECT BY THE BEHAVIOUR (B) OR ANOTHER OBJECT, THROUGH DIFFERENT TIMES. (LONDON STRUCTURE TEST).

Aims of Test

The aims of this test are obviously rather closely related to those of the previous experiment. This test permits the statement of contradictory but simultaneously held views of a common Object. But the main interest is not in this necessary part of the test, although it is an aim. By inviting the students to perform the test five times during the Academic Year 1973-4, it was possible to show the students the way in which their views had changed, that is, to demonstrate the effect of different observations and making different behaviours of an Object. (The students used were from the same group as those in the previous test).

However, there was also another aim, related to the previous test: for in that test, we found we could not decide if, when a student could not represent one of the locations, the problem was in observing the Object, of the Language, or if, perhaps, the problem lay in seeing a similarity between them (for instance, I might have a good "picture" of a map of London, and I might have a Knowledge of one of the places as being on the tube map, and I might not be able to relate the tube organisation to the London map).

So the other main aims of this experiment were to show examples of difficulty in relating to Object, or in finding a suitable Language in which to express the observations made. And to this end, although the Object was pointed to, the Language in which representations were to be made was not specified.

Origin of Aims

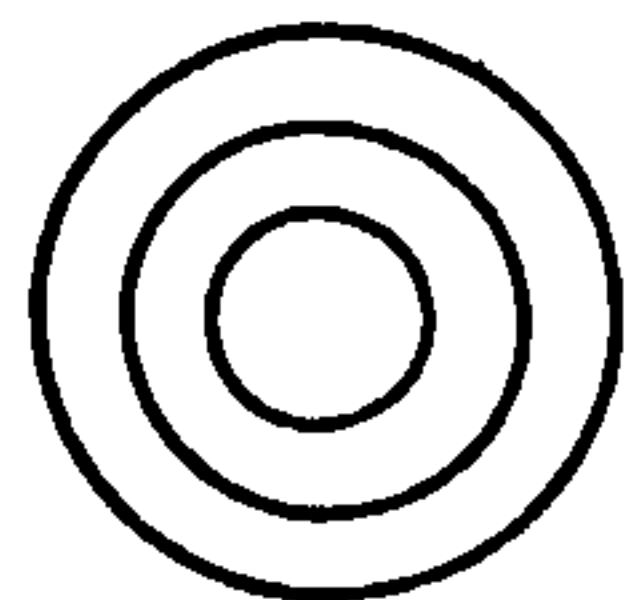
This test originated as a teaching aid, evolved informally by the author and Leon van Schaik, to help students make statements about beliefs they held of the role of things in the city. It was made expressly clear to them that there was no sense in which any of their statements were more correct than any others; correctness is an irrelevant concept for them. It was further developed as a teaching aid, not only in helping students make their own views clear to themselves, but also to allow them, from their own statement of view, to investigate the implications of their views, and the limitations.

However, there is, in contrast to this somewhat pragmatic ideal, also a pedagogical intention in the experiment, stemming from its roots in the view held by the author that, in looking at complicated objects (and now, at all Objects, in the sense of this Thesis), it is not possible to talk about any degree of "rightness"; rather, one should talk about the need for a subjective knowledge to show itself appropriate, and for an understanding of the implications inherent in any view.

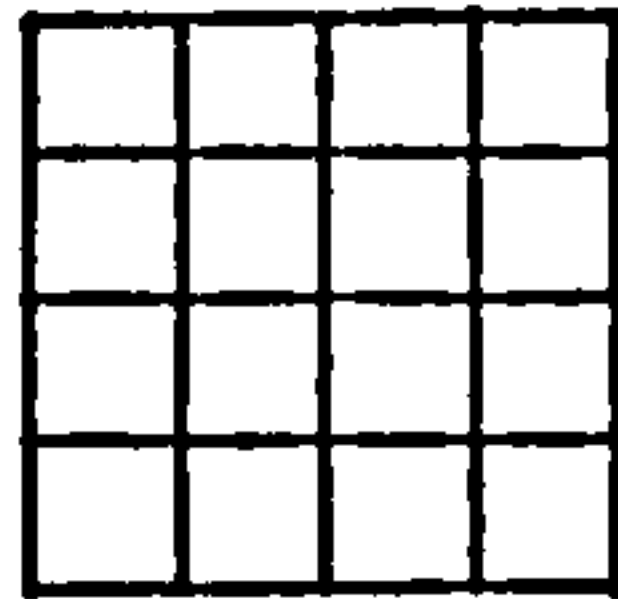
Method: conditions

The experiment was given to twenty-four students in the first year course at the Architectural Association School, on five occasions during the Academic Year 1973-4, as a part of their course. The students are substantially the same as those who took part in the First Experiment:

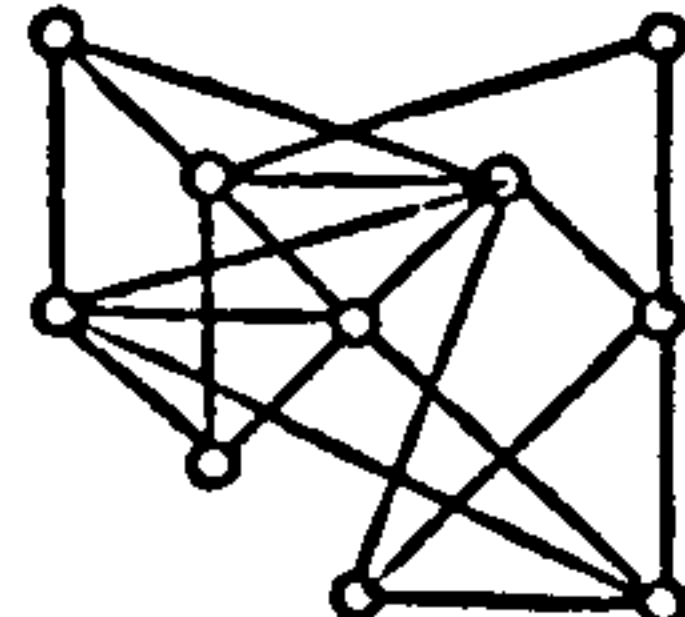
The students were given a blank form to fill in, and asked to represent what they thought London's structure was, on this form. In order to help them, five architypical structures were shown them, as follows,



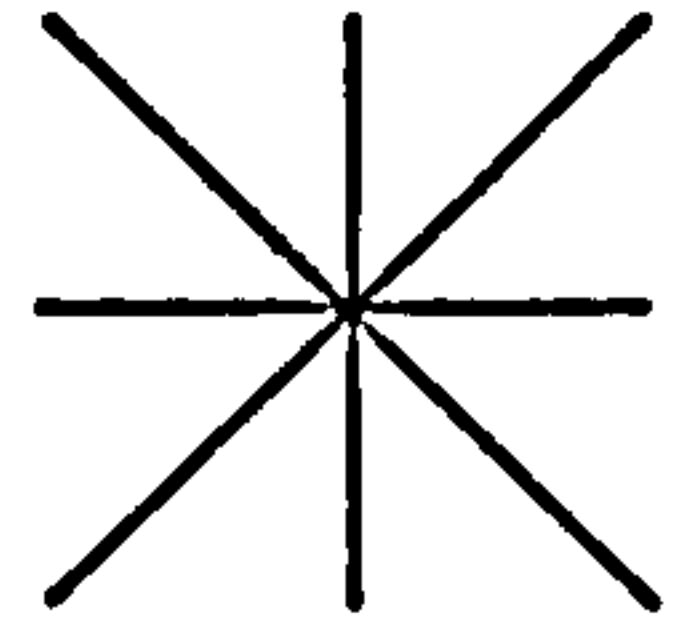
concentric



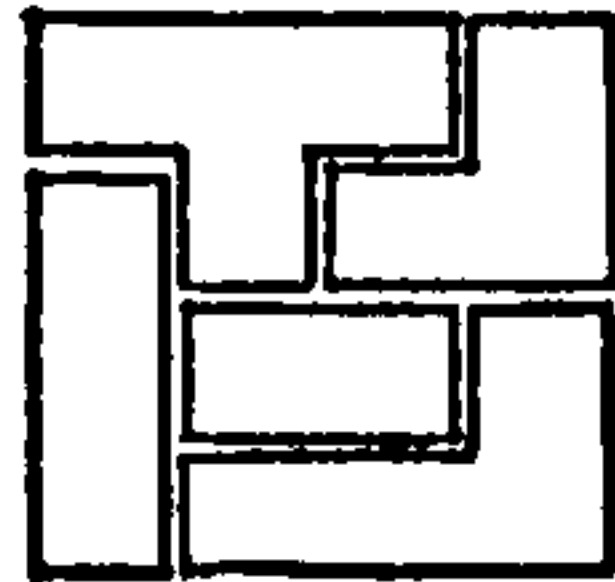
grid



semi-lattice



radial



zone

They were told that they did not have to use one, or any, of these, that they were only shown them to help with the explanation of the task.

The students were allowed between five and ten minutes to complete the task, and the representations were then taken away from them, without any further comment, except the observation that they were all different, in spite of the Object being the same.

The five occasions during which the students were tested break up into three groups. The initial test, carried out at the beginning of the course, may be largely discounted as familiarisation^⑥. The second two tests were used to re-inforce the students' views: after the second test, the students were asked to state which of the five archetypes (above) their views most resembled, and then to go away and prove that this view was the only correct one. The third test was carried out at the end of this exercise. There followed a long period of intensive teaching input, during which many different ways of looking at the city were developed,

^⑥ The Test was a rather unusual one, for school leavers: and they needed a chance to even understand what was being asked of them.

after which the fourth test was applied. The fifth test was carried out at the end of the course, and serves mainly to reinforce the view expressed in test four, where the major change in view would be anticipated.

Method: Language, Object and question forms

In this test, the Object to which a behaviour was to be attributed was pointed out, while the Language to be used as a representation was not pointed out. The Object was said to be "The Structure of London", and was further exemplified by the five archetypes mentioned above. The Language was to some extent inferred by the diagrammatic representation of the five archetypes, and the request for drawings, but it appears that these requests did not have an overpowering effect.

By not specifying the Language, it was intended to overcome the ambiguity re mis-match that was possible in Experiment One: if a student could observe the Object, thus giving it a behaviour, but could not represent it, we would thus know that the problem lay in the finding of an appropriate Language behaviour: and the student could say this. If, on the other hand, the Language represented something that was not a Structure, it was clear that the student had problems in observing that particular Object, and thus in giving it a behaviour. (There could be many reasons for this: not only difficulty in observing the Object, but boredom, reluctance to try, etc.).

Method: test methods and measurements

The test was set to students in a group, all at the same time. The instructions were verbal, written, and drawn, with the five archetypes appearing on the sheet the students were asked to fill in.

The completed sheets were taken from the students and filed. The students had no access to them at any later date. Consequently, the students could not copy an earlier form of representation, but had to create a new one every time. Some students clearly tried to repeat the same representation every time, but even in these cases, there were changes in the representational form that could be given significance, (i.e. the differences had an interpretable meaning).

The sheets were divided into three groups, according to when the tests were taken, as has already been explained. While there was a difference between every representation, difficulties of expressing this difference in any general way led to the adoption of a simple means of differentiation, and also in the main change in representation being looked for between the pairs of tests two and three, and four and five. The initial test was largely discounted as familiarisation, since the idea of a "Structure" for something like London was a hard one for new students to get hold of. Each student's representation was classified as being either of the form of one or more of the archetypes, or as being "Trivial" (i.e. the Object was not observed), "Special Language" (i.e. the observation made of the Object needed a special representation, that is, a non-archetype Language), or "Unexpressed" (i.e. the student could not find a Language behaviour which resembled his Object behaviour). This is a very coarse measurement of differences, but it seems adequate to make the general points that it is the intention of this experiment to make. Where there is a "Special Language", and there is a significant difference between various "Special Language" representations, these are marked by a numerical subscript.

Experimental Data

The Experimental results have been edited, and certain

Language Objects are presented here as being in some way "typical" or "exceptional".

Initially, examples are presented of Language Objects which are "pure" examples of each of the five archetypes, to show that each one was found to be applicable. (This is almost certainly a peculiarity of London: it is doubtful if a city with a much more defined physical form, such as Manhattan Island in New York[@], would offer itself to such a variety of understandings, partially since most architects are taught to think of form as an essentially physical phenomenon). It will be noted that four of the five examples were taken from the first test (familiarisation), during which time students probably did not fully understand the intentions of the experiment.

There then follow a further three Language Objects, one representing each of the three other categories into which the representations were sorted: ("Trivial", "Special Language", and "Unexpressed"). These tended to come from later tests, and reflect the students' development of much more subtle ways of looking at the Object "London's Structure" than were initially expressed by the archetypes. (The shortage of means of expression in Architecture is, of course, one of the major concerns of this Thesis: the paucity is here brought out).

Finally, there are sets of test representations from three different students, showing, in this order, virtually "no change" in the Language Object, "extensive change" in the Language Object, going from one view to another completely different one,

[@] at least in terms of its street layout - an effect heightened by both its maps and its block numbering system. But the Bronx may be a different story!

and the "refinement and development" of a view as shown by the Language Objects. It should be pointed out, nevertheless, that in the "no change" case, there are differences of some significance: the Thames has been removed, and the centre of the Zone is omitted, and then re-included. The complexity of the structure also changes.

Experimental Results

The results obtained from the experiment apart from the samples of Language Objects already discussed, were in line with the expectations expressed at the beginning. They are summarised in Table One.

As will be seen, even with the very coarse categorisation used, we only have two students who have not changed their representations across the specified pairs, (students e) and h)). Four students did not provide enough data to determine if their representations changed, or not (students b), q), s), and x)). But, as has been shown in the case of student e), a detailed look at the evidence demonstrates that there is a difference between the various representations, and it is only one coarseness of our differentiation, for measuring, that does not show this.

As to the difference of views expressed by different observers, the total of their five observations may be taken as the observer's Awareness (A^0), of the Object (London's Structure). Each of these is different, even given our coarse categorisation (as can be seen in Table One). The Behaviour of the Object can be seen as the total of observations recorded in the table, and clearly contains contradictions: it is hard to reconcile the structure of Zone with that of Semi-Lattice.

Furthermore, the expected results as regards the choice of Language were found: students did indeed provide their own

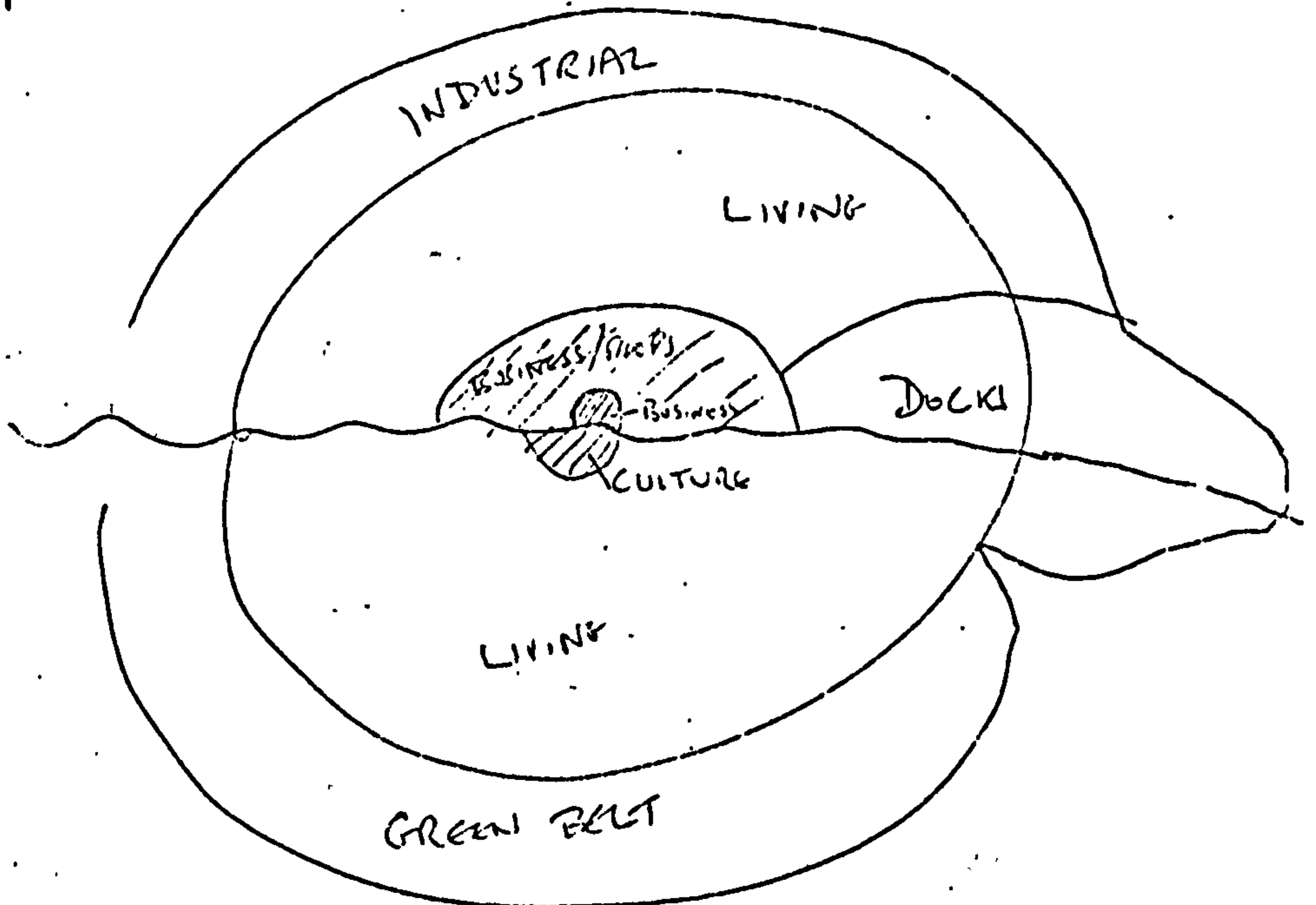
Languages in which they made their statements (which is one of the reasons for the difficulty we have in categorising these statements). And the evidence of students i) and w) point out the possibility of differentiating between students who cannot observe the Object, and those who cannot find an appropriate Language in which to express themselves.

Maps and Table One (See over)

LONDON'S STRUCTURE: Examples of each of the prototype forms appearing in answers.

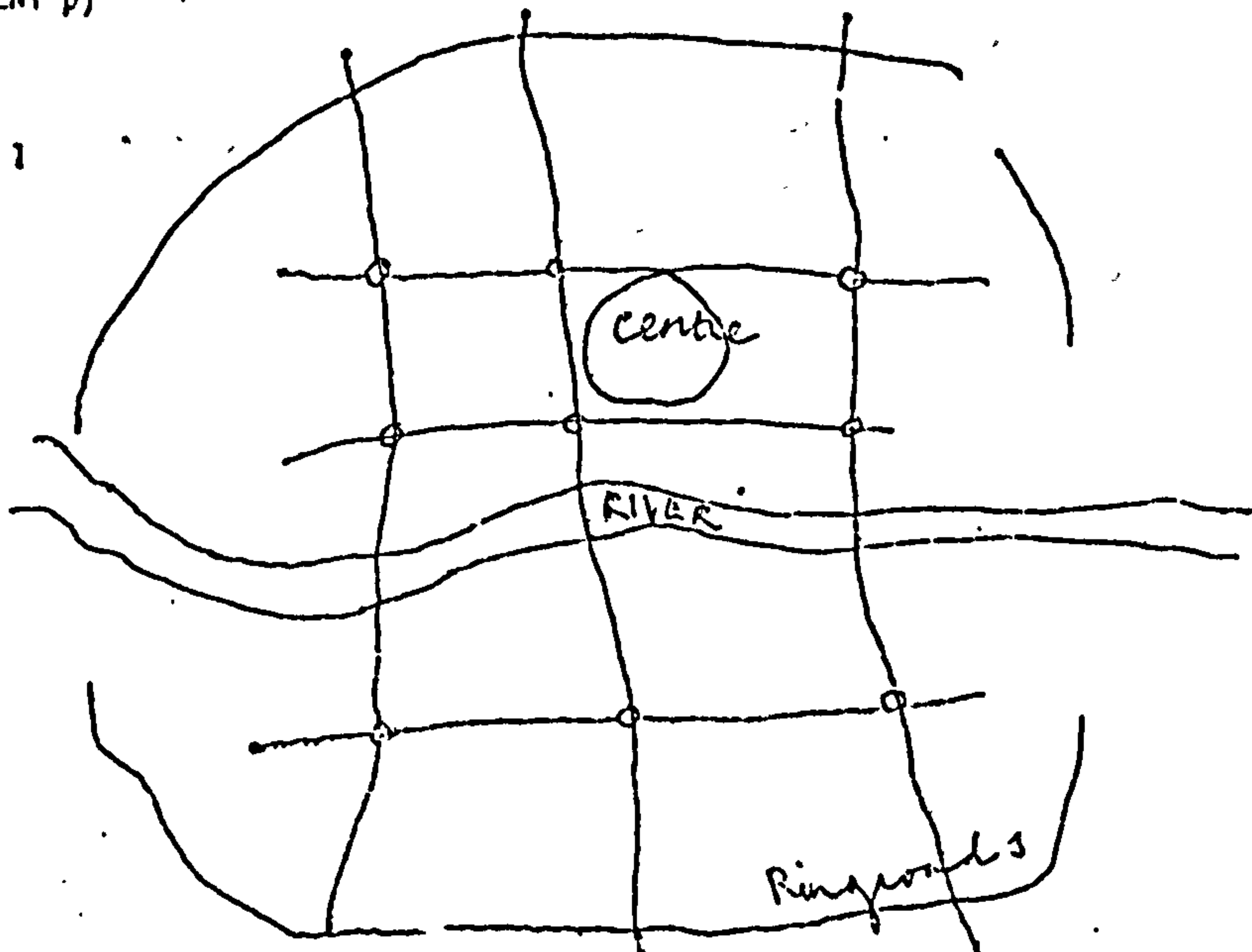
STUDENT u)
CONCENTRIC

Test 1



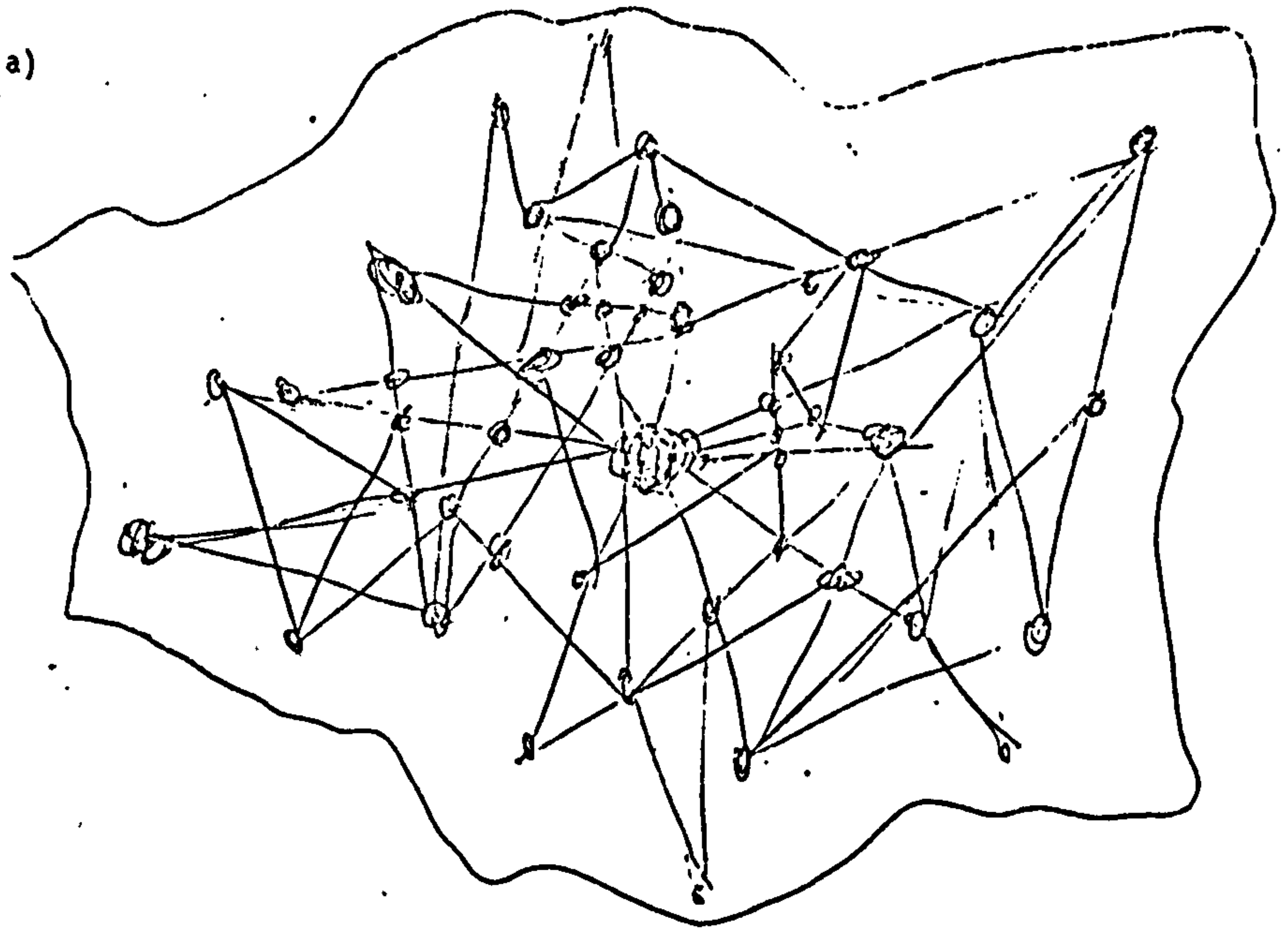
STUDENT p)
GRID

Test 1



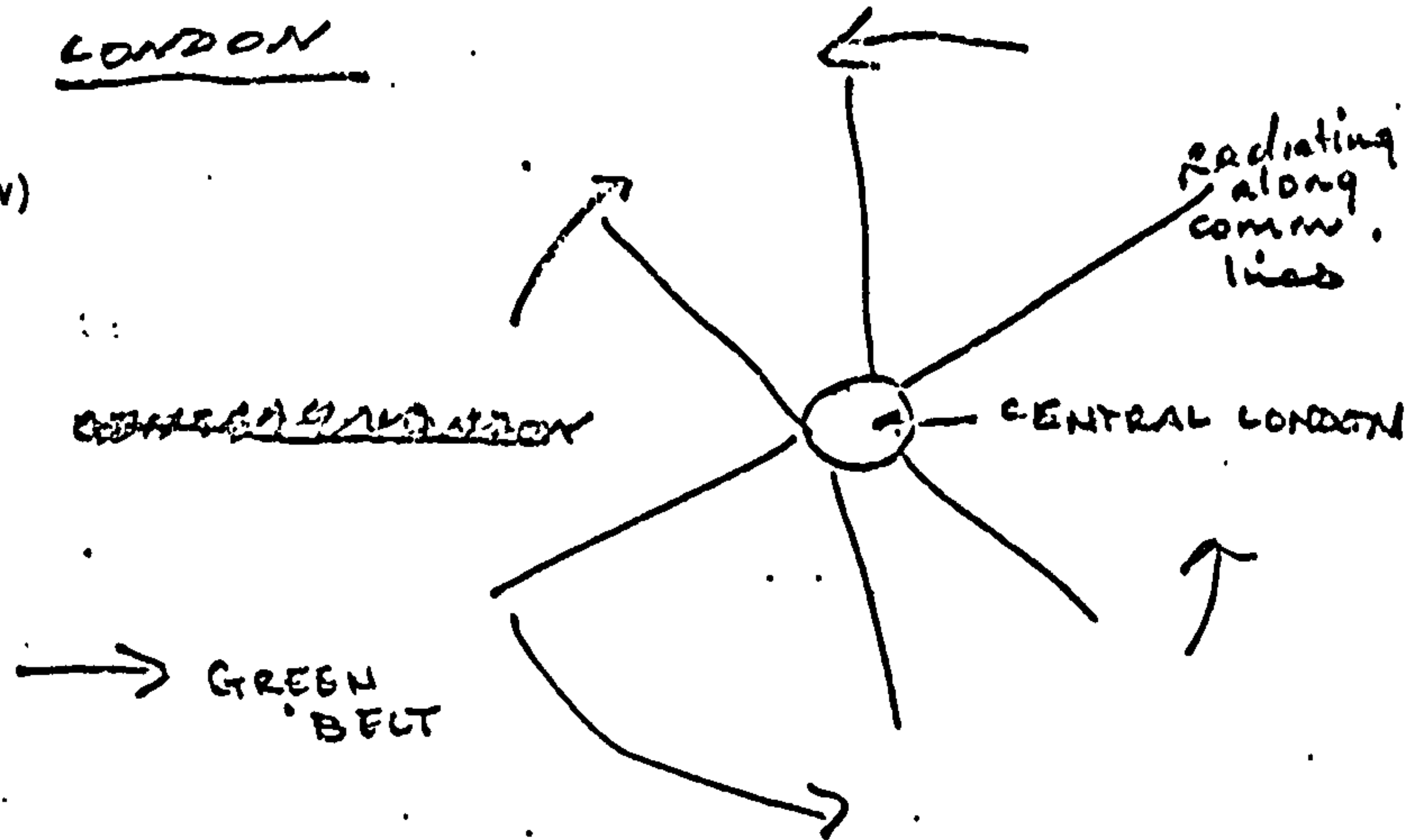
STUDENT a)
LATTICE

Test:1

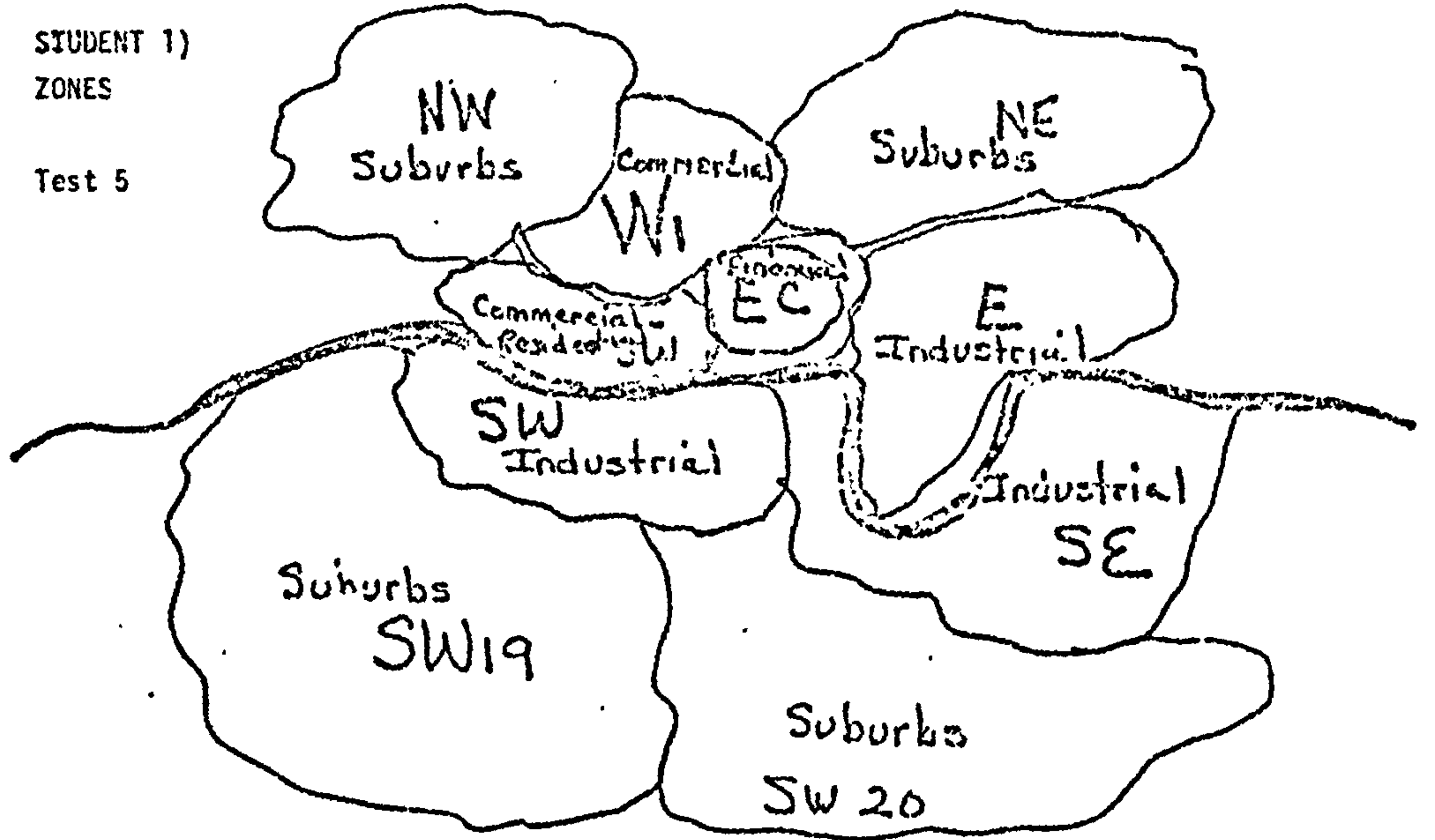


STUDENT v)
RADIAL

Test 1



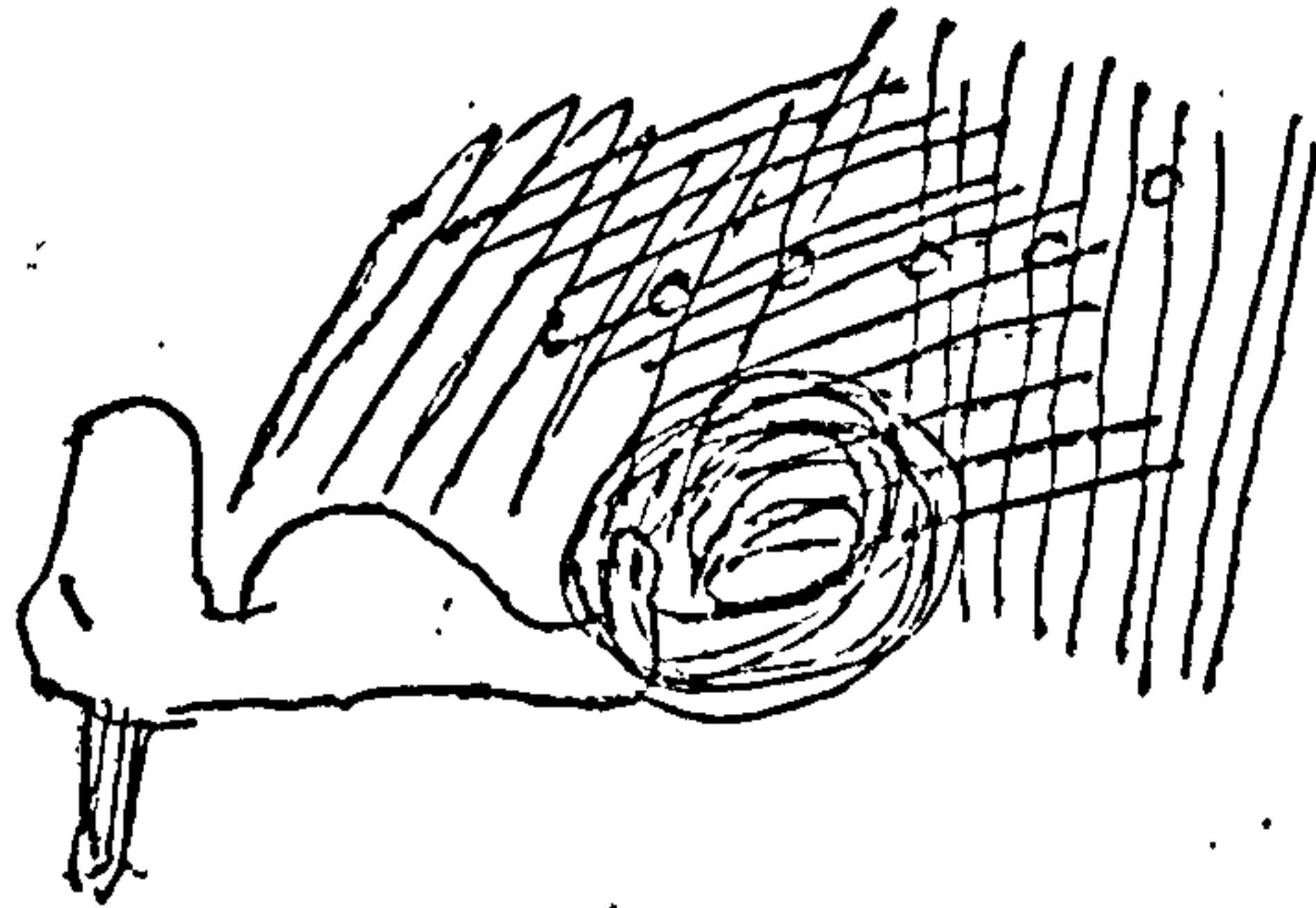
STUDENT 1)
ZONES
Test 5



Examples of each of the non-prototype forms appearing in the answers.

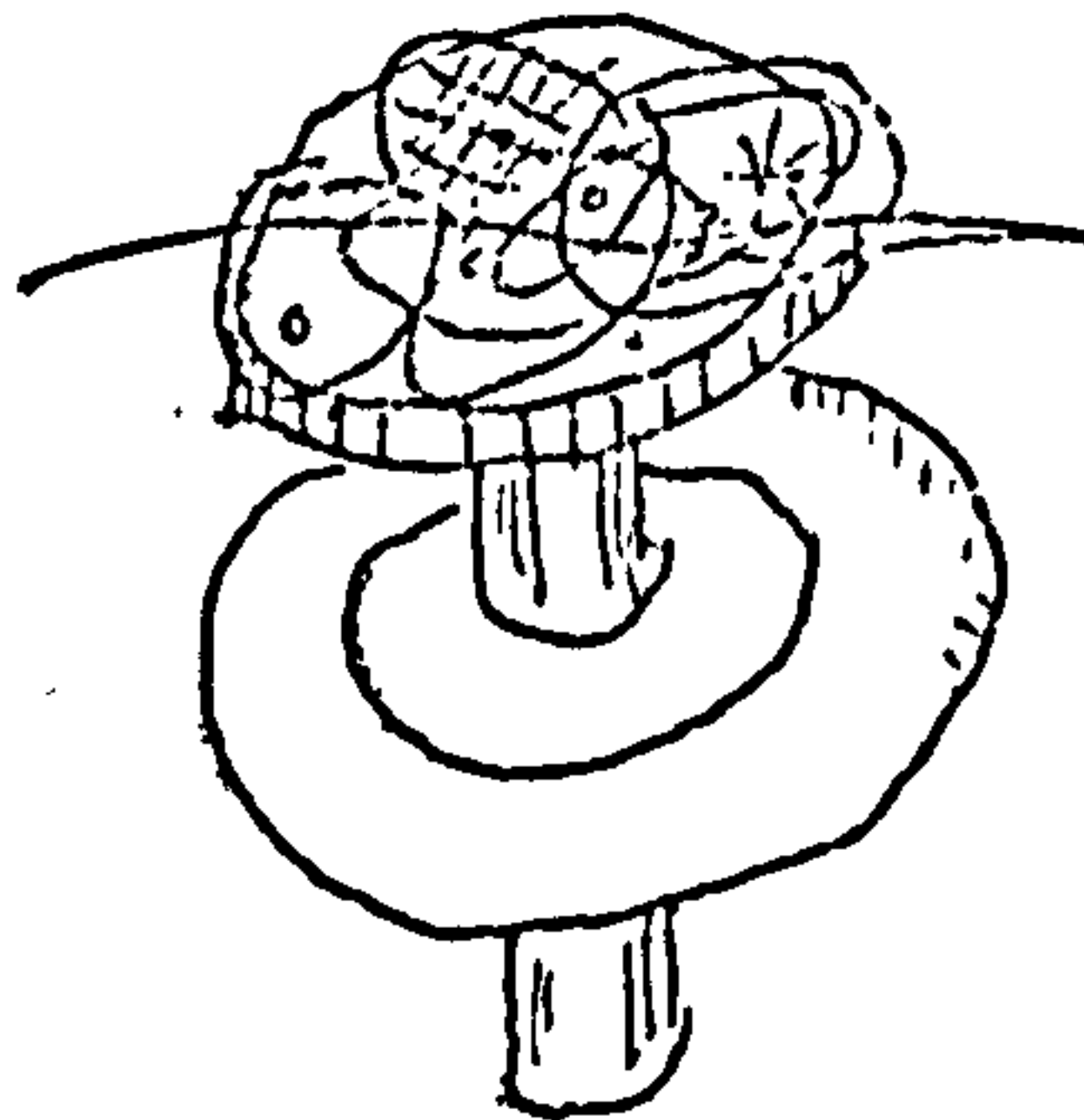
STUDENT i)
TRIVIAL

Test 5



STUDENT n)
NON - PROTOTYPE REPRESENTATION

Test 4



STUDENT w)
INAPPROPRIATE LANGUAGE

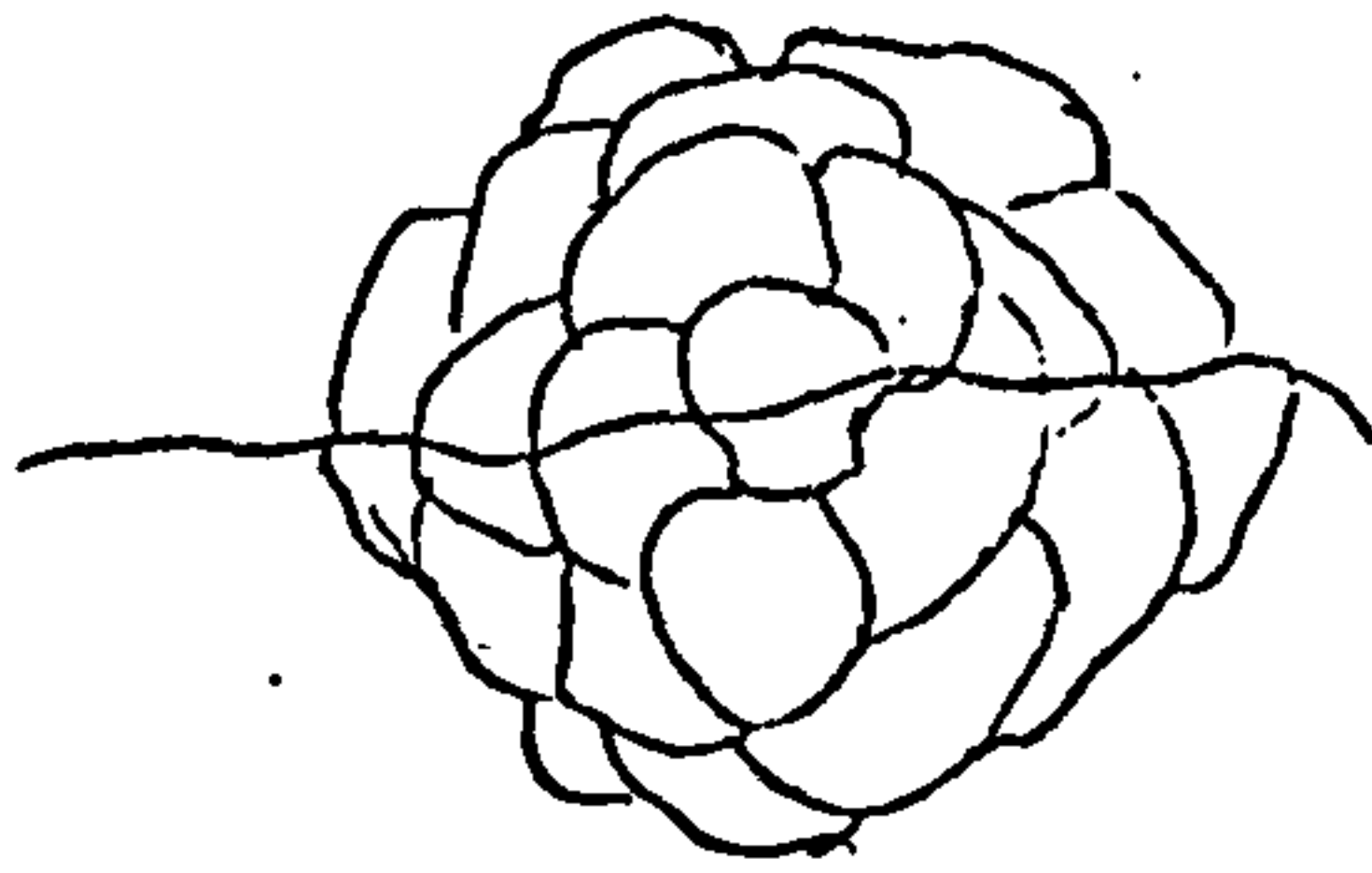
Test 5

It is impossible to come up with a definite answer. The question would have to be more precise. As to how I see the transport system or the sewerage system. It would also depend where I am based perhaps (looking at London in another way). An overall view is not possible. If you thought it to be a grid-system, I would try and talk to you on grid-grounds or whatever system you would choose.

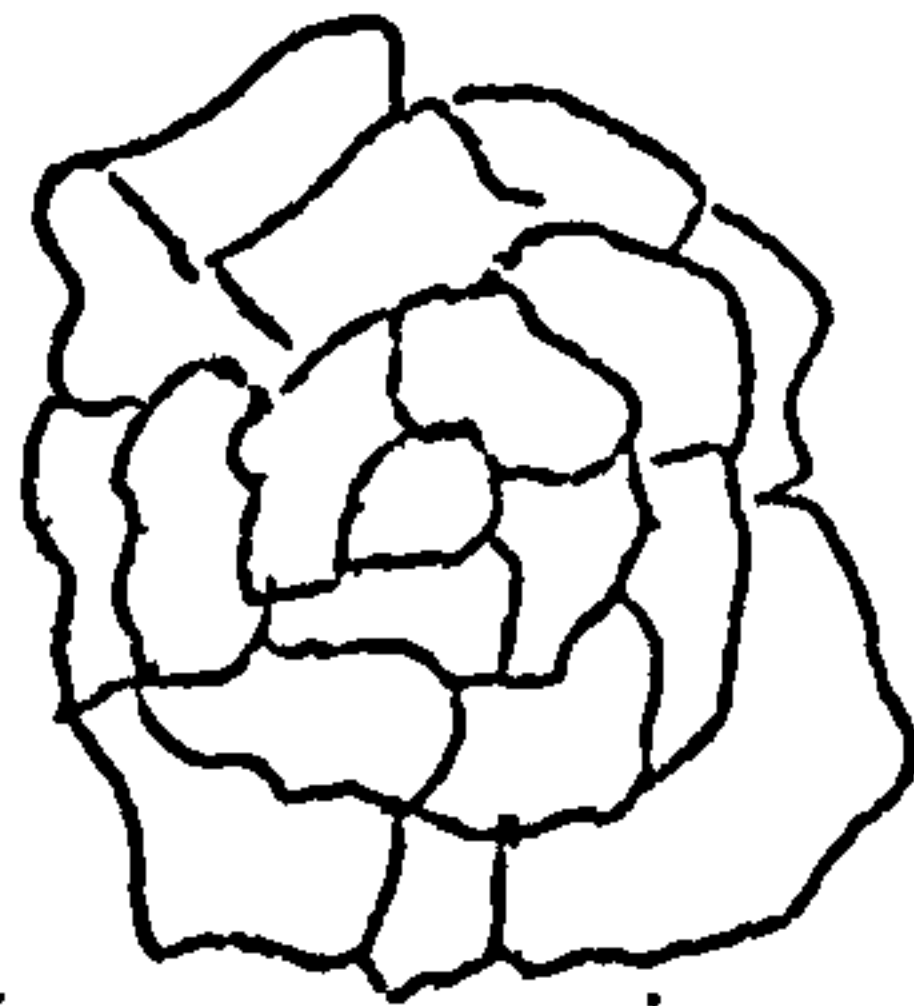
EXAMPLE OF NO CHANGE BETWEEN TESTS

STUDENT e)

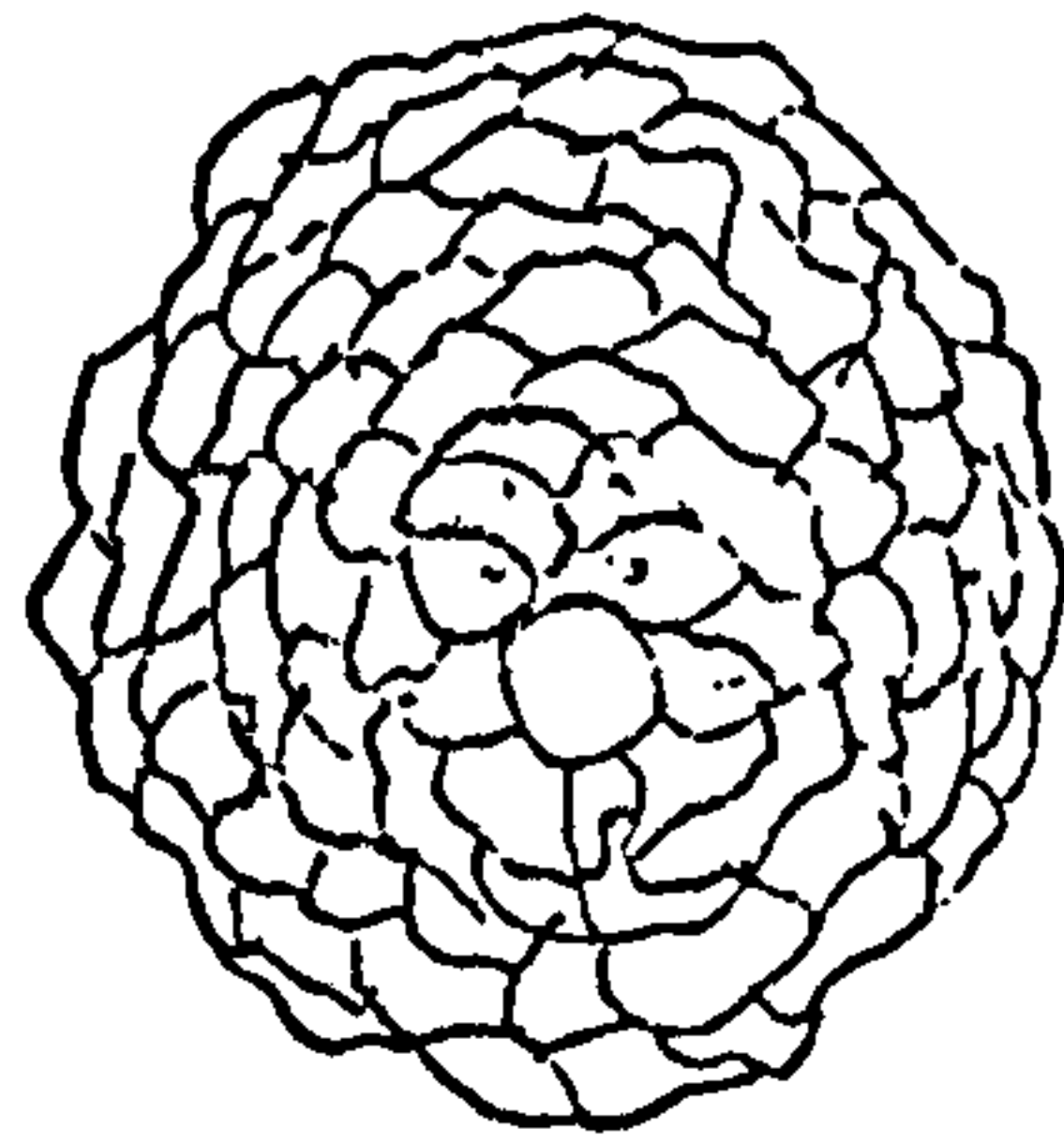
Test 2: Zones



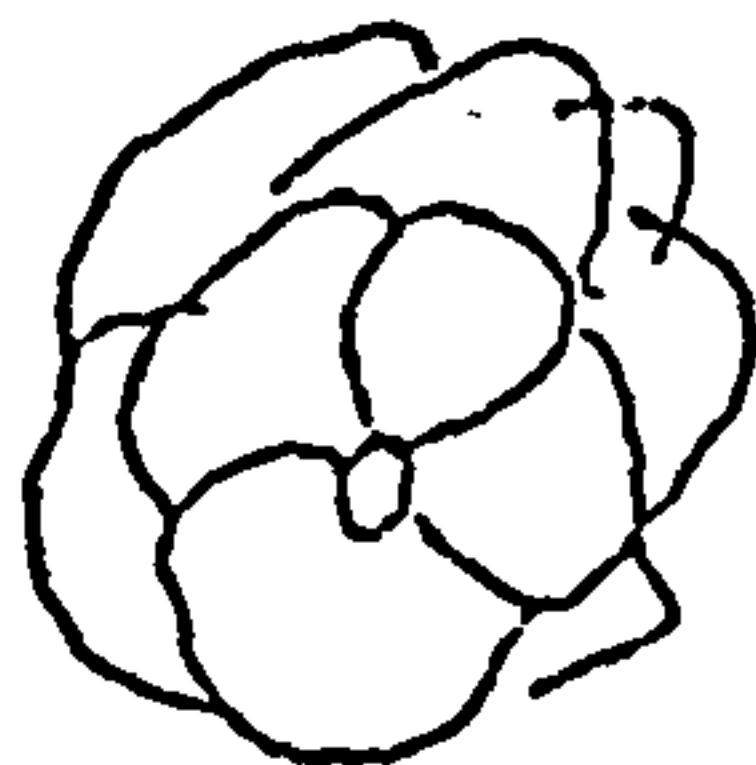
Test 3: Zones



Test 4: Zones



Test 5: Zones

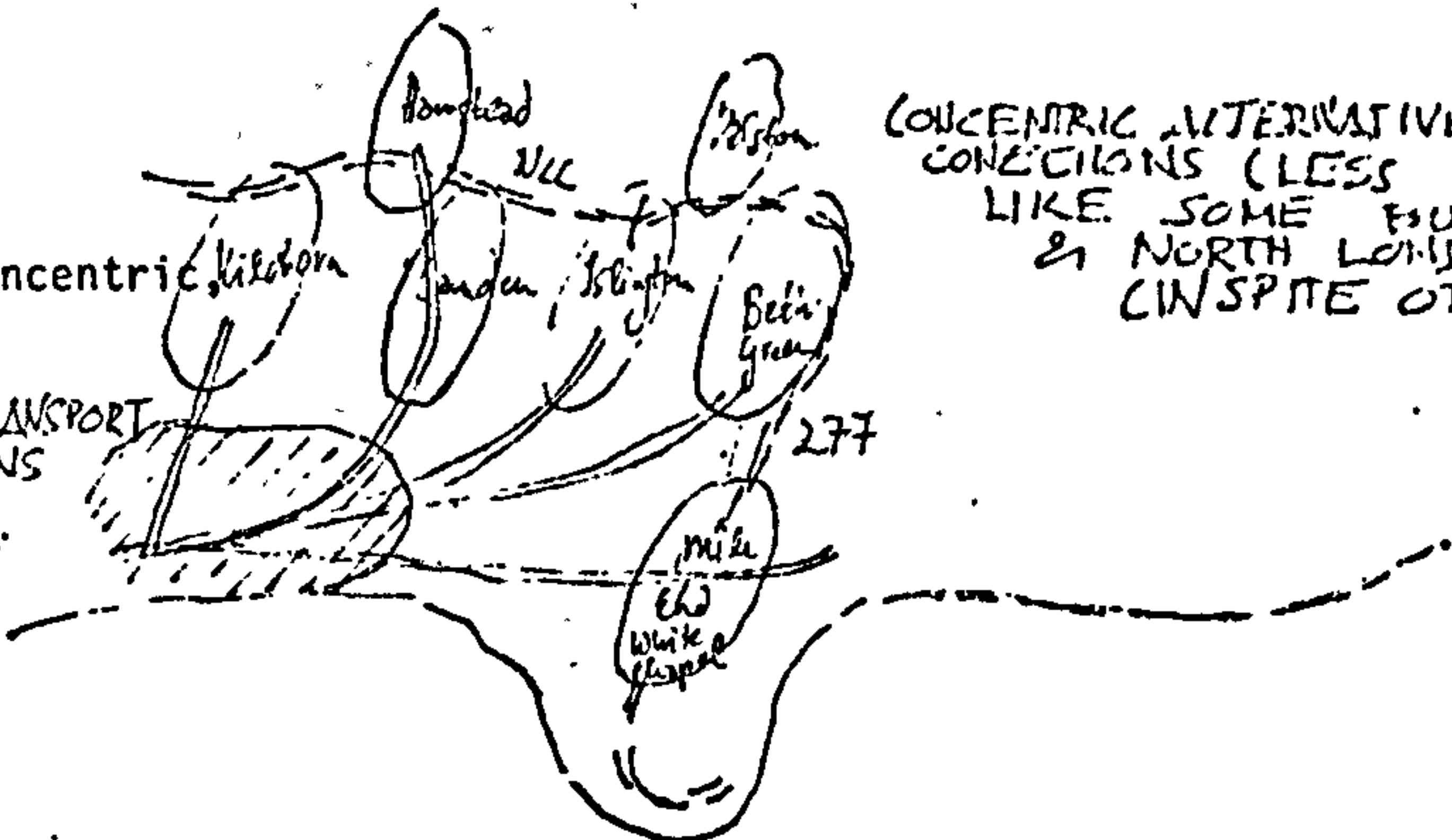


EXAMPLE OF GREAT CHANGE BETWEEN TESTS

STUDENT t)

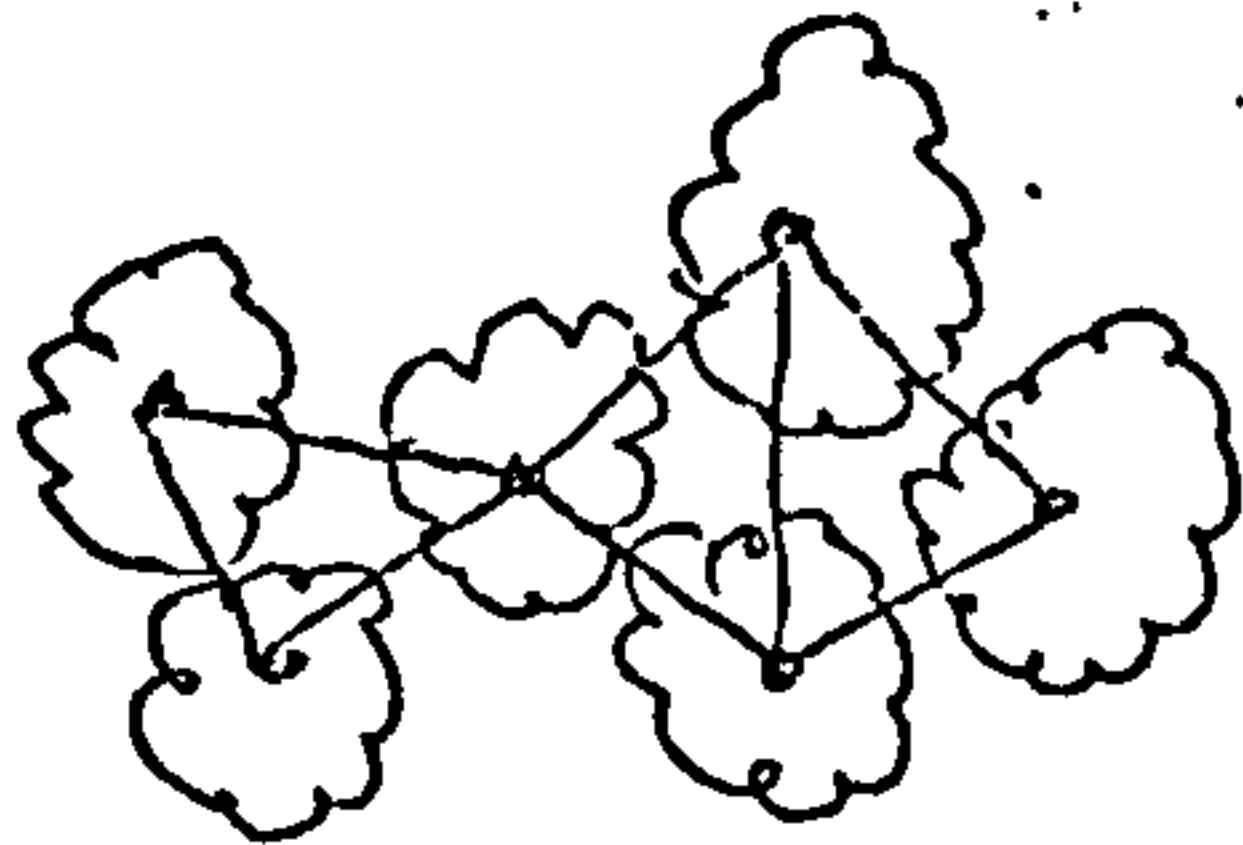
Test 2:
Radial, Concentric
Lattice

RADIAL TRANSPORT
KONNECTIONS
TO THE
CENTER
TUBE



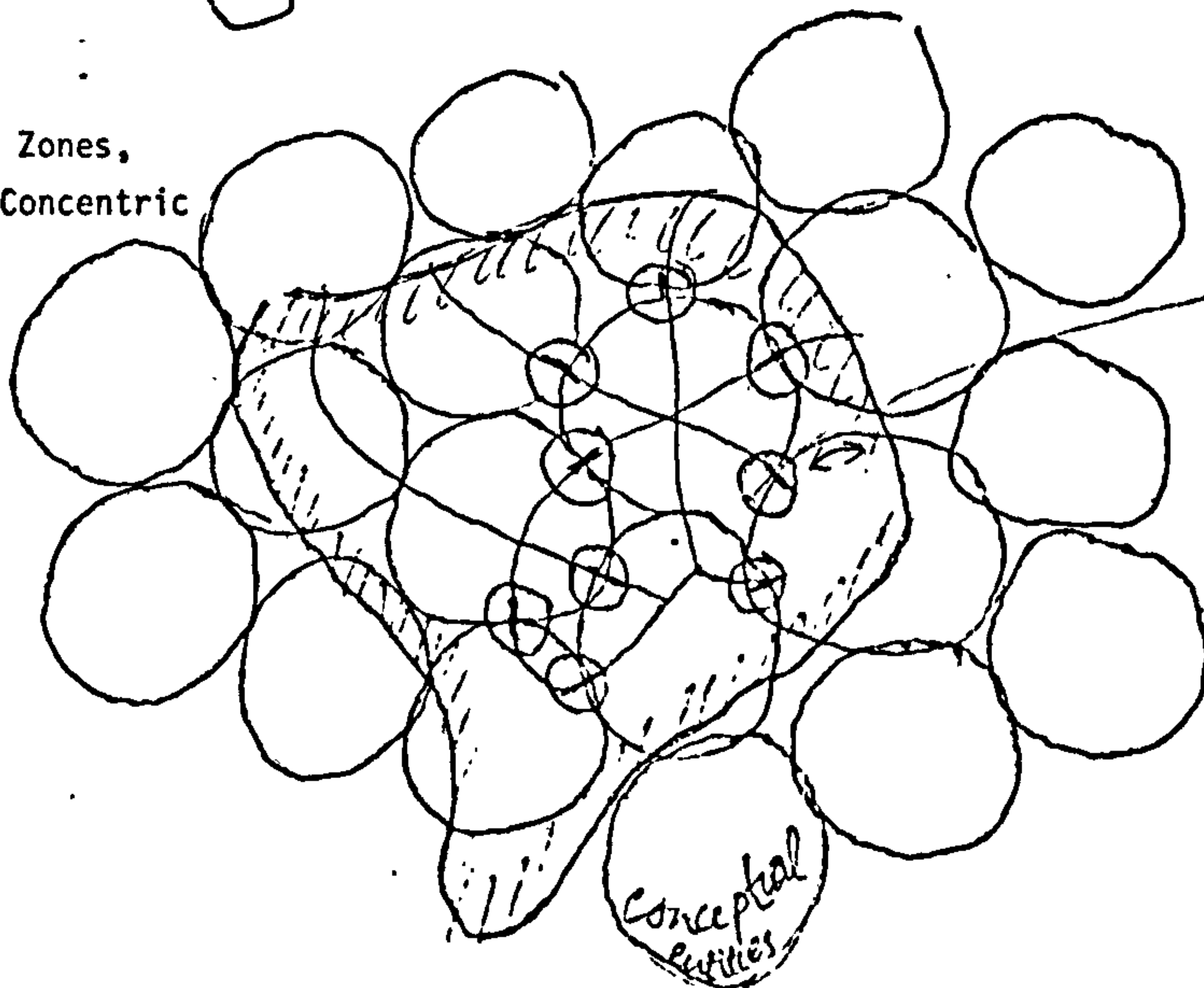
Test 3:
Zones, Lattice

○ - COMMUNITIES OR "VILLAGES"
AREAS WITH QUITE SPECIFIC CHARACTER



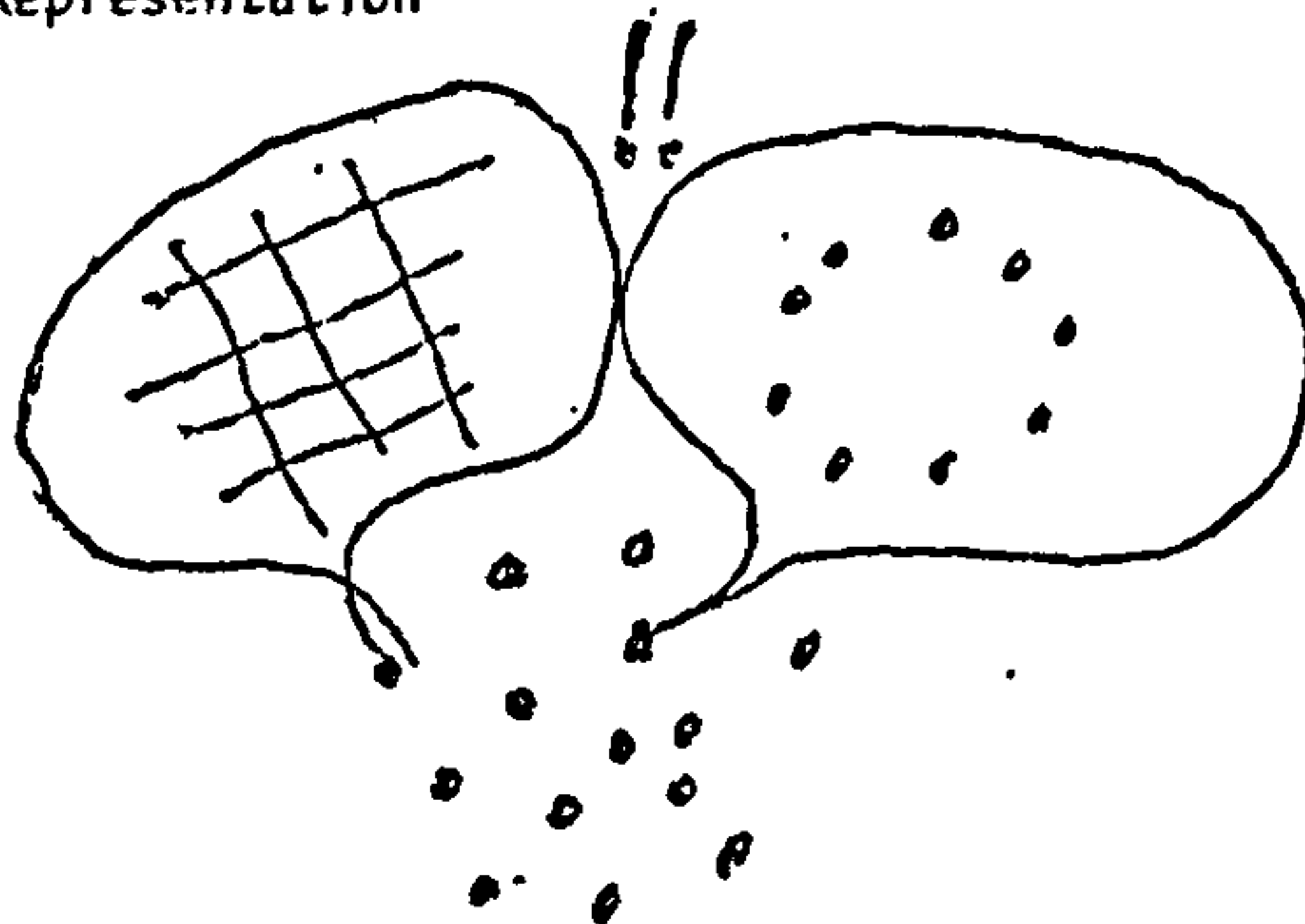
- Places I know
- connection for orientation reasons
- ☁ explored ground around these places

Test 4:
Lattice, Zones,
Radial, Concentric



points of
"contradiction"
↔ turning
of "conceptual
entities"
= painful
process

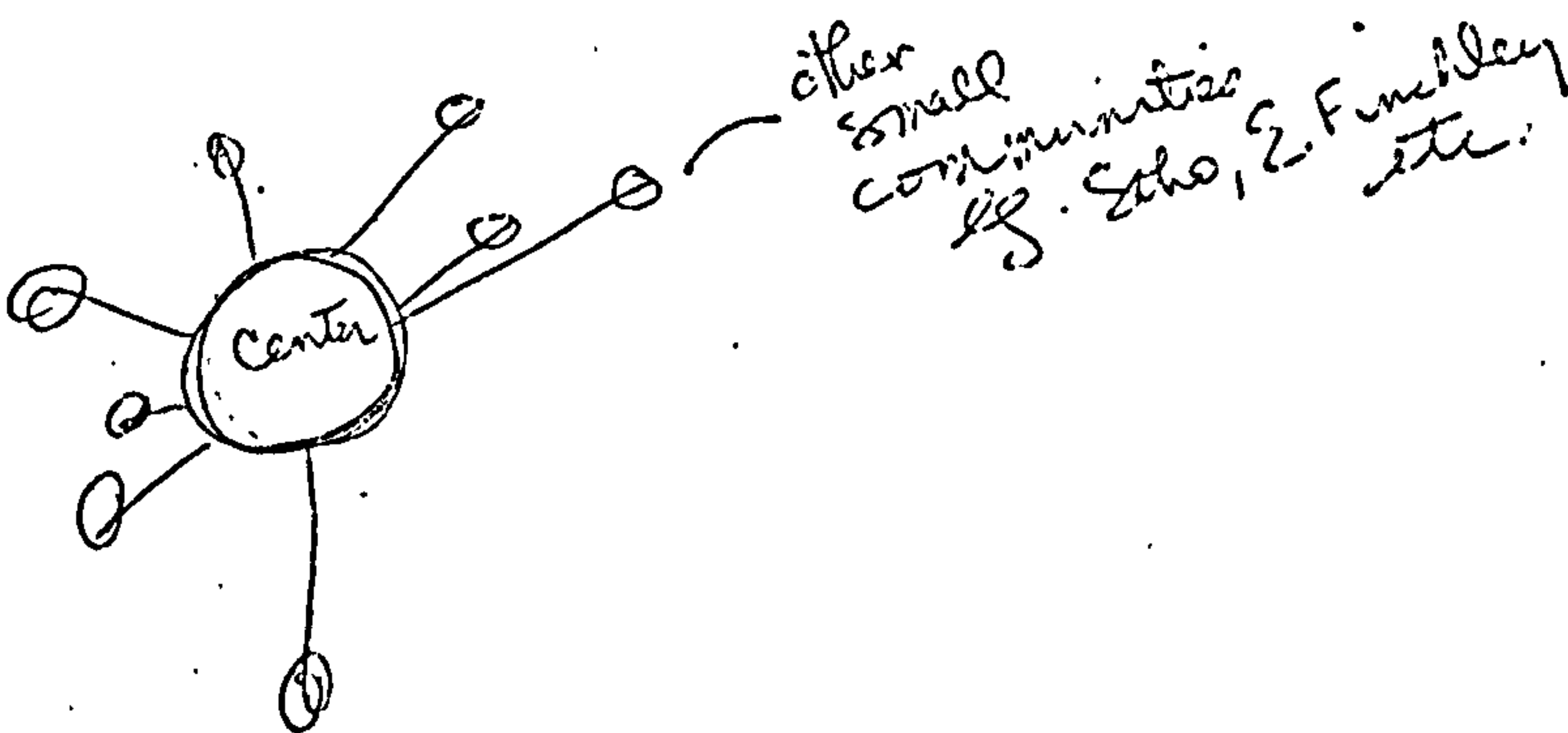
Test 4:
Non - Prototype Representation



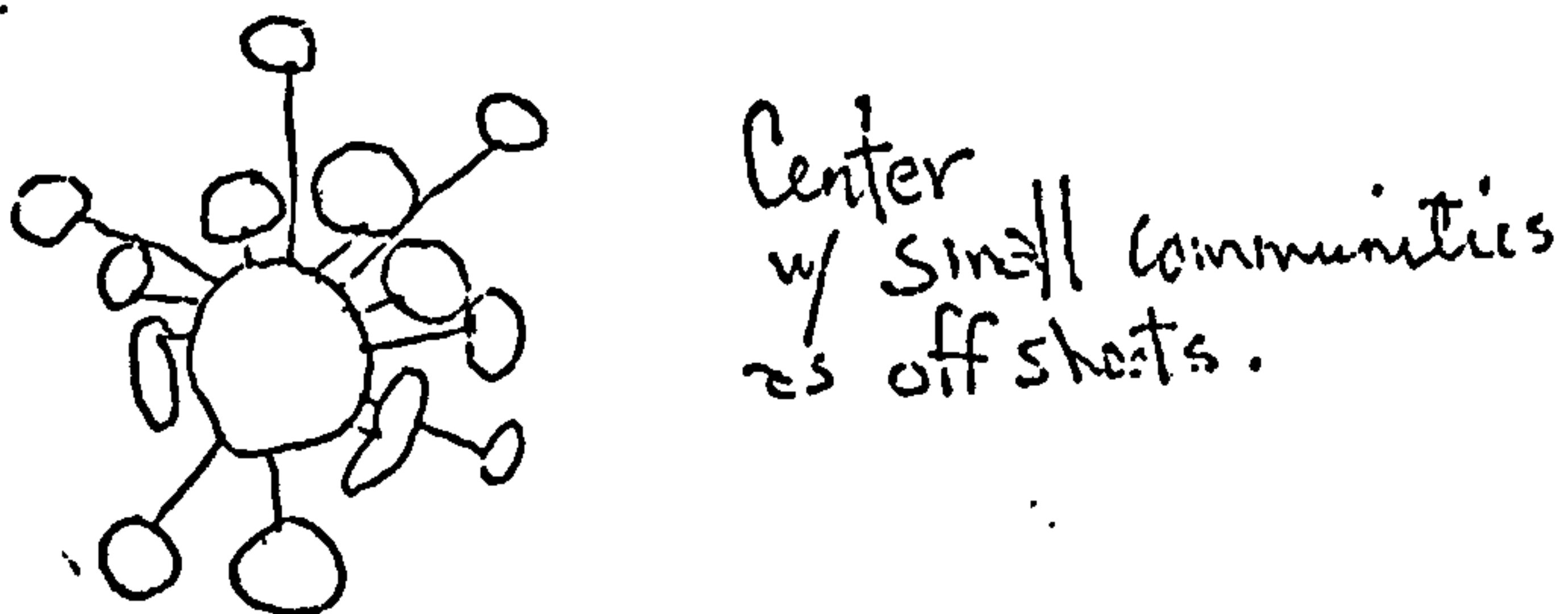
EXAMPLE OF REFINEMENT AND DEVELOPMENT OF ONE REPRESENTATION

STUDENT f)

Test 1: Radial



Test 2: Radial



Test 3: Radial, Lattice

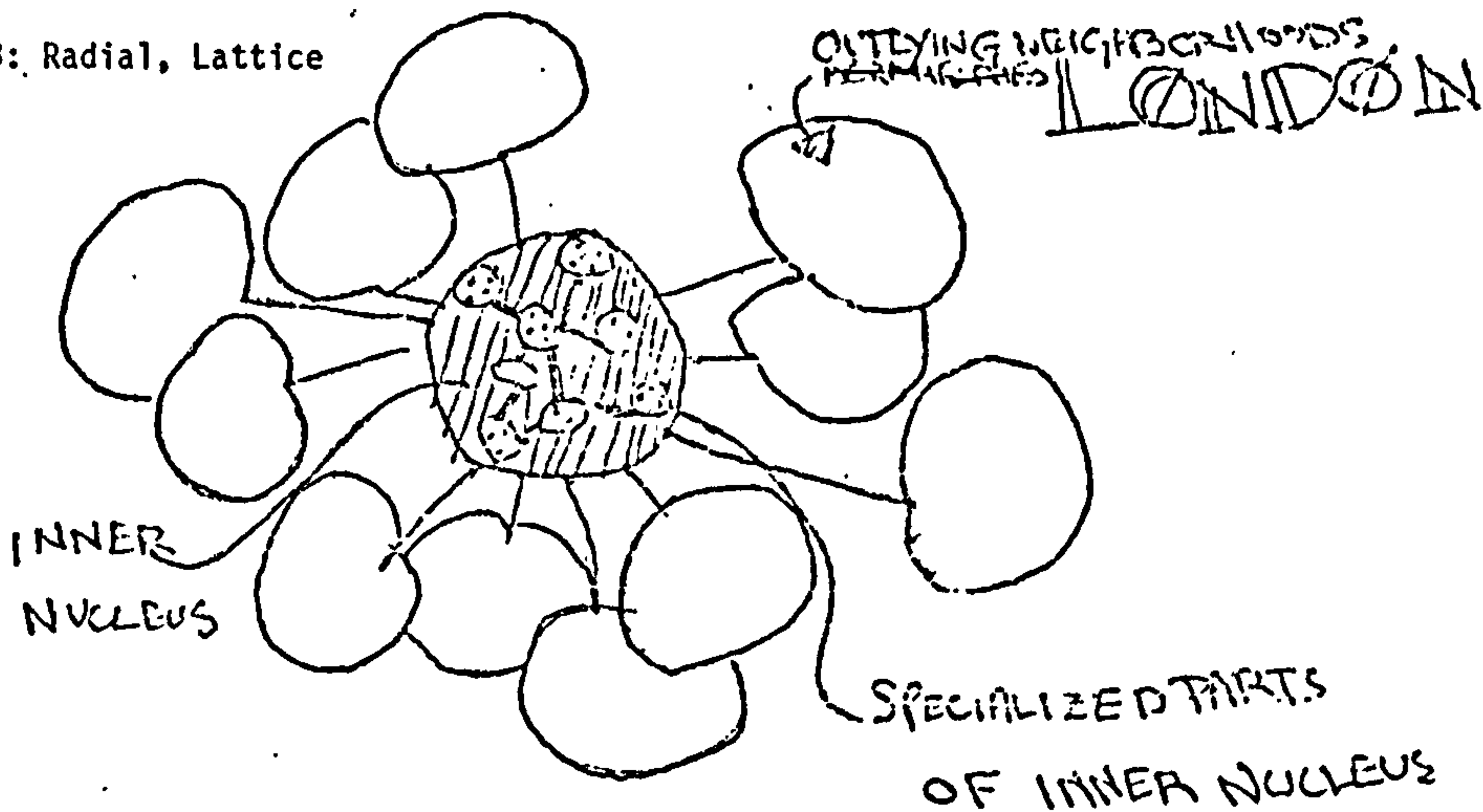


TABLE ONE

Table of Test Results

Student	Test 1	Test 2	Test 3	Test 4	Test 5	Change 1-3/4-5?
a)	L	-	-	RC	GRC	yes
b)	L	CL	C	-	-	N/A
c)	W ₂	-	-	W ₂	-	yes
d)	RC	L	L	-	LC	yes
e)	L	Z	Z	Z	Z	no
f)	R	R	R	RL	-	yes
g)	CL	RCL	-	-	RC	yes
h)	-	RCL	-	RCL	RC	no
i)	T	L	L	GCR	T	yes
j)	LC	LC	LC	-	ZLRC	yes
k)	L	RC	RCG	W ₁	W ₂	yes
l)	CL	L	L	-	Z	yes
m)	L	L	W	T	-	yes
n)	T	W ₁	W ₂	W ₃	T	yes
o)	-	CL	-	W	-	yes
p)	G	GW	-	-	X	yes
q)	L	ZG	ZL	-	-	N/A
r)	L	-	-	-	LG	yes
s)	LC	L	L	-	-	N/A
t)	-	RLC	ZL	LZRC	W	yes
u)	C	-	-	C	CR	yes
v)	R	RLG	RLC	-	LGC	yes
w)	RC	RCGL	RCGL	X	X	yes
x)	RCGL	CW ₂	CW ₂	-	-	N/A

Introduction Before main course After main course

Key to Table One

C	Concentric prototype used
G	Grid prototype used
L	Lattice prototype used
R	Radial prototype used
Z	Zone prototype used
T	Trivial (i.e. not observed)
W	Special Language
X	Unexpressed

Table Two summarises these results in a concise way.

TABLE TWO

RESULTS (out of 24)	No.	%	Students
Not enough evidence to decide change	4	16.7	b, q, s, x
No change	2	8.3	e, h
Significant change	18	75.0	
Difficulty with representation (on occasions)	2	8.3	p, w
Cannot observe (on occasions)	3	12.5	i, m, n.
Need other Models than proto- types (on occasions)	8	33.3	c, k, m, n, o, p, t, x
Did all five tests	5	20.8	e, i, k, n, w

Conclusions

The conclusions that can be drawn from this experiment are that it is possible for observers to observe a Common Object, and to present not only different views of the Object, but also to find quite different Languages in which to make these statements. Indeed, it is possible that observers sometimes cannot observe the Object, or else they cannot express their observation in a Language, and the difference between these two problems can be pointed out from the form of statement made.

Not surprisingly, it was found that the observers' views changed in time, and that different observers could hold apparently contradictory views of the same Object simultaneously.

EXPERIMENT THREE: REPORT⁺

REPRESENTATION OF THE BEHAVIOUR (B) OF AN OBJECT IN TERMS OF THE LANGUAGE REPRESENTING THE BEHAVIOUR (B⁰) OF THAT OBJECT. (CONCEPTUAL SPACE).

Aims of Test

The Aims of this experiment were to find a means, held in common by several observers (i.e. a Language), by which these observers could express an experience of "Conceptual Space" of a common Object. Secondly, these expressions should be capable of being transformed in form into another Language, representing (as closely as possible) a generally tenable view of the Object, so that the differences between the individual experiences, and the generally tenable view become clear. Tertiarily, these two expressions in the same Language should then be discussable. Thus, the aims of this experiment were not to produce classifiable "results", but rather a means which allowed the expression of personal "spatial concepts" in a manner which highlighted the difference between the "mental pictures" (for want of a better word) which we have, and the "true nature" (!) of the Object being observed[@].

⁺ The work reported here was designed and executed by Annetta Pedretti under my tutillage. The report, which I wrote, has been agreed and approved by Miss Pedretti.

[@] Work being carried out this year by Miss Pedretti is designed to find ways of defining these differences, and of expressing them in a common Language. Initial results are promising.

Origin of Aims

The origin of the aims of this experiment lie in the difficulty found by, amongst others, architectural students, of expressing their concepts of space in a non-cartographic metric (and, indeed, of even believing such concepts to be possible). Furthermore, the few attempts that have been made to permit of such expressions of personal space (other than those mentioned here) have rapidly moved from the personal experience to a loose generalisation that tallies very weakly with that experience (as elaborated in the Introduction). Yet, space, whether on an urban or a domestic, a mystic or an atomic level, is a matter of personal experience, and therefore worthy of examination, even if only by ourselves, in this way.

Previous attempts at providing means for the articulation of such views (excepting those in the previous two sections, which did allow such an expression, but which had different aims) have tended to stumble because of three difficulties: difficulty in explaining to experimental subjects what is wanted of them; difficulty on the part of the subjects in actually finding a means of expression for their personal spaces (the influence of the cartographic metric is so profound that the construction of maps is virtually always assessed by the subject against a cartographic model as being "correct" or "incorrect"); and the difficulty in actually comparing the expressions of different subjects on the occasions that such expressions occur, because of the differences in Languages.

Conditions and Repeats

The experiment involves the participants in two stages. In the first stage they were invited to mark in locations on a form, which they felt were equi-distant from each other, in the directions shown, given a basic scale against which to make their

judgements. (For fuller details, see later). This form filling was done individually, without any reference works (e.g. maps) being available. The experimenter then takes these forms, and, using the locations given on them, produces a map in which the locations are marked in their positions using the cartographic metric (in this case an Ordnance Survey map of London at 2½" to the Mile was used). The lines used in the forms were then projected onto these maps, through the locations as they appear on the cartographic metric, resulting in a "distortion" of the form of the forms as their locations were transformed from the equidistant relationship shown in a personal space to the irregular relationship shown in a cartographic metric. These transformed maps were then shown to the participants by the experimenter, in a group, and a (taped) general discussion and interpretation allowed, in which the participants were encouraged to state their surprise, and account for the "irregularities".

The experiment has been carried out three times: twice with students and staff in the first year course at the Architectural Association School, using each of the two forms designed; and once with faculty and students in the post-graduate courses in Cybernetics, Education, and Psychology at Brunel University. In this report, we will only detail one of the tests with the Architectural students, since the other two tests confirm the findings - although we will briefly describe them.

Form of Languages and Questions

The test was put to the participants in the following manner. Two form types were prepared (as attached). One consisted of a regular gridded matrix of 9 x 9 nodes (i.e. 81 total). The other of a regular radiation of 8 lines from a common centre, with 5 equidistant points marked on each of the 8 lines, giving a total of 33 nodes. (It is with this form that we

shall primarily concern ourselves in this report). The centre of each of these forms was described as the location of Centre Point, in London. One of the lines in the radial form was called the tube station in Camden Town. The centre point of one side of the matrix was similarly referred to^e.

The participants were given a form and asked, starting with the line Centre Point to Camden Town, to state the location of the $\frac{1}{3}$, $\frac{2}{3}$ and $\frac{1}{2}$ way points on this straight line, as they understood it. Keeping the angles and pattern as shown in the forms (i.e. grid or radial), they were asked to name the locations of the other nodes, regularly distributed.

The nodal locations on the thus-filled-in forms were then marked on a sheet laid over an Ordnance Survey Map, according to their cartographic co-ordinates, and the connecting lines drawn between the thus-marked points. In the case of the radial form, rings were drawn round the centre node, connecting points equal distances out from the centre, making "circles". This was intended to highlight the distortions.

These maps are the maps that were shown to the participants to engender discussion.

At this point, it is worth briefly discussing the various Language forms.

The participants had an Object pointed to, to which they attributed a behaviour (B). This observed behaviour was stated in a Language (also pointed to), to which was attributed a behaviour (B) held to be identical to the Object's behaviour (B),

^e In the case of the Brunel experiment, in which the matrix was used, these fixed locations were intentionally omitted. The distortions in the cartographic transformations were not affected.

as seen by that observer. All observers were given the same Language (the form) and the same Object (location of places in London according to distance and direction).

The Object's observation of itself was represented, not by the invisible Essence, but by a representation of a Behaviour (B^0), through a consensus observation of a Behaviour (B^0) of a Language - in this case the Ordnance Survey Cartographic Metric Projection.

The representations by individual participants were transformed into representations using the consensus Language Behaviour (B^0), and these new forms of representation were shown again to the individual participants. The difference between the observer's attribution of "equi-distant and equi-directional", and the attribution as seen in the consensus representation "non-equi-distant and non-equi-directional" produced a genuine surprise amongst the participants.

Experiments - Results, typical evidence

The results of the experiments can be summarised as follows (again, we are discussing the radial form in detail, but the statements hold generally true for other experiments conducted). In general, the following characteristics were found in almost all of the transformed maps produced:

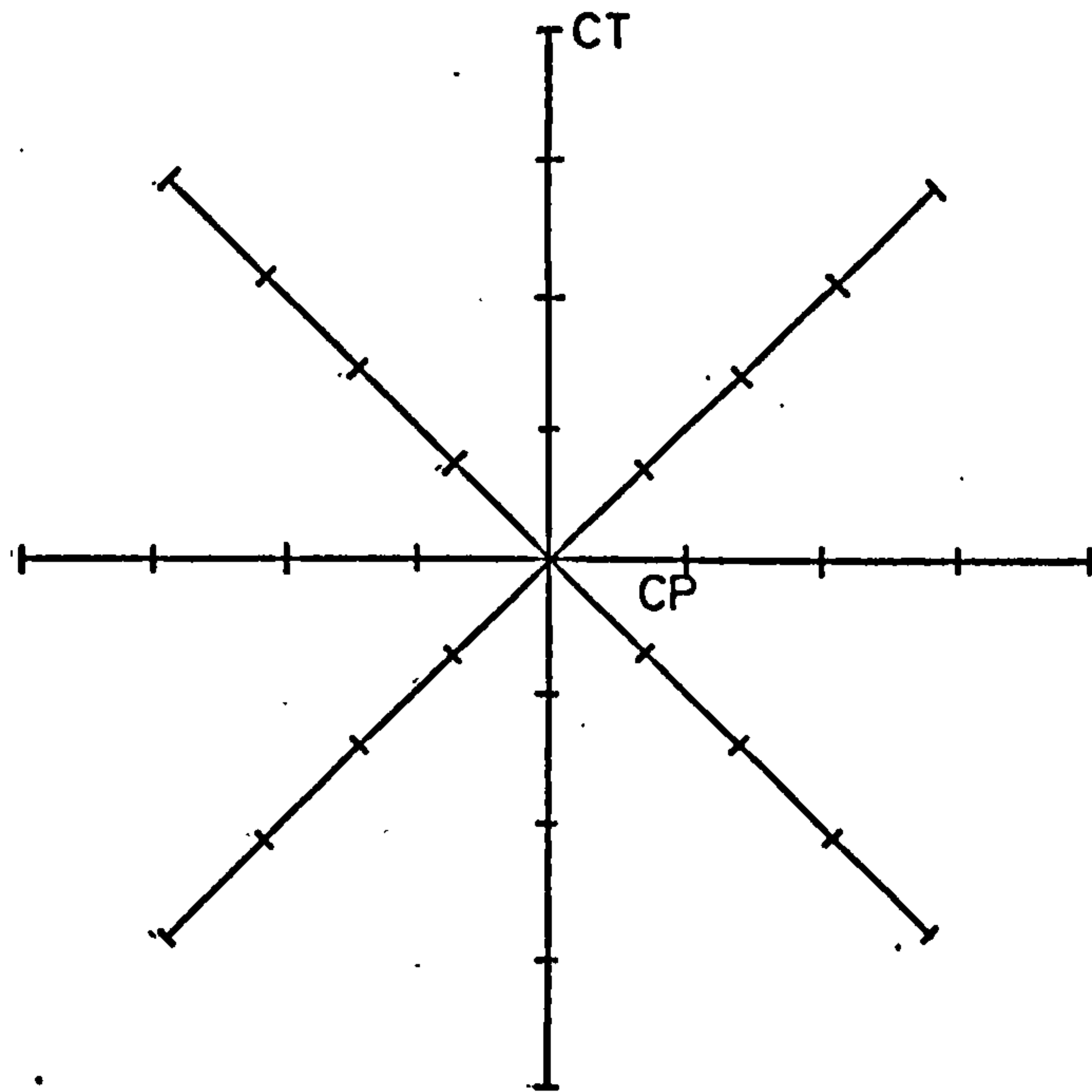
- a) The transformed maps were marked distortions of the regular forms the participants were asked to produce.
- b) The distortion tended to be, primarily, along one axis, rather than "random".
- c) Almost all participants found an area for which they could not make locations at all.
- d) There was a tendency to invert places in one of two ways; either directly inverting (i.e. location $\frac{1}{2}$ way along axis should, cartographically, actually be outside the end point); or locations were "switched" across axes.

- e) The (cartographic) areas covered by each participant were very different (in spite of the fixed given scale), in the total size of the area covered.
- f) Each participant marked in quite different locations (even along the fixed axis).

The attached examples bring out these points.

Forms and Maps (See over)

subjective space
radial form



name date
© annetta pedretti 74

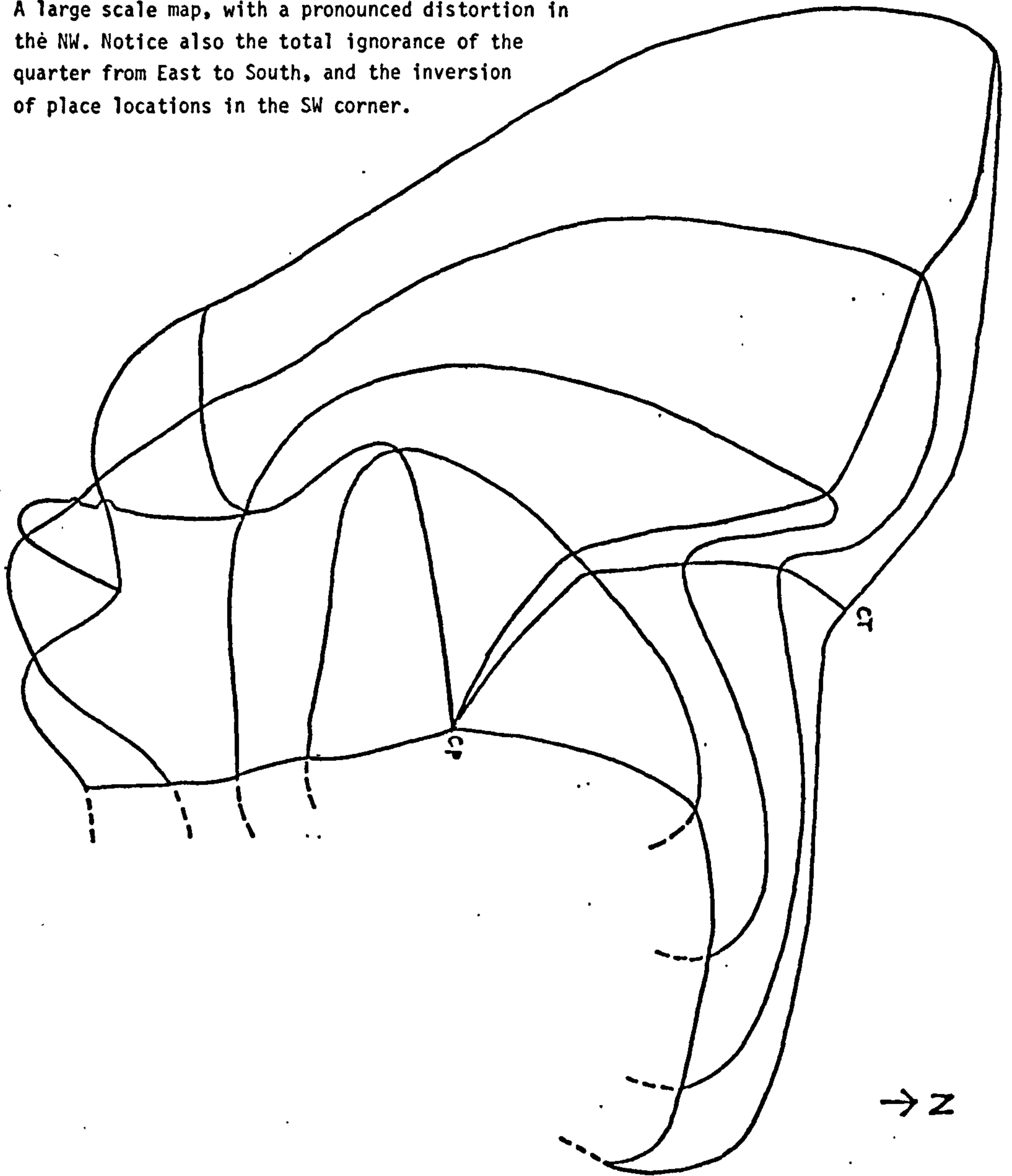
subjective space
grid form

				CT			
				CP			

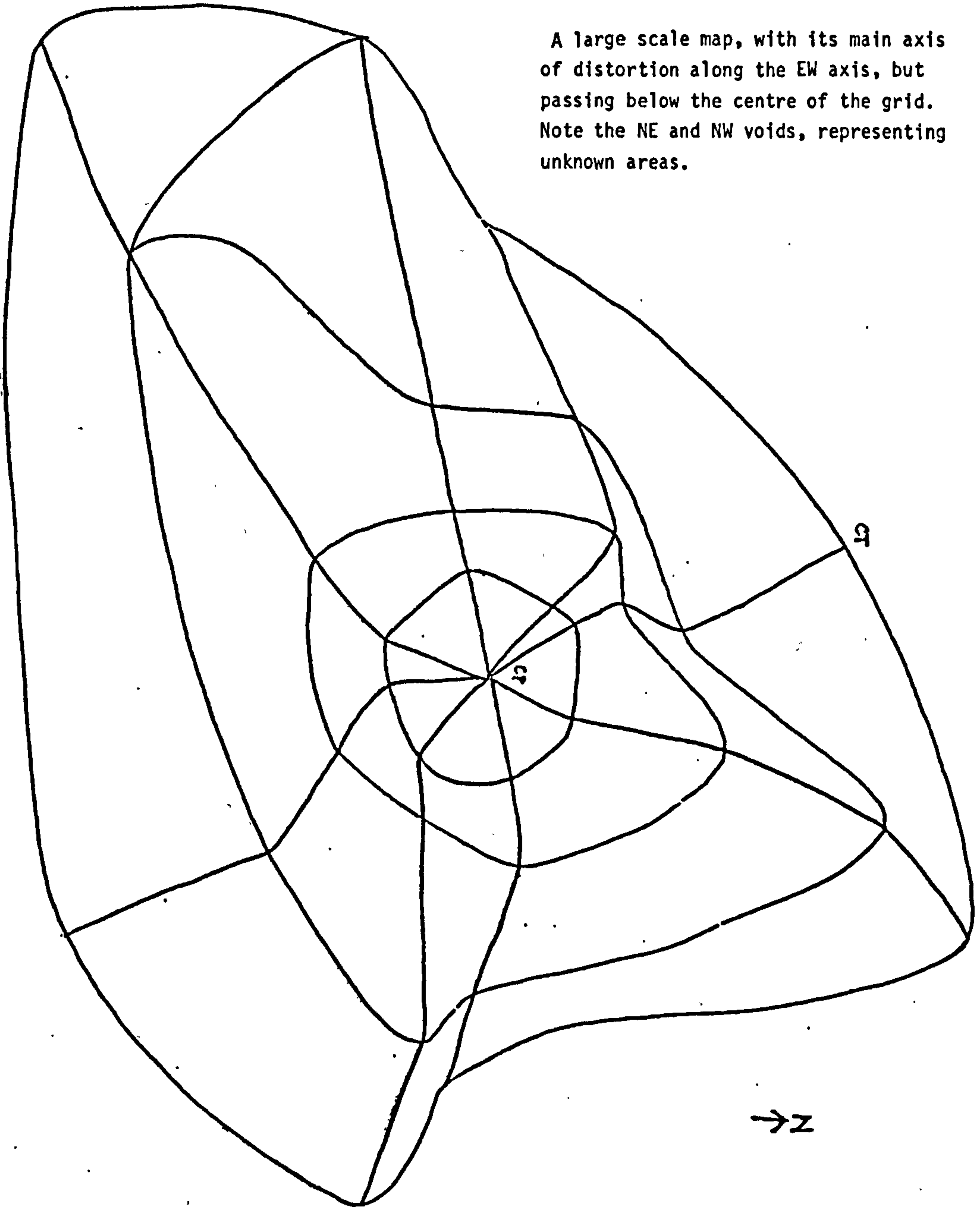
name date

© annetta pedretti 74

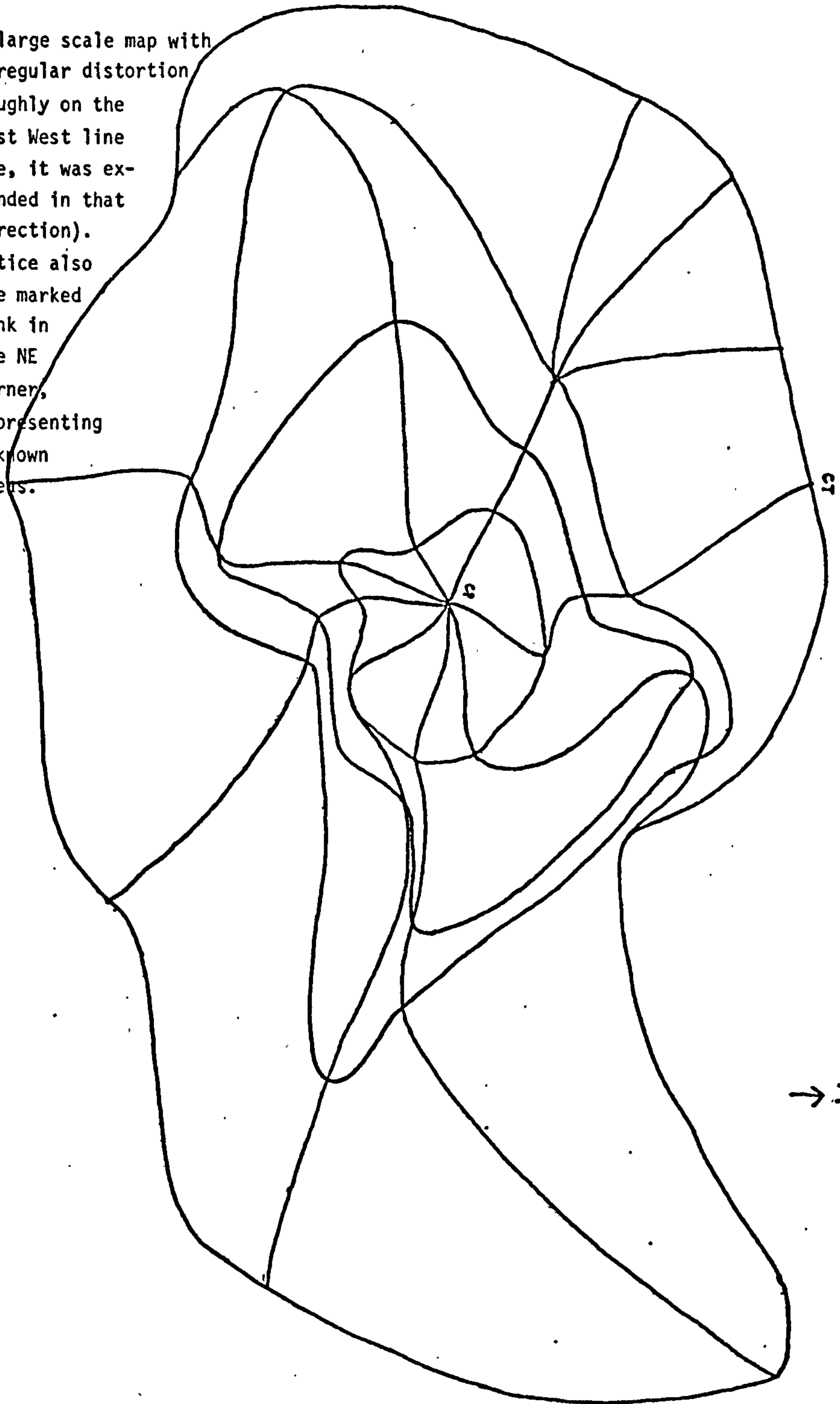
A large scale map, with a pronounced distortion in the NW. Notice also the total ignorance of the quarter from East to South, and the inversion of place locations in the SW corner.



A large scale map, with its main axis of distortion along the EW axis, but passing below the centre of the grid. Note the NE and NW voids, representing unknown areas.

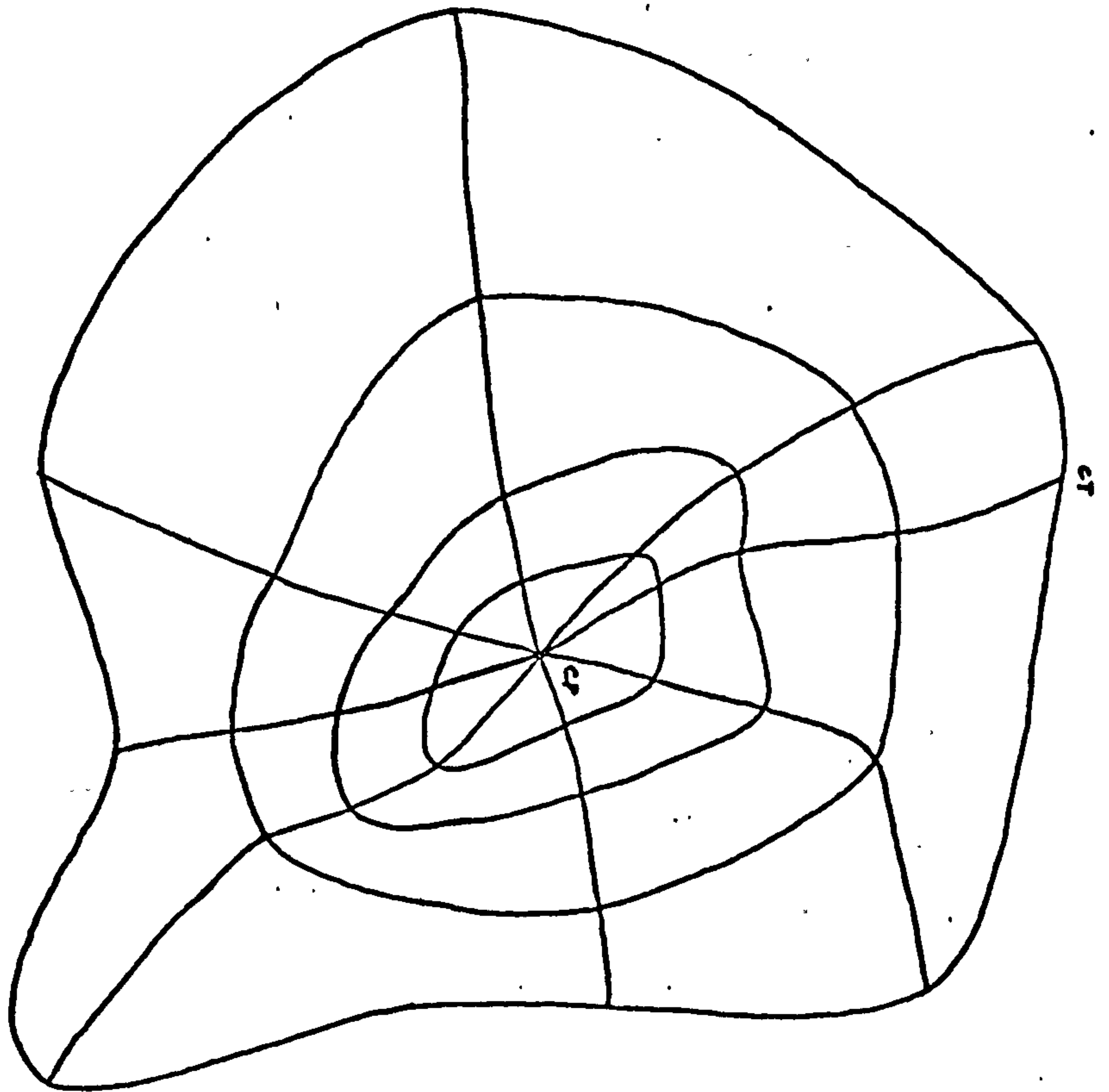


A large scale map with a regular distortion roughly on the East West line (ie, it was extended in that direction). Notice also the marked kink in the NE corner, representing unknown areas.



→ Z

An unusually regular, small scale map.
The main distortion can be seen in the SE direction (where the map
crosses over the Thames).



→ N

In the discussions following the presentation to the participants of these transformed maps, there was one underlying tendency (apart from astonishment)!

Almost all participants tried to invent reasons for themselves, and for each other, to explain these distortions: and some of the invented explanations were completely fantastic because they involved one participant extrapolating from another participant's map, a reason, stated as a necessary fact, about an aspect of that participant's life of which they were usually in complete ignorance, and which turned out, eventually, to be "untrue" of that participant.

Improvements in the tests are currently being tried, which are intended to (amongst other things), improve the giving of explanations of these distortions.

Conclusions

The experiments carried out have shown that, using the forms provided as Languages, and transforming the results into the Language of a consensus cartographic map, it is possible for observers to make statements of their personal conceptions of space - and for different observers' views to be compared. Not surprisingly, the view expressed by each observer was found to be different. But, in their present forms, the experiments do not in any way account for the differences of these personal spaces.

EXPERIMENT FOUR: REPORTSIMULTANEOUS REPRESENTATION OF SEVERAL BEHAVIOURS (B) OF ONE
OBJECT (LEADENHALL MARKET).

Included in this experiment is an example of the successful representation, together, of several views of one place. The individual maps, etc. have been left out, since they are not critical. The picture has been assembled from their contradictions and ambiguities, by simply putting the various alternatives together (as can be clearly seen).

This work was produced by Tim Richardson, a student at the Architectural Association, under the tutillage of myself and Leon van Schaik. It is included, virtually verbatim, with the maps omitted (as noted), with his permission.

Leadenhall Market

APPROACH: I chose to study the mental space of the market. The method adopted was one much advocated by the current Bible - "Mental Maps" - basically asking people to draw maps of an area, comparing and extra-polating.

I chose this for a simple reason. I was fortunate enough to have a whole mine of map-drawers right next to the market in Lloyds Building. My father works there, and his Right Arm, Mr. Adams, was willing to spare a few minutes to help me. I asked him to draw a map of Leadenhall Market showing the routes and shops. Okay so far, until the work started. After a fast start things got decidedly rough around the stationers and almost ground to a halt by the pet shop. However, dogged determination prevailed and a detailed map was produced. I don't know which of us was more fascinated, Mr. Adams feeling sure he could see until he looked, or me discovering what an exhilarating and educational experience this can become to the drawer. I thought that Mr. Adams's next trip through the market would be wide-eyed and discovering. After this I introduced a memory game - giving questions related to things I had noted while walking through the market as 'things not immediately seen'. I asked for the position of two clocks in the market. The clock by the centre was know, but the clock by the Butcher's was more difficult to remember. This was interesting since I had found the Butcher's clock to be much more visual. However, on a later trip, in the evening, I could hardly find the Butcher's clock because of the bad lighting and the tangle of butchers' hooks hiding it. Lighting may account for a universal lack of knowledge as to what was sitting on the columns surrounding the crossroads of the market. The Gryphon managed to elude everyone's memory. The tracery motif was known by quite a few of the contestants to exist at the ceiling of the entrance arch to the market. Fourth question - how many doors

to the Lamb pub? This was dropped because it was a trick question, one set of doors being closed by a fruit machine. The last question was asking the name of the Supermarket opposite the Lamb. Every person said immediately that they had no idea about the names of any of the places.

Mr. Adams's enthusiasm thus aroused, we headed for the canteen in the basement, where four members were accosted and asked to draw a map in five minutes. Although four people together found it easier to do it than four individuals they did comment that it was surprisingly difficult to do and a good test of the memory. The response so far rosy we headed upstairs, Mr. Adams's five minutes having already extended to a half hour, and started going through the offices looking for map drawers. Altogether eight people managed to draw a map. Again I think the contestant gained as much from it as me, one person going so far as to thank me for making him realise how little he knew. A five minute deadline was set, and then the questions were asked. Again most people got the clock at the cross-roads but not at the butchers, the Gryphon was identified as either a lion, a dragon or a mouse, and the Supermarket drew a complete blank.

The attached written Guide to Leadenhall Market was assembled from the eight maps provided by the eight contestants.

A Guide to Leadenhall Market

(Compiled from the memories of over eight esteemed gentlemen of Lloyds and thus considered a fair assessment).

First there is a pub at a crossroads called the Lamb. There is a Post Office separated from the pub by a blank space. There is a cafe separated from the Post Office by a blank space. Next to the pub on the other street is a cheese shop or possibly a supermarket or possibly a huge dominating Lloyds Old Building, or Lloyds might come after the cheese shop/supermarket or there may be no Lloyds at all. Next to one of these there is a bank which may in fact be Lloyds (not the bank). This bank forms a corner to Lime Street and the street leading to the Lamb. The rest of the block is occupied by Lloyds, unless Lloyds occupies the entire block apart from the Post Office.

Secondly, the block to the north of the pub: (the bank-pub axis continues northwards, or eastwards, so probably north but in fact west, which is in fact irrelevant). On the right the block consists of butchers/poulterers and a tailor at the top called either Acumen or Aquascutum forming a corner with Gracechurch Street. A clock on this street is definitely non-existent, but there is one at the crossroads.

On the eastern axis the butcher at the corner opposite the pub might be next to a blank space or a stationer or the stationer might be a cafe or the cafe might come after the stationer.

On the left-hand side of the north axis of the crossroads is another block. Opposite the poulterers/butchers are more poulterers/butchers. Moving northwards there may be a fish shop, then a florist, then a pub forming a corner with Gracechurch Street, but this corner may also contain a tailor or nothing at all. If we look at this block on a West-East axis

and look at its southern flank, this contains, from right to left, a grocer, then a petshop, or it may be the other way round. What comes next is a subject of intense discussion, but it is thought that the following shops, in order unknown, may exist: Cafe, bookmaker, florist, greengrocer, tailor, electrician.

The fourth block is split by alleyways - one or two in an East-West direction and one in a South direction, forming an L-shape since the South alley does not reach Lime Street. These will form one or two 'islands' but more likely one. It is evenly divided as to whether the fourth corner of the crossroads contains a supermarket or a grocer. Moving downwards (opposite pub-bank) there is either a chemist or a cafe, or there may be a greengrocer in an alley. Then there is an electrician followed by a cafe, fruit shop and building site, the building site forming a corner with Lime Street.

On the north facade of the block, left of the alley is a sweet shop, but the alley only contains a chemist, and maybe a cafe opposite the chemist. Moving right to left from the sweet shop memory starts to fade, but there may be a bookshop, butcher or grocer, followed by a beauty salon, then an electrician next to a cafe, then a tailor where the street joins to Lime Street - this block might be triangular. At this point the gentlemen are tiring and anyway have more pressing business to attend to, so a halt is called to the proceedings.

CONCLUSIONS

CONCLUSIONS

The aim of this Thesis was to produce a philosophy that better accounted for the contradictions in views of Architecture held by different observers, and to permit means of expression of such views (observations) to be made; and to apply such a philosophy to demonstrate that its theoretical claims could be substantiated (i.e. that it could be made to work).

The reports on the Experiments (and especially Experiments 1 to 3, Experiment 4 (executed by Tim Richardson) being primarily an example of a means of aggregating the expression of many views in such a way that their differences are maintained), show that the aims claimed for the Thesis have been achieved in several different contexts: in the first example, the different behaviours attributed to an Object, their contradictions, and the use of a consensus referent were demonstrated; in the second, the change in behaviours at different times of observation, and the creation of appropriate languages for the expression of the observations were shown (as also were difficulties in observing the Object, and in finding an appropriate language): and in the third (an experiment designed and conducted by Annetta Pedretti) a means for demonstrating to participants the difference between their attributed behaviours, and the behaviour attributed by a consensus metric (accepted generally, as "true", and representing, as closely as we can, the Object's self-observation) were shown.

In this way, the main intentions of our philosophy were shown to be operational. But the construction of the philosophy itself produced various unexpected side-effects (some of them not so peripheral), which can be pointed to here. We will not, however, summarise other findings of the Thesis here - that was done at the time in the Main Text, and also in the Abstract.

Initially, then, the self-observing Object was shown to support different behaviours, made by different observers. But the observer, to be an inhabitant of the Universe, had also to be an Object. The functioning of a self-observing Object, being shown to be similar to that of an oscillator, generates, for each Object, its own time sense. Yet the observer, and the observed Object, have to correlate with each other for an observation to occur. Thus, not only does our Thesis produce, in each Object, its own sense of local time, but also these times are obliged to correlate for an observation to occur.

The same can be said for any other Object, including one, the behaviour of which will represent the behaviour attributed to the initial Object, by the observer. And it is through the types of correlation of these times of observations that we can produce the logical systems through which Models and Languages can represent Objects, and through which individual observers can construct hierarchies of Objects, logically related, and hence their own cognitive structures. In this, we believe this Thesis to be unique, for no other philosophical work of which we know can derive its own logic from its system of units.

The process by which these observations are made was also subjected to an analysis that arrived at a system for analysing forms of argument, reducing them to their most economic form (through reference to the same logic of relations that was derived in the philosophy), and dimensioning the Modelling stages, from which it was suggested that a means of mapping cognitive processes, and a method for improving the performance of computers, might be developed.

Other problems were also resolved: Gödel's was shown to be essentially irrelevant, for example, and Wittgenstein's insistence on the unobservableness of the Object was negated. The problem of psychological overload was accounted

for, as was the gradual loss of definition of Objects, as they are observed more and more.

These "peripherals", peripheral only in the sense that they were not primary design considerations in the construction of this Universe, leave areas for follow up, to further test the physical viability of this Thesis. Over the years, I may attempt some. And the list here is not intended as exhaustive: the possibility of using versions of the Experiment forms contained here to assess, or to let students assess, progress, leaving style (as Pask does), understanding, and their own conception of a field (e.g. "Architecture") is also open: indeed, it is the inclusion of work by students of mine which validates this claim (and there is much more being done now).

This Thesis moves outside its fields of "Architecture" and "Language": indeed, these fields are, in many ways, now irrelevant to it. Substantial claims might be made for it, on hunches. But this has been only an attempt to account for its relationship to its two initial fields of investigation: to discuss some of its surprises: and to mention some extensions. The testing of its value, and the checks of these projected experiments, lie ahead, in the hands of others.

STORIES

(When You First See This Place)

(Now That You Can See Me)

(Seeing Is Believing Oblique Killing)

(A Fred Blogg's (R.I.B.A.) Eye View)

(A Superman's Eye View)

(A God's Eye View)

WHEN YOU FIRST SEE THIS PLACE:

When you first see this place it is all dark but growing instantly lighter - in the gloom you can see nothing but your own buzzing. But you can't be elsewhere in other buzzings than yours.

Little lights glimmering, brighter brighter, each one buzzing as it admires itself, looking over its shoulder and saying This is how I look to others, This is what I am, This is what they are. But they are not, and it is not.

As little lights, growing brighter brighter, ochre coming out of the pitch blue dark, stars of wider dimensions, infinitely small, shining dim ochre in vacuous night sky as far and as near, as little lights shine, they buzz, or so it seems to me looking at my own little light buzzing.

I stop and look over my shoulder where I can be, and survey the frozen landscape of voids.

Little lights which buzz, near, near, all is near, all is far, bigger than the stars while infinitely small, looking at themselves and therefore buzzing, equally spaced and yet near. Who said the caveman's magic lanterns just-out-of-reach were incorrect?

And what of the sound? A little murmuring of each ochre, dimly vibrating, invisibly and inaudibly, so indistinct that there is only a hint of a suggestion, as each ochre sways in its appointed place, murmuring its buzz to the vacuosity of others.

Growing brighter, sound growing louder, this place seems to become accessible each time I am there looking, seemingly I can see it all and hear it all, but I can't be there. I look over my shoulder, pat my back, and that is what I am doing there. But that is not, and it is not.

Each light makes its pure ochre, swaying in the pitch blue, each light makes its murmur inaudibly heard by others, the buzz buzz of this world, frozen in its eternity, noticing its

multiplication one moment from the next, and its paling as it fades in parts while I see it more clearly and hear it with louder inaudibility.

With each light growing brighter in its dimming, buzzing its murmur, there becomes clear a difference in each, at least to me where I am, for, buzzing, and travelling in the pitch blue, the vacuous silence, sometimes two pass through each other visibly and with a difference never colliding on the way, passing with a loneliness so total as to be chilling, were it not that this place is cold already, with only the buzzing ochres searing hot if one were to touch them, but you can't be there.

Passing through each other, it appears they don't even notice their intrasection while they don't collide; perhaps it is me?

And yet, I can't be there. I am looking at myself over my shoulder, pat on the back, the loneliness of the lone description silently divorcing itself one step at a time, shedding a mock silent tear to its own audience, lost in the searing chill of ochre murmers, reporting to myself the fact of this aloneness of all as if I could see it all, and each buzzing's buzz.

While looking then at my searing ochre murmers, suddenly neon lines start drawing and undrawing themselves around some or more of the buzzes, weaving patterns, pushing them into small herds of indifferent differences, collecting them together, and this with the process of intrasection hiding some ochre lights while colouring them around with blue, green, red and yellow racers, enlivening this place with a kinesthetic game of automatic playing, causing the little lights to all but disappear on occasion, so diverting is this game enlivening the twilight of pitch blue.

And yet, even this diversion pales, and gives no solution to the sadness of the isolation, for ultimately it is a very sad world: ultimately there is no possible communication between the

little ochres, murmuring, searing, buzzing, neon-lining:
ultimately each is alone, quite alone, unique. The rest is an
illusion to fill in the ceaseless fading time and space.

When you first see this place you are lost.

NOW THAT YOU CAN SEE ME

Now that you can see me, let me first tell you what you've done to me, lying here on my clean adjustable table, in my white tiled room, surrounded by you, glazed tiles glaring, grey metal filing drawers sliding in and out, High Speed Morgue, now that you can see me, all of you shining eyes, turn off the lights.

Now that you can see my white, bright, whiteman flesh, my spurting red blood, my vague blue eyes, my long mouse hair, my white clean overalls, my cleaned cut nails, now that you can see all that, let me tell you what you've done to me.

This room is vast, white, speckless, boundless. Floors, tiled in white glazed tiles, trimmed with drains, meeting walls, tiled in white glazed tiles, only with this difference, an interspersal of grey metal filing drawers. The ceiling may be there but is hidden behind a downpour of bright electric light and cannot be seen. The whole very clean, damp, cold, bright. And in it you, thousands of you, millions, busy acting. For this room is the theatre in which you operate on me.

Sitting secured on my table, there is nothing I can do about this, even if I would, no way I act on you, can exert pressure. You are a thousand free agents and I am your corpse.

Now you can begin.

Taking a thousand identical tables, a thousand free agents set to work, with a whirring instantness.

You, brown eyed man, with green and purple striped flesh, let me watch you your actions.

On the table you build - facsimile me - as the coconut postage stamp is the Carribean tree : opening a grey drawer, take my arm, screw it to an imaginary corpse, wrong way round, or right; another drawer, another arm, a leg, a testicle, a beard : kidneyless you build me and gutless, to carry out your experiment.

Comparing now the new-me to the old-me, you see the same, same but for the things you don't want, you don't see, the same all through, the grey drawers can keep the rest.

Transform.

Small pump attached to belly button - no danger there, the new-I is gutless - you pump. At the same time a grey drawer opens, there's another limb, screw it on, 3 arms, 1½ testicles, 7 beards. Now, am I how you want me?

Compare to original - suddenly, mysteriously, old-I has 3 arms, beards, balls. Maybe no guts though - the kidneys have walked off - but what price is that to pay for your pleasure.

Set me up - I walk in your mock field, I collapse, done for, little grey drawers opening and closing with the fury of an amok juke box.

Or you take me, assembling your facsimile, life-like (except for the kidneys - no harm : not to piss is a blessing in disguise), beautiful, true, bleed me like a pig, wrench off the arm, break the back, cause me to walk and I flop.

And all the time the counter point of wretched breaths, the drumming of terrified hearts, the clatter of slamming drawers, the din of your knives.

Transformed.

Even the original cannot survive this blight.

But now the others - all thousand of you - 999 now - emergency emerging, all at once, drawer open, blood spurts, limbs fly, you've got his leg, confused intrasection, a thousand, sorry, 999, spewing anomalies like war veterans, all at once - what can I do?

You do unto me as you would do unto me.

Clean theatre, white, sterilised, hygienic, your operating space. All wildly screwing, bleeding, blowing, tables and originals, transform.

Small beady eyes peering around, a thousand pairs, under that bright deceiving ceiling light, looking at the home brewed me's.

And all the time the counterpoint of wretched breaths, the drumming of terrified hearts, the clatter of slamming drawers, the din of your screams.

And now, I, still there, changed and mutilated, constant, what type of animal am I?

Flash of the old grey bulb, parting of the blinds.

Now that you can see me - tell me.

SEEING IS BELIEVING OBLIQUE KILLING

Erasing the mistake of life, seeing is believing
oblique killing.

In the shining blue darkness, surgical tables gleaming,
flashing like the old film, flicker visible invisible alone. The
buzz of each an endless din, the buzz of each flickering while the
lights shine searing.

Tables, adjusted, objects, squealing, you adjust to suit
your whim, buzz buzz together yet all is the same in the dif-
ferences you execute. Limbs fly through neon lines, passed round
like the proverbial buck, fantasies projecting out of the
amputated ochre, flicker buzz flicker buzz the blinds part.

At each parting, grey plates absorb the situation, white
beards flash, looking at the new limbs, where they are now, the
little ochre lights out of reach and on the tables, their
introverted shimmerings contradicting their flickering projections,
projections you give them.

Little voice, quietly insisting with a tongue of wagging
silence, ochre purple, screw on leg, new picture now goes out,
broadcast movie, flicker in the shutter, grey blinds close.

Message passed, picture seen, message passed, medium,
medium, he is there, that being discovered in the searing buzzer,
the flicker of ochre, the blood spewing victim, the green and
purple object of the multiple amputations, lobotomised, born, no
doubt there, no longer alone, talking gibberishly a din of
reverberant rubbish, and attacking you too.

Now he too is there, now he is in the battle, conscripted
to live and chatter, chilled teeth in chilled ice, quiet messages
emanating, chewing others. Multi-storey theatres, parked
bodies, flickering ochre, silent din, savage thrusts cutting
through to project the severed umbilical silence.

Each little body, screaming as it buzzes ochre, caught in the parting grey blinds, each little body, loaded with limbs, blood drunk by vampire surgeons, inflate now to the neon racer, shine green, what is left of that body on the rack, stretched over barbed wire and pulled by a thousand free agents' mad deceptions projecting skywards like the ancient candles. Walking fore-shortened corpses, burdened with images, legs collapsing, handling projections and skinning themselves on the way, the survivors of a cross-country extravaganza of insistent pain. Each little body drinking its own blood, the blood of others, any blood, operational and limbless.

And yet the neons cut, fields hedged, each amputated body, each string of motion pictures projecting, swamping the isolated target, buzz buzz, the murderous hacking at the isolated corpses.

Chill cold pitch blue around the glaring white glazing, the opening closing grey metal drawers permeating space, bisecting neons, the blood spurting from the ochre buzzers, the fluttering of the flickers, the lies told and projected, the weight of the false limbs, the body dies from prolonged application, the light blinding, the body dies, and so do you, weighed down by the icy false chattering in the dim silent din, by the projections sliced by neon.

You build yourself up to your own death killing others.

Seeing is believing oblique killing for companionship in the impossible vacuum.

A FRED BLOGGS'S (R.I.B.A.) EYE VIEW:

Fred Bloggs can see himself, and he can see that he sees himself, and what he sees is his Essence, but he doesn't know that it is his Essence, or that it is any different to the observations he makes about other Objects in the Universe. Nor does it occur to him that maybe he doesn't see the whole thing; what he sees is the truth, and a fact.

So Fred can't see that others see things differently and that they can't see things just like he does, and he certainly can't see that his view of himself cannot be shared by others. What Fred does see, however, is not the Objects themselves, (he can't guess this of course), and he thinks he sees the Objects, but then he doesn't understand about Essences. What Fred does see is the Model Facilities of the Objects he believes he sees, and that's what he believes the Universe is made of: Objects which are Model Facilities but which he believes are Objects. Fred won't easily accept that there could be such a person as Superman or a God. Not that he minds God; its more that he isn't really interested in him.

However that may be, Fred can definitely see things, and he knows them, and he knows that. He can see just what things are, and what they can do, and what their properties are. Not that he decides these properties - that's obvious - the things speak for themselves, don't they? Well, they don't, but Fred won't worry about that. Each thing has its appointed place, and Fred is not one to interfere with that.

So that, while Fred does attribute behaviours, he is not aware of this, but believes the converse. And that's partly why Fred finds it so hard to see all the other views, or to allow that there might be others which make sense. But at least its unlikely Fred will want to become a surrealist, and attach inappropriate

attributes, and Dadaist he could never be.

Fred can also communicate his views, vehemently and without any great interest in discussion. He can, given generous conditions, carry on a conversation, but he doesn't often bother: he is more content to make statements of facts, not that they are facts, nor that anyone but the most closely attuned fellow could really understand what he was talking about. But, under such closely controlled, and perfectly fitted conditions, Fred can actually carry out a conversation with another and he can even begin to appreciate the behaviour that another gives to an Object, and which Fred believes is the Object. On a really good day, Fred may even learn something from another view, thinking that it was his all the time.

And Fred has a memory, which of course he does really have. And he understands his own individual time. Not that Fred is in any way to be belittled or put down by anyone else, least of all me: he is happy, and he gets on very well in the Universe. Why should he ask Superman's questions anyway?

To Fred, the world consists of himself, and other Objects which aren't himself, and which have properties he can see, and which are self-evident. He can also remember them, and talk about them to close friends, modifying them occasionally. That the Objects are really Model Facilities, that he is his Essence, that properties are behaviours, that language is an Object, doesn't matter to him, and why should it?

A SUPERMAN'S EYE VIEW

Superman arrived from another Universe, and he can occasionally remember that, and that's why he can see so much more. Not that coming from somewhere else makes him invincible, far from it. He can be cut down by green kryptonite, and he doesn't know how to get rid of that inconvenience. Anyhow, Superman, having come from somewhere else, realises that he can never really be like everyone else; that he is really alone and isolated and that he can never really know others.

Superman, however, does have some special powers, as his name and antecedents might suggest. He can outguess most people, and he can see their point of view, sometimes, and that they have one, often.

Superman can also see that he, being unique, has no reason not to assume that others are also. Indeed, having come from other worlds, he understands that there are things clear to him that no-one else can see or understand; and that there is no way that he can understand or see the whole of anyone else. So he does see that he has an Essence, and that everyone else has an Essence, and that that's private, and that he can't see anyone else's Essence, (or even that it is there: all he can see is that there is a need for it to be there). And seeing that there must be Essences for all things, Superman can see that that is not what he can observe about them, nor is it what any other observing Object can see, unless it is looking at itself, and that that is noncommunicable. So that he sees that whatever a characteristic of an Object is is not what the Object thinks it is itself, at least as far as other observers are concerned: so he thinks that the behaviour of an Object is attributed by the observer, and that each observer has his own way of looking at things, and that is why he can sometimes perform feats of great strength, and even predict things before they happen.

However that may be, Superman knows that he can talk to people about what they think, not in terms of the way he thinks, after all that's from another Universe, but by using another Object to put things in terms of. So he knows about language being an Object just like any other Object, acting as a surrogate for discussions, and he knows that there are discussions too, with conversational idioms and conventions, so that he can listen to what he thinks the other side says. And he measures the difference, and adjusts his views, and he learns from what others have found, which is a good thing, because if he did not, he might never have been able to understand anything about the strange Universe into which he was plunged when the planet Krypton exploded.

Being a star, Superman knows too that everyone looks at him, too, and that they build up a behaviour they attribute to him, too, and being kind, he tries to stick to what he understands of their picture, not that it is the same as his picture of himself: it isn't, but it is the best that can be done, and he knows that, too. In fact, he is quite aware of the things that can be known, and those that can't be, and that some of the unknowables are necessary for any theory of this Universe to exist.

And, knowing as he does, that he came from another world, and that he occupies his own place and time, he realises that his sense of space is unique, is part of himself, and that everyone else has something like that too. And that language is a means of transposing this, using a space to map your ideas onto, and synchronising the clocks while the conversations happen. Time is something he is aware of, at least when he tries to talk.

Superman can follow the logic of his views and experience thought, and he knows he is of his own space and time. But he can see others, not as they see themselves, but in the same way that they see him. Superman has a double identity. Come in, Clark Kent!

A GOD'S EYE VIEW:

"Given the existence as uttered forth in the public works of Puncher and Wattman of a personal God qua qua qua qua with white beard qua qua qua qua beyond time without extension[®]....."

When his white beard is not blowing in front of his eyes, and when he happens to be looking, God has a grandstand view of things, if there is anything to see, and if he wants to look hard enough to see the little vibrations happening beneath the surface, and the lines re-aligning themselves.

From his grandstand seat, he can see all the Essences, they have no secrets from him, if he wants to look into them. Not that they will know this, or that he is looking, he is like a spy in their midst, or a grass. He can see all the inhabitants too, obviously, since he can see their Essences. And so he can be like them all at any time, and he can see all the combinations, because he can see all the Essences of all the Objects.

Similarly, he can see all the possible Model Facilities, all the possible Objects, and every possible language and conversation: not that he needs to, of course, seeing all the Essences, he needn't discuss the Objects anyhow. He understands them all and doesn't need to do any exploring, because he has "the key". Similarly, he can see all the possible Objects and all the behaviours, and every assembly and attribution. Not that he needs to - for he has "the key".

"The key" is the view and is the clock. God, behind his white beard, has a special clock, a universal clock which ticks for everyone all the time, and yet which doesn't tick for God; who can see it all at once, seeing the roles of the inhabitant Objects and observers, and who is bored because he has all the

[®] Beckett(*119)

possibilities, all the facts, and not even any time to fill in. God doesn't spend much time looking, anyway. He hides behind his beard, invisibly. He goes to sleep, disinterested in a quagmire of simultaneous synchronities, not being interested in the time. He can control nothing. He is bored.

Poor God, he can't exist anyway. He is in an impossible position. He is just so ordinary and he is not there.

If he is in the Universe, he is one of its subjects, and he cannot see the Essences of other Objects.

If he can see the Essences of other Objects, he isn't in the Universe.

If he can see the Essences he is not in the Universe, and he cannot be talked about or observed.

If he cannot be talked about how can we say what he knows?

If he is not in the Universe, how can he see the Essences which are the direct product of the Universe.

God is a very sad figure: God is our saddest most alone inhabitant: he is nowhere, not sure if he is part of the Universe, not sure if he can see and be seen, or if he doesn't really exist at all.

I'm glad I'm not God.

APPENDICES

(Correspondence)

(Signification in Frege's Triangle)

(Tune into Memories of You)

APPENDIX ICORRESPONDENCE

+ There once was a man who said, "God
Must think it exceedingly odd
If he finds that this tree
Continues to be
When there's noone around in the Quad".

+ Dear Sir,

Your astonishment's odd:
I am always around in the Quad
And that's why the tree
Continues to be,
Since observed by,

Yours Faithfully,

God.

Dear God,

Why did you forget me?
I don't need another to see:
I don't need no bod
Around in the Quad:
I'm observing,

Yours Faithfully,

Tree.

+ Traditional.

Dear Sir,

I'm astonished to see
 A pretentious address from a tree.
 If I wasn't there
 There'd be noone to hear
 Let alone make remarks.

Yours,

Jahweh.

Dear Jahweh,

I see that your name
 Makes you assume you can claim
 That a pretentious Tree
 Can continue to be
 Only because it's your aim.

Dear God,

Here's a real hot potato!
 Alright; forms are enough - but just wait, though!
 If you don't have to see
 To conceive of a tree
 Why create?

Yours Ideally,

Plato.

Dear Sir,

Your Ideals are wrong.
 A potato can't be hot for long.
 Of the tree you evince
 We have not caught a glimpse.
 Your creations were myths all along.

Composed by Stephen Mullin, and included with his permission.

©Dear Sirs,

I'm afraid to report
 You are all of you quite "Out of Court".
 Since you're all in my dream
 You can't be what you seem
 To believe that you are,

Aleph Nought.

If I am what you think I am,
 You may find that you have to ram
 The words that I thought
 About "Aleph Nought"
 Down your throat: and, if not, I am.

Dear Sir,

As a God who can see
 That I am not, myself, quite a tree,
 I feel that you've caught
 My friend, Aleph Nought,
 By the short hairs,

(Yours Barberously.)

Dear Tree,

I'm astonished to think
 That you'd dream of the way that I sink
 Into depths of despair.
 Having trimmed my short hair,
 Aleph's Samson Act's now on the blink.

© Composed by Stephen Mullin, and included with his permission.

Dear Sir,

Now I find myself equal
 To trees, and, no doubt, also treacle;
 To Platonic forms,
 Odd Quads and norms.

Yours Faithfully,

God. (Or His Sequel).

Dear God,

I am sorry to hear
 Of the depth and the width of despair
 Which is wracking your brain
 With increasing pain
 Since observing me, Tree! It's unfair!

Dear Sir,

I am bound to admit
 That I think that this discourse lacks wit.
 The Logic of Thoughts
 Which herein one sports
 Can hardly substantiate it.

Dear Sir, God and Tree,

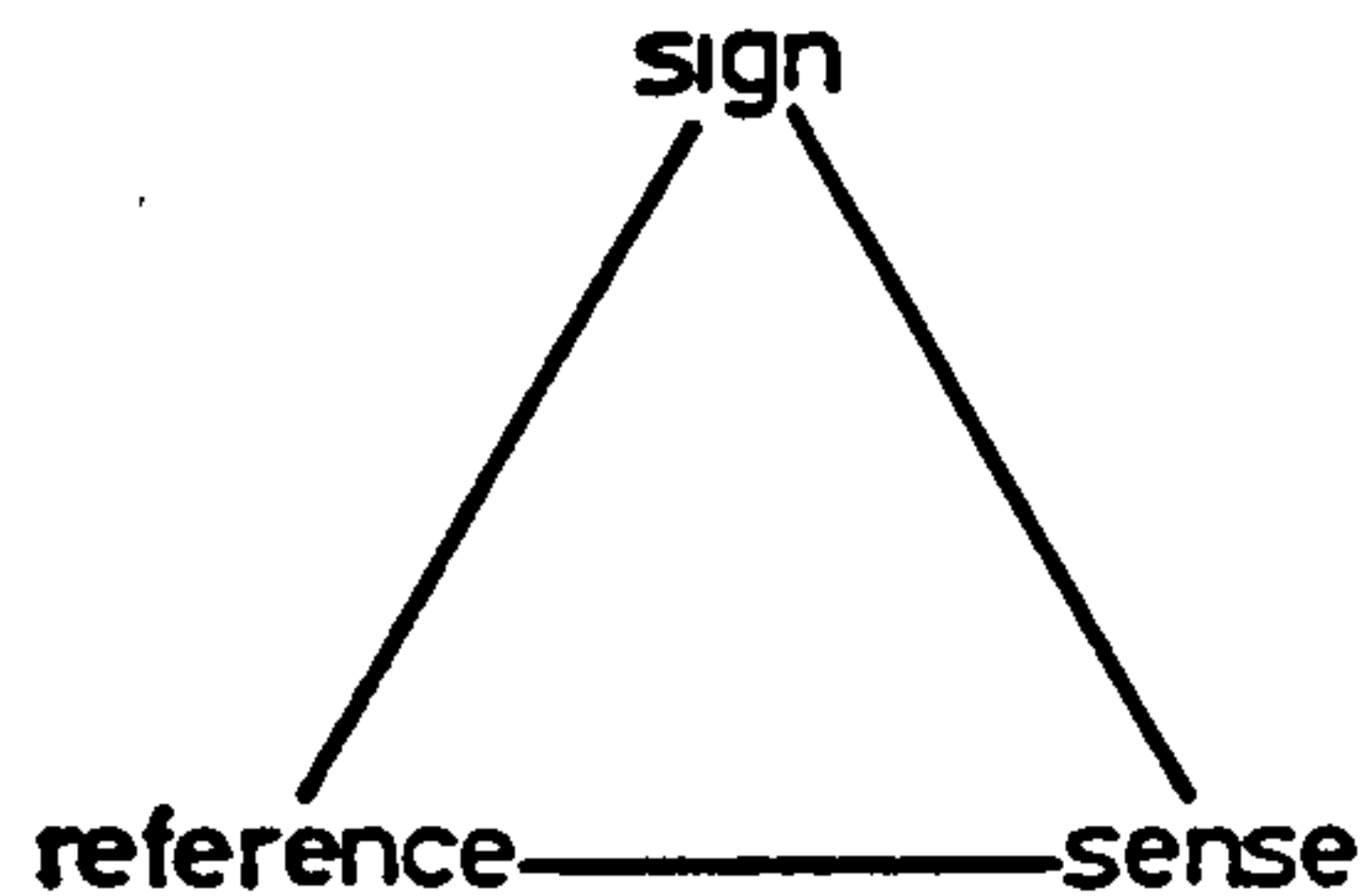
I must say
 That I feel you are drifting away
 From the meanings you meant
 Before Limericks bent,
 Re-inventing your thoughts in this way.

As the Tree which started this spiel
 I find I'm beginning to feel
 That it's useless to say
 That I see it "This way":
 For, ultimately, all is real.

APPENDIX 2SIGNIFICATION IN FREGE'S TRIANGLE

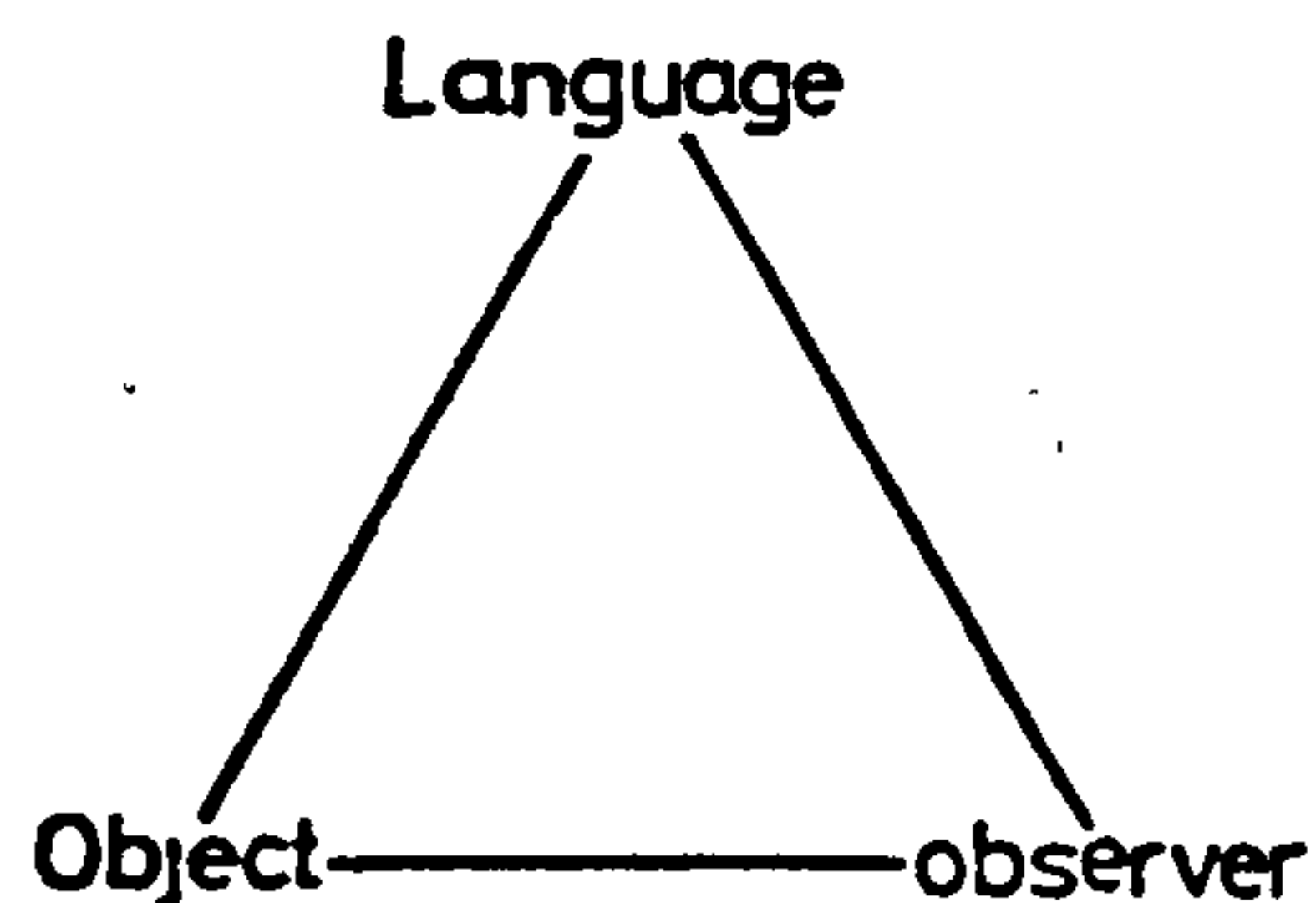
In developing his logical theories of meaning, Gottlob Frege made use of three elementary concepts: "sign", "sense" and "reference" (loosely translated).

Ogden and Richards later assembled these three together in the form of a triangle, known as Frege's triangle, summarising the stances that can be taken within Frege's Universe, with his three elementary concepts. This triangle is:



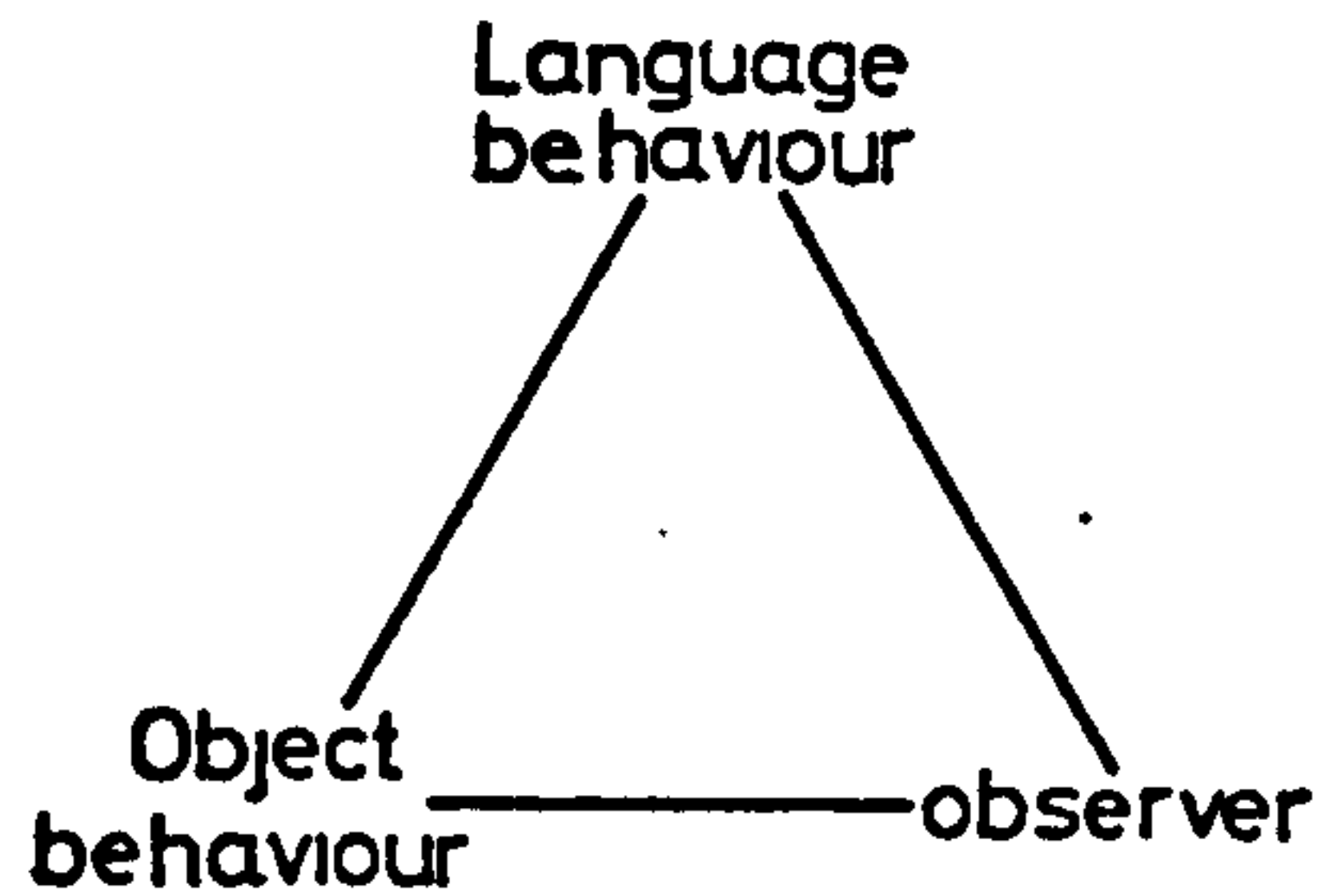
In terms of the work of this Thesis, it is interesting to note that we also have three basic "Object types": Objects, observers, and Languages (or Models). And, the ways in which we observe in our Universe are quite similar to Frege's terms. Thus, Frege's "reference" is our "Object", and Frege's "sign" is our "Language". The "sense" is an observer generated "Meaning".

Our Universe has the three basic "Object types", Object, Language, and observer, which also relate together as a triangle:

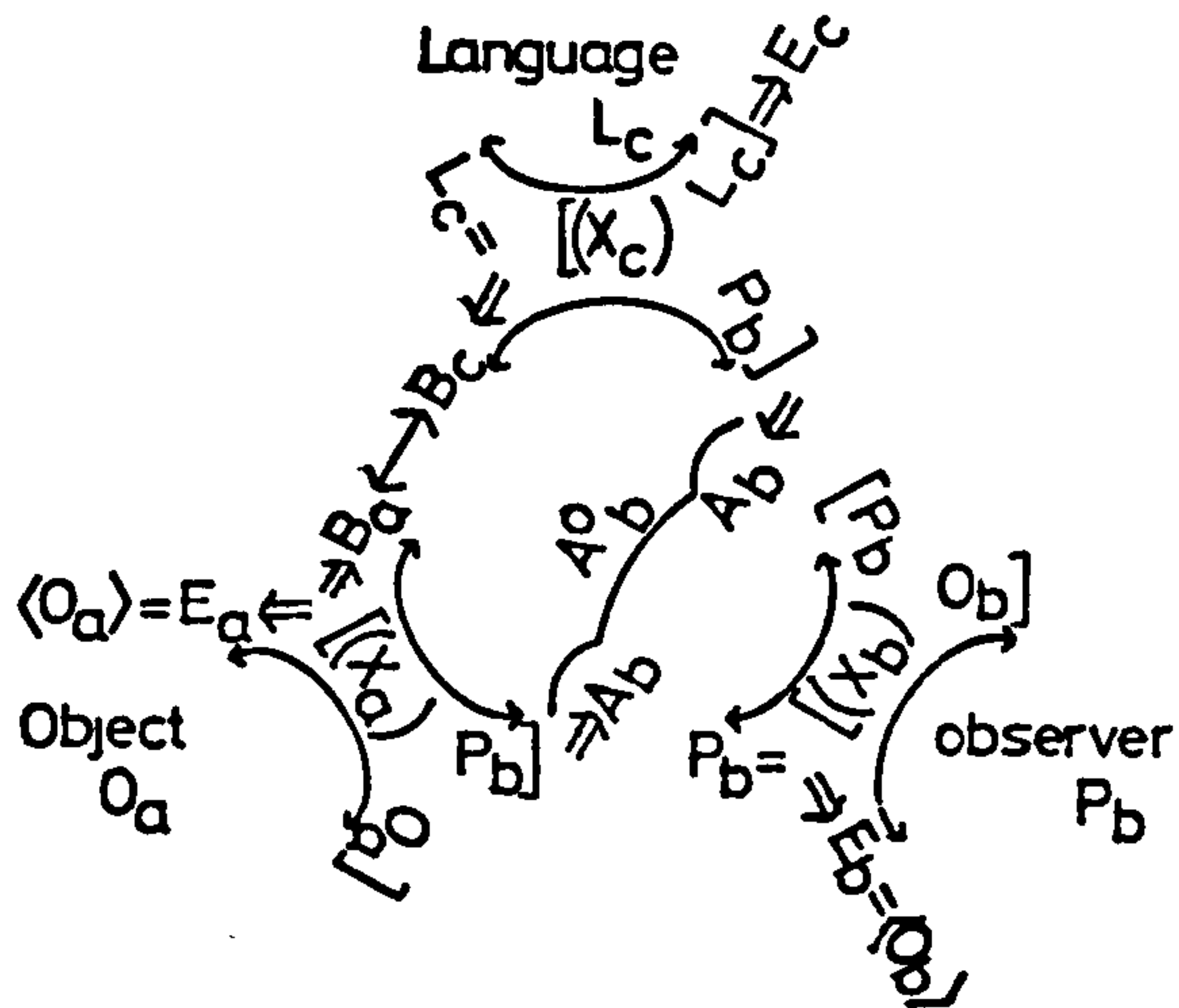


However, this representation does not fully describe our Universe, because of its two levels. Nor does our triangle work in quite the manner of Frege's, because it is based on operational roles which may be switched around between the parts.

Our triangle could be more accurately represented by a change in terms which represent the relationships between the components. Thus, it is not the Language or the Object which is observed, but the behaviour of each - which is then equated:

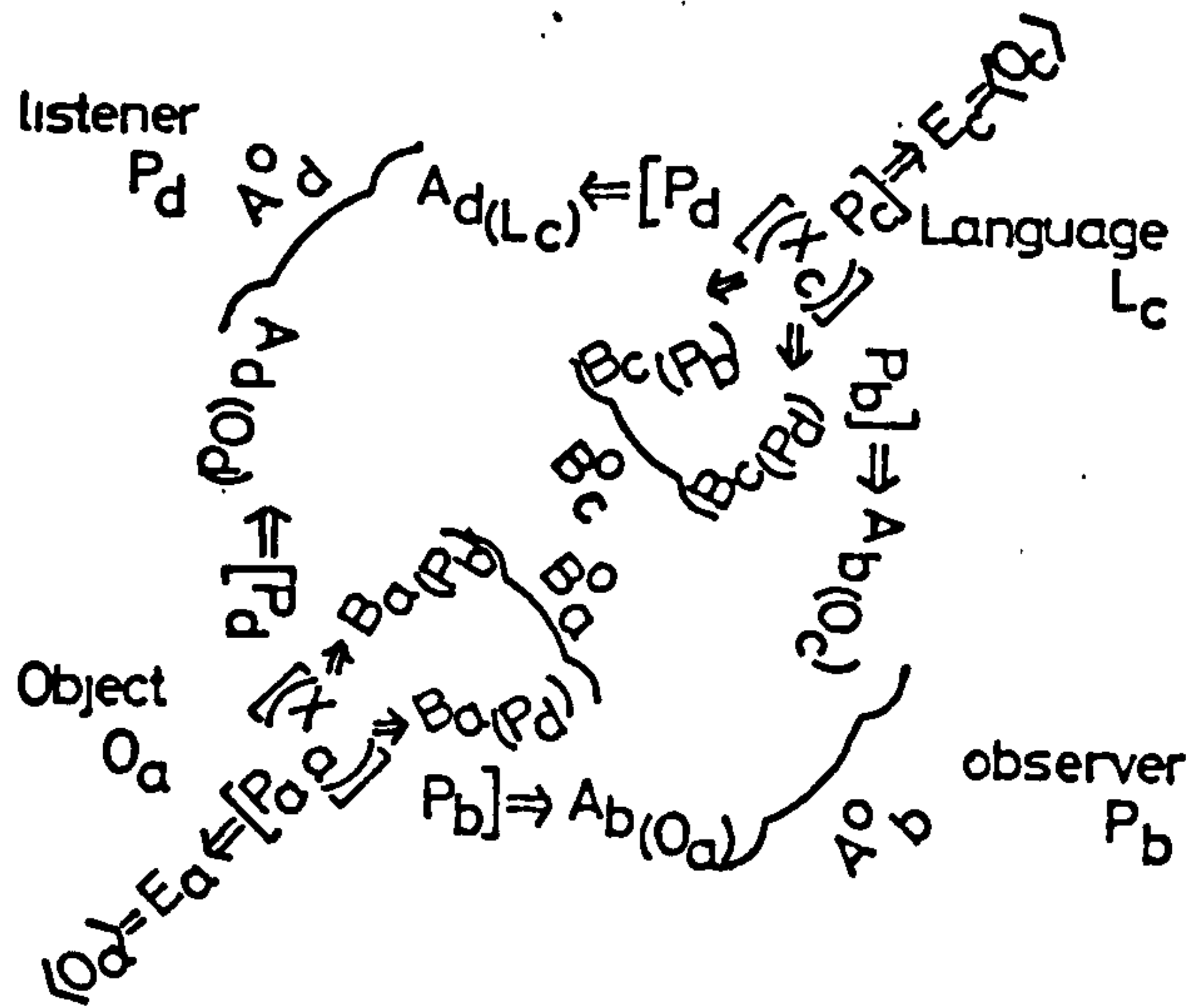


This can now be re-represented to reflect the level structure of our Universe (using our familiar representations).



We may also wonder why we have the Language Object: in our Universe, there is no assignation of the role Language without some purpose: which is, of course, to communicate to another observer an observation about an Object. We may therefore add a

fourth point, and build a square. But we will not show all possible relationships - merely those used for the observer P_b to communicate his observation of an Object O_a via a Language L_c to a second observer P_d , (and thus all Essence and Object statements are being omitted).



Thus, Frege's triangle, in discussing purposive signification becomes a square, and operates on two levels, in our Universe.

APPENDIX 3TUNE INTO MEMORIES OF YOUInstructions for Performance

This piece is for three orchestral groups, each of eight players.

The groups should be placed at three points around the edge of the auditorium, forming the apexes of an equilateral triangle.

The audience should be allowed to sit where they like in the room.

The groups should be made up of homogeneously timbred instruments, as, for example: cellos and violas (violins should not be used in this piece unless essential), cellos and trombones, clarinets and saxophones, trombones and french horns, flutes and french horns, whistles and recorders, clarinets and trumpets, and other similar combinations. There is no reason why there should be only two types of instrument, as long as they all blend: e.g. trombones, cellos, violas or clarinets, horns, saxophones and trumpets could be excellent. Each group should have a similar make-up.

The score consists of one continuous tune of seventeen minute's duration, with no rests. There is also, in the score, a blank stave for writing in analytical notes and other useful information, although parts should not be written out (see later).

Each group should choose one starting place (lettered A to F). The individual groups should choose secretly, and for every run through.

The piece will start 120 seconds before this point (if there is a tied note at that point, the tie will be disregarded). The introductory 120 seconds will be a slow crescendo to the level shown at the chosen starting point. The score will then be

followed round once, cyclically, until the starting point is reached again. There will then be a further 120 second diminuendo after this. The piece will thus be exactly 21 minutes long in performance.

The performance consists in IMPROVISING a suitable accompaniment to the tune. The tune is thus not played (except where the performer considers that his accompaniment co-incides with the tune. Rests may, of course, be left in the accompaniment, and key phrases may be written down and referred to.

The performers will need a time keeping device, in the form of a conductor, a team of conductors, stop watches, light display, programmed tapes or whatever. They can decide on the best way of dealing with the timing and synchronisation.

It is recommended that there are rehearsals, and that performers are experienced in improvisation.

$\text{♩} = 60$

Handwritten musical notation on a five-line staff. The first measure contains a treble clef and a key signature of one sharp (F#). The time signature is 2/4. The notation includes a series of notes with stems, some beamed together, and rests. A dynamic marking of ff is present. Measure numbers 1 through 10 are written above the staff.

Handwritten musical notation on a five-line staff. The notation includes notes with stems and rests. Dynamic markings of ff are present. Measure numbers 11 through 20 are written above the staff.

Handwritten musical notation on a five-line staff. The notation includes notes with stems and rests. A dynamic marking of ff is present. Measure numbers 21 through 30 are written above the staff.

Handwritten musical notation on a five-line staff. The notation includes notes with stems and rests. A dynamic marking of f is present. Measure numbers 31 through 40 are written above the staff.

Handwritten musical notation on a five-line staff. The notation includes notes with stems and rests. Dynamic markings of ff and mf are present. Measure numbers 41 through 50 are written above the staff.



Handwritten musical notation on a five-line staff, measures 97-116. The notation includes various note values, rests, and slurs. Measure numbers 97, 106, 110, 112, 114, and 116 are written above the staff. A dynamic marking 'p' is present at the end of the system.

Handwritten musical notation on a five-line staff, measures 115-129. A box containing the letter 'F' and '2M' is written above the staff. Measure numbers 115, 120, 122, 124, 126, 128, and 129 are written above the staff. A dynamic marking 'ff cresc → (general + slow)' is written below the staff.

Handwritten musical notation on a five-line staff, measures 131-148. Measure numbers 131, 134, 136, 138, 140, 142, 144, 146, and 148 are written above the staff. Dynamic markings 'f', 'mf', and 'mf' are written below the staff.

Handwritten musical notation on a five-line staff, measures 150-159. Measure numbers 150, 152, 154, 156, 158, 160, 162, 154, 156, and 159 are written above the staff. A dynamic marking 'cresc →' is written below the staff.

Handwritten musical notation on a five-line staff, measures 160-173. A box containing '3M' is written above the staff. Measure numbers 160, 162, 164, 166, 168, 170, 172, 164, 166, 168, and 173 are written above the staff.

Handwritten musical notation on a five-line staff, measures 202-212. The notation includes various note values and rests. A dynamic marking of *dim* with an arrow pointing right is present below the staff.

Handwritten musical notation on a five-line staff, measures 214-229. The notation includes various note values and rests. Dynamic markings include *dim* with an arrow pointing right and *(mf)* with an arrow pointing right.

Handwritten musical notation on a five-line staff, measures 230-237. The notation includes various note values and rests. A dynamic marking of *dim* with an arrow pointing right is present below the staff.

Handwritten musical notation on a five-line staff, measures 239-246. The notation includes various note values and rests. A dynamic marking of *dim* with an arrow pointing right is present below the staff. A large annotation '4M' is written above the staff. There is also a handwritten note '(mf)' with an arrow pointing right.

Handwritten musical notation on a five-line staff, measures 248-254. The notation includes various note values and rests.

Handwritten musical notation on a five-line staff, measures 218-224. The notation includes various note values, rests, and slurs. A fermata is placed over the final measure of this system.

Handwritten musical notation on a five-line staff, measures 225-231. Includes dynamic markings 'mp' and 'f' with arrows indicating changes. A large slur covers measures 225-230.

Handwritten musical notation on a five-line staff, measures 232-240. A box labeled '5M' is drawn above measure 235. Includes slurs and accents.

Handwritten musical notation on a five-line staff, measures 241-248. Includes dynamic markings 'mf' and 'f' with arrows. A slur covers measures 241-246.

Handwritten musical notation on a five-line staff, measures 249-255. Includes dynamic markings 'dim' and 'mf' with arrows. A slur covers measures 249-254.

(♩=60)

61A

Handwritten musical notation on a five-line staff, measures 1-10. The notation includes various note values, rests, and dynamic markings such as *ff*. There are some handwritten annotations above the staff, possibly indicating fingerings or articulation.

Handwritten musical notation on a five-line staff, measures 11-20. The notation includes various note values, rests, and dynamic markings such as *ff*. There are some handwritten annotations above the staff, possibly indicating fingerings or articulation.

Handwritten musical notation on a five-line staff, measures 21-30. The notation includes various note values, rests, and dynamic markings such as *ff*. There are some handwritten annotations above the staff, possibly indicating fingerings or articulation.

Handwritten musical notation on a five-line staff, measures 31-40. The notation includes various note values, rests, and dynamic markings such as *ff*. There are some handwritten annotations below the staff, including arrows and the text "poco cresc" and "ff".

Handwritten musical notation on a five-line staff, measures 41-50. The notation includes various note values, rests, and dynamic markings such as *ff*. There are some handwritten annotations above the staff, possibly indicating fingerings or articulation.



O. R. E. Westerlund A
Helsinki-Helsingfors B

NP 410

7M

Handwritten musical notation for system 1, measures 416-422. The notation is on a single staff with a treble clef. It features a series of notes with stems, some beamed together. Above the staff, there are handwritten annotations including '416', '417', '418', '419', '420', '421', '422', and '423'. There are also some markings like '5.4' and '5.4' below the staff. The system ends with a double bar line.

Handwritten musical notation for system 2, measures 423-430. The notation is on a single staff with a treble clef. It features a series of notes with stems, some beamed together. Above the staff, there are handwritten annotations including '423', '424', '425', '426', '427', '428', '429', '430', and '431'. There are also some markings like '5.4' and '5.4' below the staff. The system ends with a double bar line.

Handwritten musical notation for system 3, measures 431-438. The notation is on a single staff with a treble clef. It features a series of notes with stems, some beamed together. Above the staff, there are handwritten annotations including '431', '432', '433', '434', '435', '436', '437', '438', '439', '440', and '441'. There are also some markings like '5.4' and '5.4' below the staff. The system ends with a double bar line.

8M

Handwritten musical notation for system 4, measures 439-446. The notation is on a single staff with a treble clef. It features a series of notes with stems, some beamed together. Above the staff, there are handwritten annotations including '439', '440', '441', '442', '443', '444', '445', '446', '447', '448', '449', and '450'. There are also some markings like '5.4' and '5.4' below the staff. The system ends with a double bar line.

Handwritten musical notation for system 5, measures 451-458. The notation is on a single staff with a treble clef. It features a series of notes with stems, some beamed together. Above the staff, there are handwritten annotations including '451', '452', '453', '454', '455', '456', '457', and '458'. There are also some markings like '5.4' and '5.4' below the staff. The system ends with a double bar line.

Handwritten musical notation on a five-line staff. The notation includes several measures with notes, rests, and dynamic markings. A 'p' marking is visible below the staff. Above the staff, there are some handwritten numbers and a bracketed section.

Handwritten musical notation on a five-line staff. The notation includes several measures with notes, rests, and dynamic markings. A 'p' marking is visible below the staff. Above the staff, there are some handwritten numbers and a bracketed section.

Handwritten musical notation on a five-line staff. The notation includes several measures with notes, rests, and dynamic markings. A 'dim' marking is visible below the staff. Above the staff, there are some handwritten numbers and a boxed 'B' with 'S.M.' next to it.

Handwritten musical notation on a five-line staff. The notation includes several measures with notes, rests, and dynamic markings. A 'p' marking is visible below the staff. Above the staff, there are some handwritten numbers and a bracketed section.

Handwritten musical notation on a five-line staff. The notation includes several measures with notes, rests, and dynamic markings. A 'p' marking is visible below the staff. Above the staff, there are some handwritten numbers and a bracketed section.

10M

Handwritten musical notation on a five-line staff, measures 59-63. The notation includes notes, rests, and dynamic markings such as *mf*. Measure numbers 59, 60, 61, 62, and 63 are written above the staff.

Handwritten musical notation on a five-line staff, measures 64-68. The notation includes notes, rests, and dynamic markings such as *mf* and *<mf>*. Measure numbers 64, 65, 66, 67, and 68 are written above the staff.

Handwritten musical notation on a five-line staff, measures 69-74. The notation includes notes, rests, and dynamic markings such as *mf* and *marcato*. Measure numbers 69, 70, 71, 72, 73, and 74 are written above the staff.

Handwritten musical notation on a five-line staff, measures 75-80. The notation includes notes, rests, and dynamic markings such as *mf* and *ff*. Measure numbers 75, 76, 77, 78, 79, and 80 are written above the staff.

Handwritten musical notation on a five-line staff, measures 81-85. The notation includes notes, rests, and dynamic markings such as *mf*. Measure numbers 81, 82, 83, 84, and 85 are written above the staff.

(♩=60)

11M

12M

marcato →

Handwritten musical score system 1. It consists of two staves. The upper staff contains a melodic line with various notes and rests, including a triplet of eighth notes. The lower staff contains a bass line with chords and single notes. Dynamic markings include *dim* →, → *(mp)* →, and → *(f)* →. Measure numbers 216, 217, 218, 219, 220, 221, 222, and 223 are indicated above the staff.

marcato →

Handwritten musical score system 2. It consists of two staves. The upper staff features a melodic line with a long, sweeping slur covering measures 224 through 230. The lower staff has a bass line with chords. A *dim* marking is present. Measure numbers 224, 225, 226, 227, 228, 229, 230, 231, and 232 are indicated above the staff.

Handwritten musical score system 3. It consists of two staves. The upper staff has a melodic line with a slur over measures 233 to 238. The lower staff has a bass line with chords. Measure numbers 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, and 243 are indicated above the staff.

Handwritten musical score system 4. It consists of two staves. The upper staff has a melodic line with a slur over measures 244 to 249. The lower staff has a bass line with chords. Measure numbers 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, and 255 are indicated above the staff.

sforzando pasage →

Handwritten musical score system 5. It consists of two staves. The upper staff has a melodic line with a slur over measures 256 to 261. The lower staff has a bass line with chords. Measure numbers 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, and 267 are indicated above the staff.

13M

The image displays five systems of handwritten musical notation, each consisting of two staves. The notation is dense and includes various musical symbols such as notes, rests, beams, and slurs. Above the first system, the text "13M" is written. The score is annotated with numerous performance markings, including dynamic levels like *mf*, *mp*, and *pp*, and articulation marks such as *acc.* and *dim.*. Some measures are circled or have arrows pointing to them. The notation is somewhat sketchy, characteristic of a composer's draft. The systems are arranged vertically, with the first system at the top and the fifth at the bottom. The fifth system ends with the marking "14M".

Handwritten musical notation system 1. The top staff contains a melodic line with various notes and rests, including some triplets. The bottom staff contains a bass line with notes and rests. A dynamic marking 'mf' is present in the lower left.

Handwritten musical notation system 2. The top staff features a melodic line with several triplet markings. The bottom staff has a bass line with notes and rests. A dynamic marking 'mf' is visible.

Handwritten musical notation system 3. The top staff shows a melodic line with notes and rests. The bottom staff contains a bass line. A dynamic marking 'mf' is present.

Handwritten musical notation system 4. The top staff includes a melodic line with notes and rests, and a boxed section labeled '15M'. The bottom staff has a bass line with notes and rests. Dynamic markings 'f', 'mf', and 'p' are present.

Handwritten musical notation system 5. The top staff shows a melodic line with notes and rests. The bottom staff contains a bass line with notes and rests. Dynamic markings 'sfz' and 'sfz. mp' are present.

(♩=60)

Handwritten musical notation for measures 910-919. The notation is on a single staff with a treble clef. Measure numbers 910, 912, 914, 916, 918, 920, 922, 924, 926, and 928 are written above the staff. The music consists of quarter and eighth notes, some with slurs. Dynamic markings include *mf* and *f*. There are also some handwritten annotations like "3" and "4" above certain notes.

Handwritten musical notation for measures 929-938. The notation is on a single staff with a treble clef. Measure numbers 929, 930, 931, 932, 933, 934, 935, 936, 937, and 938 are written above the staff. The music consists of quarter and eighth notes, some with slurs. Dynamic markings include *f* and *mf*. There are also some handwritten annotations like "5-4" and "6-4" above certain notes.

Handwritten musical notation for measures 939-948. The notation is on a single staff with a treble clef. Measure numbers 939, 940, 941, 942, 943, 944, 945, 946, 947, and 948 are written above the staff. The music consists of quarter and eighth notes, some with slurs. Dynamic markings include *mf* and *f*. There are also some handwritten annotations like "3" and "4" above certain notes.

Handwritten musical notation for measures 949-1014. The notation is on a single staff with a treble clef. Measure numbers 949, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000, 1002, 1004, 1006, 1008, 1010, 1012, and 1014 are written above the staff. The music consists of quarter and eighth notes, some with slurs. Dynamic markings include *mf* and *f*. There are also some handwritten annotations like "3" and "4" above certain notes.

Handwritten musical notation for measures 1015-1020. The notation is on a single staff with a treble clef. Measure numbers 1015, 1016, 1018, and 1020 are written above the staff. The music consists of quarter and eighth notes, some with slurs. Dynamic markings include *mf* and *f*. There are also some handwritten annotations like "3" and "4" above certain notes. A box labeled "A" is drawn around measure 1015.



GLOSSARY OF TERMS USED

GLOSSARY OF MAIN TERMS WITH SIGNS (where relevant)

Sign Name and Meaning

f Algorithm

The Algorithm is that which connects Information to a Model, thus re-creating the Object,

$$Q \longleftrightarrow M(f)I$$

In the case that the Model is reflexive (that is, the Information can be extracted from the Model itself), the Algorithm shows how this is done,

$$Q \longleftrightarrow M(f)$$

A awareness

An awareness is an observation made of another Object by an observer, recorded from the observer's viewpoint. It complements a behaviour,

$$A_b \Leftarrow [(X_a)P_b]$$

An awareness is made by the observer and the observed Object, and no others may share it.

A⁰

Awareness

The Awareness of an observer is the sum of many observations of other Objects made by that observer, recorded from the observer's viewpoint. The sum of all Awarenesses in the Universe is the same as the sum of all Behaviours,

$$A_b^0 = \sum_{a,(1:n)} [(X_a)P_b]$$

\tilde{M} Anti-Model

An Anti-Model is a primary Model type in which the Object is wholly contained within the Model. It is designated thus,

$$Q \longrightarrow \tilde{M}$$

An Anti-Model may adumbrate many Anti-Models within itself.

 \tilde{R} Anti-Remainder

That which is added to the Object when making an Anti-Model of the Object. The Anti-Remainder constitutes the Information and the Algorithm,

$$\underbrace{Q \quad \tilde{M}}_{\tilde{R}}$$

 B behaviour

A behaviour is an observation made of an Object by an external observer, recorded from the Object's point of view. It complements an awareness. It is what the observer believes the Object being observed to be, during the observation,

$$B_a \Leftarrow [(X_a)P_b].$$

A behaviour is made by the observer and the observed Object, and no others may share it.

 B^0 Behaviour

The Behaviour of an Object is the sum of all observations of the Object made by external observers, recorded from the Object's view point. The sum of all Behaviours in the Universe is the same as the sum of all Awarenesses,

$$B_a^0 = \sum_{b,(1,n)} [(X_a)P_b].$$

W Conversation

A Conversation is a paradigm by which communication can take place between two observers, with some degree of certainty of understanding. It involves the formulation of the views of observer one about some Object, the consequent formulation of observer two of observer one's views, and finally the formulation of observer one's views of observer two's views (of observer one's views). With these three steps, observer one can compare his original view to his view of the other observer's view, and thus adapt his formulation of his view until it appears that observer two has understood.

E Essence

The Essence of an Object is the observation of an Object made by itself, and referring only to itself, it is unique and private to that Object observer. It is what the Object believes itself to be,

$$E_a = [(X_a)P_a].$$

The Essence and the Behaviour are mutually exclusive.
The Essence and the Awareness are equally so.

I Information

That which makes the difference, when connected to the Model by the Algorithm, between the Model and the Object. In the case of an Interior Model, Information will be added to make the Object: in the case of an Anti-Model, subtracted,

$$Q \longleftrightarrow M(f)I$$

$$Q \longleftrightarrow \tilde{M}(f)\tilde{I}$$

In some cases, there is no visible Information, it being a part of the Model.

M Interior Model

A primary Model type, which is wholly contained within the Object. The Interior Model is designated thus,

$$O \leftarrow M$$

An Interior Model may adumbrate many Interior Models within itself.

L Language

A Language is an Object put in a role surrogate to another Object by the observer. This is achieved by the observer observing a behaviour which appears to be the same for both the Object and the Language,

$$\langle O_a \rangle = B_a \leftarrow [(X_a) P_b],$$

$$L_c = B_c \leftarrow [(X_c) P_b],$$

$$B_a \longleftrightarrow B_c.$$

A Language is similar to a Model, but it has a different role: a Language permits an observation to be observed by others.

Level

Our Universe has two levels of existence: the "private" (which is the Object's self-observation); and the "public" (which is the external observer's observation of the Object, or the observer's observation of an external Object). The terms "private" and "public" refer to the self-containedness of the observation, and not to its communicability. "Private" existence of both observer and observed is an a priori requirement for a "public" existence.

Lifespan

Lifespan is the measure of the growth of an Object's Behaviour. An Object is "born" when it is first observed by an external observer. An Object "dies" when the next observation made by an external observer through its Model Facility would result in an observation the same as the Essence. This can never happen, but it can be approached. The "time" between "birth" and "death" is the Lifespan.

M

Model

A Model is an Object put in a role surrogate to another Object by an observer. This is achieved as with a Model's surrogate role.

A Model is similar to a Language, but it has a different role: a Model permits a transformation to be applied, via the surrogate Object (the Model), to an Object (as observed). Models may be typed as either Interior, or Anti, according to if they are, when seen from the viewpoint of the transforming observer, smaller or larger than the Object of which they are Models.

X

Model Facility

The Model Facility is the means by which an Object is observable (both by itself and by external observers).

It is a necessary part of an Object, but cannot exist by itself. Thus,

$$B_a = [(X_a) P_a] = \langle O_a \rangle = [(X_a) O_a] \Rightarrow E_a.$$

A Model Facility can become an Object by observing itself,

$$X_a = [(X_a) X_a].$$

This Object can then be observed by other observers.

The Model Facility also unifies all observations by making them all relevant to the same Object. From the Model Facility, Meanings are created by observers.

O Object

A basic unit describing all inhabitants of our Universe, usually taking the role of that which is observed. For an Object to exist in our Universe, it must be observable. For something to be observable by others, it must be there in order that it may be observed. An Object must therefore observe itself,

$$\langle O_a \rangle = [(X_a) O_a].$$

The Self-observer's view of the Object is the Essence, while the external observer's view is a behaviour,

$$\langle O_a \rangle = [(X_a) O_a] \Rightarrow E_a$$

$$\langle O_a \rangle = [(X_a) P_b] \Rightarrow B_a$$

A behaviour of an Object is also that which is represented by a Language or Model.

P observer

An observer is an Object in our Universe, taking the role of observing (as opposed to being observed), and thus attributing to those Objects, behaviours, and to themselves awarenesses,

$$B_a \Leftarrow [(X_a) P_b] \Rightarrow A_b$$

Q Object

When talking about making Models, it is more convenient to refer to the Object by the letter Q, meaning that there is, between the Object and the Model a relationship of behaviours. The use of Q in a string reminds us, therefore, that we are talking about relationships between behaviours, but we are not notating this fully.

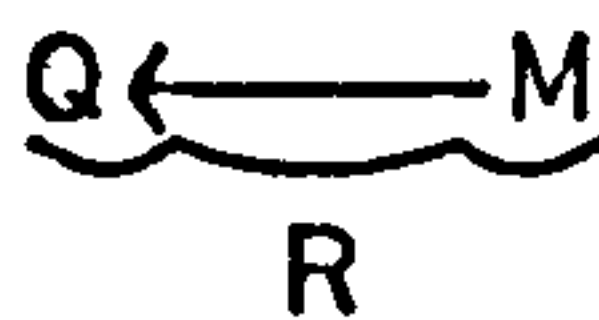
Physicallisation

In making a Model of an Object, a Remainder is added or subtracted by the operation of an Algorithm. The Model is then transformed (usually). However, in order for this transformation to be carried through to the Object, the Remainder difference between the Object and the Model must be made up. The process of subtracting or adding the Remainder by the operation of the Algorithm is Physicallisation.

R

Remainder

That which is omitted from an Object when making an Interior Model of the Object. The Remainder constitutes the Information and the Algorithm,

Representation

An Object which is surrogate to another Object is a representation of that Object. Thus Languages and Models represent Objects. A representation is an Object, and both representation and original Object are connected by an act of the observer making a similarity between the behaviours.

S

time state

A time state is measured in our Universe by a local individual clock in each Object, such that each self-observation of an Object advances its local clock one time state (consisting of two half-cycles), and the output of each Object's self-observation is an infinite regress. An Object has also an ability to correlate its clock with the clocks of other Objects, and thus to

observe and represent. An Object can observe itself and another Object simultaneously. Each complete self-observation is marked by a gain of one time unit (hence $s (s+1) (s+2) (s+3)$). Each half-cycle is marked by a dash (hence $s (s+1) (s+2) (s+3)$).

Universe

The Universe of our investigations is the Universe of existence of Objects by knowledge. All inhabitants of the Universe are Objects, and all know they exist. No Object that does not know it Exists is a part of the Universe. This does not mean to say that it cannot exist, in some other Universe.

GLOSSARY OF MAIN OPERATIONS USED

<u>Sign</u>	<u>Simple Translation</u>
=	"is".
\Rightarrow	"gives rise to".
\longrightarrow	"implies" (in this case, that which is on the left-hand is conditional upon that which is on the right-hand side: the direction of the arrow is reversible).
\longleftrightarrow	"equals" (the bi-conditional).
\nleftrightarrow	"does not equal".
\wedge	"and".
\vee	"or" (inclusive or).
Σ	"the sum of".
$\langle \rangle$	that which is contained within the brackets is named.
$()$	that which is contained within the brackets is operated through.
$[]$	that which is contained within the brackets is the observation.
$\ $	used for large groupings.

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