Spring 1987

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Subject 24.810

Topics in Philosophy of Science

Subject and Method: During the semester we'll be exploring the topic of Natural Kinds through group discussion of weekly readings. Ordinarily a member of the seminar will lead the discussion each week: preparation for that assignment must include advance consultation with one of the instructors. Students will have a choice between doing one long or two shorter papers.

Tentative Reading Assignments: We will not be able to pin down weekly assignments in final form until the makeup of the group is clearer, but except for the likely need to adjust the rate at which we cover it, the following list should get us well into the term.

I. Meetings 1 & 2 (weeks of 11 and 18 February):

J.S. Mill, A System of Logic, Bk. I, Chapt. vii; Bk. III, Chapt. xxii; Bk. IV, Chapt. vi-viii.

W. Whewell: Philosophy of the Inductive Sciences, Bk. VIII, Chapt. i, §§ 1-10; Chapt. ii, §§ 4-12, 20.

These pages are being distributed in xerox at the organizational meeting. They provide an introduction to most of the issues about natural kinds that will arise during the semester: what are natural kinds, what motivates their introduction, what are their distinguishing characteristics, etc.? Read the material thoughtfully and in full before each of these meetings. Recourse to it later in the semester may help you to hold onto the main issues. If you have additional time, get started on the reading for the next week. It presents very special problems.

II. Meetings 3 & 4 (weeks of 25 February and 4 March):

David Wiggins, Sameness and Substance, Preamble; Chapt. 1, §§ 1-5, 9; Chapt. 2 & 3.

This is much the most difficult reading to be faced during the semester. Those without background in philosophy are likely to feel lost the first time through, and even those with background will have trouble. Part of the difficulty is intrinsic to the material, but Wiggins adds to it by slipshod presentation. Dont worry! There will be signi-

ficant take home for all. Again, try to read the whole assignment at least once for each meeting.

You won't really see what Wiggins is up to until you get into Chapter Two, but you'll need some control of the back references in that chapter. Therefore, the first time through, look at the Preamble only enough to be able to recognize later when you need to go back to it. Read through the assigned parts of Chapter One, but don't expect to get much from them until you can look at them in relation to the material that follows.

There will be one copy of this book on reserve at the Reserve Book Room of the Humanities Library and a few other copies at the Linguistics/Philosophy library in Building 20, Room B-219. Probably you'll want to xerox a copy of the assigned pages for yourself.

III. Meeting 5 (week of March 11):

Nelson Goodman, Fact, Fiction, and Forecast, Chapt. 3 & 4.

W.V.O. Quine, "Natural Kinds," in Ontological Relativity and other Essays, and S.P. Schwartz, Naming, Necessity, and Natural Kinds.

There are many copies of these books around town. The Schwartz volume is particularly useful (though we'll probably not use it again), and you might want to buy it.

III. Meetings 6 & 7 (weeks of March 18 and April 1):

In these weeks we'll be looking at some of the current controversy about biological species, especially the issue: are species individuals or classes? The reading has not yet been chosen in its entirety, but we'll certainly be reading papers by Mayr and Hull, probably also by Dupré and Kitcher. More on this subject later.

IV. Later Meetings: We shall read Kripke's Naming and Necessity as well as Putnam's "Meaning of Meaning", and together they'll require at least three weeks. If you don't own the Kripke, you may want to order the Harvard Press paperback. You'll also surely be reading a recent paper by TSK and perhaps some work in progress of Bromberger's. We've got other ideas as well, but their appropriateness will depend on how the seminar develops, and we may not get to them in any case.

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Assignments for Meetings 7 and 8 (1st and 8th April)

For meeting 7:

Ernst Mayr, "Biological Classification: Toward a Synthesis of Opposing Methodologies, Science, **214** (1981), 510-516.

David L. Hull, "Exemplars and Scientific Change," in P.D. Asquith and T. Nickles (eds.), PSA 1982, Volume Two (Philosophy of Science Association: East Lansing, 1983), pp. 479-486, the beginning of the paper, only.

_____, "Are Species Really Individuals?," Systematic Zoology, **25** (1976), 174-191.

_____, "Units of Evolution: a Metaphysical Essay," in U.L. Jensen and R. Harré (eds.), The Philosophy of Evolution (Harvester Press: Brighton, 1981), pp. 142-160.

The Mayr paper should be read first, and the first selection from Hull is also useful as introduction.

For meeting 8:

John Dupré, "The Disunity of Science," Mind **92** (1983), 321-346.

Philip Kitcher, "Species," Philosophy of Science, **51** (1984), 308-333.

Questions: Most of the problems raised by these papers are said to fall under the rubric, "Are species individuals?" But both the question itself, and the problems raised in its name require much clarification. As you read, organize your notes about issues like the following, and come prepared to contribute to the discussion them. You will find much of the earlier reading in the course relevant.

1. What aspects of post-Darwinian biology motivate the question about the ontological status of species?

2. What are the main arguments favoring the thesis that species are individuals, that they are classes?

3. Is the dichotomy, individuals vs. classes, a good way to focus on problems presented by evolutionary biology? Is the

debate likely, finally, to be resolved unequivocally in favor of either side? What other sort of resolution might there be?

4. Why does the question matter? Why don't evolutionary biologists simply dispense with the notion of species?

5. (For the second meeting:) Are the problems that have emerged for biological kinds -- once the primary examples of natural kinds -- relevant to other sorts of natural kinds as well? In what way?

Approaching this material and these questions, we are all amateurs in one way or another. None of us is equipped to give a lecture, and none is going to do so. Come expecting to collaborate.

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Assignments for Meetings 9 through 13

For Meeting 9:

Saul Kripke, Naming and Necessity, pp. 22-143. Page references are to the edition published by the Harvard Press, but the material can be read in the earlier Rydel edition instead. The assignment omits the Preface and Addenda to the Harvard edition as well as the discussion of the Identity Thesis at the end of Lecture III. Otherwise, you're to read the whole work.

The assignment is long but the presentation is informal, repetitious, and reads quite quickly. The material most relevant to the seminar doesn't enter until Lecture III, but most of the earlier discussion is needed in order to understand it. Do get through everything in preparation for this meeting even if it necessitates some skimming.

Meeting 10:

Hilary Putnam, "The Meaning of Meaning," in Mind, Language and Reality, pp. 215-252, 268-271. The paper can also be found in Minnesota Studies in Philosophy of Science, VII. The first block of pages concludes with the section "The 'operational meaning' of stereotypes" and the second block is the concluding section, "The meaning of meaning".

There will probably be some further discussion of Kripke in this meeting, and the discussion of Putnam will carry over into the next one.

Meeting 11:

T.S. Kuhn, "What are Scientific Revolutions" and "Possible Worlds in History of Science". Copies will be available in 20D-210.

Meeting 12:

This meeting must be rescheduled because of a conflict with the Cognitive Science Seminar. Reading will be an article of Sylvain's to be announced.

Meeting 13:

No additional reading. Come prepared to discuss where we are and how we got there.

Quotes from Mill on Universal Causation in *A System of Logic.*

(Note. In this discussion Mill often uses the word "Phenomenon" to mention whatever has or is a cause. I am not sure what goes on. Many passages suggest that he thinks that events are causes and that events are (among other things) effects, and that he uses "phenomenon" and not "properties" for that reason. Thus the removal of properties, or the occurrence of ones, constitute phenomena. But that needs more checking.

Chapter 5 of Book III ("Of Induction)

..This fundamental law must resemble the truths of geometry in their most remarkable peculiarity, that of never being, in any instance whatever, defeated or suspended by any change in circumstances. (p212)

And there is only one such law!

"In that one, however we recognize a law which is universal also in another sense: it is co-extensive with the entire field of successive phenomena, all instances whatever of succession being examples of it. This law is the Law of Causation. The truth that every fact which has a beginning has a cause, is co-extensive with human experience." (p212)

The Law of Causation ....is but the familiar truth that invariability of succession is found by observation to obtain between every fact and some other fact which has preceded it, independently of all considerations of production of that phenomena." (p213)

Very Humean.

"We may not have found out what this concurrence of circumstances may be; but we have never doubt that there is such a one, and that it never occurs without having the phenomenon in question as its effect or consequence. On the universality of this truths depends the possibility of reducing the inductive process to rules." (p214)

"Invariable sequence, therefore, is not synonymous with causation, unless the sequence, besides being invariable, is unconditional." (p222) (He has in mind day-night succession. He says that "...it is conditional on the occurrence of other antecedents." (Same page a bit above.)

<u>Chapter VIII. Of the Four Methods of Experimental Inquiry.</u>

(The availability of these canons and methods is a consequence of the universal law of causation.)

"First Canon: If two or more instances of the phenomenon under investigation have only one circumstance in common, the circumstance in which alone all the instances agree is the cause (or effect) of the given phenomenon." (p 255)

The above is the basis of the Method of Agreement.

"Second Canon: If an instance under which the phenomenon under investigation occurs, and an instance under which it does not occur, have every circumstance in common save one, that one occurring only in the former; the circumstance in which alone the two instances differ is the effect, or the cause, or an indispensable part of the cause, of the phenomenon." (p256)

The above is the basis of the method of difference.

"Third Canon: If two or more instances in which the phenomena occurs have only one circumstance in common, while two or more instances in which it does not occur have nothing in common save the absence of that circumstance,the circumstance in which alone the two sets of instances differ is the effect, or the cause, or an indispensable part of the cause, of the phenomenon.

The above is the basis of the Joint Method of Agreement and difference.

"Fourth Canon: Subduct from any phenomenon such part as is known by previous inductions to the effect of certain antecedents, and the residue of the phenomenon is the effect of the remaining antecedent."

The above is the basis of the Method of Residues.

"Fifth Canon: Whatever phenomenon varies in any manner whenever another phenomenon varies in some particular manner, is either a cause or an effect of that phenomenon, or is connected with it through some fact of causation.

The above is the basis of the Method of Concomitant Variation.

Comments about the methods:

1. They purport to be both methods of ***proof*** (Ch 9 par. 6) and methods of ***discovery***.

2. These methods depend on prior analysis of some sort. The case of the drunken freshman. Also cannot distinguish between correlation and causal effect. Example: variation in sun spots and price of hog bellies.

What is an ***empirical law***? (Chapt XVI):

"Scientists give the name of Empirical Law to those uniformities which observation or experimentation has shown to exist, but on which they hesitate to rely in cases varying much from those which have been actually observed, for want of seeing any reason ***why*** such laws should exist." (p338)

"An empirical law, then, is an observed uniformity, presumed to be resolvable into simpler laws, but not yet resolved into them." (p339)

Elsewhere he seems to say that an empirical law is a purported law that cannot receive the support that laws can receive when they are shown to be the consequence of an established causal law.

Note also, for our purposes:

"...in the resolution of a derivative law, the element which is not a law of causation, but a collocation of causes, cannot ~~itself~~ be itself reduced to any law. There is no uniformity, no *norma*, principle, or rule, perceivable in the distribution of the primeval natural agents through the universe." (p 339)

What goes on in chapter XXII?

The heart of what goes on seems straightforward enough.

1. Uniformities of co-existence are either ultimate or derivative.

   This seems to mean the following: each property of every set of properties that have been observed to always co-exist in different individuals, each such property is present in these individuals as an effect of laws (and other circumstances i.e. what we would call "boundary conditions"), or is not such an effect, i.e. is "ultimate".

2. If the latter is the case for ***all*** of them then the uniformity is ***ultimate***. Otherwise it is ***derivative.***

3. If it is derivative, then the presence of each property (or of some at least) in the set is a consequence of

   (1) causal laws pertaining to ultimate properties

   (2) occurrence of (?) or creation of (?) ultimate properties of the objects

   (3) possibly phenomena outside the objects

   (4) absence of counter-acting forces.

Thus, the co-existence of the properties in the various individuals is a consequence of the co-existence of ultimate properties in each of these individuals, facts outside the individual, operation of the laws, and absence of counter-acting forces.

But we have no way of ***testing***
- whether the responsible ultimate properties (and other phenomena) will always co-exist

If ultimate, they must always co-exist but this does not show that they are ultimate.

- or whether no counter-acting force will ever intervene when the ultimate properties do co-exist in some individual.

4. Nor do we have any way of ***demonstrating*** that the observed uniformity is an instance of a uniformity to which there cannot be any exception.

   Why not? There is nothing in the case of co-existences that corresponds to the Law of Causation (exceptionless)and hence that supports anything like the Canons of Induction.

   Thus we have no way of demonstrating of a purported uniformity that it is an exceptionless regularity, (even if it happens to be a derived one).

   All that we have available to enhance our conviction is induction by enumeration from observed cases.

5. If the purported uniformity happens to be an ultimate uniformity, we again have no way of knowing that ~~that~~ it is a real, exceptionless uniformity. Ditto.

   Again all we have available is induction by enumeration from observed cases.

<u>What follows that is relevant for the theory of kinds?</u>

Go back to the definition of kind.

Something is a named kind if

(5) There is a general term of which it is the denotation.

(6) The members of that extension share all the properties connoted by the term.

(7) But they also share an indefinite number of other properties blah blah.

We can know that they share the properties connoted by the term. That follows analytically. But can we know with certainty that they meet condition (7)?

No. The best evidence we can have is that provided by induction by enumeration on previous cases.

Hence whether a general name is a (natural) kind term or not is a contingent fact. And furthermore the evidence that it is is of a rather weak sort.

Now later on he says something about terms that belong to nomenclatures. (Book IV, chapt VI, Sect 5 -- p 493 in our reading.) Let us turn to that now. The question he raises there is whether in the case of ***general names belonging to a nomenclature*** the meaning (signification) of the term reside in

the denotation (" and can not, therefore be unfolded by means of a definition" or the connotation.

- a. What is a nomenclature?

- b. What distinguishes general names belonging to a nomenclature from other ones?

    (8) They come in sets presumed to partition a domain of entities.

    (9) They have a differently structured connotation (the term ***connotation*** is not very felicitous) viz. one which contains a metalinguistic component to the effect that the denotation of the term is a kind.

- c. Even if we accept this weird doctrine, (to clear up what goes on here one would have to discuss the difference between pragmatic presupposition and semantic entailment!) does it follow that we can ever know with certainty -- of a general name belonging to a nomenclature -- that is it denotes a kind?

- d. It may seem to we can: The connotation of the term implies that it is.

- e. However: Such general names may fail to have a denotation. This will happen if the class determined by the first part of the connotation fails to be a kind. (Weird!)

- f. And our evidence that this will not happen -- in the case of any given such name -- is at best inductive-by-enumeration.

Question to discuss: Is this consequence right? (a) First though, is Mill right in asserting that there are names with the semantic property that they are natural kind terms?

FROM EXCHANGE WITH SYLVAIN

1. Question raised by Kitcher's overlapping natural kinds.

2. I thought it was contradictory: overlap is an intersection; incompatible natural kinds being picked out by substance sortals, etc., which also serve to individuate.

3. Sylvain saw no reason why there couldn't be overlap: things in overlap area obeying both sets of laws (and perhaps still others).

4. Now, realize I've seen some of this before in criticizing Putnam. Is water an intersection of two natural kinds, liquid-kind and H_2O-kind?

5. I guess one can, depending on what conditions one wants to put on them, have natural kinds at various levels, and also need not make the levels nest as Wiggins does.

6. But then one is not, I think, restricting natural kinds to <u>infima species</u>. Here I think there's no matter of right and wrong, but there is a consequential choice involved.

7. Not clear what it involves, but it's got something to do with primary substance, characteristics it possesses (being like an individual?) vs. simply projectibility. Probably also gets into the question of a floor for explanation; ultimate ontological constitutents. THINK!

Let H hi: Vitriol :: H_2SO_4.

Lavoisier says $\Diamond H$. O

∵ knows $H \rightarrow \Box H$)

∴ $\Box(H \rightarrow \Box H)$ I

By Brouwer Axiom.

$\neg H \rightarrow \Box \Diamond \neg H$. II

From I $\Box(\Diamond \neg \Box H \rightarrow \neg H)$

Else. from dilemb

$\Box \neg \Box H \rightarrow \Box \neg \Diamond$

$\neg \Box \neg \Box H \rightarrow \neg \Box \neg H$

|

$\Diamond H \rightarrow \Diamond \Box H$

$\Diamond \Box H$ by O

From II: $\neg \Box \Diamond \neg H \rightarrow \neg \Diamond H$

$\neg \Diamond \neg \Box H \rightarrow H$

$\Diamond \Box H \rightarrow H$

So H (O.K. D.

Answer: O is epistemic. ~~not~~ I, metaphysical.

NOTES ON SYLVAIN

I. "WHAT WE DON'T KNOW WHEN WE DON'T KNOW WHY":

1. Central human activity is pursuit of answers to pre-chosen questions.

   a) Children must engage in it to "learn the phonemes, words, phrases, and parameters of the ambient language."

   b) "[W]e must unconsciously engage in it if our vision is to find the properties of distal stimuli on the basis of proximate ones".

   c) "[A]nd, of course, scientific research and pooling of knowledge wouldn't be possible without it".

   [d) In fact, it's only the third process that fits what follows, and the inclusion of the first two is very unfortunate.]

2. Consider a rational ignoramus and the set Q_1 of sound questions to which he does not know the answers at t. Under what conditions can he rationally remove questions from the set.

   a) He must be able to represent the sentences that express members of Q_1 in order to target them.

      i) Some questions are beyond the reach of some systems of representation.

      ii) Ability to understand and express a question doesn't imply ability to formulate all possible answers.

   b) Must know that question is sound, i.e. that it's existential and attributive presuppositions are satisfied.

      i) Thus, that the Empire State Building exists and has a height.

      ii) And also, for example, that it doesn't have a square root.

      iii) Rational ignoramus must therefore have concepts for the predicates that occur in the questions considered and of their range and domains.

   c) Rational ignoramus must be conscious, aware, of the questions to be evaluated.

      i) This condition entails first two but goes beyond them in requiring that question has arisen.

ii) Also requires that Rational Ignoramus not mistakenly believe he knows answer to it.

d) Questions satisfying these three conditions are accessible to Rational Ignoramus, and not all questions can be accessible.

i) Easy to show that there are non-denumerably many sound questions of which only a denumerably infinite number can be represented by RA.

ii) Nor can RA know the existence of all things past, present, and future.

iii) Nor of all the attributes manifested somewhere.

3. The evaluation of accessible questions depends on other conditions.

a) The value of having an answer, which itself comes in various forms.

i) Peircean (formerly "gosh") value: purely intellectual value of answer.

ii) Jamesian (formery "cash") value: material benefits of having answer.

iii) Collingwood (formerly "golly") value: generation of other questions with their own values.

iv) Machian (formerly "added") value: knowing answer will itself give answers to other questions.

b) Thus, some answers produce value adders, and these also come in various forms.

i) Some add an answer only if first answer is yes: conditional value adders.

ii) Some are unconditional.

iii) Some add answers to all questions of a given form.

iv) Thus, have begun a hierarchy.

4. All the questions so far considered have been "How", "What", "Where" questions.

a) Results don't seem to permit answers to "Why" questions.

b) They seem to stand in a different relation to their presuppositions.

c) Why is that?

5. There follows an interesting section on traces, syntactic markers to be conceived as like variables bound by operators.

   a) Thus "Who did John hit?" has logical form "(Who t)(did John hit t)".

      i) Here t is the trace and is generated why interogative operature 'who' is moved to initial position from its fundamental position in the deep structure: John hit who.

      ii) In terminal position the 'who' indicates target of hit, and a trace must be left there when it's moved to intial position.

   b) Much illustration of ambiguities which result from different positions for the trace in the logical forms of the disambiguated versions.

      i) "Who do you want to eat?" as "(Who t)(do you want to eat t)" versus "(Who t)(do you want t to eat)".

      ii) In this example, difference shows also in surface structure (where traces are present but usually invisible), because sentence is disambituated by substituting 'wanna' for 'want to'.

   c) English interogative sentences (not including 'Why' sentences) have mid-sentences traces in both surface structure and in logical form, where mid-sentence position is the one in the parentheses above.

6. Why sentences are different, for they have no mid-sentence traces.

   a) "Who did John hit where?" and "Where did John hit who?" are both acceptable.

      i) But only "Why did John hit who?" (not "Who did John hit why?") will do.

      ii) In the corresponding deep structure 'Why' can occur only in initial position and it doesn't move.

      iii) So there's no trace for 'why' to bind in surface structure.

   b) A more elaborate argument indicates that there's no trace in logical form either, and this is specially important for it presumably is governing also for languages different from English.

      i) Sentence like "Why did Adam eat the apple?" behaves

very differently with changing stress from "When did Adam eat the apple?"

ii) In first case but not in second change of stress changes implicatures of the question and also acceptable answers.

iii) And these differences can be neatly accounted for in terms of absence of trace in logical form.

c) There's a further argument given for case in which 'Why' is in another position in the logical form.

7. Last part of paper shows that, where there's a mid-sentence trace, there's a transparent way in which presuppositions of question follow from undertanding the question itself.

a) Thus, if Rational Ignoramus understands question, he knows its presuppositions, can examine them, and can thus tell what he has to find out to know whether question is sound and accessible to him.

b) Nothing of same sort follows from form of a why question.

i) Rational Ignoramus can know his lack of an answer without knowing that there's anything to find out or knowing how to determine whether there is.

II. "RATIONAL IGNORANCE", in L.M. Vaina (ed.), Matters of Intelligence (Reidel, 1987), 333-352:

1. Most of paper is earlier version of "WWDKWWDKW", above.

a) Improves on that presentation by acknowledging that the makeup of the set of questions presents problems if it's to contain all the questions to which RA knows no answer.

i) Then, relatives definition of RA to time t and the particular set of questions Q.

2. New material on pp. 346-348 deals with models, natural kinds, and categories.

a) Presupposes notion of super-erotetic value adder, which is a value adder like $T = {}^{2}\sqrt{1/g}$ which generates answer to any question of the form, What is the period of pendulum X? from answer to question, What is the length of pendulum X?

b) Then, M is model of O relative to a set of triples $\langle Q_m Q_o A \rangle$ iff Q_m is a set of questions about M, Q_o is a set of questions about O, and A is an algorithm that translates any answer to a question in Q_m into an answer to a question in Q_o, and turns correct answers to first into correct answers to second.

i) Thus, models are super-erotetic value adders.

c) A natural kind is a class of objects each of which can serve as a model for all the rest.

i) Thus answer to What is the freezing point of this sample of water? supplies answer to same question about all other samples of water.

d) Natural kinds fall into categories: e.g., substances, animals, etc., each of which contains a number of natural kinds.

i) The kinds in a category share projectible predicates like What is its boiling point?, What is it's anatomical structure?, etc., though different kinds get different answer.

ii) It's at the level of categories that formulae come into play. They generate the answers to one projectible question about the kinds in the category into the answers to a second question about the corresponding kind.

3. Then, description of a cute game called M.I.T., Minimizing Investigative Travails or Maximizing Ivestigative Trade-offs.

NOTES FOR MEETING 11

I. INTRODUCTION:

1. Business: next meeting is monday evening, 7:00 pm, this room. Sylvain's paper is the assignment.

2. Caroli has a couple of reprints, just received, of a second paper of Sylvain's.

    a) It's called "Rational Ignorance", and much of it is summarized in the paper you've got.

    b) But it includes a section on natural kinds, which you may want to look at.

        i) Can drop in and xerox it.

3. Following meeting is back to Wednesday, ten days later.

    a) No additional reading, but an attempt to put the pieces together, to look at ground we've been over.

    b) Success requires work from all of us.

        i) Look back at your notes: Mill & Whewell, Wiggins, biology, and so on.

        ii) How do they fit together? Where do they agree and disagree? What issues remain open? Etc.?

        iii) Come prepared to discuss.

II. RELATION TO NATURAL KINDS:

1. The lexicon as providing a taxonomy:

    a) Where lexicon is to be understood as set of intensional categories, not necessarily words.

    b) And where the categories include the natural kinds of the corresponding species, culture, language community, whatever.

2. More than in other things we've read, role of language as carrier of kinds is important.

    a) Position is a bit like Mill's: nature provides the differences, but it's man who puts them to use in taxonomy.

    b) Plus, there are a variety of different ways in which this taxonomizing can legitimately be done.

3. The parallel between my version of the water story and the problems encountered in biology.

    a) No permanent taxonomy over historic time; resulting problems for nomic generalizations.

III. ISSUES IN TSK'S PAPERS:

1. Non-translatability:

    a) Roots in experience as historian's need for special ways of reading.

    b) Can't translate -- in Quinean truth-preserving sense -- but can teach language and thereafter use it.

        i) That's what incommensurability is about.

    c) Thus, restrictions on stipulatible possible worlds.

2. Process of language learning, some characteristics:

    a) Terms acquired in layers, strata. Space-time vocabulary before that of mechanics.

    b) Role of concrete examples: ostensions.

        i) Two senses: direct and descriptive (given in antecdent vocabulary).

    c) Several examples needed, and often examples of misuse as well.

    d) A number of terms must generally be learned together (remember Mill and Whewell on classifying).

    e) Different routes to same term available. Two routes to mass and weight.

    f) Thus, language and world learned together. Can't get one without the other.

        i) Hence, restriction by lexicon to particular set of possible worlds.

3. Causal theory.

    a) Note parallels to above: role of examples, transmission as redubbing.

    b) The gold case and the water case.

        i) Extent to which former works.

c) The problems with water case.

i) There isn't any XYZ.

ii) H_2O includes ice and steam, so not equivalent to water, and the adjustments aren't marginal.

iii) The corresponding shift in chemical theory, and the problem of finding vocabulary in which to express old views.

iv) The superficial vs. essential properties.

4. The issue of realism.

5. The problem of separating metaphysical and epistemic.

a) Given the lexicon, have a set of possible worlds.

i) With it the metaphysics is in place.

ii) Question of finding out which possible world is actual is then epistemic.

b) But change of lexical structure produces simultaneous change in the metaphysics and related epistemology.

i) Parallel to my view that truth is for us only intra-theoretical.

NOTES ON PUTNAM

THE MEANING OF MEANING: pp. 215-52, 268-271

1. The great progress in linguistics has been with respect to syntax. Meaning is in dreadful shape, especially word meaning.

2. Standard distinction between extension and intension is needed, but has troubles (216-219).

    a) Extension is set of referents, but sets have clear boundaries, extensions often don't.

        i) Thus, drastic idealization is required.

    b) Term may have different senses, depending on context.

        i) Usually handled as though they were different terms, subscripting.

        ii) Again, this distorts character of language.

    c) 'Creature with a heart' vs. 'Creature with a kidney' shows that intension can differ while extension stays the same.

        i) But intension is very fuzzy notion, equated for a long time with concept, thus something mental.

        ii) Frege and Carnap thought it external -- different people could grasp same meaning -- but still thought that knowing the meaning was still an individual psychological act.

        iii) And continued to suppose that, though two intensions could have same extension, a single intension could have only one extension.

    d) Putnam will show that it cannot be be case <u>both</u> that meanings are mental and that same intension determines same extension.

3. Relevant sense of mental is traditional: methodological solipsism. No mental state presupposes existence of the subject's mind, ~~but~~ not true of another individual or even subject's body (220-222).

    a) To know two different intensions is therefore to be in two different psychological states.

        i) Also, standard view holds that, if A & B differ in extension, they must also differ in intension.

        ii) Thus there can't be two possible worlds in which Oscar,

though in same psychological state in both, understands A to mean different things in the two worlds.

b) Psychological states are public in sense that two people can be in the same one.

i) Thus, can't have Oscar and Elmer in same state but with different meanings for one and the same term.

4. The Twin Earth, Water, H_2O story (223-227).

a) XYZ abbreviates a "very long and complicated" chemical formula, but "XYZ is indistinguishable from water at normal temperatures and pressures".

i) XYZ serves functions on Twin Earth that H_2O does here, and is refered to with term 'water' by Twin Earthians.

ii) No problem yet: the extensions of '$water_E$' and '$water_{TE}$' are different.

b) Now back to 1750, before knowledge of hydrogen, oxygen, etc., or of chemical formulae.

i) Suppose $Oscar_E$ and $Oscar_{TE}$ in identical psychological states including all the same beliefs about what each calls water.

ii) Nevertheless, one picks out H_2O the other XYZ, thus different extensions.

iii) Meanings aren't in the head.

c) The indexical story: role of relation $Same_L$.

i) Where relation is a theoretical one which may not yet hve been made out.

ii) Thus, meaning is in part a promisory note.

iii) Meaning change isn't what occurred between 1750 and 1950.

d) The aluminum/molybdenum version: former plentiful on earth, latter on Twin Earth, only experts can tell the two apart, and the words are switched.

i) $Oscar_E$ and $Oscar_{TE}$ are non-experts, both in same psychological state, but have different extensions.

ii) Like the preceding except that experts can tell easily [which ought to lead Putnam to say that experts are not in same state and that therefore the culture isn't.]

e) The elm/beach story: Putnam and his interlocutor can't tell an elm from a beach.

i) But in both their ideolects, 'elm' refers to elms, 'beach' to beaches.

ii) A difference that can't be due to their being in different psycholgical states when using 'elm' and 'beach'.

* * * * *

Some problems in this argument. For the historical water case, see my paper. The contemporary water case reduces to the aluminum/molybdenum case. Now, either Earth and Twin Earth exist within a single possible world, or they are themselves different possible worlds. If the latter, then should use same language in stipulating both, so stuff is aluminum in one world, molybdenum in other, and there's no problem. If the former, then case reduces to that of elm/beach. But since speakers have both terms, and since they know that a tree can't be both an elm and a beach, they're not in same psychological state when <u>identifying</u> an elm as they are when they <u>identify</u> a beach. Not clear that identifying is relevant. But think of propositional attitudes: believing, desiring, etc.

* * * * *

5. All the above depends upon the division of linguistic labor (227-229).

a) A member of a speech community may use a word, know its meaning [why say that?], without being able to establish its referent.

b) Relevant experts do that for the members of the society.

i) "It is only the sociolinguistic state of the collective linguistic body to which the speaker belongs that fixes the extension."

[c) But it needs pointing out that members of the community who cannot determine referents for themselves need to know how to find out who can. Also, that communities whose experts differ are themselves different in linguistic behavior.]

6. One way of introducing someone to a natural kind term is by ostension: this stuff is water. Other way is by descriptively, by markers and stereotypes. (229-235)

a) Could say that 'water' has same meaning in different possible worlds but refers differently, or that it always refers to what act of ostension introduced in this world.

i) Either Kripke's view or earlier description of Twin Earth case permits only the latter interpretation.

ii) Thus relation $Same_L$ is cross-world, i.e., it leads back in all worlds to the sample ostended in this one.

iii) Thus leading to metaphysical necessities of Kripke's sort.

b) Can get to same viewpoint via indexicality.

i) Noone ever suggested that intension of an indexical, e.g., 'I', always determined same extension.

ii) Putnam is suggesting that 'water' also has an indexical component so that it's referent isn't determined by something in the head.

7. The need to retain realism motivates much that's preceded (235-238).

a) Why might one want to say that Archimedes meant something different by 'gold' ('kronos') than we do?

i) Because, says Putnam, the "operational criteria" for picking it out were different and led to identifications different from ours.

ii) Thus "meaning change" which appeals to those who don't conceive that there's a realm of things independent of us which are simply better described by recent theory than by older ones.

iii) These are the antirealists, and for them truth makes no sense except intratheoretically.

b) But no operational definitions can provide necessary and sufficient conditions for applying word or any account of meaning that applies to actual science.

i) Scientists (including Archimedes) do believe they're referring to same things as their predecessors but saying more true things about them.

ii) Can't account for why science works without supposing they're right, cf, Boyd's paper.

c) Indexicality and rigid designation supply what's needed.

8. Natural kind terms have more than one sense, but generally the secondary ones build out from a core determined by $Same_L$, and they vary with interest, with importance of distinction being made (239-245).

a) Gold sometimes means pure gold, other times not, etc.

i) 'Lemon' might even, on occasions, properly refer to a plastic lemon.

ii) But that doesn't make the mere possession of superficial qualities yield an appropriate sense except under very deviant circumstances.

b) Where it exists, common hidden structure generally provides the core sense.

i) But there needn't be any such core. Water could have referred to samples that shared only superficial qualities and that would have been what word then meant.

[ii) Putnam seems not to notice that word would no longer be a natural kind term under these circumstances.]

iii) The case of jade -- there are, in fact, two sorts -- is a case where shared superficial qualities lead to two natural kinds, not one and not none.

iv) If both H_2O and XYZ had been plentiful on earth, then it would have been a case like jade.

c) Similar analyses apply to other sorts of terms, especially artefact terms.

i) Consider Albritton's example: pencils' turning out to be organisms.

ii) That's an epistemically possible case, and it depends upon the organisms' sharing superficial properities of of pencils.

iii) But there's no possible world in which pencils are organisms (the same-structure-as-here applies), which shows that pencil isn't synonymous with the cluster of properties. (Reference to Kripke on the ice table.)

d) There may be a few "one criterion" words in the language ('bachelor' or 'hunter', for example), but they're very rare.

9. Where have we now gotten with meaning (245-249).

a) Can't identify meaning with concept except by giving up connection between meaning and extension (e.g., water' would mean the same on earth and Twin Earth) but have a different extension.

i) That's o.k. for a pure indexical like I, but not for water or elm, etc.

ii) Avoid this by making the extension part of the meaning,

but without any implication that differences in meaning imply differences in mental state or concept.

b) Thereafter problem of meaning splits in determination of extension and determination of individual competence.

i) Determination of extension is societal and belongs to sociolinguistics. Causal theory, as theory of result of dubbing, falls into this category.

ii) Individual competence, which no long is required to determine extension but is nonetheless somehow constrained, is matter for psycholinguistics.

c) We don't count someone as knowing 'tiger' if he puts it into sentences (e.g., "Hand me that tiger") which clearly make no sense at all.

i) Also require that, in his total social situation, his use refers to same extension as that socially determined by his community.

ii) Thus, Twin Earthians don't know what 'water' means, and neither does person who says that "he drove here is his lovely water".

iii) The second of these criteria is, however, itself socially determined. Some societies wouldn't think someone who referred to an elm as a beach knew either term.

10. Stereotypes are conventional ideas, often more or less inaccurate, that a community requires a licensed speaker to know.

a) Thus English speakers must know that tigers are striped even though albino tigers may not be, etc.

i) That doesn't make the stereotypical characteristics hold analytically.

ii) But they do help term serve its social function: thus gold is stereotypically yellow -- since gold jewelery is -- even though chemically pure gold is nearly white.

b) We do hold some that go badly wrong (e.g., stereotype of witches several centuries ago).

i) But communication couldn't work so well as it does if it weren't the case that most stereotypes are pretty accurate.

c) As an idealization, we could establish stereotypes by seeing what the community makes it obligatory for a speaker to know.

i) Mostly, though, native speakers have a very clear sense of where the boundaries of stereotypicality are located.

11. Summary [after a big skip], meaning is a "vector" with components that include, at least, the following:

a) Example, is for term 'water'.

i) Syntactic markers (mass noun, concrete).

ii) Semantic markers (natural kind, liquid).

iii) Stereotype (colorless, transparent, tasteless, thirst-quenching, etc.).

iv) Extension (H_2O -- give or take impurities).

[v) This is nice, but what's missing is the contast sets which place meaning of one term in a field.]

b) Descriptions are equivalent if the same except for the extension and also coextensive.

i) Equivalent descriptions are, then, correct or incorrect together.

ii) So that meaning does determine extension but is no longer in the head.

c) Can then get a "paradox": if Oscar is a German-English bilingual, the words 'beech' and '<u>Buche</u>' may be for him exact synonyms without his being aware of it [I don't see how this comes about].

i) Then, he may believe something under one representation (the tree has a sign saying "beech" but not under the other).

d) All this shows how deep the penalties have been for philosophy's ignoring role of the world and role of the community when considering meaning.

NOTES FOR MEETING 9

I. INTRODUCTION:

1. First, business: Asked last time that those who'd not yet talked to us about term paper bring a brief statement of their intention.

   a) Please, pass them now to Sylvain.

   b) Remind you now that they're due 14 ~~April~~ May, four weeks from tomorrow.

      i) Available extensions will be very brief, because of Sylvain's departure on leave.

      ii) Maybe even briefer, if he leaves earlier, since I'm going to leave for just over two weeks on June 1st.

   c) If you've not got a topic, talk to us very very soon. It's now urgent.

2. Most of issues raised by this week's reading relate to problems we've encountered earlier.

   a) Want therefore to proceed as I did last time: by guided discussion.

   b) But two sorts of problems.

      i) There are too many issues, and a number of them will be back in future weeks, at least with Putnam reading and with my papers.

      ii) A lot of them involve questions of modality, which we've got to touch on but which is only indirectly relevant to seminar.

      iii) So I'm going to reserve the right to cut off one or another topic, and ask you to come back at me later.

   c) Second problem is just that this reading gets deeply into areas where my own current concerns lie.

      i) Can't engage in discussion without here and there locating myself.

      ii) Can't, that is, wait entirely for the meeting on my papers.

      iii) So this meeting won't be quite so exclusively on Kripke as it probably ought to be.

II. SENSE OF PROPER AND OF GENERAL NAMES:

1. First topic I'd like to do briefly, but I'm not sure how much of it this group is prepared to take for granted.

   a) Kripke on Mill: proper names have no connotation, no sense, are just tags; general terms have connotation, sense, intensions.

      i) Where sense was supposed to supply necessary and sufficient conditions for application of the name.

   b) Kripke thinks neither sort of name has a sense sufficient to govern its application.

      i) Idea was that some properties of an individual or a kind were defining features, others were associated with them empirically.

      ii) Kripke maintains that there may be some properties that an individual or the members of a kind necessarily possess, but there's no identifiable set sufficient for singling them out.

      iii) With the possible exception of highly theoretical properties, not directly accessible, like having atomic number 79.

   c) That seems to right to me and to an increasing number of others, but we may need to kick it around.

Q! (1) Does anyone want to defend notion of sense as determiner of reference?

      ii) If so, let's begin separately for proper names and for kinds.

   d) What about cluster concepts, the Searle notion.

      i) Kripke never quite says why it won't work, though he obviously believes it won't.

      ii) But the argument at intuitive level is pretty readily available.

D! iii) Where do you set the boundary, the minimum score such that the word applies?

III. INDIVIDUALS AND LIFELINES:

1. Most of the book is about proper names, mostly of humans, and I want to start there, holding off kind terms for the moment.

a) Baby is born, baptised with a name which designates in the future whatever later happens to it.

i) Name is passed to people not present at baptism by a chain of intermediaries which links later speakers to the baptism itself.

ii) That's all there is to it.

b) To identify the person who bears the name, to pick out the referent, may have to have that person pointed out or may need extra information:

i) It's the man drinking vodka in the corner, or it's the author of Waverly.

ii) But neither is part of the meaning of the name. Indeed name has no meaning.

iii) The individual who bears the name may have a few necessary properties -- perhaps being human or having particular parents -- but everything else about it is contingent, could have been otherwise.

iv) But is nevertheless may appropriately be used to single out the bearer of the name.

c) As a theory of proper names, that all seems to me just right and immensely illuminating.

i) But not everyone feels that way.

D ii) Discuss.

2. One of the reasons I like the theory so well is that it so closely resembles actual human practice, and that practice -- giving names and using them -- is apparently universal.

a) Want therefore to ask a question about it. Why does it work? What does it's use presuppose?

i) Takes us away from Kripke, who would probably resist it, but we'll be back.

ii) On the other hand, as a hint, brings us back to central aspects of Wiggins.

b) Non-branching, non-intersecting spatiotemporal continuants.

i) Draw lifeline through a quality space.

ii) Show behavior that's barred.

iii) Things didn't have to be this way: stones are, electrons are not.

iv) It's a characteristic of the world that lets the naming game work.

v) And the characteristic is the presence of substances or at least of spatiotemporal continuants.

3. That's a first condition, and there's a second. Need also to be able to tell different individuals apart.

a) If God were the only user of names, there would be no difficulty.

i) He could keep his eye on each individual all the time; identify them exclusively by spatiotemporal continuity.

b) But naming is a human practice, and it's the practice that's shaped the language and whatever commitments may be built into it.

i) And humans can't watch all the individuals in the vicinity at once or any of them all the time.

ii) They therefore need to be able to make qualititive distinctions.

iii) Naming game wouldn't be playable in a society characterized by large populations of identical twins; would have to tatoo names on them.

iv) Furthermore, differences mustn't be too subtle. Can't involve detailed tests every time.

v) Can't require us to follow the individual around day and night without sleeping.

D c) Discuss. Minimum conditions for success of naming game.

4. Second condition seems to me specially important, because it interjects an element we've not seen explicitly before.

a) Put it therefore another way: being able to tell the continuants apart requires that we be able to map lifelines in a property or feature space,

i) one that displays both the similarity between them in successive stages

ii) and that also keeps different individuals apart, perhaps using details of facial expression, other configurations which one must learn to use.

b) Within that space, need a triadic similarity relation, S(a,b,c). Just need anything of strength of this sort of properties. Can do

i) Read it a is more like b than like c.

ii) And need also an "appropriate" time interval Δ such that for any two points a, b, separated by Δ, on the lifeline of one individual, a and b must be more like each other each other than like any point c in the corresponding period along the other.

iii) It's again a no-intersection condition, but now one that can't be done just geometrically, by pure spatio-temporal continuity.

iv) Have to compare properties, qualities of different individuals at a given time.

D c) Discuss, questions.

5. Two important characteristics:

a) If this is roughly on track it provides an answer to a question I've kept asking about Wiggins.

i) Why does an identity claim require a sortal: same man, vs. same dog, or same stone?

ii) Not so much because, as Wiggins suggests, you need the sortal to know how to trace the life line, though you may often make use of it.

iii) But rather because you need to know what sort of thing it is in order to tell it from others of the same kind, to be sure you've got the same one of those.

b) If you want to know whether the horse tied to the post outside your house in the morning is the same one that was there last night, you'd better know something about horses.

i) Including how much they can change overnight, something which affects also the length of the appropriate interval Δ.

ii) And this seem also to be why "same thing" isn't a sufficient sortal.

6. Other corollary of this viewpoint I just want to point to, saving discussion for another occasion.

a) It looks to me very much as though the same sort of tripartite similarity relation required to discriminate individuals is also the relation needed to discriminate kinds, or species.

i) You'll have to somewhat enrich the property space in order to get it to do that, but the properties involved should largely overlap.

ii) If you find them, then identify things by family resemblance.

iii) Within the appropriate space, this dog is more like some other dogs than it is like any cat.

b) If the world is appropriately constituted, then can identify class members this way in absence of a set of necessary and sufficient conditions.

i) It's a way of classifying that I come to from Wittgenstein's talk of family resemblance, which in spite of Kripke's remarks is not a cluster concept notion.

ii) Also, its way of classifying that should be reminscent of Whewell's position in the debate with Mill.

iii) Gives a key role to actual examples: type specimens.

IV. MODALITY:

1. Now back to Kripke, other part of title: Necessity or more generally modality.

a) A great deal of work on modal logic lies behind this book.

i) We don't need more than a taste of it, but do need that.

b) Key is notion of other possible worlds.

i) Informal talk of them goes back to Leibniz.

ii) Without some intuitions about them, we couldn't use terms like possible, counterfactual and so on.

iii) Need to make notion explicit, but not with the considerable formalism and refinement that's recently been built from it for modal logic and semantics.

D c) So, what is a possible world? DISCUSS.

d) Two special points about them that Kripke specially emphasizes.

i) Question: Can there be unimaginable possible worlds?

ii) Some say yes: but Kripke insists -- and I think it important -- that we must be able to stipulate them. (Notes, p. 3)

iii) Take off from our world and stipulate something counterfactual about it.

iv) No telescopes, space ships, etc.

v) Not standard, but Kripke's view here, and one I think essential for reasons to which we'll get back.

e) Other point emphasized by Kripke is that we must do the specification in our language, whatever is spoken there.

i) At the very least it avoids confusions due to change of terminology.

ii) Also opens a possibility I am going to want to exploit.

iii) Possibility that the set of worlds stipulatable using different languages may be different.

2. What Kripke wants to do in this book with possible world talk is drive a wedge between the notions of <u>a priori</u> truth and necessary truth.

a) Where <u>a priori</u> is an epistemic notion, a notion about how one knows something.

i) And necessary is metaphysical, about the way things must be.

b) Pythagorean theorem is known <u>a priori</u> because there's no its proved without appeal to experience.

i) Also, my parents knew <u>a priori</u> that my name was Tom, because they gave it to me, stipulated it.

ii) Others had to learn it from experience.

c) But my name wasn't a necessary characteristic of me.

i) Necessary means true in all possible worlds, and in other worlds I might have been given other names.

ii) My own name, Tom, is nevertheless a rigid designator. It picks out my lifeline in other worlds. It picks in other worlds the substance who is called 'Tom' in this one.

iii) Perhaps being human is a necessary property of me, but not my name.

d) In same way, length of meter stick S in Paris is one meter is an <u>a priori</u> truth because that's a stipulation.

i) But it's not a necessary property of that very stick.

ii) It might have been bent before it was selected for the standard, or heated or something else.

D e) DISCUSS.

3. This separates the <u>a priori</u> from the necessary. A truth can be <u>a priori</u> without being necessary.

   a) But Kripke's makes also a more surprising and central claim:

      i) Necessary truths need not be <u>a priori</u>. there can be necessary <u>a posteriori</u> truths.

   b) This is more problematic, but I think there are at least a few clear examples.

      i) Cicero is Tully, other cases of two names for same lifeline.

      ii) Probably also Hesperus is Phosphorus, though I'm not well satisfied with the argument for reasons I don't want to engage with now.

Q! iii) What do you think of Cicero is Tully?

   c) But also wants to move from necessary truths to necessary properties, properties which, unlike being elected President, have to hold on a given lifeline.

      i) These would be essential properties, they're the rentry point for essences.

      ii) And they quickly become the bridge from properties of an individual to properties of a kind: having atomic number 79 for gold or being H_2O for water.

4. It's of course it's just when it's transferred to kinds that the thesis becomes most relevant for us.

   a) But we're going to have more of it in that form in next two meetings, and some of what's involved is a good deal clarified by Putnam's formulation.

      i) So, for the moment, stick to essential properties of individuals.

      ii) Kripke gives a number of examples, all of which seem to me highly problematic, but not necessarily wrong.

   b) Most of them involve origins.

      i) Table's having been made from this very block of wood, not from another block or from frozen water. (What happens to that wood later is, he suggests, another matter.)

ii) Queen's having had just the parents that she had, perhaps even precisely the same sperm and egg.

c) But some are properties that seem to last as long as the individual which has them.

i) My being human.

ii) This table's being made of molecules, not just at the beginning, but throughout.

d) What do you think of these? DISCUSS.

5. A suggestion.

a) Cases where Kripke's necessities seem most clearly successful are with identity statements.

i) Those you can get off of bare lifelines, spatiotemporal continuity.

b) In the stronger of these more recent necessary-property cases, he's trying to extend lifeline approach.

i) Question of origin, inheritance. Reminiscent of both Wiggins and perhaps also of biology, especially cladist approach.

c) But he's after properties, and it's quite unclear that you can get them off of bare lifelines.

d) On the other hand, if lifelines must be described under a sortal, in a property space appropriate to the kind of thing that is tracing the lifeline, then there may be possibilities.

i) I think more Wiggins is needed for these claims to stand a chance.

6. Hesperus : Phosphorus.

NOTES ON NAMING AND NECESSITY

I. LECTURE I

1. Preliminaries:

   a) Albritton called to his attention problem of necessity and aprioricity in natural kinds by asking whether we could discover that lemons are not fruits (23n).

      i) Albritton and Geach were in early discussions about the essentiality of origins.

   b) Famous remark about specimens that satisfied all the descriptions would nevertheless not be unicorns.

   c) 'Name' will be used here exclusively in sense of proper name; names and descriptors will both be called "designators" (24).

   d) Will take the referent of a descriptor to be the object which fulfills the description whether or not, pace Donnelan, it fulfills speaker's intention.

2. Mill said names had denotation but not connotation; Frege and Russell insisted that names were just abberviations of descriptions which (at least for Frege) provided their sense (25).

   a) Arguments for Frege-Russell view have seemed very strong (26-29):

      i) How else pick out referent of a proper name?

      ii) How else decide truth value of identity statements (e.g., Hesperus = Phosophorus).

      iii) How else analyse a question such as whether Aristotle ever existed? Isn't it about whether anyone with the properties attributed to Aristotle ever existed?

   b) Cluster concepts introduced to solve problems of the Mill-Russell view (30-33).

      i) Frege noted that opinions about the sense of a given name may vary from speaker to speaker; said that made no difference if the referent stayed the same but should be avoided in a perfect language.

      ii) Wittgenstein recognizes same difficulty (Moses examples) and raises question how many of the descriptors must be shared.

      iii) Cluster concepts introduced as set of descriptors many of which must hold but not all.

iv) Can be a theory of meaning of names or else merely of reference determination (Ziff), but only former can hope to provide solutions to problems above.

3. Much controversy over the categories of truth: e.g., a priori, necessary, analytic, certain. [Kripke's primary concern will be with first two.] (34-39).

a) A priori truth is that which can be known independent of experience.

i) Thus it's an epistemological notion.

ii) Those who substitute 'must' for 'can' are just mistaken.

b) 'Necessary' is sometimes used for 'a priori' and sometimes for 'physical necessity', but conern here is with metaphical necessity, something that couldn't have been otherwise.

i) Contrast is with contingent.

c) We do not now and may never know a priori whether Goldbach's conjecture is true.

i) But we do know that if it's true, then it's necessarily true, couldn't have been otherwise.

ii) There may nevertheless be an argument that makes 'a prior' and 'necessary' into synonyms, but it's not obvious.

iii) Will argue that there are necessary a posteriori and perhaps even contingent a priori truths.

d) The two notions get conflated because:

i) People think if a statement is necessarily true, then should be able to know it's truth by running through all possible worlds in the head, but not clear that one can do that.

ii) Conversely, if something's known a priori, then it's thought to be true in all possible worlds because known without looking at this one.

e) We'll take it that any analytic statement (true by virtue of meaning) is both a priori and necessary.

i) Certainty seems not quite the same as either a priori or necessary.

4. Look at distinction between de re and de dicto modality, i.e.,

statements true of the thing itself, on the one hand, and of the thing as described, on the other (40-42).

a) Thus, number nine is necessarily odd, if nine is described under some mathematical description, but not if its picked out as the number of planets.

i) Nixon might have lost the election is contingent under one description of Nixon but not under another.

b) Need to be able to retain naive view that statement "Nixon might have lost the election" is contingent truth about this man however he's picked out.

i) Thus, am asserting that there are accidental properties.

ii) Must therefore admit that notion of essential properties is meaningful, though not that such properties exist.

iii) Where essential properties of object are those which apply to it in apw.

c) People have rejected the notion of accidental properties because, inter alia, they've seen no way to supply conditions for transworld identity.

i) They thus reject possibility of essential properties, without which possibility, no accidental properites.

5. Kripke acknowledges that problem of qualitative criteria of transworld identity is probably not to be solved (43-49).

a) Suggests source of the felt difficulties is not there, however, but in notion of what a possible world is.

i) "`Possible worlds' are stipulated not discovered by a powerful telescope."

ii) A possible world is not something we travel to. Instead it's "given by the descriptive conditions we associate with it."

iii) Later (49f): "possible worlds need not be given purely qualitatively, as if we were looking at them through a telescope."

iv) Elsewhere (109n): Must use our language in describing Hesperus/Phosphorus example, whatever language was used by the natives.

v) Thus can stipulate of Nixon that he lost the election, that he was not named Nixon, and so on.

b) Note that all this leaves the question of necessary properties open.

i) Perhaps Nixon was necessarily a human being, etc.

ii) What's being denied is only that there are sufficient conditions, and those are required for criteria of transworld identity.

iii) And note also that question of whether Nixon was necessarily a human being -- like question whether this table could not have been composed of molecules (given that it is) -- is a metaphysical, not an epistemological question.

c) Now some terminology:

i) A <u>rigid designator</u> pick out same thing in apw's.

ii) Other designators are <u>accidental</u> or <u>nonrigid</u>.

iii) A designator that picks out necessary existents is strongly rigid.

iv) Elsewhere (21n): a designator may be rigid <u>de jure</u>, by stipulation, as are proper names. Or it may be rigid <u>de facto</u>, like "the smallest prime". Latter is a description which rigidly designates the number 2.

d) Argument of these lectures is that proper names are rigid designators.

6. Problem of transworld identity may exist in another, very different sense (50-53).

a) Consider statement that England fought Germany in 1942:

i) It may not be reducible to statement about individuals but it seems not to be a fact 'over and above' the set of all facts individuals and their behavior.

ii) Similarly for facts about material objects and about their component molecules.

b) One can legitimately ask (though not necessarily find straightforward answers) for conditions of identity of the more macroscopic description while details of the microdescription vary. [Consider Sylvain on mereological identity conditions.]

i) But we needn't do so. Can stay at macro level.

ii) There's no presumption in this case that n & s conditions exist.

iii) What's involved here is conditions on parts, not on qualities.

7. Now remember, theory of names as disguised descriptors can be a theory either about meanings or about reference determination (54-60).

   a) Consider the standard meter stick in Paris.

      i) Kripke argues, it's used to fix the reference of the term 'one meter', not to give the meaning of that term.

      ii) Thus, no problem in saying that that stick might have been more than a meter long, or that it would be longer if heat were applied to it, etc.

      iii) 'One meter' is a rigid designator, but 'length of the stick in Paris is not.

   b) Thus "S is one meter long" is known a priori for it's stipulated.

      i) Nonetheless, something else might have served as standard, so statement is contingent.

   c) Same distinction can enter with names:

      i) If the name means the same as a description, then it doesn't designate rigidly.

      ii) But if the description simply fixes the reference, then the name may designate rigidly in world's where the description doesn't apply.

      iii) Considers case of introducing Hesperus by pointing on a particular occasion. It works in apw even though, in some of them, Hesperus was hit by a comet and wans't at the appropriate position at the appropriate time.

   d) Frege used the notion of 'sense' in two ways, as meaning and as reference-fixer, and much trouble has resulted.

      i) Considers Π as an example: it's introduced often as ratio of circumference to diameter, but that's not it's meaning.

8. Back to cluster concepts, and to Searle's contention that although there are no single necessary conditions for being, say Aristotle, nevertheless Aristotle must necessarily have the appropriate disjunction of properties commonly attributed to him (61-70).

   a) Kripke states, but with almost no argument:

      i) Some properties in the cluster may be necessary.

ii) And some may, in a sense, be a priori since known because they were used in a particular case to fix reference.

iii) But still the cluster as a whole is contingent, and the statement that the object is characterized by the disjunction is only contingently true.

b) States six theses which may enter concpetion of cluster concepts in various ways, and uses them to make following points.

i) For any designating expression and any individual A, there must be a cluster of properties which A believes the designated object to possess.

ii) For any reasonable theory, the properties must be weighted.

iii) It's important to specify properties in such a way that the story from which they derive could be false (a myth) without the corresponding object's failing to exist.

iv) Any account of meaning of names must avoid circularity: 'Socrates' means the man called Socrates fails, as does Moses means the man to whom the Bible attributes the following characteristics.

II. LECTURE II:

1. The first twenty pages of this lecture (71-91) are largely waste motion.

a) Goes over no-circularity condition: triviality of saying "The word 'horses' simply means 'the animal called a "horse"' (70-73).

b) Looks at Searle again and insists: "It just is not, in any intuitive sense of necessity, a necessary truth that Aristotle had the properites commonly attributed to him" (74).

i) Seems fine, but there's really no argument given that takes account of the difference between the cluster theory and the defining property version.

[ii) One can be given by distinguishing essential from non-essential properties, then looking at disjunctive clusters, and finally asking why one can't drop some single one of the properties in a cluster, but he doesn't do it.]

iii) Finds Lewis' counterpart theory bizarre. Talk of resemblance with respect to important qualities just won't do (74-76).

c) Insists that in describing another possible world we do so in our language even though situation is one in which people (or we while there) speak another language (77).

d) Cluster theory as described (even when a theory of reference) makes it sound as though we pinned reference on by a description (79-82).

i) Probably does sometime occur (naming of Neptune, for example), but not usually.

ii) Conditions in cluster are supposed to pick out a unique object, but often don't.

iii) People use the name 'Feynman' to refer to Feynam, even though all they know about him is that he's a famous physicist.

e) The conditions in the cluster could fail to be satisfied by the referent (83-85).

i) Gödel could fail to be inventor of incompleteness theorem (he stole it, for example), but one would still be referring to Gödel.

f) The beliefs one uses to pick out the referent, even if true, are not true <u>a priori</u>, for can't be known to be true (86f).

g) Can't get around these problems by saying, by Gödel I mean the man generally thought to have invented the incompleteness theorem (88f).

i) Violates the circularity condition (we'll be saying we attribute achievement to person to whom we attribute it) unless there's an independent criterion.

h) One can't pass the buck by specifying a particular person who fixed the name for you, as Strawson seem to (90).

i) It risks circularity, for you may pass buck in a loop.

ii) In any case, you may not remember where you heard the name (Feynman, say) and nevertheless be referring to individual who bears it.

2. View to be substituted is causal theory.

a) Baby is born and baptized Richard Feynman. Name passes from person to person in a chain that finally reaches the speaker (91f).

i) Speaker need know nothing about, Feynman except that he was born and carries the name.

ii) Also, pace Strawson, needn't remember from whom he heard about the bearer of name.

b) This is not complete. There's a causal chain for 'Santa Claus' reaching back to particular saint, but that's not the referent of the children's term (93 & 96f).

i) One essential is that at each link in chain, hearer must intend to use name to refer to same individual as did the person from whom he acquired it.

ii) Thus, this "theory" of reference doesn't eliminate notion but presupposes it, by reference to character of links in chain.

c) Further conditions are needed but hard to give (94f).

i) There may be no full set of n & s conditions.

ii) In general "reference depends not just on what we think ourselves, but on other people in the community, the history of how the name reached one, and things like that."

iii) Besides, Kripke's not aiming for a real theory, just an alternate picture very different from the traditional one.

3. Finally, look at identity statements, are they necessary or contingent (98f).

a) Some descriptive identity statements are surely contingent.

i) For example, the man who invented bifocals was the same as the first Postmaster General.

b) But what about those involving names: Hesperus is Phosphorus or Cicero is Tully.

i) And what about light is a stream of photons, heat is the motion of molecules?

ii) These are hard won empirically, but given that they are true, could they have been otherwise?

iii) Will stick to names until next lecture, but will there argue that these scientific statements are necessary if true.

4. Argue that, pace Quine and Marcus, identity statements between

names are necessary, which follows, of course, from names being rigid designators.

a) They are not, of course, a priori (101).

   i) Could use 'Cicero' for Cicero and 'Tully' for Tully without knowing the two were the same.

   ii) No amount of introspection would give you what was missing.

b) How about 'Hesperus' and 'Phosphorus'? Imagine "someone goes by and he calls two different stars 'Hesperus' and 'Phosphorus' (102).

   i) If he pointed to Venus twice, identity statement holds.

   ii) Has to be a case in which he pointed to Venus on neither occasion or on only one, in which case identity statement is false.

   iii) Remember he's using the terms as we do.

c) Seems strange because the two names might have referred differently, just as four color problem might have been true or false (103f).

   i) But that's the purely epistemic use of 'might', not incompatible with necessity.

   ii) But here situation is stronger: given everything that namer knows prior to naming 'Hesperus' and 'Phosphorus' might have been either same or different.

   iii) Only if they are in fact the same is their identity necessary.

d) Now puzzle: "So two things are true: first, that we do not know a priori that Hesperus is Phosphorus, and are in no position to find out except empirically. Second, that is so because we could have evidence qualitatively indistinguishable from the evidence we have and determine the reference of the two names by the position of two planets in the sky, without the planets being the same" (104).

   i) If "indistinguishable from the evidence we have" means at the time of initial naming, then quote is o.k. (though one can imagine a motive for calling the morning and evening presentations by different names even after having all current evidence).

   ii) But if quote means at present time, after getting evidence, then statement is in trouble.

iii) Note also that Saul has switched from talk of stars to talk of planets, something that may not be significant, but that could display unease.

iv) Subject comes up again on pp. 109ff, in ways that suggest he means all evidence at hand.

III. LECTURE III:

1. Discussion of de re modality, about an object's having essential properties, requires distinction between necessary and a priori (110-113).

   a) Ask of Elizabeth II whether it's necessary that she have royal blood or have been human. (Latter gets dropped.)

      i) Probably not the case for royal blood, for it demands that a member of her family line had royal power, and that's contingent.

   b) But could she have had other parents? Could she, for example, have been born to the Trumans and then swapped?

      i) Given that she, in fact, was not, she couldn't have been.

      ii) Being this very woman involves being the product of the same pair of eggs according to Kripke's intuition.

   c) Thus, nature of origin (unlike what happens later) is essential property.

      [i) My impression is that this is part of where the sortal human enters, but don't entirely see how, for that would determine process of origin, but not the specific parentage.

      ii) What analysis does, in any case, is give us a higher level lifeline, one that relates also to speciation, though I again can't altogether spell it out.]

2. Now asks, could this very table, given that it's made of some particular piece of wood, have been made of another block or even of a block of ice (113-115).

   a) Suggests that it could not: case would be that of a different table, exactly like this one, being made of the other block.

      i) Note suggests that hunk of matter from which a given material object originated is necessary characteristic of it.

b) Second note, long and of particular interest, emphasizes distinction between timeless properties like material of origin, and temporal properties, like being transformed into ice later. [Difference between birth phase and later phases with respect to modality isn't clear.]

i) Asking whether something might have happened to a given object ultimately is asking whether history might have gone as it did to a certain point and then diverged.

c) Third note speaks of Geach (1957), who says baptism by ostension requires naming the sortal to make sure it's the whole animal, not just a part (the nose) that's being baptized.

i) The sortal then becomes part of the name, a sort of nominal essence.

ii) Kripke says this sort of essence is to be understood, if at all, in terms of <u>a prioricity</u>, not necessity.

iii) And doubts it's even <u>a priori</u>. Dobbin might have turned out not to be horse.

3. Now necessity with respect to natural kinds.

a) Kant thought that we know gold to be yellow <u>a priori</u> and could not discover it to be false (116-119).

i) Kripke argues that it could have been blue: because of an optical illusion or demonic deception we thought it yellow, but it isn't.

ii) Conversely, there could be a substances which looked to us just like gold but which was another substance.

b) Similarly, similarly looking like the tigers we know is neither necessary nor sufficient for being a tiger (120f).

i) Some (or all) tigers could turn out to be three legged because of accident (or optical illusion) but still be tigers.

ii) Creatures that looked just like tigers but were actually reptiles, wouldn't be tigers.

c) Putnam says things much like this in "It ain't necessarily so," Kripke points out, but fails to distinguish <u>a priori</u> from necessary (122f).

4. Now argues that having-atomic-number 79 is necessary property of gold.

a) Whole theory, of course could have been mistaken, but given

that it's not, then something with a different atomic number can't be gold (123d).

i) Even if, like iron pyrites, it has same properties as gold, and even if it were counterfactually found in all the places gold were.

ii) What's set this up is: "Let us suppose the scientists have investigated gold and found that it is part of the very nature of this substance, so to speak, that it have the atomic number 79." [What would it be to make that discovery?]

b) Then says can look to see what follows from gold's having atomic number 79, e.g., color and metallic properties (124).

i) Those properties will be necessary.

ii) Though not part of the meaning of 'gold' and not known <u>a priori</u>.

c) Ditto for cats, say, which must necessarily be animals (not demons) given that they are animals (125f).

d) Suppose science has discovered that this particular object is composed of molecules.

i) If that's right, then this very object can't be some ethereal entelechy.

[ii) Which seems to conflict with ice table story. Couldn't the object have originated as one or the other and then changed. What sort of thing have the scientists discovered?]

e) Aside: Mill was right about proper names but wrong about general names (127).

i) Latter are much more like proper names than has been supposed.

5. Similar discussion of identies like heat and molecular motion, water and H_2O, light and stream of photons (128-134).

a) Includes case where we can't see light or, alternatively can't sense heat.

i) Though allows in passing (and excludes for simplicity) that being able to sense heat might be a necessary property of ours (133).

6. Recapitulation.

a) What Mill got right and what he missed (134).

b) For natural kinds, as for proper names, way in which reference is fixed doesn't produce a synonym (135f).

i) There's baptism by means of a sample but some differences.

ii) Sample might include a few things that weren't, say, gold.

iii) Gold could have existed even though no member of the sample did.

iv) The alleged kind might be two not one or might not be a kind at all.

c) Properties believed to be at least roughly characteristic of the kind are used to place new members in sample (137).

i) These properties need not apply a priori.

ii) An object might belong to the kind though it possessed none of them.

iii) Sometimes failure may lead us to reject the species, but this phenomenon is not frequent, much less universal.

d) Progress of science discovers characteristics of gold which are far better than those in the original set (138).

i) Resulting identity statements are necessary rather than a priori.

e) Science also augments the population of the kind (139).

7. Look finally at what seems wrong with notion of a posteriori necessities (140-144).

a) Speaks to critic who insists that: P could have been the case entails (e.g., gold could have been a compound) that P is possiblle.

i) It's not like case of Fermat's last theorem in which it's mathematically impossible for answer to turn out other than it is.

b) Reply includes (142): "This table itself could not have had an origin different from the one it in fact had, but in a situation qualitatively identical to this one with respect to all the evidence I had in advance, the room could have contained a table made of ice in place of this one."

i) "Something like counterpart theory is thus applicable to the situation, but it applies only because we are

not interested in what might have been true of this particular table, but in what might or might not be true of a table given certain evidence."

ii) "The inaccurate statement that Hesperus might have turned out not to be Phosphorus should be replaced by the true contingency metntioned earlier in these lectures: two distinct bodies might have occupied, in the morning and the evening respectively, the very positions actually occupied by Hesperus-Phosphorus-Venus."

EVOLUTION NOTES

I. MAYR, "Biological Classification," Science, 1981:

1. Until c. 1950 no competing methodologies for classification were recognized.

   a) All classification were held to reflect degree of relatedness, though there were great differences in the characters used, the use of phylogeny, and the use of fossil record.

   b) Resulting disagreements in classification led to methodological debate from which emerged two new schools and a more sophisticated version of the the evolutionary one.

2. The three schools are:

   a) Numerical phenentics, where phenetics generally does grouping by classification and more recently by overall similarity, i.e., using all characters.

      i) Numerical phenetics is then an elaborate technique for computing phenetic distance and converting result directly into a taxonomy.

   b) Cladism bases classification exclusively on geneology or phylogeny, which it takes to be strictly a pattern of successive dichotomies.

      i) Ancestral species ceases to exist at each branch point.

      ii) Sister groups must have same categorical rank.

      iii) Ancestral species and all its descendents form a single holophyletic taxon.

   c) Evolutionary classification (the traditional form) bases taxonomy on geneology but not exclusively.

      i) Result is a phylogram, diagram which displays both branching points and also degree of subsequent divergence.

3. A classificatory system aims at several objectives, largely but not entirely compatible.

   a) One of the two basic goals is a convenient information and retrieval system.

      i) Phenetic systems work fine for a given set of characters but misfunction when characters change. (Carefully selected sets of characters would help, but then systems would no longer be automatic.)

ii) Cladists give back directly only the ancestral information (thus preserving only the information required for dichotomizing?).

iii) Evolutionary taxonomists get much more information into their classification, but can't indicate it in the name. The classification becomes just an index to information stored elsewhere.

b) Other major goal is a system that permits generalizations within (and between?) groups.

i) Methods based on descent assume that common ancestry brings with it common characteristics.

4. Both pheneticists and cladists claim that their methods are non-arbitrary, automatics, and repeatable, but they turn out not to be.

a) Both implicitly take classification to be a one step process, and it's not.

i) Look at the steps, and the methods each calls for.

b) First step is establishment of similarity classes for species and genus by "inspection".

i) Works pretty well because descendents of a common ancestor tend to be similar.

ii) This is pheneticist in approach, but neither automatic, nor independent of characters used, nor infallible.

c) Second step involves two procedures which overlap: character analysis and construction of a geneology.

i) Must pick out the characters that are most important in establishing the preliminary groupings, and see whether they group descendents of the nearest common ancestor.

ii) This involves questions of geneology, and is thus rejected by pheneticists.

ii) No way to do the analysis without leaning hard on biological theory and experience.

d) Other part of this step (the two parts recycle again and again) is the geneological: check on common ancestry and rule out superficial similarity or those due to convergence.

i) Partition characters into ancestral and derived, i.e., those due to nearest common ancestor. Lots of difficulties in doing this; much evidence from varied sources may be required.

ii) Shared characters that is not ancestral may be due to convergence rather than inheritance from nearest common ancestor. Hard to spot.

iii) Also, there are shared characters that were acquired after branching off had taken place.

5. Last stages are producing a classification.

a) For cladists job has already been done in second stage.

i) But they pay no attention to degree of divergence, and they give same rank to sisters produced by a divergence. Thus get a taxon containing only crocodiles and birds, etc.

ii) Also, cladists must assume that new apomorph characters orginate at all branchings, which is unlikely. [I don't understand the argument at this points.]

iii) Method results in separating very similar oranisms and lumping together very different one.

iv) And method can't be carried through unless exact branching points can be determined. But they're often not needed (must, for example, know whether birds originated from dinosaur-like, lizard-like, or crocodile-like creatures, but not from which species).

b) Evolutionary taxonomists pay major attention to divergence after branching and thus to autapomorph characters.

i) These characters may reflect entry into a new niche, a new adaptive zone, and may thus have vast evolutionary significance.

ii) Product of evolutionary taxonomist is the phylogram, a cladogram with information about divergence.

iii) In it two sisters may be separately grouped, one with the parental branch, which it greatly resembles, the other as starting a new taxon. The result is introduction of "paraphylactic" taxa, ones which actually violate the branching pattern.

c) Final stage is producing higher taxa, e.g., order and family.

i) It's the most difficult and subjective part of the job, depending radically on what characters are emphasized (including molecular versus morphological characters).

ii) Mayr sort of throws up his hands but suggests that "a classification can usually be constructed that can

serve conveniently as as an all-purpose classification or ... a 'general reference system'."

6. Last section of article gives the show away.

    a) Mayr insists no system is adequate that doesn't take evolution fully into consideration.

        i) But way of doing so is necessarily, he suggests, eclectic.

    b) Then acknowledges that there may be conflicts between classifications that aim to promote generalizations and those that aim for economic storage and retrieval of information.

        i) Thus, at key points in the design of a classification, choices must be made: these "may be scientically equivalent, but some may be more convenient in aiding information retrieval than others."

        ii) "Scientific theories are nearly always judged by criteria additional truth or falsity, for instance by their simplicity or ... 'elegance'. Therefore it can be asserted that convenience in the use of a classification,... is not necessarily in conflict with its more purely scientific objectives."

        [iii) Misses fact that simplicity and so forth are ways of judging truth or falsity, not additional to those judgements. Two incompatible systems can't both be true.]

II. HULL, "Exemplars and Scientific Change," PSA 1982, 1983:

1. Taxonomic biology deal with temporally extended entitities, and the techniques evolved for this purpose can help also with temporally extended conceptual entities like Darwinism which are internally quite heterogenous.

    a) The similarities that matter in either sphere are those due to "identity by descent".

        i) They're handled by type-specimen method whose development and history are outlined in next two sections, [which are all we read.]

2. Before Darwin species were held to be natural kinds, thus eternal, immutable, discrete.

    a) Might be created at different times, and might perish, but the category and its boundaries existed throughout in some sense.

b) Boundaries were thought to be determined by something like an essence, set of necessary and sufficient conditions from which other properties followed.

c) The Mill/Whewell debate.

i) Whewell says that n & s conditions haven't been produced. It's global resemblance to a type-specimen that's important.

ii) Common descent was important only as source of the resemblance, not as definition of species.

iii) Mill & Jevons insist on doing it by characters.

d) Experience showed that no diagnoses written down helped much when new specimens were brought it.

i) Instead, taxonomists had to go look at the actual specimens.

[ii) Hull thinks of this difficulty as infirming Whewell, but it's not clear why it's not just Mill who's in trouble.]

3. In post-Darwinian taxonomy the method of the type-specimen was developed.

a) It was supposed to be typical member of the species, thus both a basis for definition and a standard of comparison.

i) But ideas about relevant characters and about boundaries resulted in constant shifts in notion of what specimen was typical.

ii) Outcome was that specimen only carried name (and did so rigidly), so that it wasn't important whether it was typical or not.

b) Doesn't eliminate all difficulties. There's a case in which what became three species all had same type specimen.

c) Nor does it eliminate all need for description.

i) At the very least it's needed to find the geneological nexus (that's all cladists do with it).

ii) Pheneticists would say it's required to define the species, type-specimen determining only the name.

III. HULL, "Are Species Really Individuals, "Syst. Zool.", 1976:

1. Traditional view makes each species a class whose members are organisms picked out by the characters definitory of the class.

a) Some traditionalists say classes must be determined independent of all theory; other that evolutionary theory should play some role in selecting classes.

b) Ghiselin insists that species must be basic units of evolution, and that they must be conceived as individuals, known by proper names, words without intensions.

i) Organisms are also individuals, but they're parts of the species, not members.

ii) The species category is then a class rather than a class of classes.

c) Hull will argue for Ghiselin's viewpoint, pointing out that decision can't be made on purely empirical grounds, but on grounds of coherence and solution of difficulties confronted by traditional versions of theory of evolution.

i) Compares transition involved to that of space and time from Newton to Einstein.

2. Single organisms are individuated by spatio-temporal continuity rather than by possession of any specified set of attributed characters (these change in any case).

a) Hull allows two individuals to be identical in everything except spatio-temporal location.

b) Confused rerence to essences as things which make an individual the kind of individual it is.

i) Takes no stand, but states that species can't have such essences since no set of traits can be usually be discovered which distinguish a species from others throughout its existence.

ii) Seems odd, for he lets genetic endowment be a sort of essence for the individual organism (necessary but not sufficient for individuation). [Note this is no longer what makes it the kind of creature it is. Cf., Wiggins on overlap of the two sorts of essence.]

iii) Why, then, won't gene pool do the same for the species?

c) Retention of substance (i.e., material substrate) won't do as individuating condition on empirical ground.

d) The gradualness of speciation needn't block claim that species are individuals: look at creatures that propagate by division or budding.

i) Here, as with organism like slime mold, the distinction

is one of degree of organization, and there are no firm lines.

3. Sloppy section on individuals versus classes.

    a) Parts of an individual can be diverse -- stomach and liver -- while class members must be similar.

    b) Classes require membership criteria [this is persistent, though natural error in this literature, one which next Hull paper does better with] while individuals are denoted by proper names which, in principal, have no intension.

        i) Discovering that gold didn't have atomic number 79 would make problems for physics, but Gargantua might turn out not to be larges gorrilla in captivity without damage to anything.

    c) Notes that standard set-theoretic notion of extensionality of sets won't fit biology, but relapses to notion of classes as intensional.

    d) Refers to Kripke on proper names and on dubbing. Accepts it for individuals. Is sceptical that it works for kinds in view of conceptual change.

    e) Suggests that it's theory which determines whether something (an atom, for example) should be treated as an individual or a class member. [Discussion is badly confused]

        i) Species started as classes. Then it was found that the best that could be done with membership conditions was cluster concepts.

        ii) Now there's an alternative. Proper names.

4. Arguments favoring notion that species are individuals.

    a) Spatio-temporal continuity is basic to evolution since organisms must not only survive but also reproduce. This makes descent crucial to the concept of species and brings continuity with it.

    b) Ditto the notion of a gene pool, basic to evolution, where spatio-temporal continuity is also essential.

    c) Living world is characterized by intermeshed levels of organization: macromolcules, organelles, and cells to organs, organisms and kinship groups.

        i) The relation between entities at different level is part-to-whole throughout.

ii) Relation which an organ has to an organism is same as the relation which an organism has to its species.

d) Main biological levels for theory of evolution are: Species, Populations, Kindship groups, Organisms, Cells (e.g., gametes), and Macromolecules (e.g., genes).

i) Evolution occurs at least at level of top two (much below that, the elements don't last long enough).

ii) Selection occurs at most intermediate levels.

iii) Mutuation occurs at lowest level.

e) Higher taxa present a problem. They surely evolve, but they don't seem to function as units in evolution, thus to have the needed cohesiveness.

i) Related problem occurs with respect to asexual reproduction.

ii) There's nothing binding together the various strands in a lineage. If there's speciation, it's due entirely to external factors operating on individual strands, not to any process with respect to which all coexistent sections of the strands function as a unit.

5. Counterarguments.

a) Individuals are supposed to be individuated on basis of spatio-temporal continuity. But speciation is a gradual process.

i) Hull replies that some processes (reproductively isolated populations or saltative processes) can greatly shorten the time.

ii) If absolutely discrete boundaries are required, then there are no individuals at all.

iii) It's only our relative size and duration that makes organisms seem different from species.

b) Individuals are supposed to be spatially compact, something that's true of species only to the extent that we look at actual interbreeding populations.

i) But think of slime molds. And remember that U.S. remained an individual when Alaska and Hawaii were made parts of it.

c) Nothing but spatio-temporal continuity is involved in individuating individuals. Shared properties are irrelevant.

i) Phyletic evolution (one species evolving into another without splitting) presents no problems, says Hull. Simply recognize that old one goes out of existence when new one comes it. [That's awful. It's just extent of change in properties that determines death and birth.]

ii) No problems also if one classifies so that parent species dies when it splits between progeny.

iii) But other biologists allow offspring to bud off while parental species remains. Then two successive buddings might later recombine.

iv) Hull sees no problem with recombination. It just shows that history is the issue, not pure class combination, and that's what he's after. [But the conflict with notion of individual as bearer of proper name is absolute.]

6. There are also more fundamental sorts of replies to Hull's position: e.g., that there's no difference between classes and individuals or that the same unity might be one or the other depending on context. Hull's reply grows, he says, from fundamental view concerning science and its goals. [What follows is often very confused.]

a) Distinction between spatio-temporal and all other properties is, Hull believes, fundamental.

i) Acknowledges that spatio-temporal relations can enter into a definition (planet defined as "relatively large non-luminous body revolving about some star", ditto forest, river system) without getting classes that are spatio-temporally restricted as a result. [He's fishing for the difference from accidental generalizations.]

ii) But the "Black Forest", or "Mississipi River system" would still be an individual, so spatio-temporal relational system won't do it alone.

iii) And it's just when we get to individuals that intensionless names seem appropriate.

b) More fundamental: scientific laws are supposed to be spatio-temporally unrestricted. That's fundamental to our conception of what it is to be a law.

i) Some have objected to this characterization because it seems to deprive statements like "Mammals arose from reptiles" of all force. They may be historical, factual, but not explanatory.

ii) Hull wants to hold the concept of law, but allow historical statements to be explanatory.

iii) Then, a statement like "All swans are white" would not be a law, even if true, but it would still be consequential.

iv) Evolutionary theory, on the other hand, would be o.k. as science, since it makes no reference to particular species.

c) Finally, might say that whether something is an individual or a class depends on context.

i) Hull takes off from something by Johnathan Cohen that suggests that species as classes may fit taxonomy better, as individual is better for explanation.

ii) Acknowledges that class/individual issue is determined by theory and that evolutionary theory might not be the last relevant one.

iii) But insists that scientific theories must be consistent with one another, thus not one for taxonomy another for evolution.

iv) And denies also that classification and explanation (e.g., theory) can be separated.

d) Finally, Hull finds suggestion that maybe neither individual nor class is the right answer "plausible and intriguing".

i) But doesn't know what to do with them at this time.

ii) And thinks he's shown that, in any case, species aren't classes.

IV. HULL, "Units of Evolution," in <u>Philosophy of Evolution</u>:

1. Advocates of organism selection take organisms to be the only level at which individuals enter biology.

a) Gene selectionists (Dawkins) say that organism and populations are alike in being too large and too temporary to be units of selection.

b) Group selectionists (Gould and Eldredge) think that both organisms and species are homeostatic systems, thus also alike but at opposite end of spectrum.

c) The issues involved are intrinsically metaphysical, and correspondingly strange: what are the units required to handle evlutionary phenomena.

d) Existing discussion is marred by ambiguous use of "units of selection" which sometimes means the units which replicate and sometimes those which interact with environment in ways which make the replication differential.

2. Paper will examine the following categories:

a) Individuals: "any spatiotemporally localized entity that develops continuously through time, exhibits internal cohesiveness at any one time, and is reasonably discrete in both space and time."

b) Classes: things that can have members, determined in any way that does not limit then in advance to a finite number of entities or a particular spatiotemporal location.

i) Natural kinds: classes whose members obey laws of nature, i.e., generalizations that are not spatiotemporally restricted, etc. (Acknowledges difficulty in making out notion of nomic generalizations.)

ii) Choice between individual and class as appropriate category depends upon "relative primacy of similarity and descent."

c) Lineages: spatiotemporal sequences of entities that causally produce one another.

i) Lineages are individuals, for though descendents are usually similar to parents, they need not be, and descent is the relevant character in case of conflict.

ii) Also, lineages are capable of indefinite variation over time, just as individuals are and classes are not.

3. Outlines Dawkins notion of the gene as replicator, that which produces structure-preserving copies of itself.

a) Hull points to circumstances in which one might well also want to call the organisms themselves replicators.

b) Also, criticizes Dawkins for failing to distinguish unit of replication from unit of interaction.

i) Concludes genes, as compared with organisms, replicate more directly and interact less with the environment.

ii) But if organisms are considered as the units of interaction, all they can do is differentially affect the relative frequencies in the gene pool.

iii) That way of conceiving the evolutionary process seems to Hull fatally contaminated with thinking of species as classes.

4. Next shows how a homeostatic control system is said to produce evolution by feed back.

    a) Changes in environment produce changes (small) in differential reproduction.

        i) These in turn produce small changes in the gene pool of the poulation, and these combine with mutuations induced externally as a second source of variation.

        ii) Both together result in changes in physiological and behavioral characteristics of pupulation which enters into next round.

    b) Hull emphasizes that difficulty with this model is that feedback on successive loops is not to the numerically same system of organisms.

        i) Thus, the homeostatic mechanism involved in evolution acts on and in the species as the unit being controlled.

    c) Finally, points out (reacting to doctrine of species selection) that species themselves could be units of interaction, though probably not of selection.

        i) In that case, species would survive or become extinct because of characteristics of the species as a whole not because of aggregative effects of success or failure of individual organisms.

        ii) On this view, species would not evolve, but would form lineages which are the units of evolution. (Characteristics go with the species but change with time for the lineage.)

V. DUPRé, "The Disunity of Science," Mind (1983):

1. Overall concern of paper is with reductionism in biology, and must be clear (Dupré doesn't entirely succeed) at start what reductionism is.

    a) Distinction between theoretical and practical possibility of reduction is needed, and it's not always clear where to draw it.

        i) But his concern is with substantive claims about the prospects for science (which he appears to equate with practical possibility of reduction).

    b) Also must distinguish diachronic from synchronic reduction, where his concern is with the latter.

i) Thus reduction of change in genetic endowment of a population to molecular events, his main concern, is about relationship between best current theories.

ii) It's here confusion enters, for he talks about scientific process can "reach a terminus" and about things that "will be shown" etc. So, at any rate, he's not restricing attention to the actual current relation between molecular and genetic theory, but perhaps to what might be achieved.

c) Among "practical reductions" must also distinguish reduction by derivation (e.g., Putnam and Oppenheim) and derivation by replacement, which renders reduced viewpoint obsolete, e.g., by expansion of physics.

i) Former, which is his target is too simplistic in anything like standard form.

ii) A pig is an assembly of organs, not of cells, and its components include both molecules (hormones) and ions (sub-molecular level), etc.

2. Reduction requires bridge principles identifying types of structurally complex objects with particular structures of simpler objects.

a) Call these objects the natural kinds of the corresponding science, and note that classification which yields these objects is inextricable part of the corresponding science.

i) On this usage, kinds are natural if implied by a correct (whatever that indicates) scientific theory.

b) Stronger usage would say that there's a correct classification independent of any theory.

i) These are the kinds that would be needed by the ultimate correct theory.

c) Applied to either interpretation, the need for bridge principles in reductions results in impossibly strong constraints.

i) Condition must be both necessary and sufficient to pick out the members of the kinds required by the reduced theory.

ii) Must be sufficient in order to tell whether given object is of relevant type. Must be necessary to ensure conformity of those kinds with laws of the reducing theory.

iii) Dupré says he's argued elsewhere that biological kinds, at least, can't be captured by N & S condions.

d) It's often taken for granted that natural kinds must satisfy N & S conditions, since, by definition, its members must satisfy laws of nature, so that above must apply.

i) Response, to be developed, suggests that strict laws of nature are an abstraction.

ii) Has biology in minds but suggests that there are similar problems with taking, say, atoms with atomic number 26 as a natural kind, for these exist in different forms (e.g. atom and ion) with significant properties that are very different because electronic configurations differ widely from one to another.

iii) We shouldn't expect homogenous kinds.

3. Consider difference between abstract and general systems of laws.

a) General laws specify the kinds to which they attach and are thus genuinely explanatory, while abstract systems simply specify behavior of systems that happen to conform to the abstract laws.

i) Thus, Newton's or Maxwell's laws vs. electrical network theory or functional psychology.

ii) Dupré does not think distinction altogether holds up, since he takes all laws to be abstract, but it points to a difference that's important here.

b) Population genetics produces mathematical models of, for example, results of prey-predator interactions.

i) Thus, example of wasps that lay eggs in members of a host species which, if thus parasitized must die and be consumed, but otherwise lay N eggs.

ii) Can show by modelling that situation leads to oscillations of both populations with increasing amplitude to extinction.

c) Model is abstract system and as such capable of refinement.

i) But no refinement will bridge gap between it and biological categories to which it's applied.

4. Illustrates what's involved with ecological study of relation between populations of Canadian lynx and hares.

a) Can't pick out hares with model. If model were for lynx-prey, wouldn't know how to exclude rabbits, etc.

i) More generally, characteristic of hares by which they enter model may not be at all among the characteristics which gives hares their taxonomic position, makes them what they are.

ii) And the former is, in any case, constrained by interest.

b) The argument concerns difference between a theory about individual lynxes (which permits their identification and explains their propensity to eat hares as a function of age, children to be fed, etc. etc.) with one that's about a population of thatcan be inserted in the model.

i) That theory wouldn't help with model, for all it requires is average propensity of population of lynxes to eat hares, and that is not determined by laws for individual and, in any case, varies with things like population density which theory of individual doesn't give.

5. Same line of argument is then applied to reduction of evolution to molecular genetics.

a) Reduction seems to depend on preserving some notion of gene-for-X, where X is a macroscopic property which promotes or hinders differential reproduction.

i) But, though there's no question about molecular basis of heridity, there's little or no prospect of isolating genes (now cistrons, lengths of DNA) or relating molecular structure one-to-one to macroscopic traits.

b) No reason to think it's possible to do this even in principle.

i) But evolution requires explanation in terms of traits at the macrolevel.

c) Brief discussion of view that biology (evoluytionary) is just history, not to be confused with science, with physics and chemistry.

i) Dupré suggests sense in which laws of latter may not be universal either and in which what they deal with is successions of events and thus history.

6. Nice conclusion on "Theological reductionism," the belief that though many phenomena cannot be explained in terms of physical laws, nevertheless they are reducible in principle: God can do it.

a) Physical systems are governed by laws, but the evidence that they are universal and precise is very limited.

i) Also, there are physical systems like the earth's climate, for which there's no reason to think that such laws exist at all.

b) There are also systems, not prima facie physical, that appear to obey laws that are neither very precise nor very strong (thus statistical).

i) In physics, highly deterministic laws are often derivable from statistics of low populations.

ii) Natural to conclude that biology differs from physics just in size and homogeneity of populations.

c) But (macro-) biological events are unique, and they need not be governed by laws all.

i) The existence of statistical facts (e.g., about proportion of hares eaten by lynxes) is logically necessary, and the nature of those facts need not result from any laws.

ii) Evidence for such laws would require either that events not be unique or else that they be reducible to processes which were not unique.

iii) Thus, reduction in principle is through-and-through dependent on the reductionism argument we've been through.

d) What makes all this important is extent to which philosophers (above all people in philosophy of mind) tend to take the generality of reductionism for granted without really knowing anything about the technical issues it involves.

VI. PHILIP KITCHER, "Species," Philosophy of Science, 1984:

1. Argues for what Kitcher calls "pluralistic realism" with respect to species. Here I'll pick out only main points of what seems to me an often intellectually irresponsible article.

2. Species are sets:

a) Members of a set don't have to any properties in common except set membership. O.K.

b) Membership of a set can vary with time.

i) Also o.k., but he sets it up "for sake of the present argument" in way that hides the real problem.

ii) Supposes, that is, that a species is a set of organisms

consisting of a founder population and some (but not necessarily all) descendents of that population.

iii) Problem that get's brushed over is what the characteristics of a founder population must be.

iv) Not that he should produce a definition, but that he's ignoring precisely that feature of species-concept (the tension between descent and shared characters) which gives rise to the debate.

c) Species may support laws (see below)

d) Hull makes little sense about spatiotemporal restrictions. O.K.

i) Many law-supporting classes are spatiotemporally restricted. Indeed, modern cosmology makes even gold spatiotemporally restricted.

ii) True, definition of gold is independent of spatiotemporal restrictions, but that's a characteristic of the name, not the thing.

iii) Hull's central criteria is spatiotemporal connectedness, which for him is a conceptual issue, not a contingent one.

iv) Kitcher argues that it's contingent and could be false, but he's simply showing that one need not adopt Hull's concept, not that it's incoherent or false. N.G.

v) No mention of the part whole issue even in passing. This seems to me irresponsible.

e) Species can, <u>pace</u> Hull, support laws. O.K.

i) "All Swans are white" doesn't qualify because experience of evolution suggests that a minor modification could produce colored swans. Few other properties would change much. No temptation to suggest a new species.

ii) But there could perfectly well be modifications that went deep enough to produce new candidate for species, etc., and these would support laws.

3. There are many different proposals for determination of membership in a species: Mayr's biological species concept, definitions based on speciation events plus descendents, cladistics, phenetics, ecological differentiation.

a) Most are motivated by needs of a particular type of biological enquiry.

i) But their proponents say that they, and they alone, have got the notion of species right.

b) Examines problems with which biological species concept does and doesn't work, most notably asexual reproduction.

i) Mayr minimizes difficulties by saying they're rare and provide no occasion for "watering" species concept.

ii) Kitcher thinks this odd since Mayr was presumably explicating an extant notion (as chemists explicated antecedent concept of element) not changing it.

iii) But this is just what happened in chemistry.

iv) What's required is plurality of species notions for different tasks, Kitcher suggests. But this is instrumentalism which he resists.

4. There are two basic sorts of species concept, each with several subdivisions.

a) Likes Mayr's distinction between functional biology, concerned with proximate causation, and evolutionary biology, concerned with ultimate causation.

i) Example is explanation of shape of hinge on bivalves in physiological, cellular, etc., terms verus explanation that of why hinge came into being where and when it did.

ii) But Mayr takes latter to be more fundamental, Kitcher insists they have equal status.

iii) And each leads to different classificatory schema, which can in turn be further subdivided.

b) Kitcher sketches several of the alternate approaches.

i) Speaks of each as as providing an explanatory framework which delineates the "real kinds" (quotes are his) in nature. p. 322

ii) And says, "Evidently, this scenarious recapitualates the views of Putnam and Kripke about the conceptualization of natural kinds." ibid.

c) Later, speaks of parallel differences in segmenting DNA into genes.

i) For some problems method of segmentation is irrelevant. For others, it's only important to be clear which one you're using, what relevant mode of segmentation is.

ii) Then "The case of the many genes shows how the multiplicity of overlapping natural kinds can be acknowledged without either arbitrary choice or inevitable confusion." p. 327, my italics.

iii) Illustrates his point with reference to Hempel's "celebated critique" of operationalism which he gets badly wrong.

iv) Talks of it as exposing the futility if attempts to fashion some perfectly unambiguous language. Scientists should instead "recognize where dangerous ambiguities are likely to occur and ... be prepared to forestall misunderstandings." ibid.

5. Concluding section suggests three sorts of consequences:

a) First, an example in biology itself, where two different interpretations, both fully legitimate, of the same data are available.

i) Want to legitimize them both but points out that one of them may be subject to criticism on empirical grounds, other not.

ii) So, what price legitimacy?

b) Talks about realism issue as involving correspondence to "something in the objective structure of nature." p. 330 his italics.

i) Says, "Pluralistic realism rests on the idea that our objective interests may be diverse, that we may be objectively correct in purusing biological inquiries which demand different forms of explanation". ibid.

ii) Seems a poor play on term "objectively".

c) Finally, what is for me the give away, drawn from contemplating the usual philosophical response to conceptual change in science.

i) Either predecessors were dealing with a real natural kind but had false beliefs about it.

ii) Or they referred to sets that cut across the natural kinds in a bizarre way.

iii) In cases like species and gene, however, neither of these alternatives is quite available: can neither dismiss groupings by predecessors as absurd nor identify modern category they were after.

iv) "The set of species taxa is heterogeneous, but it is

not wrongheaded in the way that some early attempts at chemical classification are." p. 331.

d) But Philip knows enough history of science and enough of my treatment of it to have noticed that this doesn't work for chemistry either.

DISCUSSION TOPICS FOR MEETING 7

I. INTRODUCTION:

1. Announcement: Reading for next time is relatively light, and there's reasonably large duplication of issues with this week.

    a) Good idea, therefore, if you get started on Kripke, Maming and Necessity, to which we come next.

        i) Probably won't read it all, but surely all of introduction and first two chapters. Familiarize yourselves with it.

    b) But, WE WON'T YET BE TALKING ABOUT IT, so don't let it supplant the bioology in your mind.

2. Said last time I wanted to talk a bit today about similarity as a way of sorting out natural kinds, and may yet do something of that sort.

    a) But have had some second thoughts.

        i) Don't still want to attach it to Quine reading. I'm not trying to solve same problem.

        ii) And don't want to take time to motivate it separately before getting involved with this reading.

        iii) So maybe a bit of it after the break. If not, will return to problem later in the course.

    b) Meanwhile, try to set up discussion of this week's reading.

        i) Presents issues that are important for us, but not ones which I could introduce by giving a lecture. Among other things, never had a biology course.

        ii) So attempt to unpack them through discussion.

        iii) And unpacking is going to be needed, for much of the reading seems me a good deal muddier than the topic requires.

    c) So for now, main aim is clarification, first run through.

        i) Another crack at it next week, with only a bit of additional reading.

        ii) Also, at that time, Sylvain will provide some additional background by talking about mereology, a calculus based on part-whole relations rather than on class membership.

II. ROLE OF DARWINISM:

1. Last dealt with species as the standard examples of natural kinds in Mill and Whewell.

   a) Encountered one big problem, subject of debate between them.

      i) Could species be given a nominal essence in terms of characters and differentia, a set of necessary and sufficient conditions for class membership?

      ii) Or was membership in a species determined rather by a some sort of global resemblance to typical member of the species? The type specimen.

      iii) Intermediate positions available (some characters, some specimens, etc.), but that was the basic form ofthe conflict.

   b) The problem is still very much with us, and still very important.

      i) But it's been significantly transformed by the advent of Darwinism, theory of evolution.

      ii) And that same theory has added numerous additional problems.

2. So first big area for discussion seems to me to be: What difference has evolutionary theory made to the issue of biological kinds?

   a) But I want to prepare the way with another question:

      i) Evolution is a theory, and problems it raises are results of nature of that theory.

Q!   ii) Was there also also a theory or proto-theory behind the viewpoint of Mill and Whewell (and other pre-Darwinian taxonomists) or was the enterprise purely and merely descriptive?

      iii) Not primarily a question about history, but about the presuppositions, if any, of the taxonomic enterprise before Darwin.

      iv) **DISCUSS**

   b) What I'm after is:

      i) Some original created pair that bred true.

      ii) Descent as source (through heridity) of similarity, so that observations of either leads to same conclusions.

iii) Ability to produce fertile offspring is important test of species membership.

iv) Commonsense view embedded in Bible. God created the plants and animals. Adam named them.

v) Species as well as individuals bear proper names, terms without intentensions.

c) Note relation to Wiggins:

i) Species are a sort of supersubstance with individual organisms as successive phases.

ii) Have beginnings and perhaps ends. Pick up any generation, any phase, and capture the whole thing.

Q! 3. What does theory of evolution do to upset this?

a) Basic answer: separate the criteria of similarity and descent?

i) Thus, lineage vs. species. DRAW. One lineage, multiple species.

ii) Thus, proper names go with lineages, but only problematically with species.

iii) And also possibility, of large-scale character change without splitting (phyletic evolution [?]).

Q! b) Two big consequences for at least the taxonomic enterprise.

i) Which criteria to follow in case of conflict. This is the pheneticist (pure character) vs. the cladist (pure branching patterns) with evolutionary taxonomist trying for the best of both. (Mayr)

ii) And the conflict between two goals: the convenient information retrieval system vs. the scientific. (Scientific in sense both of conforming to theory and of producing units that support generalization (natural kinds?).

Q! c) And a big question: can one have both?

i) Arises particularly forcefully next week from Kitcher's article: his pluralistic realism, which we'll need to discuss.

ii) But Mayr takes a stab at it in closing his article, and the result seems uncharacteristically lame. Discuss last two paragraphs. **DISCUSS**

d) Finally, before going to the next big area for discussion, an anticipation.

i) We go on from here to Kripke.

ii) One way of describing enterprise in Naming and Necessity is as an attempt to separate the similarity and the descent criteria in the naming of natural kinds.

iii) Carry the referential properties of property names over to natural kind terms.

iv) Eliminate intensional criteria in favor of an act of dubbing, after which one simply traces the line of development of the things dubbed.

v) He doesn't appear to run into the sorts of problems there that are encountered by biological taxonomists.

vi) I suggest, as you read both Kripke and Putnam, ask yourselves whether they've really succeeded in making the separation work?

III. WHY SPECIES?

1. Now, another sort of question, one that's puzzled me for many years. It's only very recently that I've seen an answer.

a) Why did the concept of species survive the acceptance of the theory of evolution?

i) Why not conclude that species are only apparent?

ii) Resemblance to be explained as product of inheritance over intermediate ranges of time (many generations).

iii) Long term change to be explained in terms of variation in successive generations, and selection of favorable variations by natural selection.

iv) And separation between the kinds of organism around at any one time in terms adaptation to different ecological niches, different form of life.

Q! v) **DISCUSS**

b) One part of answer: the professional interest of classifiers; the need for an information retrieval system.

c) But also an intellectually based, less sociological answer. The unit or something like it is needed to understand evolutionary process. Why?

i) Have to consider the whole interbreeding population, and more particularly its gene pool.

d) Contrast asexual reproduction, by budding or division.

i) Then change is due entirely to mutuation and recombination of genes.

ii) Such changes are then preserved and reproduced by chromosomal divisions from one generation to the next.

iii) Selection pressure does the rest.

iv) It's not a very effective form of evolution, and some don't want to call it evolution at all.

v) But for it don't need notion of species.

e) But the situation is different for organisms which reproduce sexually.

i) Mutuation and recombination are important. But major source of variation is mating between individuals with different genetic endowments.

ii) The genetic inheritance of the parents is not duplicated in the offspring.

iii) And the offspring of the same parents carry there differing genetic endowments to matings with individuals with still other endowments.

iv) Thus, it's changes over time in the statistical makeup of the gene pool, changes in the sorts of genetic makeup that the population can produce, that results in evolution.

v) A conceptual entity that represents that population or something like it is essential.

2. Some such unit is essential to evolutionary theory, and it's the species.

IV. ARE SPECIES INDIVIDUALS?

1. Now the central question: Are species individuals?

a) Saying it's the central question needn't mean that it's necessarily the right one, that it's got a yes or no answer.

i) But it does seem central in the sense that it highlights the problems presented by evolutionary taxonomy.

Q! 2. What are the arguments (or even what are the motives), then, for saying species are individuals. There aren't many, so hold off a bit on counterarguments.

a) Get rid of concern with resemblance, similarity, and intensionality.

i) Single out spatiotemporal continuity which is characteristic for the species as a descent unit and which permits non-intensional (thus proper) names.

b) The part-whole relation of organisms to species. Need the gene-pool or something of the sort.

Q! 3. How do you rate them?

a) First is weak, especially because, as Hull and others present it, the only other possibility is classes which are said to require intensional definition.

i) They don't, you can put anything you like in a class, though you may not get much explanatory force, etc.

b) Also, first seems to me to give away too much by abandoning similarities entirely.

i) Members of species are supposed to resemble each other. If they are too scattered, one resists strenuously the notion that it's a single species.

ii) Problem shows particularly strongly at branch points. O.K. for amoebas. As in Wiggins, just say branch is end of the line. New proper names on both sides.

iii) That's what cladists do for banch points in general. Parent species ends there, etc. New proper names.

iv) But makes side branches impossible to represent in terms of speciation, etc. Parent species can't go on.

v) And it often does. Change to a new set of characters and new niche is most likely to occur in an isolated population, the parental population going on as before.

c) Example of general point I tried to make in talking about Wiggins and notion of substance.

i) Branch points, crossovers, junctures are subversive of notions of substance and of utility of proper names.

ii) Shows in strange behavior of the modern type specimen. It is an individual, but now <u>all</u> it carries is the name. The individual of which the specimen was a part has gone elsewhere.

Q! 4. What about the second one: parts/wholes.

a) Seems much stronger.

i) Here there is an interrelationship and interdependence that is much harder (not necessarily impossible) to catch with the notion of a class.

Q! 5. Other counterarguments?

a) Time required to divide.

i) Hull dismisses this since all births and divisions take time.

ii) In the relevant other cases there's an isolable releasing mechanism after which the division occurs, usually division that goes in germ cell from which new organism is formed.

iii) River forks you either come upon already formed and waiting to be named, or else they ordinarily originate in a flood, earthquake, or other such event.

iv) But speciation is intrinsically a process that you can in principle watch without being able to tell whether it will occur until it's over.

b) The problem of compactness. The scattered populations that belong to a single species.

i) That one doesn't grab me.

V. NATURAL KINDS:

1. Finally, what is for us the key issue: are species natural kinds?

a) For Hull, and I think for us also, this questions is equivalent to: do species support laws of nature?

i) Hull says, no! "All swans are white" wouldn't be a law of nature even if it were true.

ii) But it's not clear that he's got an argument beyond making it a consequence of species being individuals.

Q! iii) What are the arguments, what the issues?

iv) And notice what question is about: not whether there are strong laws, exceptionless as against probabilistic or whatever, but just whether there are laws at all.

v) Also, not about whether a particular proposed law is true, but whether it's an appropriate candidate for the status of a law. Is it nomic in form?

b) Intuitions in this area may and do vary. Important to explore their force.

Q! i) I've found it useful to subdivide. Can there be laws about: PLANETS, MAMMALS, SWANS, TOM KUHN?

ii) For Hull the first is a class, all the others are individuals.

iii) The first supports laws, the other three not. Why?

iv) **DISCUSS**

2. Think about Kepler's laws:

a) If derived from Newton's laws, they're surely laws. No spatiotemporal restrictions.

b) In Kepler's form, they're also laws, I think.

i) They apply only to bodies circulating around the sun, and that's spatiotemporal localization.

ii) But that's within a theory (though not one that will support their derivations) that explains why they behave as they do.

iii) Other planets would do the same if theRE could be any.

iv) An independent law prohibits their doing so (the Cosmic Solids) but that's doesn't make Kepler's laws accidental.

3. What about mammals? ["Warm-blooded animals which are covered with hair at some stage, suckle their young, and have a diaphram between thorax and abdomen."]

a) Intuition says yes, but I don't know enough to make it out.

i) All mammals have lungs, have hearts, etc.

ii) Most mammals give live birth.

b) Key question is whether there's a natural causal connection between certain aspects of a way of solving the problems of life and others.

i) Could you predict some things about a creature if you knew certain other ones.

ii) Think how much follows from knowing about a tooth.

iii) Laws for herbivores, carnivores, etc.

c) All swans are white?

i) If I say it's a law I'm saying, inter alia, that if a the creature in question weren't white, then it would differ from swans in many respects besides color as well.

4. What about Tom Kuhn, are there laws about him?

a) I should think so.

i) There are people who know me so well that they can often predict what I'll do in the given circumstances even though I don't know myself.

ii) And even though there may be noone else who would do the same thing in those circumstances.

b) To say that what they know about me are laws governing my behavior is only to say that there's some system or other for analysing personality -- a system which psychology should ultimately be able to spell out -- such that if anyone else were like me, then they'd do the same things in the same circumstances.

i) And that system need not, I think, yet be in place.

5. I conclude that the ability to support counterfactuals, the key criterion of lawlikeness, does presuppose theory, potential or actual, but not necessarily more.

a) Do we need more from natural kinds?

VI. ARE THERE OTHER QUESTIONS NEEDING DISCUSSION:

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VII. SIMILARITY:

1. Said I wanted to talk about similarity, but not in ways intended to solve Quine's problem.

a) What then?

i) Ultimately, perhaps, problem of natural kinds, though I'm not sure.

ii) For the moment, just an answer to the question: What would a truly minimal system of taxonomy for things in the world need to involve?

iii) An answer modelled pretty directly on Wittgenstein's family resemblance, games.

b) Put it this way:

i) A taxonomy must divide things in the world into categories, and must provide some account of how to decide which category an individual things belong in.

ii) What does that take?

iii) Answer with a speculative psychological theory.

2. Do it with games, imagine being introduced to them by someone who already knows how to pick them out.

a) Points to various games: football, baseball, etc. to card games, etc. etc.

i) Map them on board.

ii) The ones more alike are closer.

iii) Others picked out because they're close to ones already acquired.

b) For that to work, need a second ingredient: contrast sets.

i) No non-game closer to a game than it is too some other game.

ii) Thus, combat: empty space.

c) What does "closer" stand for?

i) Build up features while you encounter examples.

ii) Games: **Rules, *Equal Sides, Fun, Winner, Special equipment, etc.

iii) Combat: **Sides, *No Rules, *Damaging, etc.

iv) Need metric over these: e.g., number of shared features.

v) Then can play game in terms of the metric.

3. What are characteristics of this mode of categorization?

a) No need for necessary and sufficient conditions, defining features, etc.

i) Any features useful to deciding what you've got goes into space.

b) Also, no need for a floor, minimimum degree of resemblance such that two things belong in the same category.

i) Thus avoid the perils of cluster concepts. How much is enough?

c) And, finally, no need that any two people use the same features as long as their features succeed in preserving the same similarity relations.

i) Learner tries to pick out in what respects exhibited objects are alike and are different, but doesn't have to single out same ones as teacher.

4. Given a sufficiency of exemplary objects (paradigms) and features abstracted from them, can classify all other objects using a triadic similarity relation, S(a,b,c).

a) Read it, a is more like b than like c.

b) Then if a ε A, and (x)S(a,b,x), then b ε A.

5. To which add one more feature that seems to me particularly intriguing.

a) That same S(a,b,c) is what one needs to pick out individuals, substances.

i) Show lifelines. Conditions on points on the line.

ii) Thus, no overlaps, intersections, etc.

iii) Therefore, can give proper names.

b) What goes with that is the likelihood, in some cases the necessity, that the tracing be in one of the feature spaces as that required to made members of the kind resemble each other.

i) That would be pure Wiggins.

Species, Classes, and Individuals
Notes for April 7 '87 Seminar.

ADMINISTRATIVE: 1. HANDOUT NEXT READING ASSIGNMENTS. 2. THOSE OF YOU WHO HAVE NOT SPOKEN TO US YET ABOUT A TERM PAPER AND NOT SUBMITTED A PAPER TOPIC TO US MUST DO SO BY THE NEXT MEETING. 3. OUR MEETING ON MAY 6 WILL HAVE TO BE MOVED EITHER TO THE PREVIOUS TUESD

1. What reasons are there for believing that species are classes?

They are!

Proof: What is a class? How are classes individuated?

1.1. A class is a thing to which some things stand in the relation of member, to which other things stand in the relation of subset, which itself can stand in the relation of subset. etc. etc.

1.2. Note that the relation of class membership is not transitive. It does not establish a partial ordering among the things in its field.

1.3. Classes are individuated by their members. Thus {x y} is not the same class as { {a} {b} }. Contact with Wiggins

What is a species?

A belongs to the same meshp as B:
(Ex)(AncxA & AncxB)

Ancxy: (a)([y in a & (z)(v)(z in a & v Par v then v in a)] then x in a)

Mesh A: The class of all the things that are in the same meshp as A.

A belongs to the same species with regard to trait T as B:
A belong to the same meshp as B and there is a common ancestor who has trait T but who has no ancestor who has trait T. (We could fix that somewhat and introduce distance in ancestry. Messy but easy.)(Do we want to say that A and B also have trait T? This is where we have to look at the practice that people follow.)

Species (with regard to trait) T:
{x: (Ey)(x in same species with regard to trait T as y)}

Species T changed with regard to trait P:
(Ex)(x is in species T and Px and (Ey) (x Anc y but not y Anc x & not-Py))

(or perhaps as follows)

Species-T-at-t:
The set of members of T who exist at t.

Species T changed with regard to trait P P:
$(Et_1)(Et_1)(t_1 < t_2$ & (x)(x a member of species-T-at-t_1 then Px) & (x)(x a member of species-t-at-t_2 then notPx)

2. What reason are there for believing that species are individuals?

2.1. They are!

2.2. Proof: What is an individual? How are individuals individuated?

2.3. There are two notions of individual around. One notion is that an individual is the sort of thing about which at least one thing is true. In that sense classes are individuals. That is not very interesting. Everything is an individual.

2.4. Another notion of individual is that an individual is something that has parts, to which cetain things stand in the part whole relation, and in particular to which ***atoms*** stand in the part whole relation. Atoms are things to which nothing stands in the part whole relation.

2.5. Given a part whole relation, individuals are individuated by some such principle as:

(1) $x =_R y$ iff all and only atoms (of S) which bears R to x bear R to y

2.6. What do we know about part-whole relations. The are partial (may prefer strict partial) ordering relation for their field. (Reflexive, antisymmetric, transitive.) Not every partial ordering is a part whole relation. E.g. *greater than or equal to*

2.7. Physical part-whole is one example.

2.8. Is there a relation such that two distinct classes "generated out of" the same atoms will turn out to be the same "individual"? Actually there are many. But one interesting one is the ancestral of the membership relation:
$(Ancest_{\in}xy$ =(def)(a)(y $\in$ a & (u)(v)(u $\in$ a & v $\in$ u --> v $\in$ a) --> x $\in$ a)

2.9. Two classes A and B are generated out of exactly the same atoms if and only if (x:atomx)(x R A iff xRb) (Where R is the membership ancestral relation).

2.10. So we have a concept of same Individual for classes here: Two classes are the same individual iff they are composed of the same atoms under the R relation above. It is a perfectly good concept.
It does violate Wiggin's principle (whatever its number) but that is too bad for Wiggins.OP

2.11. So species being individuals does not prevent them from being classes. The terminology is misleading! There are A's that are classes and that are also individuals in that they come under two distinct principles of individuations.

3. What reasons are there for believing that they are not classes?

3.1. There are certain things that are or can be true of species that are not and cannot be true of classes, e.g.

(2)

a. The members of a species change across time.

b. The species changes.

c. The species splits.

d. The species ceases to exist.

If we replace 'species' with 'class' in the above (or with an expression denoting a species), we get nonsense. (Note: not falsehoods, but nonsense.) On the other hand if we replaced 'species' by 'physical object' or even 'individual' then truth is preserved. Logical form of statement contain 'species' and species terms require special treatment. Not unique to this sort of class.

Reply: The facts recorded by such statements can be expressed in a different way. See above.

3.2. An organism is included in a species by virtue of being related to other individuals and not (only) by virtue of having certain intrinsic traits. Members of a species are connected through a network of actual physical contacts (at birth).

Reply: see above; that does not preclude the species from being a class. (Analogy with natural numbers.)

3.3. Generalizations whose subject are species terms are always accidental generalizations, if true. e.g.

(3) All swans are white.

is claimed not to entail counterfactuals.

Reply: that strikes me as false under one interpreatation. In any case, I don't see the relevance. One might even see an argument here for the view that species are classes. But perhaps bringing this out is the whole point of claiming that species are individuals. (That is the way Kitcher seems to take it.) The following is probably an accidental generalization that can be expressed by the sentence 3:

(4) All actual swans are white.

For surely the following entailments by (4) are problematic:

(5) If this (black) thing was an (actual) swan it would be white.

(6) If this (black) thing was an (actual) swan some actual swan would not be white.

(There are problems about conditionals involved here. See the iffiness literature. But the case about lawlikeness seems clear.)

3.4. The theory of evolution and theories of ecology etc use species terms not only for distributed reference, but also to assert things about the whole species. Assertions about distribution of traits, changes of traits, ratio of females to males etc, etc.

Reply: That is compatible with species being classes. We can mention the class and we can mention the members of the class, and we can mention members of partitions of the species etc.

3.5. The theory of evolution only deals with actual individuals. In other words, as used by the theory, species terms must be construed as having an extension that encompasses the whole of the ***comprehension*** (A term used by C.I. Lewis the set of all possible ... things to which the term would be correctly applicable")

Reply: We might discuss that. Is it true that the theory does not tell us anything and does not imply anything about what sorts of individuals would have occured where and when under some possible but not actual situations? Natural history is like history!

Even if the answer is yes, it does not follow that species are individuals that are not classes.

3.6. Names of species are rigid designators, *de jure* not just *de facto* rigid designators, i.e. must be assigned through an act of baptism.

This is an interesting argument! Acts of baptism involve confrontation with a physical baptee. Classes are not physical but abstract, and therefore classes cannot be baptised. Since species can, species are not classes.

3.7. Another reason altogether viz. we can apply the calculus of individual to them.

3.7.1. What is the calculus of individuals?

3.7.2. A bit of history.

3.7.3. The Leonard-Goodman calculus.

3.7.4. Other calculi.

3.7.5. That is not an argument for holding that they are not classes, but only for holding that they are individuals. See all the above. However one might hold the view that the notion of class is a flawed notion and should not be trusted in any area.

Next topic. Kitcher and Dupree.

QUINE-GOODMAN NOTES

I. QUINE ON NATURAL KINDS:

1. Both Hempel's non-black ravens and Goodman's grue emeralds raise problems for justification of induction. (Ontological Relativity, pp. 114f)

    a) Both might be resolved together if something could be made of notion of projectibility.

        i) Declare that complement of a projectible predicate need not be projectible.

        ii) Then, a black raven counts towards all ravens are black and it's logical equivalent all non-black things are non-ravens.

        iii) But a green leaf doesn't count towards second of these generalizations, for it's stated in non-projectible predicates.

2. Intuitively we prefer 'grue' to 'green' because two green things are more similar than two grue things if only one of the two is green.

    a) Suggests making a projectible predicate one that's true of all and only things of a kind. [Why, "and only"?] (116f)

        i) But both similarity and kind are suspect notions.

        ii) Appears to show also in their etymology: 'kind', 'akin', 'kindred'; 'like', 'ilk'; 'similar', 'same', 'resemble', with 'sammel' and 'assemble' into kinds. [Note, as Quine doesn't, that these include terms for descent.]

    b) Part of problem is determining what's a property in order to use shared properties in defining similarity. All things are similar to each other in some respects. (117f)

        i) Need a notion of significant similarity, and don't know where to get it.

    c) Try, to be similar is to belong to the same kind. (118f)

        i) Then, if similarity is yes/no, can't nest kinds (all colored things are similar precludes all red things being a kind also).

        ii) If it's triadic, then it can allow nesting, but it gets trivial. Any two things can be members of some broad kind or other.

d) Tries defining a kind in terms of qualitative distance: all members of the kind differ less than so and so much from a specified norm. [N.b type specimens.] (119f)

i) Thus need one or more actual paradigms and one or more foils, where foils "deviate just barely too much to be counted into the desired kind". [This is the mistake, a bad one!]

ii) But this will only enable us to do kinds in terms of a single property (e.g., red things), not build clusters out of mixed properties.

e) Carnap suggested members of a kind were more like all the members than like any non-member. (120)

i) Goodman invented set of all red-round, red-wooden, and round-wooden things. It admits yellow croquet balls, but not yellow rubber balls.

ii) [But kinds have to be found, not manufactured. Quine is not talking about natural kinds.]

3. Notion of similarity is basic to learning language [and world].

a) Learns 'yellow' from ostensions of what to call yellow, guided by sense of similarity of samples and experience with corrections when one extends too far. (121-124)

i) Needs to be comparative similarity, S(a,b,c).

ii) And should if possible be global, not similar with respect to named properties. That can come later.

iii) And the quality space involved must be innate and uniform, for it's visible early.

b) Ostensive learning of language is implicit induction. (125-127)

i) Learner is working towards a law of English verbal behavior [but also learning about the world inhabited by English speakers, something Quine doesn't say.]

ii) Because it uses innate and shared quality space and involves acquisition of language, success is almost inevitable.

iii) Quality space itself presumably comes from evolution, and that ensures that, up to a point, it accords well with functionally relevant groupings in nature.

iv) Which is why these early implicit inductions work.

c) But these inductions also go wrong as civilization develops. (127f)

i) Color is important for food gathering, but less so for advanced societies.

ii) Here's where science comes in: we acquire additional properties and new kinds.

d) Process continues, Quine has already suggested, until "the notion of similarity or kind finally dissolves so far as it is relevant to that branch of science." (121) [Fundamental disagreement]

i) Same place: "the notion of similarity or kind changes as science progresses."

ii) But here (128) it's just that by "the-trial-and-error process of theorizing he {man} has regrouped things into new kinds which prove to lend themselves to many inductions better than the old."

iii) Different fields use different notion's of similarity, and the old innate one continues to function in some realms.

4. Brief discussion of disposition terms, counterfactual conditionals, and causes. (130-33)

a) All three are helped by notion of kind, or would be if kind were itself a reputable notion.

i) But, as science develops, all three become manageable in terms of theory.

b) Theory gives us kinds in terms of scientifically worked out properties. (134-138)

i) Using those properties we also find we can often get along without kinds, for we can directly handles the questions with which kinds helped out.

ii) "In general we can take it as a very special mark of the maturity of a branch of science that it no longer needs an irreducible notion of similarity and kind." (138)

[c) What Quine misses, I think, is that the problems he's solving are still stated in the everyday language of solubility, cause of the Chicago fire, etc. But the questions that the scientists themselves work on aren't stateable in this older language, and for their pursuit the scientist may well use the old notions of kind and similarity, just not the old feature space.]

II. GOODMAN, CHAPTER 3: "The New Riddle of Induction"

1. The old problem of induction has been solved or dissolved, but we're left with equally severe difficulties. (59-66)

   a) Hume described our practice of generalizing from past regularities to future recurrences as resulting from habit.

      i) Said to be inadquate because it describes practice but doesn't justify it.

   b) Goodman says that Hume's done much better than that. After all, what's the issue, what been asked for?

      i) Not how we know that something will be correct or even probable, because we can't know that.

   c) Consider case of deduction: we justify particular deductions by showing they fit the cannons of deduction.

      i) But, some controversial positions aside, we don't justify the cannons except by noting that they're accepted practice.

      ii) Which practice is subject to modification when we find it giving results we don't want to accept.

   d) But that's what Hume was doing, however, imperfectly with induction, describing accepted practice.

      i) Problem he left was not that of justification but of differentiating between valid and invalid inductions.

2. To get started look at Hempel's work on problem: define the relation between two statements S_1 and S_2 that holds iff S_2 in any degree confirms S_1. (66-72)

   a) Start with reverse deduction: S_1 must imply S_2.

      i) Breaks down because for any S_2, S_1 implies $S_1 \cdot S_2$ and the conjunction implies S_2.

      ii) To eliminate this difficulty restrict S_2 to instances of S_1, i.e., to statements from which S_1 can be derived by generalization.

   b) But then we get Hempel's raven paradox.

      i) Goodman dissolves this by saying it results from our being asked to proceed in ignorance of other information.

      ii) With that requirement can conclude from green leaf that there are not black objects nor ravens.

      iii) But if we know there are black ravens already can't draw those conclusions.

iv) Mayn't insist that all possibly evidence be included, but must insist that all stated evidence be included (i.e., that there are black ravens and green leaves).

c) This is only a beginning, but it shows the direction.

3. But now there's worse, the Grue problem. (72-81)

a) Goodman relates it to the problem of accidental generalizations (this piece of copper conducts electricity vs. this man is third son).

i) Something about the generalization, other than its syntactic form, is involved.

ii) All copper conducts electricity is projectible, ditto all emeralds are green.

iii) But not all emeralds are grue or all men in this room are third sons.

b) It's not like the problem of smuggled information, the case of the ravens.

i) There, with the added information the induction failed to satisfy the cannon.

ii) Here, the cannon is still satisfied.

c) Can try to talk of indirect effect of other evidence through its confirmation of other generalizations.

i) Thus, know of iron that it conducts electricity, which makes copper a likely candidate as evidence comes.

ii) But we know of other room's that not all men in them are third sons.

iii) But what is the relevant relation between such hypotheses.

d) Standard attempt is to talk of barring restrictions to spatio-temporal location or, when that fails, barring predicates that involve reference to time or place.

i) But all grass in London is green is projectible.

ii) And there's full symmetry between the 'blue' 'green' vocabulary and the 'grue' 'bleen' (where 'bleen' refers to emeralds examined before t and blue or otherwise to green objects. Either vocbulary can be used to introduce the other.

iii) For example, 'green' applies to emeralds examined before t and found to be grue and to emeralds examined after t and found to be bleen.

4. The new riddle of induction is the problem of distinguishing hypotheses that are confirmed by positive instances from those that are not. (81-83)

    a) Have gone from "Why does a positive instance of a hypothesis give any grounds for predicting further instances?" to "What is a positive instance of an hypothesis?" to "What hypotheses are confirmed by their positive instances?"

        i) Last is special case of problem of projectibility, of projecting from any one set of cases to another.

[5. Should be noted that Goodman does all this without every using phrase "natural kind", and Quine shows why that phrase wouldn't help him. But it's what this chapter (III) is about.]

III. GODDMAN, CHAPTER IV: "Prospects for a Theory of Projection"

1. To get a theory of projection need to reorient ourselves. (84-87)

    a) Shouldn't continue to define confirmation relation in terms solely of the relation between hypothesis and evidence.

    b) Take into account also any and all experience or knowledge that may prove relevant, including experience with past projections.

2. For the moment stick to actual projections, those actually made at a given time, including good, bad, and indifferent ones. (88-92)

    a) Also, for any projection, made or unmade, divide its instances into positive (those already determined and true), negative (those already determined and false), and indeterminate (not yet determined).

        i) Positive cases are the evidence class for the hypothesis, and the hyp is supported by them.

        ii) The undetermined cases are the projective class.

        iii) Negative cases violate the hypothesis; a violated hypothesis is false, but may be unviolated at any time.

    b) Adoption of a hypothesis constitutes projection only if at the time in question the hypothesis has some undetermined cases, some positive cases, and no negative cases.

3. Now consider how to eliminate bad projections from the set of actual ones. (95-99)

a) Eliminate all that have been violated since they were made and also all for which no undetermined instances remain.

b) In the case of conflicting projections, e.g., green vs. grue, look at the record of past projections to see which is better entrenched.

i) Here entrenched must mean simply used more often, not more successful.

ii) In any circumstance where both were tried, they would work equally well. It's actual use <u>in projections</u> not potential use that's involved.

c) Note that like Hume we're talking of recurrences, but in this case recurrences of terms as well as of events to which they apply.

i) "Somewhat like Kant, we are saying that inductive validity depends not only upon what is presented but also upon how it is organized; but the organization we point to is effected by the use of language and is not attributed to anything inevitable or immutable in the nature of humand cognitions." (96f)

d) We're not rejecting new predicates and must not do so.

i) Rule applies only when there's actual conflict.

ii) Superior entrenchment is a sufficience but not a necessary indication of projectibility.

iii) It looks as though judgment of projectibility has arisen from habitual projection rather than vice versa so we're not just guilty of genetic fallacy.

4. Other sorts of disagreement also permit elimination of projections. (99-106)

a) The hypothesis with the better entrenched predicate need not have actually been projected so long as it is formulated.

b) Consider hypothesis all emeralds are grund, where grund means examined before t and green or not examined before t and round.

i) Don't presume that 'green' and 'grund' are coextensive for unexamined emeralds unless there's actual evidence from examined ones.

ii) Then can eliminate proposed hypothesis in favor of the entrenched predicate.

c) Trouble may also come from use of non-entrenched term in antecedent, e.g., all emerubies are green.

i) Similar rules work for these.

d) Strong rules come from noticing that entrenchment can be inherited from a parent, where parental predicate is one that determines a class that includes members of class determined by descendent.

i) Thus generalizations about all marbles in bag A involves a better entrenched predicate (bag A) than all marbles in zig A because bag is better entrenched than zig.

5. Need also technique for distinguishing relative projectibility. (106-119)

a) Consider class of all projectible hypotheses, whether or not actually projected, and eliminate all those that would violate one of the preceding rules if projected.

i) Then, relelative entrenchment of predicates determines relative projectibility.

b) Now turns out that evidence which neither supports nor violates a given hypothesis may (by eliminating equally well entrenched alternates) affect its degree of projectibility.

i) Example, all the marbles in bag A are red becomes more likely if bag A is from a stack each bag in which has, to date, had marbles of only one color.

ii) That is, many antecedently projectible hypotheses about multicolored collections are eliminated, and only hypotheses projecting single colors other than red remain.

c) Hypotheses like all marbles in bag are of same color is called an overhypothesis, and only projectible overhypotheses have the effect in question.

i) Some discussion follows on how to evaluate the variety of available overhypotheses.

6. Conclusion: "If I am at all correct, then, the roots of inductive validity are to be found in our use of language.... The suggestion I have been developing here is that such [Humean] agreement with regularities in what has been observed is a function of our linguistic practices. Thus the line between valid and invalid predictions (or inductions or projections) is drawn upon the basis of how the world is an has been described and anticipated in words. (119)

DISCUSSION TOPICS FOR MEETING 6

1. Where do natural kinds enter the Quine and the Goodman reading.

    a) Quine seems not to be dealing with natural kinds at all. He takes red things to be a kind, repeatedly thinks of kinds as classes, but recognizes that not all classes are kinds and asks for special properties of predicates.

        i) Seems to be reaching for the answer that kinds are picked out by projectible predicates (thus, **116f**) notion that predicate is projectible iff it picks out a kind. (But projectible <u>predicates</u> pick out far more than kinds.) Nothing about the question of laws, etc., except implicitly through Goodman.

        ii) When he deals with more than one property, gets into a mess over Goodman's (**120**) principle of imperfect community. That is, he constructs a class that's not a kind.

        iii) Kinds are not to be distinguished by the some special characteristics of the predicates that pick them out. Those predicates must be projectible (whatever that means) but that doesn't say what combination of them will pick out a kind.

    b) Goodman is talking about natural kinds throughout, without using the words. But he's doing it for kinds of properties as well as of things. And he's concerned with terms, not just what they refer to.

        i) What things can one do induction over (metals, not things on the desk). With respect to what properties may one seek laws (green, not grue).

2. Quine on etymology: fails to notice that descent as well as resemblance get into act.

3. Quine on three triadic similarity relation, and on paradigms and foils.

    a) Paradigms are just Whewell's type specimens. Problem arises over foils that "deviate just barely too much to be counted into the desired kind". (119) Why this is not needed.

        i) Don't need something that works in all possible worlds, just our own.

        ii) There, empty space will do.

        iii) Even Carnap's similarity condition is stronger than required.

b) Now notice that the required S(a,b,c) relation needed to identify kinds-members is also what's needed to trace individual members of the kind.

i) Thus, back to Wiggins.

4. Quine on the future of the innate similarity relationship as science develops.

a) Note his equivocations:

Process continues until "the notion of similarity or kind finally dissolves so far as it is relevant to that branch of science." (121)

Same place: "the notion of similarity or kind changes as science progresses."

But here (128) it's just that by "the-trial-and-error process of theorizing he {man} has regrouped things into new kinds which prove to lend themselves to many inductions better than the old."

b) Which is it, better kinds or a different process, one which dissolves kinds?

c) And do kinds really become functionless?

i) They needn't. We exclaim soluble in terms of other kinds.

ii) Question is whether same problem about similarity in a feature space doesn't exist with respect to those kinds.

iii) Also note that solubility in water needn't remain a simple unitary phenomenon (projectible predicate) within chemistry.

5. What about Goodman on language and categories it provides?

Note that like Hume we're talking of recurrences, but in this case recurrences of terms as well as of events to which they apply.

"Somewhat like Kant, we are saying that inductive validity depends not only upon what is presented but also upon how it is organized; but the organization we point to is effected by the use of language and is not attributed to anything inevitable or immutable in the nature of humand cognitions." (96f)

Conclusion: "If I am at all correct, then, the roots of inductive validity are to be found in our use of language....

The suggestion I have been developing here is that such [Humean] agreement with regularities in what has been observed is a function of our linguistic practices. Thus the line between valid and invalid predictions (or inductions or projections) is drawn upon the basis of how the world is an has been described and anticipated in words. (119)

MISCELLANY FROM QUINE-GOODMAN NOTES

1. 1. Suggests making a projectible predicate one that's true of all and only things of a kind. [Why, "and only"?] (116f)

2. ii) Appears to show also in their etymology: 'kind', 'akin', 'kindred'; 'like', 'ilk'; 'similar', 'same', 'resemble', with 'sammel' and 'assemble' into kinds. [Note, as Quine doesn't, that these include terms for descent.]

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   [But kinds have to be found, not manufactured. Quine is not talking about natural kinds.]

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6.[A. Should be noted that Goodman does all this without every using phrase "natural kind", and Quine shows why that phrase wouldn't help him. But it's what this chapter (III) is about.]

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   "Somewhat like Kant, we are saying that inductive validity depends not only upon what is presented but also upon how it is organized; but the organization we point to is effected by the use of language and is not

attributed to anything inevitable or immutable in the nature of humand cognitions." (96f)

7. Conclusion: "If I am at all correct, then, the roots of inductive validity are to be found in our use of language.... The suggestion I have been developing here is that such [Humean] agreement with regularities in what has been observed is a function of our linguistic practices. Thus the line between valid and invalid predictions (or inductions or projections) is drawn upon the basis of how the world is an has been described and anticipated in words. (119)

NOTES ON WIGGINS

I. PREAMBLE

1. Book aims at theory of individuation of continuants, which must comprise three things: (1)

   a) Elucidate primitive concept of identity or sameness;

   b) Provide some account of what it is to be a substance that persists through change;

   c) Use first two in preliminary description of how a thinker does single out continuants.

2. Accepts thesis that meaning of terms is their use but with two provisos: (1f)

   a) Meaning and use are two aspects of one and the same thing.

   b) To understand linguistic usages must understand subject to which they apply.

   c) Thus, start from our pretheoretic ideas of identity, persistence, etc., and from fundamental datum that there is persistence through change, and bootstrap up. (2f)

   d) Difference between W and an opponent who doubts his starting point is "both holistic and dialectical". Can be resolved only by trying out two developed theories against background of practices they purport to describe. (3f)

3. Notion of sameness we're after is not reducible or a matter of degree: coincidence as substance. (4f)

   a) Must elucidate substance, but only by abstracting from our indubitable experience of knowing a variety of substances.

   b) Need notion of individuating, singling out, picking out.

      i) Thus, it's drawing spatio-temporal boundaries that distinguish it from other like and unlike things in its environment.

      ii) It's not intensional (not under a description), and it's independent of referring. (5)

   c) We'll find that singling out at time t reaches backward and forward in time. (6)

4. Must resist standard temptations for analytic philosophy:

   a) That there's a unique starting point at which to pick up a thread that can thereafter be followed step by step. (3)

b) That one can rise to a metalanguage from which to supplement and clarify the object language. (6)

5. Sortal predicates are those whose extensions consist of all particular things or substances of a particular kind. (Here, 'kind' need not refer to natural kinds.) ~~[Not clear whether, say, 'red' is a sortal predicate. Yes it is.]~~ Sortal predicates must pick out substances. (7) (63)

6. Notation a =/donkey b stands for a is the same donkey as b. There are many different ways of explicating this notion and we're not ready to do it. (9)

7. As used in this book a real predicate is one whose elucidation requires allusion to members of its extension; a nominal predicate can be elucdated in words alone. (10)

II. CHAPTER ONE: THE ABSOLUTENESS OF SAMENESS

1. Thesis D is the Sortal Dependence of Individuation: (15)

   a) I.e., it cannot be true that a is the same thing as b unless:

      i) There's some particular kind under which a and b fall.

      ii) The answer to question, same what?, affords some principles for tracing and reidentifying things of this kind over space and time. [These need not, so far as I can see, be the same as those required to pick out members of the kind.]

2. Thesis R is the Relativity of Identity: (16f)

   a) I.e., whether or not a is the same as b depends on the sortal under which the judgment is made.

      i) Thus, a might be the same f as b but not the same g.

   b) Wiggins insists that R and D are utterly distinct and that R is false, D true.

      i) But R may seem to imply D, resulting in much confusion

3. There's also a Counting thesis C which claims that specifying f is adequate to identity judgement only if it provides a principle for counting f's. (18)

   a) This is again distinct from other two theses. Also, it's false but a near miss.

4. The falsity of R follows from Leibniz's law (converse of the

identity of indiscernables -- sometimes known as congruence of identity) together with the reflexivity of identity.

a) Formal proof (18-20)

b) Arguments for reflexivity and congruence (20-23): mostly how-could-they-fail and what-would-you-use-instead to get substitutivity of identify?

5. Five ways (only two of them interesting) in which a is the same g as be could be false.

a) The sortal's wrong: Hesperus isn't same star as Phosphorus.

b) Objects not the same: Mars isn't same star as Venus (23).

c) Boy John Doe is same human being but not same boy as Sir John Doe, Lord Mayor of London. (24-27)

i) Must distinguish substance concepts, which apply present tensedly to an individual through its life and phased sortals which apply tensedly only during part of the life and which thus "restrict" the substance predicate.

ii) We're after identity that persists through time and permits loss of proper parts, not identity of time slices. Term 'boy' unlike 'boyhood' isn't a part of human being. Whole temporal trajectory is what get's picked out and what must be the same.

iii) All this is very deeply built into language. No trivial reform available.

d) Type-4 relativity is Cleopatra's Needle gradually eroded and replaced by concrete. It's same landmark in 1984 as in 1900 but not same stone. (28)

i) On p. 34 (not assigned) argument is that stone isn't an appropriate substance predicate for Cleopatra's Needle, tho landmark, or monument might be. Note that these and other cases all involve artefacts.

e) Type-5 relativity is boy John Doe is same human being but not same collection of cells as Sir John Doe.

i) But no particular collection of cells picks out John Doe except at particular brief interval, thus doesn't individuate the substance John Doe.

6. The problem cases that seem to support thesis R seem to depend upon one or both of two difficulties: (43f)

a) Ambiguity of 'is' as illustrated by 'is constituted of'.

b) Ambiguity of certain referring expressions as in "that Hermes". Does it refer to that statue of Hermes, its matter, and so on.

c) Interesting critique of an argument of Frege's. He's said that one can look at same thing and properly say either "it's a copse" or "it's five trees". For Frege the change is just in the concepts.

i) Wiggins points out that they're not the same things in that one supports death of the individual trees, with new ones growing up, other not.

ii) This is first time the importance of **D** begins to emerge.

III. CHAPTER II: OUTLINE OF A THEORY OF INDIVIDUATION

1. **R** is false, so **D** derives no support from it and must stand by itself. What it then asserts is: a=b iff, there's a sortal concept f such that: (47f)

relation to essence.

a) a & b belong to a kind that's in the extension of f.

b) to say x falls under f is to say what-x-is in sense that Aristotle isolated. [Cf. p. 53 for Aristotelian what-is-it?]

c) a coincides with b in the manner required of members of f.

2. Opponent wonder why **D** is worth preserving: plain Leibnizian identity, i.e., indiscernability, does everything. (49-51)

a) But identity isn't to be reduced in this way. It's primitive to be explicated discursively with aid of coeval notions. Leibniz law should be product of the elucidation.

b) If I ask whether man at table is same as boy I knew in school, answer depends on existence of a particular path in space and time connecting the two.

i) Techniques relevant to determination depend on it's being a man.

ii) Especially, utility of human memory in determining answer.

c) Having established existence of path and only then can say that all properties are shared. Without the path couldn't establish the law.

3. This approach isn't circular if we remember that we're explicating notions already in place and that notion of

continuant is developed before we explicate identity of two individual-presentations. (51-54)

a) Approach doesn't require that criteria of identity be produced.

i) We're after Aristotelian sense of what-is-it question: answer may not supply immediate tests at all, but it provides that which organizes the tests.

b) Brief excursus on problems with "identity of indiscernables" (55-57) as a definition of identity.

i) Formulation must quantify over predicates. But predicates involving identity, spatio-temporal relations, and much else must be excluded to avoid triviality. (I think the triviality involved is trivial falsehood. Differing wrt being five miles SW of Big Ben doesn't exclude identity.)

ii) Cute argument that without these elaborate exclusions, law prohibits existence of a symmetric object, for the parts disappear into each other.

[c) There's much more going on here than meets the eye, and I need to think hard, digest.

i) Identity of indiscernable arises both empirically (can't find two identical leaves), partly <u>a priori</u> (if they couldn't be distinguished they'd be one and the same).

ii) First reading is tensed, no two identical leaves at any time; this is the reading that requires excluding spatio-temporal properties. Second reading is about spatio-temporal worms; it doesn't bar spatio-temporal properties but isn't obviously trivial by virtue of the failure.

iii) Leibniz doesn't do it this way. He insists, why I don't know, that there "besides the difference of time and place there must be internal principles of distinction", a very strong condition. (56)

iv) A good hunch is L's Aristotelianism in a situation where he needs to break with Aristotle over absolute space. Can't use position to individuate bodies as Aristotle could. But can't get on without some other individuating principle, especially (?) because he's not a corpuscularian. The monadology gets into this act.

4. What follows in Wiggins indicates something of what goes on. D is a statement about identity of substances, not of cross-sectional slices.

a) First shows that if a=b, then there is some f such that a is same f as b.

i) But this is too weak a result, too nearly a tautology, to give what's needed.

b) Then (58f): "Perhaps the most important and most general single feature of sortal predicates is that they are used not only to say what things are but also to cover identity-statements in the 'x is the same f as y' form.... It is one half of our immediate task to understand (remind ourselves) what fits them for this role and how the role itself is shaped by the formal character of the identity relation.... The second part of the task is... to discover what justifies the other mark of faith in a more than grammatical distinction between noun and adjective. this is the belief, which may be called the substance-assumption, that, for any identity-statement whatever, there is always to be discovered not merely what we have called...a phased-sortal concept but also a substance-concept appropriate to cover it; and that, no matter how disparate in respect of temporal and other identifications the two designations flanking the identity symbol may be, a phased or restricted sortal predicate covering a true identity sentence can always be supplanted <u>salva veritate</u> by a more comprehensive substance predicate, to yield an equally true affirmative identity-statement."

c) To get at what's involved distinguish D(i) from D(ii): (59)

i) First, which will guarrantees ~~identity of existants a and b if, at any time t, there's an f such that at t a is same f as~~ b.

ii) Second which is what we need is that there's an f such that at all t.... Must have a sortal concept that covers whole lifeline.

iii) This concept answers Aristotle's what-is-it question. (There could be more than one such concept, a hierarchy, etc., but they must supply compatible principles of individuation. Substance concepts seem to be very like natural-kind concepts.)

d) Counterargument is story of Lot's wife: the pillar of salt isn't the same thing as Lot's wife.

i) But can't prove that it's not. Suppose transition were gradual.

ii) W concedes: "There is nothing in pure logic to force us into an ontology of changeable continuants (that is three-dimensional things, which ... have spatial parts

and no temporal parts and endure <u>through</u> time). (62, note my boldface)

iii) But nevertheless asserts: "The argument for D(ii) enters as its first claim that to fulfill its office and constitute an answer to the <u>what is it</u> question, a genuinely sortal predicate must stand for a concept that implicitly or explictly determines identity, persistence and existence conditions for members of its extension." (62)

e) Sortal predicates themselves can be very narrow or very broad, <u>Anzac</u> at one extreme, perhaps <u>animal</u> at the other. (63f)

i) But they must contain or make it possible to trace, with whatever difficulty, the relevant substance concept, e.g., man for Anzac. Otherwise they're not sortal concepts at all.

ii) Concepts like space-occupier are not sortal concepts in present sense: they supply no individuative principles.

iii) "According to whether 'x is no longer f' entails 'x is no longer', the concept that the predicate stands for is in my usage a <u>substance concept</u>."

f) One way of saving Lot's wife as counterexample is to invent a sortal 'woman pillar'. (66)

i) But we can't invent sortals at will, though we may discover/invent them with nature's prompting.

ii) If we can invent them at will, then can make identity statements true or false at will, and that won't do.

g) For a to have ceased to exist at t, on present theory, is to have nothing identical to a in the extension of a's individuative kind at t.

5. Some further properties of substance identity. 68-74)

a) D(iii): to be a substance concept f must make it possible pick out substances that are f's, distinguish them from each other and from other entities, and declare a and b identical under f only if they are congruent (satisfy the Leibnizian schema gx <=> gy.

b) D(iv): f must determine (perhaps with additional empirical information) what can happen to f's, what endangers them, etc.

i) Notice that we're obliterating the distinction between principles which pick out member's of f synchronically and those which pick out the same f diachronically.

ii) That's not an accident.

c) D(v): f must determine a principle of activity, of functioning, or of operation for members of its extension.

d) D(vi): if a is coincident with both b and c when traced under f, then b and c must be coincident under f.

e) D(vii): There are no essentially disjunctive f's.

f) D(viii): However different the stages of a substance concept may be, anything that is truly or falsely applicable to a stage must be truely or falsely applicable to all.

g) D(ix): It's usual but probably not necessary that individuation under f permits a unique answer to the question about number of f's in a region at a time.

IV. CHAPTER III: SORTAL CONCEPTS: AND THE CHARACTERISTIC ACTIVITY OR FUNCTION OR PURPOSE OF THEIR COMPLIANTS

1. Natural kind words are among the best candidates for sortal or substantial predicates.

a) If they qualify, then concept c associated with kind k "must make some conceptual link between the relevant questions of identity and the empirically ascertainable causal and dispositional properties of members of the kind as we find them in the actual world." (77f)

i) Concept can't do that if thought of as the tradition thinks of meaning, description in terms of manifest properties.

ii) They leave unexplained the way the compliants of a sortal predicate evolve and the non-arbitrariness of that evolution.

b) Here (79) a long footnote on terms relevant to sortal predicates intervenes:

i) The <u>reference</u> or <u>designation</u> such as 'horse' is the concept <u>horse</u>.

ii) The <u>extension</u> is the class falling under the concept, e.g., the class of horses.

iii) The <u>sense</u>, or <u>contribution to truth conditions</u>, is elucidated by specifying what concept the predicate stands for. [The difference between the concept and the sense appears to be like the difference between the inscription and the type.]

iv) The conception is a theory or prototheory of what a horse is. [The implication is too much as though there were one theory per sortal predicate. Note what he says about theory-change below and also my criticism of Putnam.]

2. Putnam's theory is then described: x is an f iff, given good exempars of the kind, the most explanatory and comprhensive true theoretical description of the kind... would group x alongside these exemplars." (79)

a) "For the name to stand for a natural kind, everything depends on whether there is some nomological grounding for what it is to be of the kind. If there is, and if the predicate is worthy to survive as a natural kind term, then the holding of the relevant principles is nothing less than constitutive of its exemplification by its instances." (80) The laws involved may be micro or macro or both.

i) What's new about this is combining the deixis component with the nomological one.

ii) What's specially satisfactory is that it permits an unfolding of, an improvement in, "one and the same concept of what it is to be an f, anchored to examples that are grouped together **in virtue of resemblances that are nomologically grounded**". (82) [Bold type indicates parts that Putnam wouldn't say.]

b) It follows that the semantics of a natural kind predicate "must exempt us from taking into account any situations other than those conforming to the relevant laws of the actual world." (84)

i) "Where fs make up a natural kind, the only possible worlds we need consider, being the only possible worlds having within them any entity that is an f, are worlds sufficiently similar in nomological respects to the actual world to exhibit specimens relevantly similar to actual specimens." (85)

ii) "This means that, for the special case of natural kinds, we find that ordinary necessity nearly coincides with physical necessity, and ordinary possibility with physical possibility." (85)

3. Rest of chapter (86-101) deals with artifacts and is not to our purpose. Main conclusion is that it's clear why they've seemed to be kinds, and why the transfer in practice works quite well. But also that there's no likely way to develop a criterion for natural kinds that saves the riddles that can be posed by artifacts.

a) But two remarks of great interest pop up in passing.

b) The account given of natural kinds could be extended, Wiggins says, "to genera, where these were still determinate enough to be autonomously individuative." (86)

i) What that means is suggested by passage that comes after discussion of attempts to resolve problem of the Argonauts' boat by giving a way to pick the preferred candidate of two contender with real credentials."

c) "What we need, if identity is what we want to elucidate, is a criterion which will stipulate that for a relation R to be constitutive of the identity of a and b, a's having R to b must be such that objects distinct from a or b are irrelevant to whether a has R to b.... Let us add this as D(x) to our list in Chapter Two." (96)

RECONSTRUCTING WIGGINS

1. I've been talking about Aristotle to aid the understanding of Wiggins, and now want to apply these notions back to what Wiggins says.

    a) But what I aim to supply is a sort of reconstruction of Wiggins.

        i) Given some knowledge of Aristotle's notion of substance, I read through a lot of incoherent passage in Wiggins without quite noting the incoherence.

        ii) Sylvain's shown it to me, and I want to clarify what I think is going on by putting Wiggins' points in a somewhat different way.

2. Begin with continuants, represented by: ▬▬▬▬▬▬▬▬▬▬

    With time increasing to the right, t -->

    a) They're the primary elements in the ontology to which, on Wiggins analysis, we're committed by our language.

        i) Look briefly at world they populate in juxtaposition to language which describes it.

WORLD	LANGUAGE
Individual Substances or Continuants: a, b, c,...	Proper names: Hesperus, Phosphorus, Fido etc.
Kinds; f, g,... grouped under substance concepts.	Sortal predicates or restricted sortal predicates [all the sortals which there are]: planets, dogs, puppies, etc.

Law I: All substances belong to some kind, $(x)(\exists f)f(x)$

    b) So far these entities are timeless as is everything that can be said about them.

        i) Sylvain's first two classes of sentences from last meeting provide main examples.

    1. Identity Statements: Hesperus is Phosphorus, [for which I want to use Sylvain's I relation, thus] $aI_f b$.

        The Evening Star is the Morning Star.

    2. Hesperus is a planet [for which I want to use notation] f(a).

        The evening star is a planet.

3. Both sorts of statements are about substances, make no reference to time, and have truth value independent of time of utterance.

   a) Also, situations to which they refer are time independent.

   b) But there is a third sort of 'is' statement, Sylvain's adjectival predication.

      i) Evening Star may be hot at some time in its development, cold at another.

      ii) Fido is fierce at some times, not at others.

   c) And it's in providing for these that Wiggins takes a route that produces much confusion.

      i) Preceding sentences are untensed, and what are needed to talk of time dependent situations are tensed sentences.

      ii) And a single bit of Wiggins notation serves for both.

      iii) P. 24: g(Sir John Doe) may stand for the tensed sentence "Sir John was a boy" or for a tenseless sentence saying that "Sir John Doe was, is, or will be a boy".

      iv) Temptation to confusion is irresistable, and Wiggins repeatedly falls into it.

4. Here take another route: Introduce $P_t(a)$, to be read PRESENTATION of a at time t.

   a) Think of a presentation as a set of properties, <u>including spatial location</u>:

      i) Then, to ascribe a particular property q to to a at time t, is to say $q \varepsilon P_t(a)$.

      ii) That's situation in the world to which corresponds an adjectival predication.

      iii) Birth and death are managed by saying $P_t(a)$ is empty for $t < t_b$ and $t > t_d$.

   b) Finally, for economy and familiarity, introduce an abbreviation:

      i) $(q)[P_t(a) \leftrightharpoons P_t(b)] \equiv_{(def)} (q)[q \varepsilon P_t(a) \equiv q \varepsilon P_t(b)]$

      ii) The $\leftrightharpoons$ holds between two sets of properties at a particular time iff their members are identical.

5. That's mostly notation: at last see what it's in aid of.

   a) A law about about substances, which provides a weak but admissible form of the identify of indiscernables.

      i) Law II: $(\exists t)[P_t(a) \neq P_t(b)] \equiv (t)[P_t(a) \neq P_t(b)]$

   b) Read from right to left it's trivial. Content comes from reading it in other direction.

   c) Read from left to right it's principle of no intersection: if two substances display the same properties (including position) at any time, then they must do so at every time, i.e., be the same substance.

      i) It's a direct statement about what it is to be a substance.

      ii) Remember D(vi) which bars branching developmental paths and leads to Wiggins discussion of Amoebas of which lifespans must begin and end at division points.

      iii) Or think what would happen to proper names if individuals could split, cross, etc.

      iv) Relation to paradoxes of quantum theory. Law II doesn't apply to electrons, and they can't be individuated, given proper names, in key situations.

   d) As a principle of identity of indiscernables, it allows two substance to have same properties, including location, at different times.

      i) And it allows two substances to occupy same place with different properties, thus to overlap.

      ii) But it forbids two substances to exhibit the same properties at the same place and time, and I think that's all one can get out of the notion of substance by itself.

      iii) Perfectly imaginable that there should be identical leaves in the garden, identical hydrogen atoms in this room, or what you will.

6. And there's more, which I take to be more important:

   a) The equality relation $\neq$, was introduced as a time dependent relation between presentations, and needed to be.

      i) But in virtue of Law II, we can drop the superscript: if it applies at any time it applies at all time.

      ii) And when we do that, the equality relation between

presentations becomes the same as the I relation between substances.

iii) It is thus just Wiggins relation ⊩.

b) Could we have started at this point, and avoided all this notation: I think not.

i) Talk about presentations and identity of presentations is a product of sentence type 3, the adjectival predication use of 'is'.

ii) The 'is' in identity relations between substances is clearly different, and the difference has to be seen to understand what's going on.

iii) The Sortal predication 'is' is a third use still.

c) But the three uses of 'is' shouldn't be seen as a case of mere polysemy or ambiguity.

i) I take recurrence of 'is' in all three contexts to be aspects of our language game.

ii) Only when one sees what's different about them, can one see what using a single term for all three pushes one towards.

ii) What one's got is illustration of what Wiggins has in mind when he suggests that our language commits us (or tends to commit) us to an ontology of spatio-temporal continuants.

7. Two last remarks: when Wiggins specifies the ontology to which language commits us, he speaks of continuants with spatial but without temporal parts.

a) Don't know why he puts the point that way, and want to postpone any detailed discussion of the question until we get to the biology reading.

i) That brings up the issue of part whole relations in detail.

ii) But a couple of things can be said now:

b) First, great difference in the status of space and time has run through my remarks.

i) A presentation occurs at a time, but spatial location is one of the properties it includes.

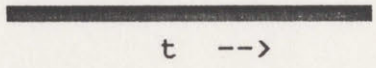
c) Second, if you take a part of an animal, for example an organ, the stomach, it has a life line rather like a substance.

i) I'm not sure that it's not a substance, though I think Aristotle would not have licensed that usage.

ii) But there's no division of the same sort into spatial intervals each of which contains a substance.

8. Second remark is just that I've not dealt with Leibniz law, rejection of the R thesis, the relativity of identity, because I've not wanted to get involved with the apparent Geachian exceptions.

a) In fact, it appears to me that for entities that are clearly substances, Wiggins argument works.

i) If this is a substance  ,

t -->

then it's presentations, $P_t(a)$ are going to be the same regardless of the description under which its picked out.

ii) The problems that make one think maybe relativity is right all, I think, involve cases in which there's real grounds for doubting that a substance is being selected under both descriptions.

iii) And for today, at least, I've been sticking with cases in which question substance-or-not doesn't arise.

Notes for the First Seminar Meeting
On Wiggins.
(February 25 1987)

Administrative:

People taking the course for credit must write either one long term paper of 20-25 pages or three shorter papers of between 6-9 pages.

We strongly urge students who are relatively inexperienced in philosophy to write three papers. If you choose that route then (a) the first paper must be turned in before Spring Vacation, i.e. before Friday March 20; (b) it should be on a topic covered in the initial part of the course, i.e. raised in Mill, Whewell, Wiggins; (c) you should talk to one of us before settling on a topic.

If you choose to write one long paper, then you should start thinking of topics now, so that you can incorporate in the paper matter discussed at this stage. You should also eventually talk to one of us to get your topic approved.

In either case, keep in mind that papers have to be turned in on or before the last day of classes. Actually we should probably have them at the last class meeting so that we can turn the grades in on time. In any case, I am leaving shortly after the last day of classes and will not be able to read papers either during the summer or next year. So people who opt for an I will get an extension of at most one week beyond the last day of classes.

Wiggins

Preliminaries.

Let us first keep in mind why we are interested in Wiggins. Our topic is ***natural kinds***. The selection from Wiggins are relevant in at least two respects: First because he has a view about natural kind words (sic. see p. 77) that they are sortal predicates. We want to see what that means, what its implications are, and whether it is right. Second, later we will consider views according to which natural kinds are not just made up of individuals, but are themselves individuals. To understand and explore that view, we will need to understand what it is to be an individual, what constitutes indivduation, etc. and Wiggins offers a theory about these matters. (That theory, by itself, does not require that natural kind turn out to be sortals.

Wiggins is difficult to understand. So I would like us to see whether we can come to terms with some of the following questions about the reading.

(1)

a. What is (or are) the issues(s) with which it is concerned
b. What are some purported resolutions of these issues?
c. What is Wiggin's solution?
d. On what grounds does he opt for that solution?

When we turn to the natural kinds, we may then want to ask what consequences his views have for the four questions that we raised in connection with Mill about Natural Kinds viz.

(2) In the determination of what count as natural kinds

a. What is the role of the world?
b. What is the role of language?
c. What is the role of knowledge or beliefs?
d. What is the role of scientific and other practice?

And now I add

e. And are there any other factors involved?

My Reconstruction of Wiggins.

If we consider English sentence whose main verb is the verb 'to be' (i.e. in which 'to be' does not function merely as an auxiliary, as in 'John was running'.>) we find that they fall into three distinct types:

1. Those in which 'to be' is flanked by singular terms. e.g.

(3) the Morning Star is the Evening Star

(4) Five is the sum of three and two

(5) The comet observed on July 7 1986 is the comet that Julius Caesar saw on his last day.

Let us call such sentences **"Identity Sentences"** and the propositions they express **"Identity Propositions."** In these sentence 'is' can be replaced without change in truth conditions by 'is the same thing' or, for that matter by '='.

2. Those in which 'to be' is flanked by a singular term on the left and an indefinite Noun Phrase on the right. e.g.

(6) The morning star is a planet.

(7) Fido is a dog

(8) France is a country.

(9) The Hudson is a river.

etc. Let us call such sentences **"zortal predications"** or perhaps "Predications in the category of substance."

3. Those in which 'to be' is flanked by a singular term on the left and an adjectival phrase on the right. E.g.

(10) The morning star is very massive.

(11) The comet seen by Caesar was shiny.

(12) Fido is ferociously jealous.

Lets call these sentences **"Adjectival predications"** and maybe "predications in the category of quality"

This certainly is not an exhaustive classification of sentences in which 'to be' is main verb. It ignores sentences with plural subjects and or objects (Among the most interesting ones among these e.g. 'Tigers are mamals'.) And a whole host of others. Including problematic ones such as 'Water is H_2O' (Is this an Identity sentence) Never mind. The first two classes are probably what interests us now in any case.

Sentences of the first sort and the propositions that they express have been a long source of philosophic problems.

For instance, Frege's problem with

(13) the morning star = the morning star.

vs

(14) The morning star = the evening star.

How to account for the difference in "cognitive value" ? His solution: make a distinction between sense and reference. The truth conditions depend on the references. The cognitive value depend on the sense. This leaves one with the question: how is the sense of '=' itself to be conceived (It picks a funny relation!)(Mumbo jumbo about "unsaturated" etc.

Or Locke: the disease A and B. Do you go in the machine. Or total brain change. Same person vs same body vs same mind etc. What then are the truth conditions of identity sentences or propositions, what are verification conditions, what can serve as evidence, etc.

Other problems found in the literature: identity through time e.g. the statue and clay problem, the Supreme Court problem (not the same members through time.), the United States Problem (Goodman and Quine and nominalism).

All of this shows that we do not have a good explicit (or even implicit) grasp of the truth conditions of Identity Sentences (or the propositions they express.)

(If this seems uninteresting -- since ostensibly only about English sentences -- one can think of related obscurities e.g. What is it to believe an identity proposition? To what is one committed when one asserts an identity proposition? What is it that one is wondering about when one is wondering about identity propositions? What conception of the world -- or of a subject-matter does the acceptance of identity propositions entail? What warrants identity propositions? Etc. etc.

What then are the truth conditions of identity sentences?

Wiggin's type of solution.

There are two types of "reductive" answers in the literature. (Roughly put, a reductive answer is one that provides a formula for eliminating '=' from identity sentences by yielding equivalent (discuss? Same meaning, same truth condition?) sentences without '='. E.g. class identity as sameness of membership)

1. "Solutions that translate identity questions about persisting substances into questions about some allegedly determinate finer-grained continuity relation analytical of '=' and holding between items from the world frozen at time *t* and items from among the contents of the world frozen at *t'* (Wiggins p51)

   Such solutions generally build on an ontology of e.g. stages of things and ask: what must be the relation between two stages for these two stages to be the stages of the same object. e.g. rabbit stages.

2. Solutions that build on the Principle of Identity of Indiscernibles. Viz ~ a = b is true if and only if (F)(Fa <-->Fb) ~.

And then there are non-reductive solutions, i.e. solutions that do not purport to offer a way of eliminating '=' but that relate '=' to other notions in an enlightening way. Sortal solutions belong among these.

3. Sortal solutions. What is a sortal solutions. It is a solution according to which an identity sentence ~a = b~ is true if and only if there is a sortal predicate f s.t ~fa~ and ~fb~ are true (i.e. a and b satisfy f) and <a b> satisfy the I-relation associated (licensed by) with f, i.e. some ≠ relation.

   What is a I-relation. Well that is one of the things that has to be clarified. But to be an I-relation a relation must be an equivalence relation i.e. reflexive, symmetric,

and transitive. Sortal solutions assume that some zortal predicates (i.e see above. Zortal predicates are what is expressed by VP in the second set of sentences above) are "attached " to, or license I-relations.

Typical I relation: The equivalence relation for classes, defined so at to be satisfied by classes, i.e. things that satisfy the sortal predicate 'is a class'. (See above.)

Sortal solutions come in two flavors.

a. Those that require furthermore that all I-relations obey Leibniz's law, i.e. that it be a *congruence* relation.

   (Discuss briefly the ***Principle of Indiscernability of Identicals*** and the ***Principle of Reference.*** I suspect that Wiggins not only conflates the two, but that it leads him in some troubles. Not sure that this is worth disentangling for our purpooses.)

b. Those that don't.

Geach opted for a sortal solution of the first kind. Wiggins opts for the sortal solution of the first kind.

Let us now think about Sortal Solutions.

<u>Why is it plausible that there may be a variety of I-relations each tied to different sortals/zortals?</u>

Think of rivers, nations, countries, words, propositions, religions, public offices, pictures, bits of paper, laws, ships (e.g. the ship of Theseus). (Each of these correspond to a sortal, i.e. is an answer to a *what is?* question, and is denotable by a sortal predicate.)

Is the Christianity practiced by Roman slaves in the catacombs the same religion as that practiced by the Pope in 1987? Is the Judaism practiced by the Falashas the same Judaism as the Judaism practiced by Williamsburg Hassids? Is the picture that you saw in the Globe the same picture that I saw in the Globe? Is the guy that kids in the U.S. call "Santa Claus" the same guy that French kids call "Pere Noel"? etc. etc.

We might mull about that a little. What is it to be the same law, nation, etc. Is the present Belgian nation the nation that was under the Dutch and that was Julius Caesar mentions as the bravest of all the Gauls? Notice that what I am doing is listing sortals.

<u>What is the evidence that Wiggins is promoting a sortal solution?</u>

"**D:** a = b if and only if there exists a sortal concept f such that

(1) a and b belong to a kind which is the extension of f;

(2) to say that x falls under f -- or that x is an f -- is to say what x (in the sense that Aristotle isolated.)
(3) a is the same f as b; or a coincides with b under f, i.e. coincides with b in the manner of coincidence required for members of f, ..." (p48)

"The claim made by **D** is that, where there is a point at issue, this depends in a systematic way upon what a and b are. (p49)

<u>What is the evidence that the relation is to be what he calls "a congruence" relation?</u> His argument against R i.e. his argument that R is incompatible with Leibniz's law.

How does the argument go?

1. g(a)
2. (a $\overline{\overline{g}}$ b)
3. Reflexivity
4. Leibniz

entail

5. (a $\overline{\overline{g}}$ b)

(The trick: use as a relevant ø 'a$\overline{\overline{g}}$...' and assume that g is a sortal i.e. grounds 'a $\overline{\overline{g}}$ a' by reflexivity. Then apply Leibniz as a consequence of 2 , using the above predicate, and one gets 5 !

<u>Problems:</u>

How can I relations differ among each other?

Wiggins writes as if they are co-extensive, but needs only assume that they do not fail in co-extension the way Geach samenesses do.

One might think that what must be going on is that I-relations are tied to predicates that have different senses. How else can they differe if they do not differ in extension, i.e. hold between the very same pairs? What other machinery does Wiggins have. Saying that they relate to different ways of tracing etc. is of no help. What are the "they's" that are so-tied. (Nowadays one might give a make-believe answer by saying talking of different methods of tracing through time as "constitutive". Big help! Does that come down to different senses? -- this better be skipped in the seminar discussion.)

I suspect that what goes on here is something like this. Consider nations and consider chemical compounds and consider animals. Animals can be similar and different along dimensions that are very different from the dimensions along which nations or chemical compounds can be compared. Nations have share or are distinguished by the territory they occupy, the people who belong to them, the wars in which they have been engaged, the languages they have used. Not so chemical compounds or animals. Chemical compounds have similar or different structures, number of atoms, boiling points, freezing points, etc. Nations don't. Animals don't. Animals have similar or different organs, skin covers, diets, susceptibilities to diseases, etc. Nations or chemical compounds don't.

This suggests that I's differ from each other in that they come with different versions of the Leibniz Law.

What do I mean? What is Leibniz's Law?

Look at p 19. Notice the Greek letter. The law is a ***schema***, not a proposition. No quantification of the Greek letter. You have to read that as holding that every proposition of that form is true, every well formed, cogent proposition of that form. Every ***substitution instance***, not every ***instantiation***! (There aren't any.) But some will not be well formed. e.g.

(15) (x)(y)(x $\overline{=}_{\beta}$ y --> x is a Republican <--> y is a Republican

is incoherent if '$\overline{=}_{\beta}$' expresses the I-relation peculiar to planets.

<u>Further details of Wiggin's theory.</u>

Bring out by discussing the Lot's wife case.

Need to recognize that some sortals come with specification of what constitutes ceasing to exist and what can befall (Connect to the previous discussion of versions of Leibniz's law.) Somehow this is a central fact of our conceptual machinery. I.e. need/have ***substance*** sortal concepts and maybe predicates.

Things that should come out: Every sortal licenses at least one I-relation. Every I-relation is licensed by at least one Substance sortal.

Are all zortals sortals? (i.e. does every zortal predicate (or concept) license some I-relation that befits some Identity sentence (or proposition)?

That is where **D**(iii), **D**(iv), and **D**(v) come in. Let us look at them.

What makes them true?

We should also discuss **D**(ii). It would be nice if I could get the seminar to explain to me what it is all about. I am at a loss about it. I understand it, but I don't see that it has to do with anything.

Musings (Must rewrite; ***Don't discuss in seminar!***): What does **D**(ii) have to do with identity? Suppose that it were false? Would it have the consequence that some entity might not be identical to itself across time? Maybe that is what is at stake. But how could an entity not be identical to itself across time? Conditions for the possibility of identity would fail if no sortal were true of the entity throughout its existence. But how could that make sense? Sortals are not true "at a time". Therefore they cannot fail to be true at any time. Any sortal that is true of a thing is true of it eternally. In a system such as the one Wiggins has, occasion predicates must be treated as diadic predicates, e.g. ~g(x) at t~(Two argument places, one for

marked by x and one marked by t) which, if true of any pair is true of that pair eternally!

I suspect that here and around **D**(viii) some such reasoning as the following is going on:

After thought - There is another trajectory through this: Think in terms of eternal sentals as associated with occasion ones - the latter being "restrictions" It may work - still misleading use this approach however to clean up Dviii.

Let n_1 and n_2 be variables for singular terms.
Let n_1 range over singular terms with a sense that "presents" A by a feature that A has at t_1 (e.g. 'The man John saw on July 7 1985')
Let n_2 range over singular terms with a sense that "presents" A by a feature that A has at t_2. (e.g. 'The man that Henry saw on August 9th 1986')
then

(16) ~$n_1 = n_2$~

could not be true unless some

(17) ~$n_1 \neq n_2$~

sentence (or proposition) is true, and that requires a sentence

(18) ~n_1 exists at t_1 and at t_2 & n_1 exists at t and at t_2 & $g(n_1)$ & $g(n_2)$~

to be true.

Generalizing, and dropping notational scruples, i.e. (allowing generalization over subscripts!), the corresponding sentence:

(19) ~(t)[n_t exists at t --> $g(n_t)$]~

must be true
And existentially generalizing, the corresponding sentence

(20) ~(E g)(t)[n_t exists at t --> $g(n_t)$]~

must be true
Universally generalizing, since this is supposed to hold for all entities, and ***passing to the material mode***

(21) (x)(E g)(t)[x exists at t --> g(x) at t]

I guess that this could pass as reasoning if one does not care about use-mention and one is willing to glibly pass from the formal mode to the material mode, i.e. infer from

(22) ~$g(n_t)$~ is true

that

(23) g(x) at t

Strikes me as pretty questionable. Is there is a way of doing all this completely in terms of quasi-quoted expressions. There may be, but it is not obvious. Even so, Wiggins notation would be misleading. He warns the reader that he will be sloppy about use-

mention. But this is not sloppiness, it is fallacious, or exploits a truth-theory that is never mentioned. Of course, I may have missed the point. Or maybe I am mistaken about his views about occasion predicates.

But unless something of the sort is going on, I don't see what Wiggins could have in mind when he complains that **D**(i) "does not guarantee what the substance assumption envisaged, that there will be any preferred sortal-concept in a hierarchy of sortal concepts (or any set of preferred sortal-concepts in such a hierarchy) that a thing will fall under throughout its existence." A need presumably to be met "If the idea of continuity is to elucidate the truth-conditions of identity statement in the manner envisaged by **D** ..." (all this on p.59 in passage introducing **D**(ii).

Topic for discussion: Can anyone enlighten me about what Wiggins writes about sortals determining ways in which individuals are traced through their life's history. I cannot get a coherent story, though something interesting seems implicated. But too much handwaving for people with my sort of lack of imagination.

Relevance to Natural Kinds.

What bearing does all this have on Natural Kinds?

Natural kind terms (if we include 'sample of water' etc. in the case of mass natural kind terms.) are zortals. Are they also sortals of the sort that license identity propositions?

If the answer is yes? Then the following problem arises. I will put it linguistically, because it is a little easier to think that way. But,if you prefer, we can then put it not linguistically.

Propositions of the form ~A is a $\dot{,}$~ have truth conditions.

Propositions of the form ~A is $\bar{=}$~ have truth conditions. (The I-relation of the nk has satisfaction condition.)

There must be a systematic connection between these two. There must be a connection between what determines whether two individuals belong to the same natural kind and what determines whether some individual of the kind under one description is the same individual as an individual under a different description.

What is the connection.

Question: Why must there be a systematic connection?
What does Wiggins say about it?

NOTES FOR MEETING 5

I. ADMINISTRATION

1. Sylvain and I have had some second thoughts about next week's meeting, which is Thursday night, not Wednesday.

   a) We've all been pushing quite hard to understand the material, and have not had much time for either digestion or discussion.

   b) Seems worth taking next week for that.

      i) So no <u>new</u> reading assignment, and no faculty discussion leader.

      ii) We'll be here and active, but need engagement from you.

   c) To assure it, ask all of you look back over what you've read, and do it with Sylvain's five questions in mind:

      i) Role of language, of the world, of non-linguistic knowledge and belief, of scientific or other practice.

      ii) And in each case: what are the arguments.

   d) Then, each of you arrive with four passages or four problems that you feel need clarification or discussion.

      i) Two from Mill/Whewell material, two from Wiggins.

      ii) And in Wiggins, one should be from Chapter 2, other from Chapter 3.

2. The week after that go on to the Quine/Goodman assignment in the original syllabus.

   a) That material is so widely available that we've not made special xeroxing arangements or anything else.

   b) You may want to get going on it.

3. As to this evening, I've got more I want to talk about then last time, fewer set questions to put to you, though I've some of those too.

   a) So I'll start out and, if I don't get interruptions, I may go for some time.

      i) Which would be a bad idea, partly since I won't always be as clear as I'd like,

      ii) Partly because you won't like it.

      iii) And partly because we'll go right by some issues that would be better off if discussed.

iii) So I do urge interruptions.

b) Also, a handout to aid with one part of my remarks, not the part I'll start with.

i) It's an earlier version of one part of my notes. Don't read it now and probably not until after class.

ii) Their availability is to keep you from getting lost in note taking.

II. SUBSTANCE

1. Want to start out by saying just a bit about the Aristotelian notion of substance, about what Wiggins calls the Aristotelian sense of what x is, and about the related notion of essence.

a) Will do it very crudely: neither time nor expertise for more.

b) And my objective is not to defend this set of related notions.

i) In Aristotle's form, I don't think they'll do.

c) But I am inclined to think that, for all the crucial gains, something important was lost to view when philosophy turned from Aristotle in 17th century.

i) Especially, something got lost to the empiricist tradition -- less so to Leibniz and the later German tradition.

ii) I read Wiggins as trying to recapture some of it, and don't think he can be understood without at least a glimpse of what the Aristotelian position was.

iii) That's what all his references to Aristotle are for.

d) Later, after attempting some reconstruction of what Wiggins is up to, I'll try to say just a bit more about what I have in mind in saying "something was lost".

i) It's not the notion of substance or of essence, as such, though those notions do point to it.

2. In talking about Aristotle it's generally helpful to remember that many of his basic conceptual categories were drawn from the organic world and then applied more widely.

a) Start by thinking about organisms: people, animals, plants.

i) Things that are born, develop to maturity changing properties as they do so, and ultimately decay and die.

ii) Thus spatio-temporal continuants with a regular life history but without, at least on the surface, enduring properties.

iii) Take categories from such entities and extend them to uncreated things like earth and water, air and fire.

iv) Chunks of these are also spatio-temporal continuants some properties of which can change with time.

b) And so, more obviously perhaps, are individual planets, Hesperus for instance, or individual molecules.

i) Here times of birth and death get to be a long way off, on some theories, on some view to minus and plus infinity.

ii) But that's incomplete knowledge, not that there are no such times.

c) These spatio-temporal continuants are substances, but many other spatio-temporal continuants may not be.

i) Sylvain mentioned a number of them last time: rivers, nations, languages, religions artifacts and so forth.

ii) For the moment, leave moot whether these are substances, whether they're picked out by substance sortals.

iii) Problems they present will also arise for biological species. I want to hold off discussion until then, by which time we'll have the needed categories under firmer control.

iv) For today, at least, restrict ourselves to individual things with life histories extending from birth to death (or from beginning to end of time).

3. Aristotle's substances come in grades.

a) Primary substances are Wiggins' individual continuants, thus Socrates or Fido or Hesperus.

i) Their concomitants in language are proper names.

b) But there are also two levels of secondary substance, the species (man or dog) and the genus (animal).

i) They are kinds, that is, and they persist through time, from the first appearance of the kind until its death.

ii) And their linguistic concomitants are what Wiggins calls sortal predicates.

iii) For Aristotle there are no other grades of substance, and we'll not here even make use of the second level.

c) For Aristotle, what groups individual continuants into a single species is their possession of a common essence.

i) Rational animal in the case of the species man, or the individual Socrates.

d) But essences also have a second function, and it's the double function that Wiggins is trying to recapture through much of the book.

i) Essences are also what endures in the individual as properties change.

ii) In particular, the development or maturation of an individual is a process of realizing essence, and the essence is somehow the cause of that realization.

iii) Thus, the essence of the oak is already in the acorn, and the process of growth is the process of its realization or fulfillment.

iv) Ditt for element earth, realized at center of universe.

4. Not all the oak's properties are, of course, determined by its essence.

a) There are also accidental properties, properties that result from external sources.

i) The wind, for example, or the fertility of the soil.

b) But essence does determine the essential properties, those which must be realized if the acorn is to realize its potential.

i) And it's thus a principle of development, or of activity, much in the spirit of Wiggins' D(v).

ii) Correspondingly, to say what the oak is in the sense of Aristotle is to state its essence, capture it's principle of activity, and describe its essential features.

5. This is where I leave Aristotle, but I suggest as I do so that you think about the parallels to the anti-essentialist Mill.

a) The correlation of ultimate properties characteristic of his <u>infima species</u> are intended to do just about what Aristotle's essences do.

i) Except that Mill needs laws of nature in addition.

b) And the mode of correlation which enables them to do so is just about as mysterious as essences.

i) One question you might ask yourselves is whether Mill has really gained anything by the transition from real to nominal essences.

ii) Or, to put same problem somewhat differently, what does Mill gain by substituting real for nominal essence by the change of level that's reminsicent of semantic ascent.

III. RECONSTRUCTING WIGGINS

1. I've been talking about Aristotle to aid the understanding of Wiggins, and now want to apply these notions back to what Wiggins says.

a) But what I aim to supply is a sort of reconstruction of Wiggins.

i) Given some knowledge of Aristotle's notion of substance, I read through a lot of incoherent passage in Wiggins without quite noting the incoherence.

ii) Sylvain's shown it to me, and I want to clarify what I think is going on by putting Wiggins' points in a somewhat different way.

2. Begin with continuants, represented by: ▬▬▬▬▬▬▬▬▬▬

With time increasing to the right, t -->

a) They're the primary elements in the ontology to which, on Wiggins analysis, we're committed by our language.

i) Look briefly at world they populate in juxtaposition to language which describes it.

WORLD	LANGUAGE
Individual Substances or Continuants: a, b, c,...	Proper names: Hesperus, Phosphorus, Fido etc.
Kinds: f, g,... [grouped under substance concepts].	Sortal predicates or restricted sortal predicates [all the sortals which there are]: planets, dogs, puppies, etc.
Law I: All substances belong to some kind, $(x)(\exists f)f(x)$	

b) So far these entities are timeless as is everything that can be said about them.

i) Sylvain's first two classes of sentences from last meeting provide main examples.

1. Identity Statements: Hesperus is Phosphorus, [for which I want to use Sylvain's I relation, thus] $aI_f b$.

The Evening Star is the Morning Star.

2. Hesperus is a planet [for which I want to use notation] f(a).

The evening star is a planet.

3. Both sorts of statements are about substances, make no reference to time, and have truth value independent of time of utterance.

a) Also, situations to which they refer are time independent.

b) But there is a third sort of 'is' statement, Sylvain's adjectival predication.

i) Evening Star may be hot at some time in its development, cold at another.

ii) Fido is fierce at some times, not at others.

c) And it's in providing for these that Wiggins takes a route that produces much confusion.

i) Preceding sentences are untensed, and what are needed to talk of time dependent situations are tensed sentences.

ii) And a single bit of Wiggins notation serves for both.

iii) P. 24: g(Sir John Doe) may stand for the tensed sentence "Sir John was a boy" or for a tenseless sentence saying that "Sir John Doe was, is, or will be a boy".

iv) Temptation to confusion is irresistable, and Wiggins repeatedly falls into it. D(viii) provides a particularly clear example, but not unique.

4. Here take another route: Introduce $P_t(a)$, to be read PRESENTATION of a at time t.

a) Think of a presentation as a set of properties, qualities, <u>including spatial location</u>:

i) Then, the ascription of a particular property q to to a at time t, is represented $q \varepsilon P_t(a)$.

ii) That's situation in the world to which corresponds an adjectival predication.

iii) Birth and death are managed by saying $P_t(a)$ is empty for $t < t_b$ and $t > t_d$.

b) Finally, for economy and familiarity, introduce an abbreviation to represent the situation in which two presentations are identical:

i) $(q)[P_t(a) \leftrightharpoons P_t(b)] \equiv_{(def)} (q)[q \varepsilon P_t(a) \equiv q \varepsilon P_t(b)]$

ii) The $\leftrightharpoons$ holds between two sets of properties at a particular time iff their members are identical.

5. That's mostly notation: at last see what it's in aid of.

a) A law about about substances, which provides a weak but admissible form of the identify of indiscernables.

i) Law II: $(\exists t)[P_t(a) \leftrightharpoons P_t(b)] \equiv (t)[P_t(a) \leftrightharpoons P_t(b)]$

b) Read from right to left it's trivial. Content comes from reading it in other direction.

c) Read from left to right it's principle of no intersection: if two substances display the same properties (including position) at any time, then they must do so at every time, i.e., be the same substance.

i) It's a direct statement about what it is to be a substance.

ii) Remember D(vi) and D(vii) which bar branching developmental paths and lead to Wiggins discussion of Amoebas of which lifespans must begin and end at division points. (71f)

iii) Or think what would happen to proper names if individuals could split, cross, etc.

iv) Relation to paradoxes of quantum theory. Law II doesn't apply to electrons, and they can't be individuated, given proper names, in key situations.

d) As a principle of identity of indiscernables, it allows two substance to have same properties, including location, at different times.

i) And it allows two substances to occupy same place with different properties, thus to overlap.

ii) But it forbids two substances to exhibit the same properties at the same place and time, and I think that's all one can get out of the notion of substance by itself.

e) Remember the problem with two Leibniz passages (55f):

i) On the one hand identity of indiscernables is an empirical principle, and as such it can be doubted: it's imaginable that there be identical leaves in the garden, identical hydrogen atoms in this room, a symmetrical object in my pocket, or what you will.

ii) On the other hand, identity of indiscernables is a sort of law of thought, a priori. But then all sorts of exclusions are required. Especially spatial location.

f) This formulation has neither of those problems:

i) It is, of course, trivial, a restatement of the obvious.

ii) But that's just what you should expect, indeed look for, when you're looking for things to which you're somehow committed by linguistic practice.

6. And there's something else, which I take to be very much to the same point.

a) The equaltity relation $\stackrel{t}{=}$, was introduced as a time dependent relation between presentations, and needed to be.

i) But in virtue of Law II, we can drop the superscript: if it applies at any time, it applies at all time.

ii) And when we do that, the equality relation between presentations becomes the same as the I relation between substances.

iii) It is thus just Wiggins relation $\vdash$.

b) Which raises the key question: couldnit we have started at this point, and avoided all this notation? I think not.

i) Talk about presentations and identity of presentations is a product of sentence type 3, the adjectival predication use of 'is'.

ii) The 'is' in identity relations between substances is clearly different, and the difference has to be seen to understand what's going on.

iii) The Sortal predication 'is' is a third use still.

c) But the three uses of 'is' shouldn't be seen as a case of mere polysemy or ambiguity.

i) I take recurrence of 'is' in all three contexts to be aspects of our language game.

ii) Only when one sees what's different about them, can one see what using a single term for all three pushes one towards.

ii) What one's got is illustration of what Wiggins has in mind when he suggests that our language commits us (or tends to commit) us to an ontology of spatio-temporal continuants.

7. Three scattered remarks about this part of my agenda, after which I want to raise the last big topic I'll be taking up.

a) When Wiggins specifies the ontology to which language commits us, he speaks of continuants with spatial but without temporal parts. (62)

b) Don't know why he puts the point that way, and want to postpone any detailed discussion of the question until we get to the biology reading.

i) It brings up the issue of part whole relations in detail.

ii) But a couple of things can be said now:

c) First, great difference in the status of space and time has run through my remarks.

i) A presentation occurs at a time, but spatial location is one of the properties it includes.

d) Second, if you take a part of an animal, for example an organ, the stomach, it has a life line rather like a substance.

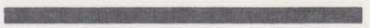
i) I'm not sure that it's not a substance, though I think Aristotle would not have licensed that usage.

ii) But there's no division of the same sort into spatial intervals each of which contains a substance.

e) Anyone with other thoughts?

8. Second remark is just that I've not dealt with Leibniz law, rejection of the R thesis, the relativity of identity, because I've not wanted to get involved with the apparent Geachian exceptions.

a) In fact, it appears to me that for entities that are clearly substances, Wiggins argument works. It's built into the conception itself.

i) If this is a substance  ,

t -->

then it's presentations, $P_t(a)$ are going to be the same regardless of the description under which its picked out.

ii) The problems that make one think maybe relativity is right all, I think, involve cases in which there's real grounds for doubting that a substance is being selected under both descriptions.

iii) The Argonauts' boat, the clay from the broken pot, and so on. Are these substances.

iv) So for today, at least, I've been sticking with cases in which question substance-or-not doesn't arise.

9. Third point is of a different sort, somewhat further from Wiggins and more speculative.

a) Said earlier that I thought something had been lost with turn from Aristotle in 17th century.

i) Indication of what it is can be head by recourse to my notion talk of a presentation, $P_t(a)$.

ii) Bundle of qualities, the sensory given, the clear and distinct.

iii) Just the way people began to talk about presentations of sense in the 17th century.

iv) And just the sort of talk which introduced the need for a homunclus inside the head to do the interpretting.

b) Aristotle's view was very different. When you see something, you take its essence in whole.

i) Intuitive process which gives you the essence, the answer to the question of what it is.

ii) Whole theory of vision goes with this, and I'm not going to pause for it.

iii) But the corresponding notion of the presentation of a substance at a time is far richer than that of a set of properties.

iv) It's one that makes the intevention of a homunculus unnecessary.

c) Wiggins says something of this sort right at the beginning of the book, and there's probably more in the parts we've not read.

i) "It will be particularly insisted that the singling out at time t of the substance s reaches backwards and forwards to times before and after t; and will categorically deny that a case where it is indeterminate what was singled out is the singling out of something indeterminate."

ii) Quite a lot more than the bare data is given in an individual perception.

d) Those of you who know recent work on vision know that views of this general sort are creeping in again. Two examples:

i) First, from psychology, points to aspect that appears to be built into neural apparatus.

ii) Neonate: square on board; expands; infant ducks.

iii) Second is work of David Marr, one aspect of which involves repertoire of "stick figures" which get referred to in process of seeing.

iv) It begins to seem likely that seeing is itself a process that occurs under a substance sortal or something of the sort.

IV. SORTAL DEPENDENCE

1. And that brigngs me at last to what I take to be central point of Wiggins book, or at least of the part we're read: three interrelated claims.

a) Identity of substance requires the existence of a sortal concept under which the substance(s) in question fall.

i) This is D, and it's built in above by my indication of the sortal dependence I-relation and of the equality relation.

b) The sortal concept which permits identity statements is the same or closely related to the concept which groups different concepts into kinds.

c) Finally, what's fundamental to either of these sorts of sameness is scientific or proto-scientific law or theory.

i) Why should we believe any of this? What's the argument? Don't find much specific in Wiggins.

ii) Just the argument (49f) for special role of memory in tracing human beings through time.

2. Question will run through seminar: what do we need to know to speak of identity; what do we need to know to speak of membership is a single kind?

   a) For tonight I'm going to restrict myself to a single example of the close interreatlationship of these questions.

      i) Then we may try discussing a case of another sort.

      ii) For my example: What am I claiming if I tell you Hesperus is Phosphorus.

   b) True but uninformative to say I'm claiming that they are a single substance, the same thing.

      i) Need something more concrete. Put it in form what evidence could there be for or against the claim?

   c) Well, lots of different sorts.

      i) Start with kind that was specially relevant when identification was made.

      ii) To present it, have to tell you something about planets, and have to begin that by telling you something about stars.

      iii) Question can only be answered with a certain amount of knowledge -- some of it theoretical -- available in advance.

      iv) In this case, some of you have it, so I'll be brief.

3. Observation of stars on clear night.

   a) Stars rise in east, set in west; diurnal circles about the poles. Sphere of stars a convenient way to think about them.

      i) Hold their relative position throughout. Thus the constellations.

   b) Other points of light that travel with them, but gradually slip back over period of many nights.

      i) Trace a generally westward path through the Zodiac.

      ii) Overwhelmingly plausible, but nonetheless theoretical assumption, that they move steadily between these positions, visible or not.

iii) Don't disappear and then reappear or get replaced.

iv) That's what makes the planets substances.

c) For a substantial portion of any year, most planets visible for some part of any clear night.

i) But the Morning Star and the Evening Star are peculiar. Neither stays in the sky for very long on any night or for very many nights in a row.

ii) Morning star first appears above the horizon shortly before the sun rises, and becomes invisible with the light of day.

iii) When it's first seen after a long absence, it rises just ahead of the sun. Then a bit further ahead each day. Then interval reduces gradually until it doesn't appear at all. Then absent for a long time.

iv) Evening star first appears just after sunset and goes through a similar cycle. Long interval between periods when its visible during successive nights. And its reappearance is in a different part of the sky.

v) Evidence that the two are the same is by plotting on a star chart and noticing that, if we suppose evening star contintinues at about same rate after it's disappeared, it should reach point among the stars that morning star next rises at at about the right time.

d) That's the intersection of what were once thought to be two substances, now seen to be one.

i) What was required to make it evident was a knowledge of the way planets behave, which is also what it takes to tell whether a given body in the skies is a planet.

ii) Here the synchronic and diachronic sort of sameness relations largely merge.

e) Well, there are other ways to show that the morning star is the evening star.

i) Powerful telescopes show characteristic appearance.

ii) Characteristic magnetic fields and other similar indices.

iii) But all of these depend on knowing more about planets and invoking a larger body of theory.

iv) Which theory is in turn relevant to deciding whether a given body is a planet or not.

v) Again, distinction between diachronic and synchronic largely disolves.

V. DISCUSSION

1. That's as far as I want to go in presentation, but there's lots to discuss.

   a) Like to start by going over what I've just done for same planet for an organism.

      i) Same tadpole. What does it take?

   b) First, isolated creature in a jar.

      i) Better know it's an animal.

      ii) Maybe enough to keep it alive. What it eats. Temperature toleration.

   c) More generally, suppose there were lots of other things around.

      i) Remember planet case. Different if there were only Venus.

      ii) Different if there were no stars.

2. A very different problem that seems important to dealing with Wiggins is one of method what's he up to?

   a) There's much that's illuminating on first two pages of preamble.

      i) He talks repeatedly there and elsewhere of "elucidating" something or other.

      ii) What gets elucidated, in what sense, and how is it done? [Concepts or system thereof, see more deeply into them, by bootstrapping]

      iii) N.b. related passages on p. 49.

   b) What do you think of this. Is it possible? Is it sound?

3. A more isolated passage, but one that I think very revealing is the bit about Frege on the copse and the trees as "the same phenomenon". (43f)

   a) What's going on?

   b) Is there a substance involved?

NOTES ON MILL AND WHEWELL

I. MILL: Book I, Chpt vii

Mill's "kinds" = our "natural kinds".

1. For Mill kinds are classes of things. The predicables (genus, species, diffentia, proprium, accidens) are, however, predicated not of the things but of their names (95). Why?

   a) It's part of effort to get away from Aristotelian notion of essence, notion which would explain the correlation of properties which are shared by the kind.

      i) Mill insists there's no such explanation to be found (100).

   b) All that's left of it, for Mill, is signification of the class name (96).

2. But Mill also thinks there's a real difference between artificial classes (those whose shared properties are exhausted by the ones conoted by its name) and those which are found to have lots more shared properties than are yet known (98).

   a) It's a condition on these "extra" properties which make a kind natural that they not be derivable from the properties connoted by the name (97, 99). That would be a sort of cause, like an essence.

   b) That difference he attributes to nature, but the properties picked out as connotation of the name are picked by man for pragmatic reasons and they may vary with motive.

      i) Thus seems to waffle between realism and nominalism (98).

3. Difficulties emerge most clearly in discussion of differentia, property that distinguishes different species within a genus from one another (100 ff).

   a) Mill says that the differentia are determined merely by interest of language user. That's why 'rational' is the 'differentia' of 'man' rather than food-cooker.

      i) Difference implicates proprium (that which follows from the connotation of the term) and accidens distinction.

   b) But speaks of the choice among alternative as producing different meanings of the word and suggests that isn't usually troublesome because both pick out same things (102).

      i) What results is a system which pack all the problems about essences back into language.

ii) Pragmatically determined or not, words do have n & s conditions: determinate signification. These permit all the operations previously managed by essences. (Note particularly the bit about black crows (104). Mill insists that if we saw one that wasn't black, we'd know it was a crow. We'd revise generalization, not meaning.)

iii) What disguises this is that we could always discover that our pragmatic concerns had led us astray in choice of connotation.

iv) But we could have been wrong about choice of essence, so what's the difference

II. MILL: Book III, chapt. xxii

1. Uniformities must be either of succession or coexistence. Former all fall under law of causation. ~~Former~~ may be derivative either from a single cause or from coexistent causes.

   a) One or other must be so if the coexistents are caused at all (407f).

2. It follows that there must also be ultimate coexistents, those which are causes but which coexist unexplained by prior causes.

   a) All such coexistents are properties of natural kinds, but not all properties of natural kinds are uncaused. Gaseous form of oxygen is due to latent heat, but oxygen is a natural kind.

   b) Can never be sure that a specified property is really ultimate. May unexpectedly be proved to result from a cause, thus diminishing list of ultimate properties at one level, but enriching it at another (408f).

   c) Since it can't be known with certainty that a pair of coexistents are really ultimate, not caused, all laws of coexistence must be treated as empirical (410).

3. The method of induction (previously discussed) for causes and effects rests on a principle (everything which has a beginning must have a cause, and among its immediate antecedents must be a set of conditions necessary and sufficient for its occuring and discoverable be elimination) that has no parallel in case of ultimate uniformities. They can be known only by the <u>unscientific induction</u> of the ancients, simple enumeration (411).

   a) But the evidence can be strong nevertheless, for there are only two ways in which it could go wrong, both improbable.

i) Suppose the coexistent not ultimate, then its either caused or there's a previously unexpected natural kind.

ii) But, if caused, then it's strange we didn't after much experience stumble upon a counter example.

iii) And, if a new kind, strange it's not been seen.

b) But though it's strong, this evidence too is empirical, so that even supposed laws of ultimate coexistence are empirical (412f).

i) Like laws of causation, they then gain special status as evidence piles up from increasing experience, etc.

ii) Still, lacking the principle available in the case of causal laws, the enumeration must always be over all possible cases includable in the species. Therefore, remain empirical, probable only, not certain (414f).

4. Mill's general point throughout is that all laws are empirical, special status of laws of ultimate coexistence is illusory.

a) But there's a consequence of the analysis which Mill doesn't draw (at least in assigned pages) but that's important for the seminar.

b) All laws must potentially terminate in natural kinds if they're to be exception free. (Is this right? I think so. Consider Mill's example -- discovery of a substance that resisted motion but didn't gravitate (414).)

i) But then, if one get a natural kind wrong, laws may be upset when it's found out.

III. MILL: Book ~~IV~~ V, Chapt. vi.

1. A philosophical language needs three sorts of terms of which first is a good Descriptive Terminology, one which possesses terms for all elementary sensations and feelings as well as for recurrent compounds of them (487f). [N.B. this is definitely a neutral observation language with atomic parts.] Then quote Whewell at length.

a) The elementary descriptive terms can be acquired only by presenting examples to the senses.

i) That's often useful but not necessary with terms for compounds. These can simply be defined (488).

b) For feelings and sensations that can't be directly confronted with external example, there can't be names. No way to tell whether two people are having same sensation (489).

c) Copious examples from the much admired example botany. Mention of chemical and geological terminology also (489).

2. Need also a term for shared properties of interest. These are often discovered during induction, perhaps by abstraction.

   a) Partly that's to save time and space, economy and perspicuity.

   b) Partly it's to focus attention, keep the combined terms in mind so as not to start from definition each time 490f).

      i) [Not clear to me that there's a real difference between a) and b).]

      ii) Gives examples: 'momentum' instead of 'product of ...' as though that were an abreviation rather than just a means of getting the numerical value of the momentum.

      iii) Speaks of the advantage of "Civilization is a different thing from Cultivation" of a volume about what writer means by 'civilization' again as though only convenience or economy were involved.

3. Finally, need a Nomenclature, i.e. a set of names for kinds, especially the <u>infima species</u>, kinds that are not made up from kinds (492).

   a) Mill holds that the terms in a nomenclature require, besides their connotation in ordinary sense, a special feature that makes them names of kinds (493f).

      i) Others say that such names have no connotation, only a denotation. (Term means only the particular group of plants, and characters are selected simply to identify the group's members.)

      ii) Mill replies that it doesn't mean the group for that would be dissolved if it were found not to be a species.

   b) It's true that we can choose different sets of characters according to convenience, the group remaining the same, but that's true of other sorts of general names.

      i) What's special about terms of a nomenclature is that their "meaning is unfolded, not indeed (as in other cases) by the definition [the set of characters] alone, but by the definition and the form of word taken together." (494)

4. Language should be designed to be used as mechanically as possible, where that can be done, and as little mechanically as possible where it cannot (494-7).

a) Discourse on the power of pure symbolism without meaning, as in the syllogism and algebra.

i) Also deplores current view that everything can be reduced to formalism.

ii) Works for deduction, at most, never for induction.

b) For ~~non-deductive~~ operational that omit meaning operations, what's essential is to keep meanings in mind. Good to form compounds from native roots as do German and Greek.

i) And keep terms in active use so that meaning stays fresh. Don't just read them in books.

IV. MILL: Book ~~IV~~ III, chapts. vii & viii.

1. Classication of objects aims for an order that conduces both "to the[ir?] remembrance and to the ascertainment of their laws" (498). [Note again the ambivalence between practical interest and what really there. There's much of it in this chapter.]

a) Goal demands holism. Can't classify "any one class properly except in reference to a general division of the whole of nature". Dykstra.

2. Natural classification are those which permit maximal generalization over members of classes (499f).

a) Best if one can use properties that are causes for many others, but they're often too hidden to serve well as diagnostics. (Observable and important are treated almost interchangeably as desiderata.)

i) Important that lots of properties be shared, but not the sine qua non. Some shared properties are superficial.

ii) Strange ambivalent paragraph on relevance of "important" characteristic. On one hand, they're dependent on particular enquiry in hand. On other, there are cases (Mill clearly cares most about them) when object is just to extend knowledge, and then shared properties and causes are what really counts.

3. Now long passage quoted from Whewell with which Mill will ultimately disagree (501f). Whewell says:

a) Classes are given not by characters but by types where a type is a central example of the class.

i) "The type-species of every genus...is then one which

possesses all the character and properties of the genus in a marked and prominent manner."

ii) Can use prominent characters to give a sort of stereotype (Putnam's word) but there will always be exceptions.

b) Mill disagrees, but weasels (503-5): "To determine them [species] by types would be as sure a way of missing the Kind, as if we were to select a set of characters arbitrarily.

i) Acts as though W had suggested no characters need be shared, in which case no generalizations would be available.

ii) Says that members of species " either possess that characters, or resemble the things that do", which is just to let examples back in again.

iii) If one character is missing, it get made up by others: cluster concepts.

c) Not clear that Whewell would have disagree at all.

4. Nomenclature should give characters in the name, but it can't usually be done except in chemistry.

a) Elsewhere usually give binomial name, the genus name first, then an identifying tag.

5. Now need for a serial order: when hoping to discover laws the species should be arranged in a series in the order of their possession of the characters characterizing the group in question (508f).

a) Again, old ambivalence about whether the order is dependent on the objective of the enquiry or actually out there in the things.

b) Method leading to the ordering is that of concommitant variation; leads to separation of characters generally conjoined.

i) Great chain of being is clearly in place throughout.

ii) Type species -- on that possesses maximum number of characters -- goes at top.

c) Finally, division into Orders, Families, and Genera. Mostly done by affinity, but this must be subordinated to the natural series (510f).

i) "The series of Animated Nature should be broken into parts at the points where the variation in the degree

of intensity of main phenomenon (as marked by its principal characters ...) begins to be attended by conspicuous changes in the miscellaneous properties of the animal."

V. WHEWELL: Book VIII, Chapt. i, §§ 1-10.

1. Both classificatory sciences and all application of words to things are predicated on things being like or unlike (467-70).

   a) Prerequisite to those judgements, however, is ability to identify individual, the tree in the forest, etc.

      i) We have to make the tree, among pattern of greens & browns. See outlines by drawing them.

      ii) Condition of unity of individual is permanence among unconnected changes in surrounding. [This is all very informal and sloppy.]

      iii) Object itself undergoes connected changes. Can describe these, generalize about them. These assertions are the condition of unity of object.

2. Group things into kinds by likeness. That process is constantly going on with all sensations. Can't categorize things as green or round without likeness.

   a) Can't be done by definitions because [note that we cross from things to words here]:

      i) They'd be given in words which, in turn, require definition.

      ii) Anyway, we're constantly identifying things we can't define, so <u>cannot</u> be tacitly depending on definition (471).

   b) But we do use words by virtue of much experience with properties of objects and the habitual connections of those properties (472f).

      i) Words aren't quite words if they express mere wanton collection of properties.

      ii) Must be able to use them for general, intelligible, consistent assertion.

   c) But uses may differ and the associated properties may differ with differences in use. (Whales as fish.)

3. Kinds come in grades: Body, includes living thing, includes animal, includes man (474).

a) It's general feature of language, not just science.

4. Why do we think things must have definitions even though we don't need them to use words 476f).

a) Because we seem to need them in order to reason about class members: can't reason if names are empty.

b) Need defitions of terms or acknowledged description of their referents.

c) These come about through process of induction from observations of the kinds themselves. That's for later.

d) Not clear where Whewell comes out.

VI. WHEWELL: Book VIII, Chapt. ii, §§ 4-12, 20.

1. Classification scheme depends on resemblances, but which ones.

a) Those which will permit us to enunciate general laws.

i) But need much prior experience for that, so it's not just a question of likeness (486f).

ii) Leads to notion of affinity among species, etc., where affinity is a deeper sort of resemblance, to be discussed later (488).

2. Artificial systems always presuppose natural grouping at a lower level (488f).

a) They use characters to group the natural kinds into higher level classes.

i) But can't be arbitrary for must not separate natural groupings, or must do so as little as possible.

b) Leads to big argument about whether genera are natural (490-92).

i) Yes in sense that that's the aim, and that there no conventional, standard set of characters.

ii) Though in the event, some of the characters used turn out to have artificial results.

c) Effort to preserve naturalness results in vagueness of what appear to be definitions. Descriptions use words like "usually", etc.. Admit of exceptions (493f).

i) Seems illogical to people whose concepts are born from experience with math, etc.

ii) But this natural historical mode is important for itself, too, not just sloppy.

3. Natural groups are thus not quite defined, but not left loose either (494-6).

   a) They're given by Types, where the type is a class member which possesses all the characters and properties of the genus in a marked an prominent manner (even though not all members of the class require them all).

      i) Not a boundary line but a central point within the class.

   b) Speaks of type-species (giving a genus), type-genus (giving a family), etc. But no talk of type specimen for a species.

4. Repeats lesson that artificial systems are not free-floating since they must restrict lower level groups. But they give up attempt at naturalness (496-9).

5. Distinction between the Systematick of a science and its Characteristick (510f).

   a) Former arranges objects by means of all their resemblances, other permits placing them (within the systematic?) by means of a fews characters.

      i) Latter is sometimes called the diagnosis.

   b) Two are the same in a rigorous artifical system.

MILL-WHEWELL DISCUSSION

I. WHAT IS A KIND?

1. A class whose members share an indefinitely large number of properties, thus which permits universal generalizations over its membership.

   a) Contrast is with classes whose members share only the specific properties (and the consequences of those properties) used to demarcate the class in the first place.

   b) Thus, there are classes which are not kinds.

2. Differences in properties don't correspond to differences in kind unless the subcategories formed by using these differences carry with them differences in correlated properties that are not derivable (causally or deductively) from the properties of the subclasses. (98f)

3. Coincidence of qualities doesn't count towards being a kind if the coincidence can be derived causally or deductively from shared properties.

   a) Only get differences of kind to the extent one gets lots of undpredictable, independent, properties with them.

4. Kinds conforming to these conditions may exist at various levels: e.g., species and genus.

   a) But there is a lowest level -- <u>infima species</u> or proximate kinds -- below which one can't go.

      i) No subdivision carries more extra properties than the kind itself.

   b) They're the ultimate constituents of nature, the starting point for explanation, themselves not further explicable.

5. A problem results:

   a) Mill needs distinction between something that's caused by the properties consitutive of the kind and those caused by something external to it.

      i) No problem when the cause is external to the organism. But case he needs is something that causes some people to be black, some daisies white, etc., but which would leave daisies or humankind a species.

      ii) His device will do, but it seems implausible to deny title kind to division due to a single basic property with lots of deductive or causal consequences, but that carries no other properties with it.

b) For explanation, see below.

II. ESSENCES OR JUST COINCIDENCE OF PROPERTIES

1. Essences were supposed to make things what they are. Their properties were the essential properties, and their consequences determined everything (except accidents) about the body.

   a) Mill says they've turned out not to exist.

      i) Therefore it's all coincidence of properties, but must still distinguish kinds from non-kinds.

   b) But can't have anything in the thing from which consequences follow, for that would be an essence.

      i) This reiterated barring, in defining kinds, of those properties which follow from others.

      ii) Shows up also in treating <u>differentia</u> and <u>propria</u>.

2. Another route to same place.

   a) Generalizations are about kinds, but kinds are known by properties, and several properties are needed to pin down a kind.

   b) To the extent that some of these properties are consequences of other, it's from the residues that the power of the kind flows.

   c) If we don't set a multi-property floor, we get back to a single property, from which nothing can flow.

   d) Unless it's an essence.

3. Two awkward consequences:

   a) There's a constant ambivalence between realism and nominalism.

      i) Kinds are just sets of properties denominated by groups of words.

      ii) But there's a special kind of set of properties given in nature and known from experience.

      iii) But there's nothing essentialist, no nature of the thing in the thing.

4. Also between pragmatism and realism.

a) Interest of language user determines choice of particular properties. 101 102

b) But if interests differ then, if that leads to different selection of members of kind, only one can be right. 500

III. NECESSARY AND SUFFICIENT CONDITIONS

1. Another difficulty for Mill is whether there are n & s conditions for being a member of a kind.

   a) In some passages the answer seems to be yes:

      i) He speaks of the connotation and denotation of terms, and he indicates that when connotation is different meaning is different even though denotation is the same (102). Cf. 101.

      ii) In same place he speaks of words "not otherwise connotative" acquiring connotation in technical use. Thus, 'white' in everday meaning is simply "attribute corresponding to a certain sensation."

      iii) Names of kind can't be of this non-connotative sort, for kinds would then be specified by types, not characters.

   b) But elsewhere answer appears to be no, for he insists all coexistence of properties is empirical.

      i) Speaks on 104 of unhesitatingly giving up blackness as an attribute if we saw a white one.

      ii) But he leaves us without any specified way of picking out crows, a fact which wouldn't be serious if he hadn't said "unhesitatingly" or something of the sort.

      iii) No acknowledgement that something like a research program is involved when you encounter a white crow.

2. Same problem shows up in response to Whewell on types vs. characters.

NOTES FOR MEETING 3

I. INTRODUCTION

1. Start with a few business items:

   a) Three weeks from now, 11 March, Chomsky at Cog. Sci. seminar, a must for Sylvain and something I think a number of us will want to be at.

      i) Can everyone meet on Thursday, evening, 12 March?

      ii) If not, take a slip of paper: Name and Evenings free. Will tell you next time where we come out.

   b) Sylvain and I have been debating the question of a mid-meeting break.

      i) Conclude we've got to allow time for a stretch, but don't want to lose momentum, have to restart.

      ii) So, five minutes around 8:30. If necessary, remind us.

   c) Do we have a student Marty Hiller? Need info later.

2. Now, my plans for the meeting.

   a) Clear we can't cover all the issue raised by Mill/Whewell reading. I'm going to try to concentrate on those that will keep coming up as we go on.

   b) And will be trying to use apparatus and speak to questions that Sylvain isolated last time:

      i)

Language				World
General names	=>	denote	=>	Objects
	=>	connote		
Attribute names	=>	denote	=>	Attributes

      ii) General terms thus denote members of classes which are specified by their connotation.

      iii) And these classes are of two sorts: Natural kinds (for Mill just kinds) and not.

      iv) Natural kinds being the ones with an indefinitely large number of shared properties.

   c) It's this division that raises Sylvain's five recurrent questions of which I now want primarily first two:

1. Role of language in the division and between classes and kind in our beliefs about it?

2. Role of the world?

3. Role of non-linguistic knowledge and belief (where non-linguistic means about things other than language).

4. Role of scientific or other practice?

5. Arguments and evidence for the above.

d) Something particularly to watch for is relation between the first two.

Wiggins seeking reference.

i) Semantic ascent: handle questions that arise about things by restating them as problems about language.

ii) Extent to which same problems arise in both.

iii) My own view that they're two sides of a single coin, something you'll also find early in Wiggins.

3. Against that background, plan for this evening is to concentrate on three sets of issues: partially touched on last time.

a) Begin with some questions about connotations, definitions, and the application of terms.

i) Then come back briefly to question of the independence of the properties which connote a kind term.

ii) Finally, the Mill-Whewell debate. Characters vs. types, connotation vs. denotation.

b) As much discussion as possible, but some issues more discussable than others.

i) Where I don't seem to be asking, please interrupt with questions, objections, or what needs saying.

II. CONNOTATIONS:

1. Start on connotations, and note that questions I want to ask can be phrased either to be about general names and their meanings or about the objects they denote and the characteristics those objects share. ~~If you see places where it makes a difference, shout.~~

a) Connotation of a general name is a set of properties.

Q! i) What's required of a property for it to be in connotation?

ii) Be shared by all members of the denoted class.

Q! b) How many properties must there be? Mill not always consistent, I think.

i) Not all there are. P. 102 on meanings of 'man'. Note it's meanings that differ, denotation remains the same.

ii) But enough to pick out the members of the class. P. 104 on black's not being in connotation of crow. "But if we were to discover a race of white birds, in other respects resembling crows, we should not say, These are not crows, we should say, These are white crows." (Passage on pp. 411f isn't really equivalent.)

iii) May be oveerinterpeting. Force of "in other respects resembling crows isn't clear".

iv) But looks as though knowledge of connotation is necessary and sufficient to identify members of kind just as it is for a mere class.

v) Or... ~~knowledge of meaning is necessary and sufficient to permit attachment~~ of word.

vi) This would be true for mere classes. The connotation tells you what's in the set. Mill uses it as a model.

vii) No evidence that he thinks anything more than the problem of factual correctness enters in the case of real kinds.

Q! c) Finally, may connotation include extra properties, e.g., both rationality and dentition?

i) Mill not clear, but what's a stake?

ii) Whether choice of connotation can result in necessary empirical regularities.

iii) A big issue as we go on. Meanings of words can't make things in the world true or false. Analytic truths aren't empirical.

iv) But there seem to be sorts of necessities, conceptual necessities that are encountered in science that are neither purely empirical nor purely linguistic. Keep your eyes out for them.

d) In short, our first big problems about natural kinds:

i) How does one pick out a member? What's meaning of corresponding term?

ii) Can one do it without introducing necessities into areas of apparent contingency in the process.

2. So far have dealt mostly with General names and the corresponding objects. Switch briefly to properties, which will take us from Book I to Book IV and introduce another recurrent problem.

a) A General terms are defined by specifying the attributes in its connotation, thus using attribute terms.

Q! b) How is an attribute term defined?

i) Mostly by exhibiting it, by ostension.

ii) Sometimes can have compounds (perhaps blue-green) or technical definitions, thus connotations. (P. 102, whiteness as color that's produced by admixture of all the other colors.)

iii) Notice they're not the same. Can recognize blue-green, but not the color that's produced by admixture of all the others.

c) First encounter with another basic distinction:

i) For Mill it's the distinction between the descriptive vocabulary which provides names for sensations and the other two parts of the vocabulary, which can be defined by means of it, by description.

ii) First can be introduced only by exhibit and then used to introduce others.

iii) For later figures, these building block don't have to be attributes. Could exhibit blue triangles and squares and teach you blue from that.

iv) We'll find other alternatives besides. Quine on primitive similarity.

d) But there must be starting points from which the list is built up.

i) And it's part of Mill's position that he knows what these building blocks are. Sensation terms.

III. INDEPENDENCE OF PROPERTIES OF KIND TERMS

1. Back to what distinguishes a mere class from a kind.

a) Kinds must be distinguished by an indefinitely large, presumably incompletely known set of shared properties.

i) And these must be ultimate properties, not derivable causally or logically from others.

ii) If properties thought to be ultimate turn out to be derivative, then class wasn't a kind, just a class.

b) Key passage in discovering what this condition means is on pp. 98f. Read it.

Q! i) Why does he say that? [Give people a chance.]

ii) Man is a kind, carries lot of properties with it. If the distinction of color can be derived from a small set of precisely specified properties, then it's only the undivided set that carries properties with it; separate parts don't introduce additional new unimplied properties.

Q! 2. That's a puzzling condition. Unique to Mill, so far as I know. Why does he introduce it?

a) Not altogether sure, but have a hunch, and it illuminates basic problem of natural kinds.

Q! b) Technical definitions aside, what's the basic intuition that leads to notion of natural kinds?

i) World comes that way, both organic and inorganic. Sets of things distinguishable from each other. The metals, the liquids, dogs and cats.

c) Suppose I'm asked to explain why these things and only these things exist and are as they are.

i) Roughly speaking, I'll derive them from other more basic things. Properties of atoms, molecules, space, etc. Gases & Liquids,

ii) But that only raises other questions. Why those properties?

iii) Every explanation has a floor. Can't go further; reach point where have to say, That's just the way it is.

iv) Brute fact. Literally or metaphorically, that's the way God made it. No further explanation is possible.

v) For the metals or the molecules, they're permanent stuff.

vi) For organic realm, God created first pair and they're bred true.

3. For Mill, if I've got it right, this is the level that science has to find.

a) It's the level of the ultimate coexistences of properties, the ones that aren't further explicable. These are the infimae species, the proximate kinds.

i) The level where the fundamental generalizations of the form All A's are B's are to be found.

b) These are the one's in terms of which everything else is to be explained.

i) If they're derivable, then we've not reached the level of basic kinds. Still have things to discover.

ii) If we attribute them to essences, we're just substituting a verbal cover for the fact that we've reached the floor. Remember the parody, Molière's doctor.

Q! c) Kick it around: Other suggestions.

4. This should also make it clear why we need kinds. It is they and only they which are subjects for the basic empirical generalizations.

a) All discoverable regularities are either about them or derivable from regularities that are about them.

b) They're the classes that ultimately support inductions.

i) If you get them wrong, inductive generalizations are likely to go wrong too.

IV. NOMENCLATURE

1. Now back to Book IV, where Mill discusses requisites of a philosophic language and insists on need for three sorts of words:

a) Descriptive terminology, already discussed.

b) Properties that are repeatedly encountered, perhaps discovered during induction.

i) Promote clarity, memory, and attention by introducing special names: thus 'circle' or 'momentum' rather than their definitions.

c) Finally, nomenclature, a terminology for kinds, especially for infimae species.

i) These terms provide a fundamental taxonomy of nature or some field of natural phenomena.

ii) Raise two related problems central to what's to come, and lead to some opposition between Mill and Whewell.

2. First issue is one mentioned earlier: how do you know you got the connotation right.

   a) Here it takes form: is the meaning of a kind term given by its denotation, the particular objects to which it applies, or is it given by a connotation (collection of characters, real definition) plus a metalabel that says it's a kind term? (493f)

      i) Those of you who've been exposed to Kripke and Putnam on causal theory will recognize that it's attempting to make sense out something like the first alternative, attaching meaning (more accurately, reference) to things.

      ii) Eliminate reference to properties as "superficial", and in the process reintroduce essences.

   b) So this opposition is about something.

      i) So what is this argument about? Why hold each side?

      ii) You're going to see it again. It's basic question.

Q! c) First, why hold that meaning is attached to denotation?

      i) Because further investigation may lead to change in the connotation -- the list of characters requisite to identification -- while the referents of the term remain the same. It's the latter that are meant.

Q! d) Mill's counterargument:

      i) Adjusting the connotation while the denotation remains the same is standard for defined terms also. Nothing special about kinds.

      ii) What is special is the rules of change. If class turns out not to be a kind, then term no longer applies to it. (Perhaps it goes with one subdivision; perhaps goes out of use, p. 102).

Q! e) What do you think?

3. Second issue emerges as disagreement between Mill and Whewell.

   a) Closely related because it again involves using a member of the class, this time a type, rather than a set of characters to determine meaning or membership.

      i) In practice, it arises principally at levels higher than species, but in principle it applies there too, and I'll discuss it at that level.

b) Problem, however, is no longer that of change, but difficulty in using characters to determine membership even at any single time.

i) Basic property of kinds, for Whewell, is that its members are like each other: similarity is for him more nearly a basic or primitive relation than it is for Mill.

ii) Remember, he asks why we think there have to be characters and definitions (475). Need them to reason but not pick things out. Speaks of "affinity".

iii) And this concern with similarity as such is another characteristic that's going to recurr in seminar.

c) So when he considers kinds, emphasizes that the characters provide a useful description, but that there are always exceptions to it. Characters thus aren't binding.

i) "Ovules very rarely erect"; "stigmata usually simple"; etc. (501)

ii) Membership in kind is determined by global similarity to a type specimen, i.e., member of the set that markedly possesses the characters of the class. (502)

4. Mill rejects this view, or says he does. (504f)

Q! a) What are his arguments and what do you think?

b) There have to be some characters, otherwise no general assertions. Can't all be global unanalysable resemblance.

i) O.K., but don't think Whewell disagrees.

c) Similarity should be reckoned with respect to characters. Quotations (α) of pp. 504, 505. All universal characters (tautology) plus most of those which admit exceptions.

i) But notice, he's given up n & s conditions. That's a real undercutting of where he's been.

ii) And he's probably missing what Whewell has in mind. When there are exceptions, can start looking for basis of resemblance. Don't have to have already given in existing characters.

iii) It's just that search for new ones when in trouble that he's previously suggested one does in cases of change. Why not here?

d) But if he'll admit that, as I suspect he'd have to if the argument continued, then he's admitted the role of examplary objects.

i) Not just a single one, as in Mill's types.

ii) But objects rather than just properties.

V. MISCELLANEOUS, IF TIME

1. There are many lesser issues that show up in the reading that will crop up again.

   a) Could wait for them, but since there's time....

2. Both Mill and Whewell insist that enterprise of taxonomy, supplying a nomenclature is intrinsically holistic. For Mill it's all of nature, for Whewell within a given field. (Mill 498, Whewell, 487f).

Q! a) Why?

   b) Is there a way around it?

3. Another set of issues, this time in Mill only: Whaffling between realism and nominalism/pragmatism.

   a) P. 98: Man's vs. nature's contribution; the interest vs. non-optional (higher purpose).

   b) P. 102: Biologist's vs. everyday definition of man.

   c) P. 501: The general interest vs. the particular one. Whale-fisheries, etc.

4. Why does this go on?

   a) Because essence has been replaced by connotation and man is has picked the connotation.

      i) Nothing but interest is left.

MEMO JAN 14 1986
ISSUES FOR THE SEMINAR.

This is a list of issues for the seminar. They are listed in the order in which we put them on the board. We should now add to the list, and order the items, and connect them to the readings, and flesh them up (out?).

1. Types of structures in which natural kinds are organized:
   - Hierarchical Structures (e.g. dogs are mamals; mamals are animals; etc. Maybe discuss in this connection some of the stuff around the tree of porphyry and Sommers' stuff (See Keil for references.
   - Lateral Structures (See Tom's stuff about ducks», geese« etc.
   - Nature of the relations and dependencies involved in these structures.
2. Projectibility:
   - Requirements for projectibility (Goodman etc. Also some parts of Quine.)
   - How this relates to topic below.
3. Real vs. nominal essences:
   - What is the issue or what are the issues. Realism, Putnam, etc.
4. Natural Kind *terms*:
   - What constitutes mastery of such a term or set of terms?
   - What determines the extension of such terms?
   - How are these terms related to the kinds themselves?
5. Are terms individuals or classes?
   - Do they require mereology or class logic?
   - Is there a difference here between the types of entities in physics and those in biology?
   - Is the name of a kind attached to a class or to a "scattered individual"?
6. What is an individual?

- What sorts of principles of individuation are there?
- What do such principles do?

7. What makes species species?
   - Historical vs. non-historical properties.
   - Intrinsic vs. relational properties.
   - Possible-world-indexicality.
8. Differences across disciplines about all this.
9. The pragmatics of taxonomies.
10. Artifacutal kinds vs. natural kinds.

Characteristics of natural kinds:
support laws, counterfactuals, & all that
implies. (Aristotle??)

Philosophy 24.810

Meeting 1 -- 2/4/87

I. INTRODUCTION:

1. Course 24.810. I'm Professor Kuhn, this Bromberger.

2. Organizational meeting -- won't use full time.

   a) Want mainly to go over mechanics of course, give you some indication what will be going on, and get information from you that will help us manage it bette4.

   b) Will then talk informally for a bit about nature of some of the issues.

3. I've agreed to lead off, but you'll discover we're both on deck at all times.

II. SYLLABUS:

1. Start by going over syllabus. (DISTRIBUTE)

2. Subject is NATURAL KINDS about which more later.

   a) Hot topic now, much literature.

      i) And its an old chestnut, traceable at least from Locke.

      ii) We'll pick it up with Mill and Whewell in mid-19th century.

   b) But until recently, been out of fashion. No index entry in Encyclopedia of Philosophy.

3. Neither of us is an expert on it, but both gotten interested for reasons to which we'll also return in a bit.

   a) Want to explore subject. Do it by discussion of common reading, not by listening to each other or to you lecture.

   b) Next week Bromberger will lead discussion -- get us started -- but each of us is asked to spend time thinking about how we'd have set it up.

      i) Vicarious practice for the real thing. What is it that needs to be understood -- what are main points.

      ii) And wha-t is it that's hard to understand, that needs special unravelling.

c) Then, starting in next substantive meeting, want one of you to take primary responsibility whenever possible.

i) One of us will also be centrally involved each week, and student must get together with that staff-member early.

ii) But you do as much as possible. Part of the assignment. Everyone involved with material at all times.

4. Rest of the assignment will be weekly reading, which you all must do, and also one or two term papers.

a) Excepting term papers that applies to auditors too.

i) Don't care a bit whether you're enrolled, but no tourists. Auditors do all reading, perhaps also serve as discussion leader.

ii) And, after early experiment, regular attendance. No dropping in and out depending on subject.

5. Now, brief look at reading list, which is pretty firm for first five meetings after this one. By then we'll know better what's feasible, what not.

a) Start with Mill and Whewell. Nice, clear overview, which raises most of problems we'll deal with during terms (though not most of the solutions). Lovely starting point.

i) Two weeks to get it solidly undercontrol. May not be needed, but better than erring in other direction.

b) Then Wiggins, about 110 pp. of <u>Sameness and Substance</u>, again two weeks.

i) Not clear, not straightforward. We'll all have trouble, especially those with little or no background. But full of important ideas. Start when you can to give yourself maximum opportunity, and look at the advice on reading list.

c) Then a week on some classic contemporary material that displays problems in contemporary form, making, we hope, a neat package.

i) That's the Quine article and Goodman chapters.

d) After which turn to recent material in philosophy of biology, where just the problems we've been looking at it the abstract turn out to be a matter of scientific debate.

i) May seem an odd turning, but you'll discover in next week's reading that biological species have always been

standard example of natural kinds -- I'll use them that way in a moment.

ii) Now biologists are suddenly wondering whether they're really natural kinds at all.

iii) And form of that worry raises questions about whether there are natural kinds at all.

iv) Or it does for me. Not sure Sylvain goes that far.

e) That's what we'll go on to. Natural kinds in physical sciences. So-called causal theory of reference. Kripke, Putnam, and a bit of Kuhn and Bromberger.

i) If there's extra time -- which doesn't seem altogether likely -- we may look at some other material. Prototype theory. Phonology. But no need to plan now.

6. Well, that will all make more sense when you know what natural kinds are and what sorts of issues they raise: will say just a bit in a moment.

a) But first, need some information from you. Questionnaire to be handed in at end. **BOARD**

b) **Name:____; Field & Status:____; Address & Phone:____.**

Previous Philosophy:_____; Other Relev. Bkgrnd:_____.

Nature of Interest in Seminar:_____;

Volunteers for 2nd meeting:_____? Other meetings:_____?

7. Leaving one last organizational issue: When can we meet?

a) This is possible, but evenings are tough for us. Are any afternoons free?

III. NATURAL KINDS & OUR INVOLVEMENT:

1. Now try, very informally, to orient you to some of the issues that arise in the seminar, where some of the reading fits in.

a) You'll get it all again in more precise and developed form.

i) So not yet time for discussion, but do ask questions.

b) I'm going to start with the obvious: What are natural kinds?

i) But before speaking to it directly point out that it's really two questions in one, and it's often important to keep them apart.

ii) It is, on the one hand, a question about things -- in particular about what properties they share -- and, on the other, a question about the words that refer to those things -- what do those words mean, how is their reference determined.

iii) In the seminar we'll start out talking about things and get to words later.

iv) Here I'll start out in the same way, but will inevitably find myself sliding back and forth between the two.

c) Roughly, they're classes of things, of entities.

i) A way of putting it that overlooks the fact that some natural kinds are denoted by mass terms: thus water.
ii) And also ignores possibility that perhaps one will want to say that color, for example, is a natural kind.

d) So, for present purposes, start with biological species as natural kinds, thus dogs and cats.

i) And also physical natural kinds: gold, water, electrons, and other sorts of material.

e) That's what makes them kinds. What makes them natural is, again roughly speaking, that they're somehow God-given.

i) They're not classes of things arbitrarily thought up by man or put together by history.

ii) Thus, not the coins in my pocket; not the class made up of my feet and Sylvain's head.

iii) And not even the historical class, the members of the seminar.

f) Well, that's the general notion, and it raises immediately two questions that will surely be coming up, though not necessarily central.

i) What about artefacts: tables & chairs, for example, or automobiles? Are they natural kinds?

ii) And what about collections of natural kinds, animals for example? Are they natural kinds?

iii) Problem in each of these cases being that man enters as fabricator or as sorter in the construction of the class.

2. Now, two central questions about natural kinds:

a) What is it that the members of a natural kind share?

i) They're similar, they overlap in their properties or attributes?

ii) But which properties and how many of them? You'll find Mill and Whewell disagreeing, and the disagreement has continued since. Causal theory is only most recent attempt to resolve it.

iii) Are there necessary and sufficient conditions for belonging to a kind?

b) And whatever the answer to that question, how are we to understand the sharing itself. Can we explain why it occurs.

i) Standard answer is in terms of sharing of essence. All members of a natural kind have the same essence.

ii) On which may or may not be known, but which must exist if the members of the class in question constitute a natural kind.

iii) But what's an essence? Are they something real in the bodies involved? Or are they nominal, just another way of saying that properties are shared?

3. Now another tack: what difference does it make whether an object belongs to a natural kind or not?

a) Again, roughly, natural kinds are the sets of things that support universal generalization.

i) They're the subjects of scientific laws; they support counterfactual statements.

ii) The class of metals share properties, but the class of things in my pockets need not.

iii) If the object in my pocket is metal, it will expand when heated, but not if the object is in my pocket it will expand when heated.

b) Or, another way to put the point, natural kinds are the sorts of things that permit induction.

i) If a number of things of the same kind behave in a certain way, all other things of the same kind probably do too.

ii) What's that about?

c) This is issue you're going to see most clearly in the Goodman and Quine reading.

i) Sometimes known as the issue of projectibility.

4. Now still another sort of issue, one that will emerge as crucial right after the Mill and Whewell material.

   a) We've been talking about the sameness relation between things, same kind of thing.

      i) But there's another sameness relation: same thing, same individual.

      ii) What makes two showings of an object, showings of the same thing?

   b) Generally thought to be a quite different issue, but may not be.

      i) Raises, for example, same question about what properties have to be shared?

      ii) Standard answer has been none. What makes an individual self-identical is simply spatio-temporaral continuity. Thus different, no question of sharing properties.

      iii) But you'll find in Wiggins a quite powerful argument that brings to sorts of sameness back together, and related them both to something like spatio-temporal continuities.

   c) It's complicated. Won't try to hint at it, but do want to suggest two reasons that make it specially interesting to us.

5. First one is what's been going on in Biology.

   a) Species were paradigm examples of natural kinds.

      i) Now, people worrying about evolution have such a bad time with shared properties that they've begun to say that species aren't natural kinds after all.

      ii) No set of conditions that all members and only members and only members satisfy.

      iii) No generalizations that hold for all and only members of the same species.

   b) What get substituted is the concept of a species as an individual, one that can be identified only by the sorts of spatio-temporal continuities that have previously beeun appealed to only for the identity of an individual.

      i) This is one source of a special appeal to Wiggins' case.

6. Another is its relation to causal theory of reference.

   a) In it's origin its a theory of reference for proper names.

      i) One that makes the reference entirely dependent on criteria of spatio-temporal continuity back to the original act of baptism.

      ii) Thus a theory for individuals.

   b) What's made it seem specially important is the attempt to extend it to natural kind terms.

      i) Talk for them also about acts of dubbing and the subsequent process of historical development.

      ii) So, again, spatio-temporal continuities get into the act for natural kinds.

      iii) In this case, not just biological species, but gold, and water, and heat.

   c) Which opens up even physical natural kinds to the same sorts of difficulties that have been encountered by species, and raises questions about whether there's anything at all that can be expected to satisfy universal generalizations or laws.

      i) That's where we're headed, and I won't try to get closer to it now.

      ii) Except to say just a brief biographical word about my own concern with it.

      iii) Sylvain will do the same, and you'll note they're quite different, something that should help make the seminar interesting.

IV. AUTOBIOGRAPHICAL POSTLUDE:

1. Philosophers of science used to believe that there was a rock bottom descriptive language in which to phrase observation reports uncontaminated by theory.

2. **Noone believes quite that any more.**

   a) One here's people talking about language being theory laden.

      i) Putnam somewhere speaks of descriptive language as soft all the way down.

   b) One of the reasons for this sort of talk has been the

experience of people like myself who looked at the sciences historically and found how deep descriptive changes go.

i) I even went so far as to talk of the world's changing at times of fundamental conceptual shift, and I still think that wasn't all wrong.

3. When I talk about such things now, I'm inclined instead to talk about changes in taxonomy. Resorting the individuals into different boxes in the process of making the transitions into different laws.

   a) And that's just a way of saying that times of conceptual reorientation are times when, in some area or other, natural kinds change, different sets of things become the support for natural laws.

   b) There are other things one might say instead, and when the time comes I'm sure you'll here about them.

      i) But it is that way of looking at older work of mine that brings me to the topic of natural kinds.

      ii) And it's some of what I've discovered in preparation for it that make me especially excited about the prospect.

Students: 24.810

Enrolled: (12)

Alexander, Matt	Linguistics, grad. stud.	Some phil.
Bao, Zhiming	Linguistics, grad. stud.	Not much phil.
Bumpus, Ann	Philosophy, 1st year.	
Cohen, Philip	Biology, undergrad. sen.	5 phil subj.
Dyer, Susan	Philosophy, 1st year.	
Hegarty, Michael	Linguist -> Phil	Phil. M.A.
Johnson, Rolf	Philosophy, 1st year.	
Klaus, Beate	Philosophy, 2nd year.	
Lee, Jintae	Computer science, AI	M.Phil, PofS
Picard, Michael	Philosophy, 1st year.	
Tollaksen, Jeff	Physics, undergrad. sen.	2 phil. subj.
Toney, Jeff	Chem/Mol.Bio., Post doc, Harvard Med School	Some reading

Audit: (8)

Bakken, Bent	Systems dynamics, 2nd yr.	Bits of PofPs.
Bloom, Paul	Cog. Sci., grad. stud.	Little phil.
Brew, Douglas	Geo/Paleo visiting schol.	No phil.
Cowan, Ann B.	Much phil. and good places,	MA in Anthro
Craig, David	Philosophy, 4th year.	
Goldman, Ricki	Media Lab, doing Ph.D with Papert	Phil of Educ.
Heckman, Stan	Earth, Air, etc. grad.	Not much phil.
Ritvo, Harriet	Fac. Writing Program, History of taxonomy	No phil.

FINAL DISCUSSION

1. What are natural kinds?

    a) Is there any substitute for notion that they're what support laws, inductions, etc.

        i) Relation to projectibility.

    b) Are there natural kinds at level of genera, higher levels, etc.

    c) Can natural kinds intersect, and does the intersection form a natural kind?

2. What is role of nature vs. role of language?

    a) Repeated appearance of concrete objects:

        i) Whewell (vs. Mill) on type specimen, but Mill on elementary descriptive terms which must, he insists, be known by direct acquaintance.

        ii) Wiggins (10) on real vs. nominal predicates.

        iii) Kripke and Putnam on baptism.

        iv) TSK on ostension.

    b) Mill on role of man in deciding how to classify, what characters to use.

    c) Are there natural kind terms?

        i) Mill says yes.

3. The key role of the time dimension.

    a) Wiggins:

        i) Substance as a key primitive.

        ii) Thus, continuous spatiotemporal worms.

        iii) Sortals and individuation.

    b) Biology.

        i) Again, role of spatiotemporal continuity.

        ii) And again in tension with shared properties.

        iii) After which the problem of transition from generation to generation still feels acute.

c) The parallel problems in Kripke.

i) Role of origins and of biological connections in intuitions of necessity.

d) TSK on SSR as a consequence, not of historical data, but of historical process.

4. Essence, nominal and real.

a) Mill insists on nominal essences only but winds up requiring n & s conditions, so that all the problems of essence are back.

b) What gets packed into Wiggins' sortals makes them strong (though perhaps still nominal) essences.

5. Similarity.

Chapter 14

Rational Ignorance

Sylvain Bromberger

14.1 Introduction

Different people know different things and are ignorant about different things. For instance, much that inhabitants of Massachusetts know and don't know is different from what inhabitants of Provence know and don't know, and much of what physicists know and don't know is different from what linguists know and don't know. These differences are to a large extent traceable to differences in circumstances and opportunities. But some are traceable to deliberate choices: people can and do choose to find out certain things and to remain ignorant about others. And they don't all make the same choices, even when the same choices are available to them.

In this chapter, I want to explore some aspects of these choices, and of the constraints that limit them. My ultimate reasons for being interested in them has to do with concrete issues in epistemology and the study of cognitive development. I will say a few words about those before concluding. But they will not be my major focus. For the time being, I want to concentrate on preliminary conceptual matters that need to be appreciated

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before we can make real progress with the more concrete problems.

Let me set the stage with a few stipulative definitions.

1. IGNORANCE is the relationship between a person P and a set of questions Q when P does not know the correct answer to any of the members of Q and has no strong views as to what the correct answer to any of them is.[1]

2. A PERSON'S (P's) IGNORANCE AT TIME t is the set of questions that is the maximal Q_t to which P stands in the ignorance relation at time t. (I use 'Q_t' as a variable ranging over sets of questions that constitute someone's ignorance at time t.)

3. A person is LESS IGNORANT AT TIME t_2 THAN AT TIME t_1 if and only if $Q_2 < Q_1$, i.e., if and only if there is at least one question that is a member of Q_1 but not of Q_2, but not vice versa.

   A decrease in P's ignorance between t_1 and t_2 can come about by chance or it can come about as a result of deliberate action. Deliberate action requires two stages: first, the selection of a question from Q_t, and then, secondly, the carrying out of whatever activities are required to get the answer to that question.

4. The first stage of a decrease of ignorance is RATIONAL if and only if it consists in selecting a question in a rational way, i.e., with a view to maximize values and to minimize costs.

5. A person P is a RATIONAL IGNORAMUS AT TIME t if and only if at time t, P has and uses a rational policy for selecting the next question to be eliminated from P's ignorance.

In what follows[2] I will explore implications of these definitions. How much and what sorts of things must one know to be rationally ignorant?

[1] In what follows, I will indulge in a number of idealizations and simplifications that a lengthier discussion would avoid. For instance, I will pretend that all questions have at most one correct answer. This is blatantly false, but should not affect the main thrust of the discussion. I will also disregard the fact that one may be said not to know the answer to a question when one mistakenly takes a false answer to be a correct answer. In fact, I will use the word "know" rather loosely.

[2] Most of these topics will be discussed in a larger work still in preparation.

How do what values come into play in the choices of a rational ignoramus? What problems must a rational ignoramus solve?

14.2 Knowing what one does not know

Since a rational ignoramus must deliberately select from his ignorance at time t one question for elimination, he must be able to survey the membership of his ignorance. How else can he establish his preferences? But to be able to do this, our ignoramus must be quite knowledgeable!

14.2.1 Representation and understanding of questions

He must be able to represent questions, i.e., be able to formulate and to understand interrogative sentences in some language.[3]

Off-hand, that may not seem to be a very constraining requirement. Most people we know will easily meet it. Even so, we should be mindful that it is a very complex requirement. In fact, at present, no semanticist can fully describe it.

To get an inkling of the difficulty—and without even considering what is required to be able to formulate questions—compare what is involved in understanding a declarative sentence with what is involved in understanding an interrogative sentence. To understand a declarative sentence, one has to be able to determine what semanticists call its *truth conditions*, i.e., what has to be the case if the sentence is to be true. What that involves is not understood completely either, but at least there are a number of theories around that give us a very good inkling. But what constitutes understanding an interrogative sentence? What constitutes understanding

(14.1) What is the distance between London and Paris?

or Heidegger's beloved question

(14.2) Why is there something rather than nothing?

[3] I use "interrogative sentence" to refer to linguistic entities and "question" to refer to what these linguistic entities express. Some complex issues related to the existence of propositions, senses, Fregean thoughts, etc. are masked by this terminology. However, nothing in what follows hinges on the stand one takes on any of these issues.

It can't be knowing truth-conditions, since questions do not have truth conditions.

Could it be knowing (or being at least in a position to determine) the truth conditions of every possible answer[4] to the question? For instance, in the case of the first example above, could it be knowing the truth conditions of

(14.3) The distance between London and Paris is one inch.
(14.4) The distance between London and Paris is two inches.
(14.5) .....

and so on *ad infinitum*?

That hardly seems plausible: we do understand many questions whose possible answers we are in no position to state. Think of the second example above. Or, for that matter, think of

(14.6) What does one need to know in order to know that one does not know something?

How many of us could state all the possible answers to that one, even if we had all the time needed to utter them? And in any case, knowing these truth conditions would not be enough. We would also have to know of each possible answer, that it *is* a possible answer. And that is very different from knowing truth conditions. Thus, understanding an interrogative sentence cannot come down to knowing the truth conditions of each of its possible answers.

14.2.2 Knowing of each item of ignorance that it is a *bona fide* item of ignorance

Our ignoramus must not only be able to formulate and understand questions, he must know of some of them that they represent genuine items of ignorance, i.e., he must know or have good reasons to believe that he does not know their answer.

[4] "Possible answer" is a semantic notion that covers correct, incorrect, plausible, implausible, etc. answers and excludes only things that are not answers at all.

To know that one does not know that, one has to know quite a bit!

First one has to know, or at least believe, that the *presupposition* of the question is true. Let me explain with an example:

(14.7) What is the age of the King of France?

That question does not represent a genuine item of ignorance. No one does not know what the age of the King of France is. Not because everyone knows: no one knows what the age of the King of France is either, and not because it is a universal mystery, but because there *is* no King of France. The question presupposes that there is a King of France, and because there isn't, the question has no answer.[5]

Contrast that with

(14.8) What binds neutrons and protons in an atomic nucleus?

It presupposes that there are atoms, protons, atomic nuclei. Since this is true, the question can—and in my case, does—represent a genuine item of ignorance.

Put somewhat roughly, the presupposition of a question is a proposition to the effect that some thing or things of a certain character exist that the question is about.[6]

To know of a question that it represents a *bona fide* item of ignorance, one must thus not only know that one cannot answer it, one must know that its presupposition is true.

Second, one must know that *the question arises.*

What I have in mind here is—like so many of the other topics in this discussion—complicated to analyze, but easy to illustrate. So let me illus-

[5]Of course, someone who thinks that there is a King of France might think that he does not know. But he would be mistaken. Admittedly, such a person will gain new information by learning that there is no king of France. But to learn that is not to learn the age of the King of France. Similarly, there was a time when people thought that they did not know the specific gravity of phlogiston, the ratio of fire to earth in wood smoke, the distance from the earth to the sky. Later discoveries did not cure that ignorance; they dissolved it.

[6]That "some thing of a certain character" need not be a physical object but can be a state of affairs or fact or event. Thus, "Why does copper turn green when exposed to air?" presupposes that copper turns green when exposed to air.

trate. Consider

(14.9) How long is the number 5?

or

(14.10) What is the main verb of an electron?

or

(14.11) What is the square root of the Empire State Building?

None of us, I presume, can give the answer to any of these questions, but not because we do not know the answer, but because there are no answers, there are no right answers, no correct answers. On the other hand, there is presumably an answer to the question

(14.12) With how much force does the earth attract the moon?

although once upon a time that would have seemed crazy to people.

Knowing that a question arises (as I use the term) requires knowing general principles of a peculiarly abstract kind, e.g., that all objects attract each other with a force that has magnitude and direction (hence the question, "What is the force with which the earth attracts the moon?" arises), that atoms have mass (hence the question "What is the mass of a lithium atom?" arises), that every event has a cause (hence the question, "What was the cause of the fire?" arises for every fire), that objects have inertia (hence, "What force is responsible for change of direction or velocity?" arises in connection with every deviation from straight uniform travel). Let me call such principles *question raising principles.*

Knowing that a question arises is very similar to knowing that the presupposition of the question is true. The difference lies in the fact that knowing that a question arises requires knowing general principles of a relatively high level of abstraction, whereas knowing that the presuppositions hold requires knowing that a certain thing or certain things exist (or that certain events have occurred, or that certain facts hold).

Third, one has to know that one does not know the answer! That covers

many different kinds of situations.

There is the kind of situation in which one is able to cite many possible and plausible answers, but has absolutely no reason to prefer any of them, has no evidence that favors one above the others. That is probably how most of us stand with regard to

(14.13) What is the distance between London and Paris?

or

(14.14) What will be the name of the last person admitted to next year's freshman class at MIT?

To recognize instances of it, one must, among other things, be able to evaluate and to compare evidence.

Next, there is the kind of situation in which one does have evidence that makes some answer more likely than others, but the evidence is not conclusive, e.g.,

(14.15) "What will the weather be like tomorrow?"

To recognize that sort of situation, one must be able to determine when evidence is conclusive, or at least strong enough to warrant the belief that one knows the answer.

Next still, there is the kind of situation in which one can come up with only answers one knows to be false and yet has reason to believe that the question is sound, i.e., arises and has true presuppositions. Until recently, no one knew why the moon looked larger when near the horizon than when right overhead. A number of theories were around, but each was refuted by good evidence, and none was known that had survived refutation. To recognize that type of situation, one must have all the knowledge mentioned above, and furthermore, be able to determine that a certain set of possible answers is not complete, even though one cannot extend it.

14.2.3 Knowing enough about what one does not know

Where are we? We are examining what an ignoramus must know in order to be able to function as a rational ignoramus. We have said that he must be able to represent items in his ignorance. We have said that he must know of these that they are items of ignorance. But of *how many* items of his ignorance should he know this? How large a list should he have? Which questions from his ignorance should it contain?

Unless rationality can require the impossible, it cannot be a complete list. It cannot contain every member of his ignorance. That follows from fairly straightforward considerations. There are an infinite number of objects, events, and states of affairs whose existence any individual is doomed not to know about. Each of these gives rise to an indefinitely large number of questions. And he is thus doomed to remain ignorant about the fact that he does not know the answer to those questions.

It also follows straightforwardly from the fact that the cardinality of any expressible list cannot be as large as the total number of objects about which questions arise. There are non-denumerably many real numbers. About each, the question e.g.,

(14.16) What is the largest prime natural number smaller than it?

arises. But of course, these cannot all be formulated in one language, since at most denumerably many questions can be formulated in a single language.

Finally, it follows from the fact that many questions implicate concepts of a very special kind, i.e., *determinables*,[7] of which the following are examples: 'distance in inches', as in

(14.17) What is the distance in inches between John's two nostrils?

or 'mass', as in

(14.18) What is the mass of the moon?

[7] No "theory" of determinables, i.e., explicating their semantics, is currently available, and hence the class is difficult to demarcate, though its most typical members are easily recognized.

or 'D-structure', as in

(14.19) What is the D-structure of 'Jean est facil a convaincre'?

'Voltage', 'chemical composition', 'anatomical structure' are further examples. Determinables can express functions that map objects on questions. But to grasp a determinable, one has to have a fair amount of theory. Thus, before Newton's gravitational theory became available, no one was in a position to entertain the questions that we are able to express in English by using the expression 'gravitational mass'. Aristotle—rational though he was—not having the concept of mass, would not have been in a position to know that he did not know the answer to

(14.20) What is the mass of the Parthenon?

or to include it in a specification of his ignorance. It seems unlikely that anyone will ever grasp all the determinables that generate sound questions about actual objects, events, or states of affairs.

To what subset of his ignorance must an ignoramus then apply his policy to be deemed rational? The enumerable subset consisting of all and only the questions that he is in a position to formulate and to entertain (i.e., whose presupposition he knows to be true, and whose determinables he has grasped, etc.)?

But the construction of such a list would require an infinite amount of time, since the list would include e.g., questions about each natural number, i.e., the list would be infinitely long: rationality would defeat itself by preventing itself from getting off the ground!

There may be a way out of this paradox.[8] I do not know what it is. So let us set it aside for the time being by dropping the notion of rational ignoramus at time t as too strong for present purposes. Let us replace it with a weaker notion—that of a rational ignoramus relative to a set of questions Q at time t:

(14.21) A person P is a *rational ignoramus at time t with respect to a finite*

[8] There may be a rational policy whose application does not require that questions be selected or eliminated or ranked one by one, but that treats some of them *en bloc*, so to say. In all the cases that I have examined, difficulties similar to the above re-emerge.

set of questions Q if and only if, at time t, Qt is an *accessible*[9] proper subset of P's ignorance, and P has a rational policy for selecting the next question in Q to be eliminated from P's ignorance.

Let us now think about that rational policy. It is presumably designed to maximize certain values and to minimize certain costs. What value should it seek to maximize?

14.3 The value of questions and their types

14.3.1 Intrinsic value and added value

The correct answer to a question can be of value to us for many different reasons. For present purposes, I will sort these under three headings.

It may provide us with an *intellectual* benefit, i.e., satisfy our curiosity. There are different degrees of curiosity; hence, from that point of view, answers to different questions may turn out to have different values. Let us call that the *gosh value* of an answer, viz. a measure of the intellectual pleasure derived from coming to know the answer or maybe the relief of no longer not knowing the answer!

We may also prize the answer to a question because it enables us to construct something, to repair something, to find something, etc., i.e., to obtain some *material* benefit. Let us call that the *cash value* of the answer.

I have defined the gosh and cash value of an answer in terms of certain properties of that answer. Of course, one may not know the value of the answer before coming in possession of it, i.e., while still contemplating the question. Yet estimates of such values should obviously play a role in any policy designed to select questions to be answered. To refer to such estimates, when we talk of *the gosh and cash values of a question* (rather than of an answer), let us mean the estimated value of the gosh and cash value of the answer to that question.

Let us call the sum of the gosh value and cash value of a question the *intrinsic value of the question.* Intrinsic value is obviously a notion that has to be relativized to individual preferences, to time, to background

[9] I.E., P can express each member of Q, P knows—or has at least good reasons to believe, and no good reason not to believe—that its presupposition is true, P knows that it arises, P is in a position to know that he does not know its answer.

knowledge, and perhaps to other circumstances. So when we talk about the intrinsic value of a question, let that be shorthand for the intrinsic value of that question as estimated by our hypothetical rational ignoramus in the light of his circumstances at a time when he is using his selection policy.

14.3.2 Added value

Besides having gosh and cash value, an answer may be of further value because it puts one in a position to obtain answers to other questions with values of their own. Thus if one knows the width and length of a floor, and one knows the formula for computing the area of a rectangle, one is thereby put in a position to find the answer to "What is the area of the floor?". If the latter is of value, then surely some of that value should accrue to the answers to "What is the length of the floor?" and to "What is the width of the floor?". Let us call that the *added value of the answer*. And let us use *added value of the question* as shorthand for the estimated value of the answer relativized for preference, time, background knowledge, and other relevant circumstances.[10]

14.3.3 Value adders

Questions get added value through devices and algorithms that transform their answers into answers to other questions, i.e., through value adders. Let us look at them for a bit. They come in various shapes and forms. Consider

(14.22) All men are mortal.

and

(14.23) Is Fido a man?

[10]These "other circumstances" include many sorts of contingencies that cannot be discussed here. For instance, added value depends not only on the availability of value adders—see below—but also often on the availability of answers to other questions required by the value adder.

If the answer to (14.23) is 'yes', then (14.22) puts one in the position to compute the answer to

(14.24) Is Fido mortal?

If the answer is 'no', then it does not. That sort of a value adder is a *gappy* value adder, or at least gappy for a certain question. It generates added value to that question only for some answers and not for others. What the correct answer is matters to it. If it does not like the answer, it does not add value. Contrast that with the pair

(14.25) The distance between A and B is twice the distance between B and C.

and the question

(14.26) What is the distance between A and B?

Here, (14.25) puts one in the position to compute the answer to

(14.27) What is the distance between A and B?

no matter what the answer to (14.26). It adds value to the question (14.26) no matter what the answer turns out to be. Let us call that sort of value adder an *erotetic* value adder relative to a certain question.

But now consider the formula for the pendulum, i.e.,

(14.28) $T = 2\sqrt{\frac{l}{g}}$.

It will add value to the question

(14.29) What is the length of the pendulum?

for any pendulum under consideration that is influenced only by local gravitational force. But it is much more powerful than that. It will add to the value of any question (no matter what the answer) constructed on the determinable

(14.30) What is the length of ... (name a pendulum)...?

the value of the corresponding question of the form

(14.31) What is the period of ... (name same pendulum)...?

Let us call that sort of value adder *super-erotetic* value adders.[11]

We have here a hierarchy that can clearly be extended further. Thus, differential equations of a certain kind will generate super-erotetic value adders, and theories—or at least certain kinds of theories—will in turn generate super-super-erotetic value adders.

14.3.4 Science and value adders

Many contributions to science are designed—either explicitly or implicitly—to provide us with value adders. The value adders they provide can vary in attractiveness along a number of dimensions: they can vary in reliability, in precision, in subject matter, and of course, in power along the hierarchy that I have just sketched. They can vary in the amount of gosh and cash value of questions under their jurisdiction. The practical sciences are built around a concern about questions with high gosh and cash value.

Theoretical sciences seek powerful value adders. Primitive sciences tend to wallow at the level of gappy value adders of low precision, questionable reliability, remote subject matter, little cash value—but very high gosh value. Theology, much psychology, a fair amount of what comes under the heading of semantics and pre-generative linguistics belong here. Of course, this does not mean that they should not be pursued: low level sciences have a way of blooming into high level ones! And high level sciences like physics, biology, chemistry, and more and more of linguistics of the right sort, spew forth value adders that shine in all directions: precision, reliability, power, and intrinsic value of many of the questions in their domain.

But value adders vary not only along the valuational dimensions just described. They also vary drastically in ontological character and in the

[11] Super-erotetic value adders turn into erotetic value adders when provided with specific objects as arguments. In the case at hand, when e.g. "... (a pendulum) ..." is replaced by an expression referring to a specific pendulum.

competences that they demand of their users. To see this, let us look briefly at some banal examples.

Models

What is a model? Think of small models of a big airplane, or of plastic models of DNA molecules, or of maps. What makes one of these objects a model of another? The fact that by finding out certain things about the model one can then find out certain things about the thing modeled: by counting the stacks on the plastic model of the Queen Mary one can find out the number of smoke stacks on the real Queen Mary. By counting the number of black spheres on a wire and wood model of methane, one can find out the number of carbon atoms in a real methane molecule.

Artificial models are designed with just that sort of relationship in mind. To fix ideas, think of maps and of the territories of which they are maps. By measuring distances on a map, one can find the answer to the following sorts of questions: "What is the distance between this point on the map, and that other point on the map?" Anyone versed in map reading can translate the answer to such questions about the map into questions about the territory mapped, e.g., "What is the distance between this place in the territory and that other place in the territory?"[12]

Thus, as a first approximation, we might define a model as follows:

(14.32) M is a model of O relative to a set of triples $\langle Q_m Q_o A \rangle$ if and only if in each triple Q_m is a set of questions about M, Q_o is a set of questions O, and A is an algorithm that translates any answer to a member of Q_m into an answer to a member of Q_o, and *correct* answers to the former into *correct* answers to the latter.

In the case of maps (as in the case of other models), the set Q_m and the set Q_o are sets whose members are built around common determinables (e.g., 'distance'). But that is not an essential feature. Population graphs, for instance, do not have it.

Maps are clear instances of super-erotetic value adders. So are other

[12]Of course, many questions that can be answered by looking at the map do not translate into questions about the territory, e.g., "What is the name of the publisher printed on the map?". The converse is also true, i.e., many questions about the territory can usually not be answered through questions about the map.

models that conform to our definition of a model. The definition of a model is almost identical to that of a super-erotetic value adder.

Maps and other models are physical super-erotetic value adders[13] made of paper, ink, plastic, wood, wire, etc. There are other kinds of physical super-erotetic value adders. Gauges are physical super-erotetic value adders. Think of a pressure gauge. It is a device that enables one to obtain the correct answer to instances of "What is the pressure of ... (name a sample of gas to which the gauge is connected)... at ... (name a time) ...?" from instances of "What is the position of the needle at ... (name the same time) ...?"

But there are also ways of conceptualizing things that yield super-erotetic value adders. I will briefly mention two here.

Natural kinds

A class of objects constitutes a natural kind only when each member can serve as a model for every other member. In other words, associated to every natural kind, there is (or is presumed to be) a set of questions—call them *projectible questions*—which have the virtue that, by finding the answer to one of these questions for one member of the kind, one obtains the answer to the same question for every member of the kind, and the answer is the same.[14] For instance, by finding the answer to

(14.33) What is its boiling point under standard conditions?

for one sample of water, one *ipso facto* gets the answer for every sample of water. The same goes for

(14.34) What is its density?
(14.35) What is its freezing point?

Categories

Natural kinds arrange themselves into categories. Tigers are animals. Animals form a category that includes cats, dogs, and earth worms, as well

[13] At least in part; the algorithms are obviously not physical.

[14] This feature, although essential, is not sufficient to characterize natural kinds.

as tigers. Samples of water are samples of substances. Substances include gold, alcohol, iron, cellulose, etc. Tokens of the word 'Apotheosis' are tokens of an English word. English words include 'dog', 'cat', 'apocalypse', and 'Ticonderoga'. Members of such categories share projectible questions. Thus, every animal kind shares with every other animal kind the projectible question "What is its anatomical structure?", although, of course, different kinds get different answers. Every substance kind shares with every other kind the projectible question, "What is the boiling point under standard conditions?" (but gets a different answer).

It is at the level of categories that formulae come into play. Consider the formula governing simple pendula. Simple pendula having the same length and period can be viewed as forming a natural kind, and all simple pendula together, collected regardless of their length, as forming a category. The formula is then a device that enables us to compute the answer to one projectible question for any pendulum, whatever its kind, from the answer to other projectible questions about the same pendulum. It covers the category. Of course we do not usually think of simple pendula as forming natural kinds: nature has created very few natural simple pendula. But formulae that enable us to compute the boiling point for any substance from the structure of its molecular bond, or to compute across species some traits of plants from other traits, function essentially in the same way as the formula of the pendulum.

14.4 Types of costs

Let us return to our ignoramus. One might assume that his rational policy would select questions to be answered according to their total (gosh plus cash plus added) value, i.e., go for the ones with the greatest total value. But that is too simple a view. It overlooks at least two likely situations: (a) the answers to the questions with highest total value may be beyond reach and (b) even if they are within reach, the cost attached to finding them may be too high.

The first situation will obtain whenever the answers cannot be had "directly", e.g. by observation, or through intuition, or by asking someone, and when no appropriate (i.e., sufficiently reliable etc.) value adders are available that will produce them from answers that can be had directly, or

that are otherwise forthcoming. A rational policy will obviously pass over such questions, regardless of their total value.

This fact, by the way, puts quite a burden on our rational ignoramus: it requires him to find out whether the answer to the most highly valued question is obtainable, and if it is not, to go on searching until he comes to a question whose answer is obtainable. How is he to determine the likelihood of getting an answer? And how is he to estimate the value of these *subsidiary* questions, about questions (and their cost) raised by his very attempt to use his policy? And how are *we* to analyze the place of such higher order questions in a rational scheme?

The second situation is created by the existence of costs—a very messy topic. There are many different kinds of costs: time, financial, emotional, etc. Time is required for retrieval of information, for computation, for mastering value adders; money is needed for instrumentation, for assistance; emotional cost can be boredom, anxiety, or frustration. How these costs are to be measured and compared is far from obvious. Their bearing on the formulation of a rational policy, on the other hand, is all too obvious.

14.5 M.I.T.

A rational ignoramus as described thus far is someone engaged in making decisions based on assessments of risks, gains, and costs–in short, someone engaged in a game-theoretical situation. Simulating his situation as an actual game may therefore help us see a little more clearly the strategic demands on a rational policy.

The name of the game is clear. It must be either *Minimizing Investigative Travails* or *Maximizing Investigative Trade-offs*, but in any case, be a name that abbreviates as *M.I.T.* Other aspects of the simulation are less obvious. Here is one way of picturing them.

Think of the game as played by two agents, A and B. A is pitched against A and against luck. B plays a subsidiary role. M.I.T. is won or lost in sets.

- A set consists of n games.
- At the beginning of each game, A announces a question.
- During the game, A can do a number of things:

  - He can put questions to B—these may not include the one he announced at the outset of the game, or of any previous game, or of any future game, and must pertain to specific individuals, events, or states of affairs. (If B answers at all, B answers truly. And B answers whenever he can.) Each question costs him 10 points, whether B answers it or not.
  - He can buy value adders. Gappy value adders cost 100 points each; erotetic value adders cost 1,000 points each; super-erotetic value adders cost 10,000 points; theories cost 100,000 points.
  - He can compute; cost of computation is 1 point per minute.

- A game ends as soon as A has figured out the answer to the question he announced or after one year, whichever comes first.

- The score for the game is computed as follows: if A gets the answer to his question, he scores the intrinsic value (i.e., gosh plus cash value) of the question minus the costs he has incurred. If he does not get the answer to his question, he scores a negative value amounting to the costs he has incurred during the game.

- The games are not completely independent. When A starts a new game, he can come equipped with all the answers and all the value adders he has accumulated in previous games.

- If, at the end of a set, A has scored 100,000 points (i.e., the equivalent of a theory), he is declared the winner and gets a prize called *tenure*, and playing comes to an end or goes on, but for higher stakes (e.g., an endowed chair, or a Nobel prize). If he gets less than 100,000 points, he must go on playing another game, only this time he has to be the research assistant, and B gets to ask the questions.

M.I.T. is too simple and unrealistic to represent adequately the strategic decisions faced by a real rational ignoramus even at real M.I.T. But it is complex enough to indicate the network of problems that his policy must handle, the different roles that knowledge will play in its execution, and to bring out that the best strategy in most situations will be far from obvious.

13.1 Why bother with all this?

The time has come to stop wondering about rational ignoramuses and to start acting like one. Let us ask: of what value are the questions that we have been asking? What could their gosh or cash value possibly be?

As far as I can see, it is not very great. Nor do I think that these questions are likely to accrue added value from elsewhere. Their value is of a different nature. The value of their answers lies in their potential as question *generators!*

They will generate at least two sets of questions with high gosh value.

First, a set of questions in philosophic epistemology. Does our rational ignoramus embody plausible normative aspirations, i.e., does he represent cognitive traits and intellectual attitudes that we aspire to embody, and does his policy exhibit standards by which we measure aspects of our worth and that of other human beings? Or does he represent an unattainable, illusory, and uninteresting ideal of no relevance to a responsible epistemic conscience?

Second, a set of cognitive-psychological questions. Are human beings rational ignoramuses of a sort at points of their development? More specifically, are infants rational ignoramuses?

To conjecture that they are is to conjecture that at various stages of their development, they are endowed with representations of part of what they do not know, with weights attached to some of these representations, with concepts of determinables, with question raising principles, and with value adders; it is to conjecture that they may come innately equipped with such things, and that they may guide their attention by such things. It is to invite ourselves to find out specific features of that endowment and of its evolution. Thus the answer to our questions about rational ignoramuses should raise new issues about the nature of innate and acquired cognitive capacities.

But note that this is a dimension of value which has been given no weight so far in the policy of our rational ignoramus. It is not gosh or cash or added value, but the value that a question derives from the fact that its answer may open up new fields of ignorance, a value even less predictable than the others. Let us call it ***golly*** value, and stop.

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WHAT WE DON'T KNOW WHEN WE DON'T KNOW WHY

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INTRODUCTION.[1]

Some twenty years ago, I gave a paper on why-questions to this Center. The occasion was -- at least for me -- a happy one. When I was invited to join in this twenty-fifth anniversary celebration of the Center, it struck me that a talk on the same topic would make a fitting birthday present. So this talk too will be on why-questions. But unlike the previous one, it won't be on answers to why-questions. It will be on a certain predicament to which why-questions themselves can give rise. That predicament interests me mainly because of its consequences for something I call "rational ignorance". Therefore, I will begin with a brief discussion of rational ignorance. It is also crucially related to the fact that why-questions do not have what linguists call "traces". I will therefore go on by explaining the notion of a trace and give reasons for believing that

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why-questions don't have any. I will turn to the predicament itself only in the last part of the paper.

PART I

RATIONAL IGNORANCE.

According to received history, Eratosthenes was the first person to come close to figuring out the circumference of the earth. You remember how he went about it. He knew that, at noon on the summer solstice, the sun would be straight overhead in Syene and that no shadow would be cast there by any gnomon. He assumed (almost rightly) that Alexandria was straight north of Syene. He also knew the distance (d) between Syene and Alexandria. He erected a vertical gnomon in Syene and another in Alexandria and, at noon on the summer solstice, he measured the angle (θ) formed by the gnomon in Alexandria and the sun ray skimming its top. He had correctly reasoned that θ would be equal to the angle at the center of the earth subtending the arc between the gnomon in Alexandria and that in Syene. Then using some version of the formula

$$(1) \quad C = (2\pi \div \theta) \times d$$

he calculated that the circumference of the earth was 250,000 stades, a good approximation that we can adopt for present purposes.

Eratosthenes's discovery was not an accident. He did not stumble on the answer to "What is the circumference of the earth?" the way, for example, Roentgen stumbled on radiation phenomena or Oersted on electro-magnetic ones. Eratosthenes knew

that he did not know the answer and set himself to find it. In doing so, he engaged in a pivotal human activity: the pursuit of answers to pre-chosen questions. I say "pivotal" for good reasons: human cognitive growth turns on it. Children must engage in it if they are to learn the phonemes, words, phrases, and parameters of the ambient language; we must unconsciously engage in it if our vision is to find the properties of distal stimuli on the basis of proximate ones; and, of course scientific research and pooling of knowledge wouldn't be possible without it.

An activity that central to our mental, intellectual, and communal life calls for investigation. Philosophers in particular should try to clarify how knowledge and rationality can influence it. What we need to clarify can be put a little more explicitly. Imagine an ideal but intellectually ambitious rational agent -- call him Rational Ignoramus -- and let Q_1 be the set of all the sound[2] questions to which Rational Ignoramus does not know the answer at t_1. Being intellectually ambitious, Rational Ignoramus wants to remove questions from Q_1, that is, wants to bring it about that at some later moment t_2 he will have the answer to some member of Q_1. Under what conditions can he rationally undertake to do this?[3]

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2. By a sound question, I simply mean a question that has a correct, true answer.

3. By defining Q_1 as made up of only sound questions we leave out of considerations, for the present, problems caused by the fact that Rational Ignoramus must also cope with questions he mistakenly believes to be sound.

Four conditions come immediately to mind.[4]

First Condition: Representations. Rational Ignoramus must be able to formulate and to understand interrogative sentences that express members of Q_1. He must therefore have access to some system in which some members of Q_1 can be represented. How else can he target any of them?

Many things about that requirement will remain obscure until we see clearly what is distinct about the systems of representations that humans can use. One thing is clear, however: some questions are beyond the reach of some systems of representation.

Consider for instance a system that admits only single-clause surface interrogative sentences of English.[5] Such a system could not represent the question now represented by

(2) There is something whose destruction calls for explanation. What is it?

since (2) is not a single-clause surface interrogative sentence. The single clause

(3) What does the destruction of call for explanation?

does express what (2) does, but is ungrammatical.

Such a system, by the way, would in all likelihood not be able to avoid ambiguities. For instance,

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4. These are not the only ones, but they are the only ones that matter for present purposes.

5. English is not such a system.

(4) Who did John tell what to do when?

though a single interrogative sentence, is ambiguous in that it can be construed with 'when' questioning either 'tell' or 'do'.[6]

Another thing is clear: Rational Ignoramus may be able to formulate and to understand a question and yet not be able to formulate and understand all its possible answers. Most of us understand "Who will be the President of the U.S. in 2054?" yet cannot begin to express all the possibilities.

Second Condition: Soundness. Rational Ignoramus must know[7] of some questions in Q_1 that they are sound, that is, that they have a correct answer. This does not mean that he must know the answer! In most cases he only needs to know that two sorts of presuppositions are satisfied.

First Rational Ignoramus must know of some questions in Q_1 that their existential presuppositions are satisfied, that is, that their referential constituents have actual references.[8] The

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6. Ambiguity of interrogative sentences raises a vexing problem. To say that an interrogative sentence is ambiguous is to say that it can be used to express more than one question. If there are ambiguous interrogative sentences -- as there obviously are -- this means in effect that we cannot identify a question by just any sentence that expresses it. How then shall we identify questions? In the case of declarative sentences helpful notions of ambiguity are available: for example, that a declarative sentence is ambiguous if and only if it can be evaluated through more than one set of truth-conditions. This suggests that what a declarative sentence expresses may turn out to be identifiable by a set of truth conditions. Working out this notion is fraught with difficulties. But it gives us some sort of grasp. Nothing of the sort is available for interrogative sentences: interrogative sentences do not have truth conditions. Identifying them through the truth conditions of the declarative sentences that express their possible answers or their presuppositions doesn't work either. In a later section I will presume that these sentences have unambiguous logical forms.

7. 'Know' here and elsewhere may seem too strong. 'Believe' or 'believe on good grounds' may seem better. These subtleties are beyond the accuracy of this discussion.

8. This way of putting the point implies that questions can have referring constituents, that is, are sentence-like objects. I happen to think that this is true, but the condition can, in any case, be

idea is a familiar one. The question expressed by[9]

(5) What was the age of the King of France in 1945?

presupposes that there was a King of France in 1945. There was none, and the question is not sound, has no true answer. On the other hand

(6) How are neutrons and protons bound in an atomic nucleus?

presupposes that there are neutrons, and protons, and atomic nuclei. This is true, and the question is sound, must have an answer. However that answer cannot be deliberately sought by someone who does not know that there are neutrons, protons, or atomic nuclei.

Secondly, Rational Ignoramus must know of some questions in Q_i that their attributive presuppositions are satisfied. So, for instance

(7) What is the height of the Empire State Building?

presupposes not only that the Empire State Building exists, but also that it has a height. This is true, and hence (7) is sound, must have a true answer. On the other hand,

(8) What is the square root of the Empire State Building?

presupposes that the Empire State Building has a square root. It does not, and hence (8) cannot have a true answer.

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restated so as to mention only constituents of the sentences used by Rational Ignoramus to express questions. The restatement is joylessly convoluted and forces issues about ontological and conceptual relativity to the surface. I will by-pass it.

9. From here on, I will drop this awkward 'the question expressed by' and let context indicate whether the example is to be taken as a question expressed by the sentence or the sentence itself.

There are a number of ways of looking at what I have called attributive presuppositions. I will come back to the topic later, but here is a rough sketch of what is involved. (7) expresses a question built around the predicate function

(9) ... is the height of ...

which pairs objects and distances. The attributive presupposition of the question is satisfied if and only if the related predicate represented by the open sentence

(10) (Ex:x a distance)(x is the height of ...)

is satisfied at the Empire State Building,[10] that is, if the Empire State Building has height, which it does.

On the other hand, (8) is built around

(11) ... is the square root of ...

and would be sound only if the predicate represented by the open sentence

(12) (Ex: x a number)(x is the square root of ...)

were satisfied at the Empire State Building, that is, if the Empire State Building were a square, which it isn't.

Questions are built around such predicates. Many are intimately related to what used to be called determinables, that is, height ('what is the height of ...?'), color ('what is the color of ...?'), mass ('what is the mass of ...?), voltage ('what

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10. The use of a (restricted) existential quantifier in (10) may suggest that we are simply dealing with another existential presupposition. Note that (7) can be expressed with 'how' rather than 'what' ('How high is the Empire State Building') to mark the difference between existential and attributive presuppositions. Which is which in specific cases cannot be settled without settling general and specific issues of ontology and ideology.

is the voltage between ...?') and so on, a class of notions that has for too long been ignored by erotetic logicians.

Rational Ignoramus cannot know whether a given attributive presupposition is satisfied unless he has the concept of its corresponding predicate function in his intellectual kit. That fact can severely narrow his choices. To see this, imagine what things were like before the concepts of mass, electric resistance, atomic number, standard deviation, marginal utility, constituent structure, and other technical determinables were available.

He must also have some knowledge of that function's range and domain. For example, he must know that square root is defined at numbers but not at buildings or even plants, that height is defined at buildings, but not at oceans or snakes, and so on.

The grounds for that sort of knowledge, and how it can be acquired, are far from clear. Whence do we know that all physical forces have direction and magnitude, that material objects have mass, that events may have causes, that pairs of numbers have products, that sets have cardinality?

The knowledge in many cases -- perhaps in all -- must be grounded on the conceptual structures in terms of which we categorize, classify, taxonomize, and otherwise group things for the projection of properties and principles. Thus it is a feature of the concept of a building that a building is the sort of thing for which there must an answer to the questions "What is its height?", "Where is it located?", "Who built it?", and so on. It

is a feature of our concept of a sphere that a sphere is the sort of thing for which there must be an answer to the questions "What is its volume?", "What is its radius?", "What is the areas of its surface?" and so on[11]. If anything is a priori knowledge, that sort of thing surely is.

Third Condition: Awareness. Rational Ignoramus must know of some questions in Q_1 that he does not know their answer. In other words, he must be occurrently -- not merely dispositionally -- attending to some questions in Q_1 through some of their representations, be aware of them as sound, and know that he lacks sufficient reasons for accepting any particular answers to them.

The third condition obviously entails the first two. But it also goes beyond them. It demands that the questions have "arisen" for Rational Ignoramus, a matter over which he himself has very little control, and which his rationality can no more influence than it can influence the flow of inner and outer events of which he is aware. And it furthermore demands that he should not mistakenly believe that he knows the answers when he does not. That too is a matter over which he may have very little control and on which his rationality has less influence than some philosophers have acknowledged: insufficient reasons can be unrecognizably disguised as sufficient ones when possible answers

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11. But there can be conceptual changes. It is no longer a feature of the concept of physical object that a physical object is the sort of thing for which there must be an answer to the questions "What is its mass?", "Where was it located when?", "What was its velocity relative to what frame of reference when?" and so on.

-- including perhaps the right one -- fail to come to mind, or are unrepresentable, in spite of the most assiduous and appropriate intellectual efforts.

Let us call members of Q_1 that meet the first three conditions at t_1 the questions accessible to Rational Ignoramus at t_1.

Even under the best of circumstances, there will be members of Q_1 that are not accessible to Rational Ignoramus. This follows first from technical considerations.[12] It also follows furthermore from predicaments that Rational Ignoramus cannot avoid. Rational Ignoramus cannot possibly know of each thing, present, past, future, nearby, and far away, that it exists. Nor can he be aware of all the attributes manifested somewhere. How likely is it, for instance, that Eratosthenes could have conjured up the notion of space curvature or of valence? And it follows from the fact that the circumstances in Rational Ignoramus's life cannot raise every member of Q_1 for him, not even every member otherwise accessible to him.

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12. For instance, there are as at least as many questions as there are real numbers -- that is, nondenumerably many -- since there are questions of the form

(13)

a. What is its square?
b. What is the prime number closest to it?
c. What is the difference between it and the average population of New York in 1924?

for each real number. But the total number of questions expressible in Rational Ignoramus's language can be at most denumerably infinite, since each must be expressed in a finite structure constructed out of a finite -- or at best denumerably infinite -- vocabulary. Thus, after taking into account all the expressible questions to which Rational Ignoramus knows the answer (a denumerable set), we will still be left with nondenumerably many sound questions.

Fourth Condition: Value. Since the sub-set of accessible questions in Q_1 is apt to be enormous, Rational Ignoramus can't try to answer them all and must make choices. If the choices are to be rational, he must have values to maximize and costs to minimize.[13] What values? The main relevant values come under four headings. I have named each after a philosopher biased in its favor.

1. Peircean value: The value that a question gets from the expected intellectual value of its answer, that is, the pleasure, or relief, or cognitive stability expected from its answer.[14]

2. Jamesian value: The value that a question gets from the material benefits expected from its answer.[15]

3. Collingwood value: The value that a question gets from the prospect that its answer will raise new questions with expected values of their own.[16]

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13. I omit discussion of costs and of certain other relevant considerations such as likelihood of success in the pursuit of an answer.

14. Elsewhere I have called this "gosh" value.

15. Elsewhere I have called this "cash" value.

16. Elsewhere I have called this "golly" value.

4. Machian value: The value that a question gets from the prospect that its answer will yield answers to other questions with values of their own.[17]

All these values obviously are relativized to Rational Ignoramus's preferences and background knowledge at the time the choices have to be made.

Machian value depends on devices that turn answers to some questions into answers to other questions, that is, things like (1) and the algorithmic procedures associated with it.[18] Let us call such devices "value adders".[19]

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17. Elsewhere I have called this "added" value. Naming it after Mach is a little misleading. I do so because he valued laws and theories for the "intellectual economy" they made possible. That comes close to valuing them as means for yielding what I call Machian value to questions.

18. (1) gave added value to both "What is the value of θ?" and to "What is the value of d?". The added value given to each of these depended, of course, on the prospects of getting the answer to the other.

19. Intellectual value adders differ along such dimensions as precision, reliability, accuracy. But they also differ in power. Consider for instance

(14)

a. All elephants have warm blood.
b. Is Jumbo an elephant?
c. Is Jumbo warm-blooded?

The value adder (14.a) adds the value of (14.c) to the value of (14.b) only if the answer to the latter is "yes". Otherwise it adds no value to (14.b). It is a conditional value adder. Contrast that with

(15)

a. The distance between Memorial Hall and Kresge is twice the distance between Central Square and the middle of Harvard Bridge.
b. What is the distance between Memorial Hall and Kresge?
c. What is the distance between Central Square and the middle of Harvard Bridge?

(15.a) adds the value of (15.c) to the value of (15.b) no matter what the answer to the latter. It adds value unconditionally. And now consider

(16)

a. $T = 2\pi \sqrt{l/g}$
b. What is the length of the pendulum built by Foucault?
c. What is the period of the pendulum built by Foucault?

Let me summarize where we are by returning to Eratosthenes, our near-incarnation of Rational Ignoramus.

Before his discovery of the circumference of the earth, Eratosthenes knew that the earth existed, knew, that it was spherical, knew that spheres have circumferences, knew that there was a gnomon in Alexandria, knew that there was one in Syene, knew that at noon on the summer solstice sun rays near the gnomon in Syene would cast no shadows and therefore be on a line through the center of the earth, knew that at that very time a sun ray skimming the top of the gnomon in Alexandria would form an angle with that gnomon equal to the angle at the center of the earth subtending the arc between Alexandria and Syene. The questions

(19)

a. What is the sunray-gnomon angle in Alexandria?
b. What is the circumference of the earth?

were accessible to him. The first had little intrinsic value, but the second had enormous Peircean and possibly Jamesian value. Eratosthenes knew how to use the value adder (1). That added the value of (19.b) to that of (19.a). Long before others had considered

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(16.a) adds unconditionally the value of (16.c) to the value of (16.b). But, more important, it adds to any question of the form

(17) What is the length of ...?

about some pendulum, the value of the corresponding question of the form

(18) What is the period of ...?

about the same pendulum.

We have here the beginnings of a hierarchy that extends to the farthest levels of theory.

(20) What is the shape of the earth?

which had the Collingwood value of generating (19.b).

So far so good. But now consider the question

(21) Why is the circumference of the earth 250,000 stades?

Eratosthenes clearly did not answer that question. Nor did his discovery of the answer to (19.b) -- even with all the rest of his knowledge -- put him in a position to answer that why-question. But did it at least make that why-question accessible to him? Did it put him in a position to see that it was sound (assuming that it is sound), that it had an answer (assuming that it has an answer)? It obviously didn't.

What else did he need to know? Was he at least in a position to figure *that* out? We know that he wasn't! But why-questions must then be different, must stand in a different relation to their presuppositions. What is the difference?

Linguistic facts provide an important clue, namely that why-questions bind no traces. Let us then look at that clue.

PART II

TRACES AND WHY-QUESTIONS.

A: TRACES.

And to begin with, what is a trace?

Think of a trace on the analogy of a variable bound to a quantifier.

(22) John hit someone.

for many purposes is analyzed as having the form

(23) (Ex)(John hit x)

Think then of

(24) Who did John hit?

as having the form

(25) (Who t)(did John hit t)

where the t in mid-sentence is the trace of 'who' and is bound to it as x is bound to 'Ex' in (23). Note that the x and the t -- that is, the bound variable and the bound trace -- both occur in a position dictated by meaning considerations: the position in which the target of 'hit' is indicated. That is the interpretive job of that position. The interpretive job of the operators' positions -- that is, of the position occupied by '(Ex)' and '(Who t)' -- is to indicate scope.

Traces are associated syntactically with a "movement" of the interrogative operator. In the example above, (24) and (25) derive from the deep structure[20]

(26) John hit who

-- in which 'who' is in a position indicating the target of 'hit' -- through a transformation that "raises" 'who' to a sentence-initial position but that leaves a trace bound to it. The trace

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20. The expressions 'deep structure', 'surface structure', and 'logical form' are shunned nowadays because they call up misleading associations. Linguists prefer to use 'D-structure', 'S-structure', 'L-form'. I will use the old terminology in the belief that some mnemonic association is better than none.

preserves the information that the target of 'hit' is the questioned.[21] It plays therefore a semantic role.

Traces have as much reality as real words. They not only affect what an interrogative sentence means, but, like real words, they can affect pronunciation. Chomsky somewhere[22] brings out evidence of the following sort:

The interrogative sentence

(27) Who do you want to eat?

is ambiguous. It can express either a question that can take (28.a) as answer, or one that can take (28.b) as answer:

(28)
a. I want to eat the missionary.
b. I want the missionary to eat.

The ambiguity is easily explained: 'Who' can "start out" *in situ* -- that is, in a location indicating what is being questioned -- as either the theme or the agent of 'eat'. And (27) may thus be the perceptual shape of either (29.a) or (29.b)

(29)
a. (Who t)(do you want to eat t)
b. (Who t)(do you want t to eat)

What is more, the ambiguity of (27) vanishes when 'want' and 'to' are contracted into 'wanna':

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21. Linguists use the term 'raise' because the transformation moves 'who' from the end of a lower branch to that of a higher one in a tree-like representation of the sentence's structure. Other transformations -- of no interest here -- are also required to get (24) and (25): one that inserts 'did', for example. All this talk of transformation is not to be taken literally: it is a picturesque way of talking about relationships among various levels of analysis.

22. Chomsky, Noam (1977) "On Wh-movement" in Culicover, P.W. et al. (eds) *Formal Syntax* Academic Press.

(30) Who do you wanna eat?

can only mean(29.a), it cannot mean (29.b). This is accounted for if the trace in (29.b) stands like a real word between 'want' and 'to' and blocks their contraction.[23,24]

English interrogative sentences then contain mid-sentences traces in their surface structure. But they also contain traces in their logical form. To see this, let's look again at quantified sentences.

(31) Someone is loved by everyone.

is ambiguous: it can be interpreted either with 'someone' in the scope of 'everyone' or with 'everyone' in the scope of 'someone'. We account for this by distinguishing between surface structure and logical form, and by imputing to (31) two logical forms, viz., to a first approximation

(32)

a. (Ey)(x)(y is loved by x)
b. (x)(Ey)(y is loved by x)

in which the ordering of the quantifiers indicates their relative scope. Scope ambiguities of surface structures then indicate the existence of logical forms.

But interrogative operators can also be the source of scope ambiguities. For instance,

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23. This argument must be handled with extreme caution: traces are "visible" and block contractions only under specific conditions. Many traces do not block contraction. But for present purposes, it is sufficient that some do.

24. The data are from a dialect of English that does not have 'whom'. Speakers of dialects that have 'whom' may find 'What do you want to smell?', 'I want the flowers to smell', 'I want to smell the flowers', 'What do you wanna smell?' more convincing. But since their dialect probably does not tolerate 'wanna' in any case, they should look at the data as taken from a dialect that happens not to be theirs. That does not make it less real.

(33) Where did everyone go?

can be construed as presupposing that everyone went to one place, or as not presupposing it. We account for this by imputing two logical forms to (33) also, namely, to a first approximation,

(34)

a. (Where t)(x)(x went to t)
b. (x)(where t)(x went to t)

in which the ordering of the quantifier and the interrogative operator indicates their relative scope. The account obviously requires that traces occur in the logical form of interrogative sentences as well as in their surface form.[25]

English interrogative sentences then have traces in both their surface structure and their logical form. That is not true of interrogative sentences in every language. In Chinese for instance, no traces of interrogative words occur in surface structures: the interrogative words corresponding to our 'who', 'where', 'what', 'when', and so on, remain *in situ* there; they never move to the sentence-initial position. In other words, they behave very much like quantifiers in English,[26] which occur *in situ* in the surface structure and "move" only in the logical form. But there is evidence that Chinese interrogative operators do move in logical form. For instance, they can be the source of scope ambiguities that English interrogative operators never

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25. There are many other grounds for holding that sentences have logical forms as well as surface and deep structures.

26. Or like all but one wh-operator in English multiple questions. For example, 'Who went where, when, how?'. See (35.a) below.

produce.[27] In view of these ambiguities, Chinese sentences must have logical forms distinct from their surface structure. More to the point, these logical forms, when interrogative operators are present, must contain traces. How else could they mark both the relative scope of the operators and the position questioned?[28]

B: NO TRACES IN WHY-QUESTIONS.

I said that why-questions don't have mid-sentence traces.[29] I can now be more specific: first, they do not have mid-sentence traces bound to 'why' in their surface structure, and, second, they don't even have mid-sentence traces bound to 'why' in their logical form. Furthermore, since translation across languages must share binding relations and relative scopes in the logical forms, it is a good bet that their expression in other languages don't have 'why'-bound (or whatever the word for 'why' in the other language) traces in the logical form either.[30]

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27. The sequence 'John know his mother see who?' matches the sequence of words in a Chinese sentence that can be interpreted as either "Who does John know that his mother saw" or "John knows who his mother saw".

28. Everything has to be qualified! We have known ever since Schönfinkel that sometimes combinators properly arranged can perform the two corresponding jobs for quantifiers without binding anything. The same is probably true of traces. Offhand, I don't know how to handle that complication and save the rhetorical point of my question. But the thesis that why-questions have no mid-sentence traces should translate into an equivalent thesis in a scheme using combinators, if it turn out that the logical forms of sentences in a natural language are representable with combinators.

29. I use 'mid-sentence' out of technical caution. As far as I know, 'why' may bind traces in sentence-initial positions, that is, in what will be called COMP below.

30. Another qualification! 'How come' questions do have a trace bound to 'how' after 'come'. Doesn't that pose a problem if -- as seems plausible -- '(how t)(come t that p)' turns out to be a synonym of 'why p', or if some expression much like it turns out to be the translate of 'why' in some other language? Not really. The argument below hinges on the absence of a trace bound to 'why' -- or to any of its translates -- inside of p -- or any of p's translates. The innards of p are what matters. I thank Ken Hale for helping me with this point.

But what reason is there to believe that 'why' does not bind mid-sentence traces?

Here is one well-known argument.

Both

(35)

a. Who did John hit where?

and

b. Where did John hit who?

are acceptable sentences.

The explanation is straightforward: (35.a) and (35.b) both start with the deep structure

(36) John hit who where

(35.a) results when 'who' is raised to the sentence-initial position[31], and (35.b) results when 'where' is raised to the sentence-initial position.[32] It happens that in English only one wh-operator can be raised to a sentence-initial position at surface structure. The other wh-operators, if any, must stay *in situ*. Therefore either 'who' or 'where' (though not both) can leave a trace and move to the sentence-initial position, and either (though not both) can end up in a mid-sentence position.

On the other hand,

(37)

a. Why did John hit who?

and

b. Who did John hit why?[33]

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31. When the trace is made visible, (35.a) is '(Who t)(did John hit t where?)'

32. When the trace is made visible (35.b) is '(Where t)(did John hit who (at) t?)'

33. Not to be confused with 'Who did John hit and why?'.

though at first sight related exactly like (35.b) and (35.a), are not both acceptable sentences. (37.a) is acceptable, but (37.b) is not.

The explanation is straightforward if 'why' cannot occur in mid-sentence position in deep structure; in other words if there is no deep structure (38)

(38) John hit who why

but there is a deep structure (39)

(39) Why John hit who

The unacceptability of (37.b) then follows from the fact that since 'why' never occurs in mid-sentence, it cannot be "left" there while 'who' moves to the front of the sentence. The acceptability of (37.a) follows from the fact that 'why' can occur in sentence-initial position in deep structure and can occupy that position in (37.a) without having to move into it.

Since wh-words in surface structures bind traces only in positions from which they have moved, it also follows that 'why' does not bind a mid-sentence trace in (37.a). And from general considerations it follows that it does not bind a mid-sentence trace in any surface structure.[34,35]

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34. The account also implies that 'why' cannot carry the sort of thematic role that arguments of verbs or prepositions carry.

35. This argument, being an inductions to a (best?) explanation, needs strengthening from further evidence. Such evidence exists. For instance, Giuseppe Longobardi, in a conversation, has shown me a beautiful argument based on the observation that whereas both members of a pair like

(40)

a. Why do you think John left?
b. Why do you think that John left?

The argument shows that 'why' does not bind a mid-sentence trace in surface structure. I now want to turn to an argument which shows that 'why' does not bind a trace in logical forms. That is of greater import for Rational Ignoramus since it carries cross-linguistic consequences. The argument is also philosophically important. It is based on data that have deeply shaped recent philosophic conceptions of what why-questions are all about. In fact, the argument occured to me while I was mulling over examples used by van Fraassen in *The Scientific Image*[36] and viewed by him as proving that all why-questions have an essential indexical aspect. To underline this connection, I will use an example taken from the discussion of why-questions in that book.

Consider

(42) Why did Adam eat the apple?

(42) can be uttered with different intonation contours. It can be uttered with a normal intonation contour or with emphatic stress on one of the words, as below

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-- construed as about the reasons for John's leaving, not for thinking that he left -- are acceptable, only (41.a) of the pair below is acceptable:

(41)

a. Who do you think went to London?
b. Who do you think that went to London?

Yet, at first sight, the difference between the members of both pairs is the same, namely the absence or presence of 'that'.

36. van Fraassen, Bas C. (1980) *The Scientific Image*, Oxford University Press, Oxford, England Chapter 5, Section 2.

(43)

a. Why did Adam eat the apple?
b. Why did ADAM eat the apple?
c. Why did Adam EAT the apple?
d. Why did Adam eat the APPLE?

These differences affect the question expressed in two ways.

First, different placements of emphatic stress create different implicatures. So, (43.b) implicates that someone else than Adam might have eaten the apple but didn't. (43.c), on the other hand, implicates that Adam might have done something else to the apple but didn't. (43.d), in turn, implicates that there was something else that Adam might have eaten but didn't. (43.a) has none of these implicatures.

Second, different placement of emphatic stress impose different conditions on what counts as an answer.[37] For instance (43.a) can tolerate as an answer

(44) Because God intended that to happen.

(43.b) can tolerate

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37. The fact that stress affects what counts as an answer has wrongly been taken to show that the construal of why-interrogative sentences like (42) -- even if we abstract from the presence of explicit indexicals -- is more crucially dependent on context of utterance than that of other sentences. It shows nothing of the sort. What it does show is that accentuation is one of the individuating features of sentences. It has also been taken to show that (43.b), (43.c) and (43.d) expresse different ways of construing (43.a). They don't. Their readings are not among the readings of (43.a) even if -- as some believe -- the answers they tolerate are among the answers that (43.a) tolerates. (The converse is not true, as lovers of poor jokes well know.) (43.b) is no closer to expressing a way of construing (43.a) than the cleft interrogative sentence 'Why was it Adam who ate the apple' -- with which it shares logical form -- is. (43.a), (43.b), (43.c), (43.d) are different sentences each with its own construal. (43.b), (43.c), (43.d) -- though not (43.a) -- happen to share logical form with clefted interrogative sentences, and each therefore expresses the same question as its corresponding clefted interrogative sentences. But interrogatives with different logical forms express different questions, regardless of the similarities in their surface structure. The point may be obvious but it is overlooked by theories that take why-questions with emphatic stress (or clefted) as paradigmatic cases of why-questions, and that do so on the mistaken presumption that every why-question can be expressed with emphatic stress on one of the words, or by a cleft interrogative. Such theories start off on the wrong foot in any case, since their inductions rest on biased samples with idiosyncratic logical forms.

(45) Because he (Adam) was the one that Eve worked on.

(43.c) can tolerate

(46) Because he couldn't think of anything else to do with it.

(43.d) can tolerate

(47) Because it (the apple) was the only food around.

Compare this with non-why-questions.

Non-why questions, of course, can also be uttered with normal intonation contour or with emphatic stress placed on one of the words. Take 'when'[38] for instance. We have

(48)

a. When did Adam eat the apple?
b. When did ADAM eat the apple?
c. When did Adam EAT the apple?
d. When did Adam eat the APPLE?

But these different placements of emphatic stress don't have the consequences they have for why-questions.

First, though emphatic stress still creates implicatures that vary with the location of the stress, these are not the ones created for why-questions. Thus (48.b) implicates that others also ate the apple,[39] not that they could have but didn't. (48.c) implicates that Adam also did other things with the apple, not that he could have but didn't. (48.d) implicates that Adam ate also other things, not that he could have but didn't.

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38. 'How' or 'where', and so on, would do just as well.

39. Admittedly *that* implicature is rather difficult to swallow.

Second, different placements of emphatic stress do not impose different conditions on what counts as an answer. Thus (48.a), (48.b), (48.c), (48.d) all tolerate the answer:

(49) At 4 p.m. on July 7 24,000,000 B.C.

or any other answer that one of them tolerates. And they must all share the same correct answer, if there is one.

How shall we account for all this?

First note that English declarative sentences too can be produced either with normal intonation contour or with stress placed on one of the words, and that stress placed on one of the words results in a sentence logically equivalent to a so-called cleft sentences.[40] So (50.a) is logically equivalent to (50.b), and (51.a) is logically equivalent to (51.b):

(50)
a. ADAM ate the apple.
b. It was Adam who ate the apple.

(51)
a. Adam ate the APPLE.
b. It is the apple that Adam ate.

To a first approximation,[41] (50.a) and (50.b) share the logical form

(52) ( )((Ex: x = Adam)(( )(x ate the apple)))

whereas (51.a) and (51.b) share

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40. This is not the only instance in which departure from normal intonation contour changes logical form. Declarative sentences produced with an interrogative intonation contour have the logical form of an interrogative sentence.

41. I say "to a first approximation" because many details are left out and because the '(Ex: x = N)' representation of the focusing operator is crude.

(53) ( )((Ex: x = the apple)(( )(Adam ate the apple))}

The blanks between parentheses indicate sentence-initial positions. Those are the positions into which interrogative words, if any, are "raised." Because they are also the positions in which complementizer (words like 'that' which initiate subordinate sentences) would occur, linguists label these positions COMP (for 'complementizer').

With these analyses of declaratives in mind, we can look at our when-questions again.

Their logical forms must be similar to that of the declarative sentences, but with the interrogative operator 'when' and its trace added. The logical form of (54.a), in which there is no emphatic stress, is, to a first approximation, simply (54.b), that of (55.a) is (55.b), and that of (56.a) is (56.b):

(54)

a. When did Adam eat the apple?
b. (When t)(Adam ate the apple at t)

(55)

a. When did ADAM eat the apple?
b. ( )((Ex: x = Adam)((when t)(x ate the apple at t))}

(56)

a. When did Adam eat the APPLE?
b. ( )((Ex: x = the apple)((when t)(Adam ate x at t.))}

These analyses account for the differences among the implicatures. (54.b) does not have a focusing operator; (55.b) and (56.a) have different ones.

They also account for the common answers: all the constituents under the scope of 'when' have the same interpretation since their referential expressions and variables have the same assignments.

Note that in each case, 'when' binds a mid-sentence trace, for that turns out to be crucial.

There are two sentence-initial positions -- two COMPs -- in the logical forms of the stressed when-questions, one with the focusing operator under its scope, and one under the scope of that operator; or, to put things a little differently, one that prefixes the whole logical form, and one that prefixes the inner clause only. 'When' cannot occur in the former because it binds a trace. Traces of wh-operators are anaphors, that is, they behave like reflexive pronouns and must be in the same innermost clause as their antecedents.[42] If 'when' were in the outermost initial position, it would be too far from its trace, it would be outside the innermost clause containing its trace, outside the domain it must cohabit with its trace.

Now let us return to why-questions.

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42. That this is so for reflexives is illustrated by the contrast between (57.a) and (57.b):

(57)

a. John helped himself

b. John asked Mary to help himself

In (57.b), unlike in (57.a), 'himself' is not in the same innermost clause as 'John'. The full story requires further elaborations of what counts as a clause here.

The logical form of (58.a), in which there is no emphatic stress, is, to a first approximation, simply (58.b), that of (59.a) is (59.b), that of (60.a) is (60.b):

(58)

a. Why did Adam eat the apple?
b. (Why)(Adam ate the apple)

(59)

a. Why did ADAM eat the apple?
b. (Why){(Ex: x = Adam){( )(x ate the apple)}}

(60)

a. Why did Adam eat the APPLE
b. (Why){(Ex: x = the apple){( )(Adam ate x)}}

Note that 'Why' occurs in each case in the initial position (COMP) of the whole sentence. Nothing prevents it from occuring there, nothing requires that it be within the innermost sentence, since, unlike 'when', it binds no trace.

The difference among the implicatures, again, is accounted for by the differences among the focusing operators. (58.a) does not have any; (59.b) and (60.b) have different ones.

The difference between these implicatures and those created in the corresponding when-questions is accounted for by the fact that the focusing operators in (59.b) and (60.b) are within the scope of 'why', whereas in (55.b) and (56.b) they are outside the scope of 'when'. As a consequence, in the why-questions, the focusing operators serve to specify an aspect of the subject matter under question, to attach uniqueness to a presupposed item. In the when-questions, they do not serve to specify an aspect of the subject matter under question: they serve as an item in the context in which that subject matter is represented,

and convey an attitude of the speaker; they attach uniqueness to an interest of that speaker.[43]

The difference among the answers called for by the different why-questions is also accounted for by the occurrence of the focusing operators within the scope of 'why': since in that position they serve to specify an aspect of the subject matter under question -- of the presupposition -- differences among them become differences of subject matters specified, of presuppositions; and different presuppositions call for different answers.

So, everything is accounted for on the assumption that 'why', unlike 'when', has no mid-sentence trace in logical form.

However, one point remains. The argument hinges on the assumption that 'why', unlike 'when', occurs in the outermost COMP. What prevents it from occurring in the innermost COMP?

Nothing!

'Why' *can* occur in the innermost COMP. But when it does, we get a set of why-interrogatives whose implicatures and answers are like those of the when-interrogatives. To see this, picture a situation in which the speaker believes that Adam, and Eve, and God all ate the apple and asks "Why did ADAM eat the apple?" thereby indicating that he does not care about the others. Then picture a situation in which a speaker believes that Adam ate the

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43. They function like parentheticals.

apple, the banana, the orange, and the hamburger, and asks "Why did Adam eat the APPLE?" thereby indicating that he does not care about the rest of Adam's meal.[44]

The crux of the argument was not that emphatic 'why' cannot behave like emphatic 'when' (or 'how', 'where', and so on) but that it can behave in ways that emphatic 'when' (and the others) can't.

PART III

RATIONAL IGNORAMUS AND WHY-QUESTIONS.

The fact that why-questions have no mid-sentence traces has consequences for Rational Ignoramus.

Let us briefly return to the topic of attributive presuppositions.

Example (7) (repeated as (61))

(61) What is the height of the Empire State Building?

has the logical form

(62) (What t: t a distance)(t is the height of the Empire State Building)

and the attributive presupposition whose logical form is

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44. People with sharp ears will notice a slight change in the tonality of the stress. That fact too constitutes confirming evidence: we know that logical form and phonology interact.

(63) (Ex: x a distance)(x is the height of the Empire State Building)

The connection between the attributive presupposition and the question is transparent when we look at their logical form: the only difference between (62) and (63) is their binding operator.

This means that the attributive presupposition and the question are mutually deducible by anyone who has access to these logical forms; and anyone who understands them has that access.

The transparency depends critically on the fact that the interrogative operator in (62) binds a mid-sentence trace. It is the mid-sentence trace in (62) that is the analogue of the bound variable in (63). The mutual deducibility of the question and its attributive presupposition therefore also depends on the fact that the interrogative operator binds a mid-sentence trace.

Every question whose interrogative operator binds a mid-sentence trace -- that is every question initiated in English with 'when', 'where', 'how', 'which', 'what', 'who', and so forth -- is transparently connected in this way to its attributive presupposition.[45] Each of them has a logical form that fits the schema (64.a) and a matching attributive presupposition that fits the schema (64.b)

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45. Pesetsky and others have recently suggested that some of these English operators do not move into a COMP in logical form but remain *in situ* and that the same holds in other languages. My main point should not be affected if they turn out to be right, though I would then have to complicate the presentation. My point rests on the presumption that 'why' is different from the others in that it never occurs *in situ* in mid-sentence -- and hence never has a trace there -- whereas the others either occur *in situ* or have a trace there.

(64)

a. (Ex: x...)(... x ...)
b. (Wh t: t...)(... t ...)

As a consequence, in every case, attributive presupposition and question are mutually deducible by anyone who understands the question.

But in every case mutual deducibility critically depends on the fact that the interrogative operator binds a mid-sentence trace, since it is the trace bound to the interrogative operator that matches the variable bound to the quantificational one.

So, as long as he limits himself to these sorts of questions , Rational Ignoramus only needs access to their logical form -- that is, only needs to understand them -- and his wits, to figure out their attributive presuppositions. The same is true for their existential presuppositions, since logical forms display purported reference.

In short, unassisted wits and cogitation on meaning[46] alone will tell him what he has to find out to know whether the question is sound, and thus to know whether it is accessible to him.[47]

But nothing of the sort follows for why-questions. The interrogative operator in their logical form does not bind a mid-

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46. 'Meaning' makes some people cringe. But it shouldn't in this context where it carries very minimal commitments.

47. Cogitation on meaning will often also tell him whether an attributive presupposition is satisfied: as I mentioned a while back, that sort of knowledge often springs directly from conceptual structure, is *a-priori* if anything is.

sentence trace, and nothing stands to their logical form as (63) stands to (62).

Unassisted wits and cogitation on meaning alone, therefore, will not enable Rational Ignoramus to figure out the attributive presupposition of a why-question, even when he understands it. Or, more precisely, unassisted wits cannot lead him to that attributive presupposition in the way it can in the case of questions with bound traces. But there is no reason to believe that it can do so in any other way.

We could draw a different conclusion from the fact that why-questions do not have mid-sentence traces, namely that why-questions simply don't have attributive presuppositions at all. That is another way of looking at the fact that nothing stands to any why-question as (63) and (62) stand to (61).

But that way of looking at the facts is of little help to Rational Ignoramus. It may force me to relabel presuppositions, but it does not change the fact that why-questions have presuppositions that cannot be discovered through cogitation on meaning alone. This can be shown very quickly.

Why-questions do have presuppositions that Rational Ignoramus can discover through cogitations on meaning alone. For instance,

(65) Why is the circumference of the earth 250,000 stades?

cannot have a true answer unless the circumference of the earth is 250,000 stades. To know whether (65) is sound, Rational Ignoramus must know whether that presupposition is true. But he

can obviously figure out that presupposition from his understanding of the question, that is from its logical form.

What is true of (65) is generally true. Every why-question presupposes the proposition represented by deleting the why-operator from its logical form. Let us call that kind of presupposition the propositional presupposition. Whether we classify propositional presuppositions of why-questions with existential presuppositions of other questions is immaterial here.

But why-questions can have a true propositional presuppositon and still not be sound. To believe otherwise is to believe that semantics alone can rule out brute facts, random events, things coming about without rhyme or reason, occurrences happening because of nothing in particular, capricious actions, ultimate truths, so's without why-so's. Semantics may be the handmaiden of rational theology, but it is not revealed theology! It cannot require that (65) have an answer.

So, to know that a why-question is sound, Rational Ignoramus must not only know that its propositional presupposition is true. He must know something else. But there is no reason to believe that cogitation on meaning alone can tell him what that something else is. (Whether we call that something else "attributive presupposition" is immaterial again.)

How can that be?

A full account would requires a detailed discussion of the conditions that define true answers to why-questions. I am not prepared to do that here or now. However many a blind person -- myself included -- has already reported on the shape of that elephant, and its general outline is beginning to emerge.

A why-question can have a true answer only if its propositional presupposition expresses a fact. But that fact in turn must be construable as the answer to a question which is linkable to other questions by means of value adders, and not just any value adder, but a value adder that occupies a particular position in the hierarchy of value adders.[48] However, Rational Ignoramus cannot always know in advance whether a given fact can be construed that way, or how it is to be construed that way. The right value adders, predicates, determinables, and attributes must first be conceived and checked. The logical form of the why-question is no guide to these. It does not even constrain them. It has no direct conceptual relation to them. In fact, a why-question may be expressible long before the relevant value adders and attributes. "Having mass", "having outer electrons", "having a logical form", "being a combination of distinctive features" and so forth, and the value adders that link them to other determinables were conceived and received expression long *after* why-questions that called for them had been raised. The logical form of these why-questions was of no help to

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48. See footnote (19) above.

those who raised them. It had no direct conceptual relation to the requisite ideas.

Where does that leave Rational Ignoramus?

In the very non-plussing predicament of knowing that he does not know the answer to some why-questions, yet not knowing what he must find out in order to know whether there is anything to know at all![49]

What is Rational Ignoramus to do under the burden of such ignorance? My guess is that the rational thing for him to do is to forget about the why-question and to turn to other questions instead, remembering that answers to why-questions usually emerge from work on questions with more reliable credentials. That same guess probably looms behind the distrust of why-questions often felt by experimentalists, and behind the eagerness of some philosophers to reconstrue why-questions as non-why-questions in disguise, for example, as "What is the cause of ...?", "From what laws and antecedent conditions does it follow that ...?", "What mechanisms are responsible for ...?", "For what reason did ...?"

But even if my guess is right, it should not be taken as denigrating answers to why-questions. Those answers include some of our most beautiful intellectual prizes. Answers to why-

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49. Why-questions are not unique in this respect: "What-is X?" questions, under certain circumstances, will raise the same predicament, but in a different way. There must be others. The topic deserves investigation. This predicament, by the way, is not to be confused with what I once called the p-predicament, viz. the predicament in which one is with regard to a question q when one knows that the presuppositions of q are true but every possible answer to q one can excogitate is incompatible with other things one knows. Why-questions can put one in either predicament. Questions whose presuppositions entail that at least one possible answer is true can only put one in a p-predicament.

questions reveal the surprising in the familiar and the familiar in the surprising, they unveil what is otherwise hidden, they link what seems otherwise unconnected; they generate new questions; they come with new value adders. The credentials of why-questions may be unclear, but their Peircean, Jamesian, Collingwood, and Machian value is beyond doubt. That is probably why distrust of why-questions has never influenced theory construction for very long, and why philosophical reconstruals have never gained wide acceptance.

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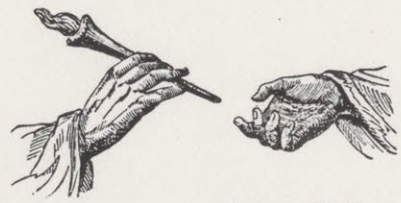

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BOOK VIII.

THE PHILOSOPHY OF THE CLASSIFICATORY SCIENCES.

CHAPTER I.

THE IDEA OF LIKENESS AS GOVERNING THE USE OF COMMON NAMES.

1. *Object of the Chapter.*—NOT only the Classificatory Sciences, but the application of names to things in the rudest and most unscientific manner, depends upon our apprehending them as *like* each other. We must therefore endeavour to trace the influence and operation of the Idea of Likeness in the common use of language, before we speak of the conditions under which it acquires its utmost exactness and efficacy.

It will be my object to show in this, as in previous cases, that the impressions of sense are apprehended by acts of the mind; and that these mental acts necessarily imply certain relations which may be made the subjects of speculative reasoning. We shall have, if we can, to seize and bring into clear view the principles which the relation of *like* and *unlike* involves, and the mode in which these principles have been developed.

2. *Unity of the Individual.*—But before we can attend to several things as like or unlike, we must be able to apprehend each of these by itself as *one thing*. It may at first sight perhaps appear that this apprehension results immediately from the impressions on our senses, without

any act of our thoughts. A very little attention, however, enables us to see that thus to single out special objects requires a mental operation as well as a sensation. How, for example, without an exertion of mental activity, can we see one tree, in a forest where there are many? We have, spread before us, a collection of colours and forms, green and brown, dark and light, irregular and straight: this is all that sensation gives or can give. But we associate one brown trunk with one portion of the green mass, excluding the rest, although the neighbouring leaves are both nearer in contiguity and more similar in appearance than is the stem. We thus have before us one tree; but this unity is given by the mind itself. We see the green and the brown, but we must *make* the tree before we can see *it*.

That this composition of our sensations so as to form *one thing* implies an act of our own, will perhaps be more readily allowed, if we once more turn our attention to the manner in which we sometimes attempt to imitate and record the objects of sight, by drawing. When we do this, as we have already observed, we mark this unity of each object, by drawing a line to separate the parts which we include from those which we exclude;—an *Outline*. This line corresponds to nothing which we see; the beginner in drawing has great difficulty in discerning it; he has in fact to make it. It is, as has been said by a painter of our own time*, a fiction: but it is a fiction employed to mark a real act of the mind; to designate the singleness of the object in our conception. As we have said elsewhere, we see lines, but especially outlines, by mentally drawing them ourselves.

The same act of conception which the outline thus represents and commemorates in visible objects,—the same combination of sensible impressions into a unit,—is

* Phillips *On Painting*,—Design.

exercised also with regard to the objects of all our senses: and the singleness thus given to each object, is a necessary preliminary to its being named or represented in any other way.

But it may be said, Is it then by an arbitrary act of our own that we put together the branches of the same tree, or the limbs of the same animal? Have we equally the power and the right to make the branch of the fir a part of the neighbouring oak? Can we include in the outline of a man any object with which he happens to be in contact?

Such suppositions are manifestly absurd. And the answer is, that though we give unity to objects by an act of thought, it is not by an *arbitrary* act; but by a process subject to certain conditions;—to conditions which exclude such incongruous combinations as have just been spoken of.

What are these conditions which regulate our apprehension of an object as one?—which determine what portion of our impressions does, and what portion does not belong to the same thing?

3. *Condition of Unity.*—I reply, that the primary and fundamental condition is, that we must be able to make intelligible assertions respecting the object, and to entertain that belief of which assertions are the exposition. A tree *grows*, *sheds* its leaves in autumn, and *buds* again in the spring, *waves* in the wind, or *falls* before the storm. And to the tree belong all those parts which must be included in order that such declarations, and the thoughts which they convey, shall have a coherent and permanent meaning. Those are *its* branches which wave and fall with *its* trunk; those are *its* leaves which grow on *its* branches. The permanent connexions which we observe,—permanent, among unconnected changes which affect the surrounding appearances,—are what we bind together as

belonging to one object. This permanence is the condition of our conceiving the object *as* one. The connected changes may always be described by means of assertions; and the connexion is seen in the identity of the subject of successive predications; in the possibility of applying many verbs to one substantive. We may therefore express the condition of the unity of an object to be this: that *assertions concerning the object shall be possible:* or rather we should say, that the acts of belief which such assertions enunciate shall be possible.

It may seem to be superfluous to put in a form so abstract and remote, the grounds of a process apparently so simple as our conceiving an object to be one. But the same condition to which we have thus been led, as the essential principle of the unity of objects, namely, that propositions shall be possible, will repeatedly occur in the present chapter; and it may serve to illustrate our views, to show that this condition pervades even the simplest cases.

4. *Kinds.*—The mental synthesis of which we have thus spoken, gives us our knowledge of *individual* things; it enables me to apprehend that particular tree or man which I now see, or, by the help of memory, the tree or the man I saw yesterday. But the knowledge with which we have mainly here to do is not a knowledge of individuals but of kinds; of such classes as are indicated by common names. We have to make assertions concerning a tree or a man in general, without regarding what is peculiar to this man or that tree.

Now it is clear that certain individual objects are all called *man*, or all called *tree*, in virtue of some resemblance which they have. If we had not the power of perceiving in the appearances around us, likeness and unlikeness, we could not consider objects as distributed into kinds at all. The impressions of sense would throng

upon us, but being uncompared with each other, they would flow away like the waves of the sea, and each vanish from our contemplation when the sensation faded. That we do apprehend surrounding objects as belonging to permanent kinds, as being men and horses, oaks and roses, arises from our having the idea of likeness, and from our applying it habitually, and so far as such a classification requires.

Not only can we employ the idea of likeness in this manner, but we apply it incessantly and universally to the whole mass and train of our sensations. For we have no external sensations to which we cannot apply some language or other, and all language necessarily implies recognition of resemblances. We cannot call an object *green* or *round* without comparing in our thoughts its colour or its shape, with a shape and a colour seen in other objects. All our sensations, therefore, without any exception of kind or time, are subject to this constant process of classification; and the idea of likeness is perpetually operating to distribute them into kinds, at least so far as the use of language requires.

We come then again to the question, Upon what principle, under what conditions, is the idea of likeness thus operative? What are the limits of the classes thus formed? Where does that similarity end, which induces and entitles us to call a thing a *tree*? What universal rule is there for the application of common names, so that we may not apply them wrongly?

5. *Not made by Definitions.*—Perhaps some one might expect in answer to these inquiries a definition or a series of definitions;—might imagine that some description of a tree might be given which might show when the term was applicable and when it was not; and that we might construct a body of rules to which such descriptions must conform. But on consideration it will be clear that the

real solution of our difficulty cannot be obtained in such a manner. For *first;* such descriptions must be given in words, and therefore suppose that we have already satisfied ourselves how words are to be used. If we define a tree to be "a living thing without the power of voluntary motion," we shall be called upon to define "a living thing;" and it is manifest that this renewal of the demand for definition might be repeated indefinitely; and, therefore, we cannot in this way come to a final principle. And in the *next* place, most of those who use language, even with great precision and consistency, would find it difficult or impossible to give good definitions even of a few of the general names which they use; and therefore their practice cannot be regulated by any tacit reference to such definitions. That definitions of terms are of great use and importance in their right place, we shall soon see; but their place is not to regulate the use of common language.

What then, once more, is this regulative principle? What rules do men follow in the use of words, so as commonly to avoid confusion and ambiguity? How do they come to understand each other so well as they ordinarily do, respecting the limits of classes never defined, and which they cannot define? What is the common Convention, or Condition to which they conform?

6. *Condition of the Use of Terms.*—To this we reply, that the Condition which regulates the use of language, is that it shall be capable of being used;—that is, that general assertions shall be possible. The term *tree* is applicable as far as it is useful in expressing our knowledge concerning trees:—thus we know that trees are fixed in the ground, have a solid stem, branches, leaves, and many other properties. With regard to all the objects which surround us, we have an immense store of

knowledge of such properties, and we employ the names of the objects in such a manner as enables us to express these properties.

But the connexion of such properties is variable and indefinite. Some properties are constantly combined, others occasionally only. The leaves of different oaks resemble each other, the branches resemble far less, and may differ very widely. The term *oak* does not enable us to say that all oaks have straight branches or all crooked. Terms can only express properties as far as they are constant. Not only, therefore, the accumulation of a vast mass of knowledge of the properties and attributes of objects, but also an observation of the habitual *connexion* of such properties is needed, to direct us to the consistent application of terms:—to enable us to apply them so as to express truths. But here again we are largely provided with the requisite knowledge and observation by the common course of our existence. The unintermitting stream of experience supplies us with an incalculable amount of such observed connexions. All men have observed that the associations of the same form of leaves are more constant than of the same form of branches;—that though persons walk in different attitudes none go on all fours; and thus the term *oak* is so applied as to include those cases in which the leaves are alike in form though the branches be unlike; and though we should refuse to apply the term *man* to a class of creatures which habitually and without compulsion used four legs, we make no scruple of affixing it to persons of very different figures. The whole of human experience being composed of such observed connexions, we have thus materials even for the immense multiplicity of names which human language contains; all which names are, as we have said,

regulated in their application by the condition of expressing such experience.

Thus amid the countless combinations of properties and divisions of classes which the structure of language implies, scarcely any are arbitrary or capricious. A word which expressed a mere wanton collection of unconnected attributes could hardly be called a *word;* for of such a collection of properties no truth could be asserted, and the word would disappear, for want of some occasion on which it could be used. Though much of the fabric of language appears, not unnaturally, fantastical and purely conventional, it is in fact otherwise. The associations and distinctions of phraseology are not more fanciful than is requisite to make them correspond to the apparent caprices of nature or of thought; and though much in language may be called conventional, the conventions exist for the sake of expressing some truth or opinion, and not for their own sake. The principle, that *the condition of the use of terms is the possibility of general, intelligible, consistent assertions,* is true in the most complete and extensive sense.

7. *Terms may have different Uses.*—The Terms with which we are here most concerned are Names of Classes of natural objects; and when we say that the principle and the limit of such Names are their use in expressing propositions concerning the classes, it is clear that much will depend on the kind of propositions which we mainly have to express: and that the same name may have different limits, according to the purpose we have in view. For example, is the whale properly included in the general term *fish?* When men are concerned in catching marine animals, the main features of the process are the same however the animals may differ; hence whales are classed with fishes, and we speak of the *whale-fishery.* But if we look at the analogies of organization, we find

that, according to these, the whale is clearly not a fish, but a *beast*, (confining this term, for the sake of distinctness, to suckling beasts or *mammals*). In Natural History, therefore, the whale is not included among fish. The indefinite and miscellaneous propositions which language is employed to enunciate in the course of common practical life, are replaced by a more coherent and systematic collection of properties, when we come to aim at scientific knowledge. But we shall hereafter consider the principle of the classifications of Natural History; our present subject is the application of the Idea of Likeness in common practice and common language.

8. *Gradation of Kinds.*—Common names, then, include many individuals associated in virtue of resemblances, and of permanently connected properties; and such names are applicable as far as they serve to express such properties. These collections of individuals are termed *Kinds, Sorts, Classes.*

But this association of particulars is capable of degrees. As individuals by their resemblances form Kinds, so kinds of things, though different, may resemble each other so as to be again associated in a higher Class; and there may be several successive steps of such classification. *Man, horse, tree, stone*, are each a name of a Kind; but *animal* includes the two first and excludes the others; *living thing* is a term which includes *animal* and *tree* but not *stone; body* includes all the four. And such a subordination of kinds may be traced very widely in the arrangements of language.

The condition of the use of the wider is the same as that of the narrower Names of Classes;—they are good as far as they serve to express true propositions. In common language, though such an order of generality may in a variety of instances be easily discerned, it is not systematically and extensively referred to: but this

subordination and graduated comprehensiveness is the essence of the methods and nomenclatures of Natural History, as we shall soon have to show.

But such subordination is not without its use, even in common cases, and when it is expressed in the terms of common language. Thus *organized body* is a term which includes plants and animals; *animal* includes beasts, birds, fishes; *beast* includes horses and dogs; *dogs*, again, are greyhounds, spaniels, terriers.

9. *Characters of Kinds.*—Now when we have such a Series of Names and Classes, we find that we take for granted irresistibly that each class has some *character* which distinguishes it from other classes included in the superior division. We ask what kind of beast a dog is; what kind of animal a beast is; and we assume that such questions admit of answer;—that each kind has some mark or marks by which it may be described. And such descriptions may be given: an animal is an organized body *having sensation and volition;* man is a *reasonable* animal. Whether or no we assent to the exactness of these definitions, we allow the propriety of their form. If we maintain these to be wrong, we must believe some others to be right, however difficult it may be to hit upon them. We entertain a conviction that there must be, among things so classed and named, a possibility of defining each.

Now what is the foundation of this postulate? What is the ground of this assumption, that there must exist a definition which we have never seen, and which perhaps no one has seen in a satisfactory form? The knowledge of this definition is by no means necessary to our using the word with propriety; for any one can make true assertions about dogs, but who can define a dog? And yet if the definition be not necessary to enable us to use the word, why is it necessary at all? I allow that we pos-

sess an indestructible conviction that there must be such a character of each kind as will supply a definition; but I ask, on what this conviction rests.

I reply, that our persuasion that there must needs be characteristic marks by which things can be defined in words, is founded on the assumption of *the necessary possibility of reasoning.*

The reference of any object or conception to its class without definition, may give us a persuasion that it shares the properties of its class, but such classing does not enable us to reason upon those properties. When we consider man as an animal, we ascribe to him in thought the appetites, desires, affections, which we habitually include in our notion of animal: but except we have expressed these in some definition or acknowledged description of the term animal, we can make no use of the persuasion in ratiocination. But if we have described animals as "beings impelled to action by appetites and passions," we can not only think, but say, "man is an animal, and therefore he is impelled to act by appetites and passions." And if we add a further definition, that "man is a reasonable animal," and if it appear that "reason implies conformity to a rule of action," we can then further infer that man's nature is to conform the results of animal appetite and passion to a rule of action.

The possibility of pursuing any such train of reasoning as this, depends on the definitions, of *animal* and of *man*, which we have introduced; and the possibility of reasoning concerning the objects around us being inevitably assumed by us from the constitution of our nature, we assume consequently the possibility of such definitions as may thus form part of our deduction, and the existence of such defining characters.

10. *Difficulty of Definitions.*—But though men are

on such grounds, led to make constant and importunate *demands* for definitions of the terms which they employ in their speculations, they are, in fact, far from being able to carry into complete effect the postulate on which they proceed, that they must be able to find definitions which by logical consequence shall lead to the truths they seek. The postulate overlooks the process by which our classes of things are formed and our names applied. This process consisting, as we have already said, in observing permanent connexions of properties, and in fixing them by the attribution of names, is of the nature of the process of induction, of which we shall afterwards have to speak. And the postulate is so far true, that this process of induction being once performed, its result may usually be expressed by means of a few definitions, and may thus lead by a deduction to a train of real truths.

But in the subjects where we principally find such a subordination of classes as we have spoken of, this process of deduction is rarely of much prominence: for example, in the branches of natural history. Yet it is in these subjects that the existence and importance of these characteristic marks, which we have spoken of, principally comes into view. In treating of these marks, however, we enter upon methods which are technical and scientific, not popular and common. And before we make this transition, we have a remark to make on the manner in which writers, without reference to physics or natural history, have spoken of kinds, their subordination, and their marks.

11. "*The Five Words.*"—These things,—the nature and relations of classes,—were, in fact, the subjects of minute and technical treatment by the logicians of the school of Aristotle. Porphyry wrote an Introduction to the *Categories* of that philosopher, which is entitled *On*

SECT. III.—*The Plan of the System.*

4. The collection of sound views and maxims by which the resemblances of natural objects are applied so as to form a scientific classification, is a department of the philosophy of natural history which has been termed by some writers (as Decandolle,) *Taxonomy*, as containing the *Laws* of the *Taxis*, (*arrangement*). By some Germans this has been denominated *Systematik*; if we could now form a new substantive after the analogy of the words *Logick*, *Rhetorick*, and the like, we might call it *Systematick*. But though our English writers commonly use the expression *Systematical Botany* for the Botany of Classification, they appear to prefer the term *Diataxis* for the method of constructing the classification. The rules of such a branch of science are curious and instructive.

In framing a Classification of objects we must attend to their resemblances and differences. But here the question occurs, to *what* resemblances and differences? for a different selection of the points of resemblance would give different results: a plant frequently agrees in leaves with one group of plants, in flowers with another. Which set of characters are we to take as our guide?

The view already given of the regulative principle of all classification, namely, that it must enable us to assert true and general propositions, will obviously occur as applicable here. The object of a scientific Classification is to enable us to enunciate scientific truths: we must therefore classify according to those resemblances of objects (plants or any others,) which bring to light such truths.

But this reply to the inquiry, "On what characters of resemblance we are to found our system," is still too general and vague to be satisfactory. It carries us, however, as far as this;—that since the truths we are to attend to are scientific truths, governed by precise and homogeneous relations, we must not found our scientific Classification on casual, indefinite, and unconnected considerations. We must not, for instance, be satisfied with dividing plants, as Dioscorides does, into *aromatic*, *esculent*, *medicinal*, and *vinous*; or even with the long prevalent distribution into *trees*, *shrubs*, and *herbs*; since in these subdivisions there is no consistent principle.

5. *Latent Reference to Natural Affinity.*—But there may be several kinds of truths, all exact and coherent, which may be discovered concerning plants or any other natural objects; and if this should be the case, our rule leaves us still at a loss in what manner our classification is to be constructed. And, historically speaking, a much more serious inconvenience has been this;—that the task of classification of plants was necessarily performed when the general laws of their form and nature were very little known; or rather, when the existence of such laws was only just beginning to be discerned. Even up to the present day, the general propositions which botanists are able to assert concerning the structure and properties of plants, are extremely imperfect and obscure.

We are thus led to this conclusion:—that the Idea of Likeness could not be applied so as to give rise to a scientific Classification of plants, till considerable progress was made in studying the general relations of vegetable form and life; and that the selection of the resemblances which should be taken into account, must depend upon the nature of the relations which were then brought into view.

But this amounts to saying that, in the consideration of the Classification of vegetables, other Ideas must be

called into action as well as the Idea of Likeness. The additional general views to which the more intimate study of plants leads, must depend, like all general truths, upon some regulating Idea which gives unity to scattered facts. No progress could be made in botanical knowledge without the operation of such principles: and such additional Ideas must be employed, besides those of mere likeness and unlikeness, in order to point out that Classification which has a real scientific value.

Accordingly, in the classificatory sciences, Ideas other than Likeness do make their appearance. Such Ideas in botany have influenced the progress of the science, even before they have been clearly brought into view. We have especially the Idea of Affinity, which is the basis of all Natural Systems of Classification, and which we shall consider in a succeeding chapter. The assumption that there *is* a Natural System, an assumption made by all philosophical botanists, implies a belief in the existence of Natural Affinity, and is carried into effect by means of principles which are involved in that Idea. But as the formation of all systems of classification must involve, in a great degree, the Idea of Resemblance and Difference, I shall first consider the effect of that Idea, before I treat specially of Natural Affinity.

6. *Natural Classes.*—Many attempts were made to classify vegetables before the rules which govern a natural system were clearly apprehended. Botanists agree in esteeming some characters as of more value than others, before they had agreed upon any general rules or principles for estimating the relative importance of the characters. They were convinced of the necessity of adding other considerations to that of Resemblance, without seeing clearly what these others ought to be. They aimed at a Natural Classification, without knowing distinctly in what manner it was to be Natural.

The attempts to form *Natural Classes*, therefore, in the first part of their history, belong to the Idea of Likeness, though obscurely modified, even from an early period, by the Ideas of Affinity, and even of Function and of Developement. Hence Natural Classes may, to a certain extent, be treated of in this place.

Natural Classes are opposed to Artificial Classes which are understood to be regulated by an *assumed* character. Yet no classes can be so absolutely Artificial in this sense, as to be framed upon characters *arbitrarily* assumed; for instance, no one would speak of a class of shrubs defined by the circumstance of each having a hundred leaves: for of such a class no assertion could be made, and therefore the class could never come under our notice. In what sense then are Artificial Classes to be understood, as opposed to Natural?

7. *Artificial Classes.*—To this question, the following is the answer. When Natural Classes of a certain small extent have been formed, a system may be devised which shall be regulated by a few selected characters, and which shall not dissever these small Natural Classes, but conform to them as far as they go. If these selected characters be then made absolute and imperative, and if we abandon all attempt to obtain Natural Classes of any higher order and wider extent, we form an Artificial System.

Thus in the Linnæan System of Botanical Classification, it is assumed that certain natural groups, namely, Species and Genera, are established; it is conceived, moreover, that the division of Classes according to the number of stamens and of pistils does not violate the natural connexions of Species and Genera. This arrangement, according to the number of stamens and pistils, (further modified in certain cases by other considerations,) is then made the ground of all the higher

divisions of plants, and thus we have an Artificial System.

It has been objected to this view, that the Linnæan Artificial System does not in all cases respect the boundaries of genera, but would, if rigorously applied, distribute the species of the same genus into different artificial classes; it would divide, for instance, the genera *Valeriana*, *Geranium**, &c. To this we must reply, that so far as the Linnæan System does this, it is an imperfect Artificial System. Its great merit is in its making such a disjunction in comparatively so few cases; and in the artificial characters being, for the most part, obvious and easily applied.

8. *Are Genera Natural?*—It has been objected also that Genera are not Natural groups. Linnæus asserts in the most positive manner that they are†. On which Adanson observes‡, "I know not how any Botanist can maintain such a thesis: that which is certain is, that up to the present time no one has been able to prove it, nor to give an exact definition of a natural genus, but only of an artificial." He then brings several arguments to confirm this view.

But we are to observe, in answer to this, that Adanson improperly confounds the recognition of the existence of a natural group with the invention of a technical mark or definition of it. Genera are groups of species associated in virtue of natural affinity, of general resemblance, of real propinquity: of such groups certain selected characters, one or few, may usually be discovered, by which the species may be referred to their groups. These Artificial characters do not constitute, but indicate the genus: they are the *Diagnosis*, not the basis of the *Diataxis:* and they are always subject to be

* Decand. *Theor. Elem.*, p. 45. † *Phil. Bot.*, Art. 165.
‡ *Famille de Ph.*, Pref. cv.

rejected, and to have others substituted for them, when they violate the natural connexion of species which a minute and enlarged study discovers.

It is, therefore, no proof that Genera are not Natural, to say that their artificial characters are different in different systems. Such characters are only different attempts to confine the variety of nature within the limits of definition. Nor is it sufficient to say that these groups themselves are different in different writers; that some botanists make genera what others make only species; as *Pedicularis*, *Rhinanthus*, *Euphrasia*, *Antirrhinum**. This discrepancy shows only that the natural arrangement is not yet completely known, even in the smaller groups; a conclusion to which we need not refuse our assent. But in opposition to these negatives, the manner in which Genera have been established proves that they are regulated by the principle of being natural, and by that alone. For they are not formed according to any *à priori* rule. The Botanist does not take any selected or arbitrary part or parts of the plants, and marshal his genera according to the differences of this part. On the contrary, the divisions of genera are sometimes made by means of the flower; sometimes by means of the fruit: the anthers, the stamens, the seeds, the pericarp, and the most varied features of these parts, are used in the most miscellaneous and unsystematic manner. Linnæus has indeed laid down a maxim that the characteristic differences of genera must reside in the fructification†: but Adanson has justly remarked‡, that an arbitrary restriction like this makes the groups artificial: and that in some families other characters are more essential than those of the fructification; as the leaves in the families of *Aparineæ* and *Leguminosæ*, and the disposi-

* Adanson, p. cvi. † *Phil. Bot.*, Art. 162.
‡ Adanson, Pref., p. cxx.

tion of the flowers in *Labiatæ*. And Naturalists are so far from thinking it sufficient to distribute species into genera by *arbitrary* marks, that we find them in many cases lamenting the absence of good *natural* marks: as in the families of *Umbelliferæ*, where Linnæus declared that any one who could find good characters of genera would deserve great admiration, and where it is only of late that good characters have been discovered and the arrangement settled* by means principally of the ribs of the fruit†.

It is thus clear that Genera are not established on any assumed or preconceived basis. What, then, is the principle which regulates botanists when they try to fix genera? What is the arrangement which they thus wish for, without being able to hit upon it? What is the tendency which thus drives them from the corolla to the anthers, from the flower to the fruit, from the fructification to the leaves? It is plain that they seek something, not of their own devising and creating;—not anything merely conventional and systematic; but something which they conceive to exist in the relations of the plants themselves;—something which is without the mind, not within;—in nature, not in art;—in short, a Natural Order.

Thus the regulative principle of a Genus, or of any other natural group is, that it is, or is supposed to be, natural. And by reference to this principle as our guide, we shall be able to understand the meaning of that indefiniteness and indecision which we frequently find in the descriptions of such groups, and which must appear so strange and inconsistent to any one who does not suppose these descriptions to assume any deeper ground

* Lindley, *Nat. Syst.*, p. 5.

† In like manner we find Cuvier saying of Rondelet that he has "un *sentiment* très vrai des genres." *Hist. Ichth.*, p. 39.

of connexion than an arbitrary choice of the botanist. Thus in the family of the Rose-tree, we are told that the *ovules* are *very rarely* erect*, the *stigmata* are *usually* simple. Of what use, it might be asked, can such loose accounts be? To which the answer is, that they are not inserted in order to distinguish the species, but in order to describe the family, and the total relations of the ovules and of the stigmata of the family are better known by this general statement. A similar observation may be made with regard to the Anomalies of each group, which occur so commonly, that Mr. Lindley, in his *Introduction to the Natural System of Botany*, makes the "Anomalies" an article in each Family. Thus, part of the character of the Rosaceæ is that they have alternate *stipulate* leaves, and that the *albumen* is *obliterated:* but yet in *Lowea*, one of the genera of this family, the stipulæ are *absent;* and the albumen is *present* in another, *Neillia*. This implies, as we have already seen, that the artificial character (or *diagnosis* as Mr. Lindley calls it) is imperfect. It is, though very nearly, yet not exactly, commensurate with the natural group: and hence, in certain cases, this character is made to yield to the general weight of natural affinities.

9. *Difference of Natural History and Mathematics.*—These views,—of classes determined by characters which cannot be expressed in words,—of propositions which state, not what happens in all cases, but only usually,—of particulars which are included in a class though they transgress the definition of it, may very probably surprize the reader. They are so contrary to many of the received opinions respecting the use of definitions and the nature of scientific propositions, that they will probably appear to many persons highly illogical and unphilosophical. But a disposition to such a judgment arises in a great

* Lindley, *Nat. Syst.*, p. 81.

measure from this;—that the mathematical and mathematico-physical sciences have, in a great degree, determined men's views of the general nature and form of scientific truth; while Natural History has not yet had time or opportunity to exert its due influence upon the current habits of philosophizing. The apparent indefiniteness and inconsistency of the classifications and definitions of Natural History belongs, in a far higher degree, to all other except mathematical speculations; and the modes in which approximations to exact distinctions and general truths have been made in Natural History, may be worthy our attention, even for the light they throw upon the best modes of pursuing truth of all kinds.

10. *Natural Groups given by Type not by Definition.*—The further developement of this suggestion must be considered hereafter. But we may here observe, that though in a Natural Group of objects a definition can no longer be of any use as a regulative principle, classes are not, therefore, left quite loose, without any certain standard or guide. The class is steadily fixed, though not precisely limited; it is given, though not circumscribed; it is determined, not by a boundary line without, but by a central point within; not by what it strictly excludes, but by what it eminently includes; by an example, not by a precept; in short, instead of Definition we have a *Type* for our director.

A Type is an example of any class, for instance, a species of a genus, which is considered as eminently possessing the characters of the class. All the species which have a greater affinity with this Type-species than with any others, form the genus, and are ranged about it, deviating from it in various directions and different degrees. Thus a genus may consist of several species which approach very near the type, and of which the

claim to a place with it is obvious; while there may be other species which straggle further from this central knot, and which yet are clearly more connected with it than with any other. And even if there should be some species of which the place is dubious, and which appear to be equally bound to two generic types, it is easily seen that this would not destroy the reality of the generic groups, any more than the scattered trees of the intervening plain prevent our speaking intelligibly of the distinct forests of two separate hills.

The Type-species of every genus, the Type-genus of every family, is, then, one which possesses all the characters and properties of the genus in a marked and prominent manner. The Type of the Rose family has alternate stipulate leaves, wants the albumen, has the ovules not erect, has the stigmata simple, and besides these features, which distinguish it from the exceptions or varieties of its class, it has the features which make it prominent in its class. It is one of those which possess clearly several leading attributes; and thus, though we cannot say of any one genus that it *must* be the Type of the family, or of any one species that it *must* be the Type of the genus, we are still not wholly to seek: the Type must be connected by many affinities with most of the others of its group; it must be near the center of the crowd, and not one of the stragglers.

11. It has already been repeatedly stated, as the great rule of all classification, that the classification must serve to assert general propositions. It may be asked what propositions we are able to enunciate by means of such classifications as we are now treating of. And the answer is, that the collected knowledge of the characters, habits, properties, organization, and functions of these groups and families, as it is found in the best botanical works, and as it exists in the minds of the best botanists,

exhibits to us the propositions which constitute the science, and to the expression of which the classification is to serve. All that is not strictly definition, that is, all that is not artificial character, in the descriptions of such classes, is a statement of truths, more or less general, more or less precise, but making up, together, the positive knowledge which constitutes the science. As we have said, the consideration of the properties of plants in order to form a system of classification, has been termed Taxonomy, or the Systematick of Botany; all the parts of the descriptions, which, taking the system for granted, convey additional information, are termed the *Physiography* of the science; and the same terms may be applied in the other branches of Natural History.

12. *Artificial and Natural Systems.*—If I have succeeded in making it apparent that an artificial system of characters necessarily implies natural classes which are not severed by the artificial marks, we shall now be able to compare the nature and objects of the Artificial and Natural Systems; points on which much has been written in recent times.

The Artificial System is one which is, or professes to be, entirely founded upon marks selected according to the condition which has been stated, of not violating certain narrow natural groups; namely, in the Linnæan system, the natural genera of plants. The marks which form the basis of the system, being thus selected, are applied rigorously and universally without any further regard to any other characters or indications of affinity. Thus in the Linnæan system, which depends mainly on the number of male organs or stamens, and on the number of female organs or styles, the largest divisions, or the *Classes*, are arranged according to the number of the stamens, and are *monandria*, *diandria*, *triandria*, *tetrandria*, *pentandria*, *hexandria*, and so on: the names

being formed of the Greek numerical words, and of the word which implies *male*. And the Orders of each of these Classes are distinguished by the number of styles, and are called *monogynia*, *digynia*, *trigynia*, and so on, the termination of these words meaning *female*. And so far as this numerical division and subdivision go on, the system is a rigorous system, and strictly artificial.

But the condition that the artificial system shall leave certain natural affinities untouched, makes it impossible to go through the vegetable kingdom by a method of mere numeration of stamens and styles. The distinction of flowers with twenty and with thirty stamens is not a fixed distinction: flowers of one and the same kind, as roses, have, some fewer than the former, some more than the latter number. The Artificial System, therefore, must be modified. And there are various relations of connexion and proportion among the stamina which are more permanent and important than their mere number. Thus flowers with two longer and two shorter stamens are not placed in the class *tetrandria*, but are made a separate class *didynamia*; those with four longer and two shorter are in like manner *tetradynamia*, not *hexandria*; those in which the filaments are bound into two bundles are *diadelphia*. All these and other classes are deviations from the plan of the earlier Classes, and are so far defects of the artificial system; but they are deviations requisite in order that the system may leave a basis of natural groups, without which it would not be a System of *Vegetables*. And as the division is still founded on some properties of the stamens, it combines not ill with that part of the system which depends on the number of them. The Classes framed in virtue of these various considerations make up an Artificial System which is tolerably coherent.

"But since the Artificial System thus regards natural

groups, in what does it differ from a Natural System?" It differs in this:—That though it allows certain subordinate natural groups, it merely allows *these*, and does not endeavour to ascend to any wider natural groups. It takes all the *higher* divisions of its scheme from its artificial characters, its stamens and pistils, without looking to any natural affinities. It accepts natural *Genera*, but it does not seek natural *Families*, or Orders, or Classes. It *assumes* natural groups, but does not *investigate* any; it forms wider and higher groups, but professes to frame them arbitrarily.

But then, on the other hand, the question occurs, "This being the case, what can be the use of the Artificial System?" If its characters, in the higher stages of classification, be arbitrary, how can it lead us to the natural relations of plants? And the answer is, that it does so in virtue of the original condition, that there shall be certain natural relations which the artificial system shall not transgress; and that its use arises from the facility with which we can follow the artificial arrangement as far as it goes. We can count the stamens and pistils, and thus we know the Class and Order of our plant; and we have then to discover its Genus and Species by means less symmetrical but more natural. The Artificial System, though arbitrary in a certain degree, brings us to a Class in which the whole of each Genus is contained, and there we can find the proper Genus by a suitable method of seeking. No Artificial System can conduct us into the extreme of detail, but it can place us in a situation where the detail is within our reach. We cannot find the house of a foreign friend by its latitude and longitude; but we may be enabled, by a knowledge of the latitude and longitude, to find the city in which he dwells, or at least the island; and we then can reach his abode by following the road or exploring the locality.

The Artificial System is such a method of travelling by latitude and longitude; the Natural System is that which is guided by a knowledge of the country.

The Natural System, then, is that which endeavours to arrange by the natural affinities of objects; and more especially, which attempts to ascend from the lower natural groups to the higher; as for example from genera to natural families, orders, and classes. But as we have already hinted, these expressions of natural affinities, natural groups, and the like, when considered in reference to the idea of resemblance alone, without studying analogy or function, are very vague and obscure. We must notice some of the attempts which were made under the operation of this imperfect view of the subject.

SECT. IV.—*Modes of framing Natural Systems.*

13. Decandolle* distinguishes the attempts at Natural Classifications into three sorts: those of *blind trial*, (*tâtonnement*), those of *general comparison*, and those of *subordination of characters*. The two former do not depend distinctly upon any principle, except resemblance; the third refers us to other views, and must be considered in a future chapter.

Method of Blind Trial.—The notion of the existence of natural classes dependent on the general resemblance of plants,—of an affinity showing itself in different parts and various ways,—though necessarily somewhat vague and obscure, was acted upon at an early period, as we have seen in the formation of genera; and was enunciated in general terms soon after. Thus Magnolius† says that he discerns in plants an affinity, by means of which they may be arranged in families. "Yet it is impossible to

* *Theor. Elem.*, art. 41.

† Dec. *Theor. Elem.*, art. 42. Petri Magnoli, *Prodromus Hist. Gen. Plant.*, 1689.

the name of the Class and the Order must not be expressed but understood: and hence, he says, Royen, who took *Lilium* for the name of a Class, rightly rejected it as a generic name and substituted *Lirium*, with the Greek termination.

Yet we must not too peremptorily assume such maxims as these to be universal for all classificatory sciences. It is very possible that it may be found advisable to use *three* terms, that of order, genus and species, in designating minerals, as is done in Mohs's nomenclature; for example, *Rhombohedral Calc Haloide*, *Paratomous Hal Baryte*.

It is possible also that it may be found useful in the same science to mark some of the steps of classification by the termination. Thus it has been proposed to confine the termination *ite* to the Order *Silicides* of Naumann, as Apophyll*ite*, Stilb*ite*, Leuc*ite*, &c., and to use names of different form in other orders, as Talc *Spar* for Brennerite, Pyramidal Titanium *Oxide* for Octahedrite. Some such method appears to be the most likely to give us a tolerable mineralogical nomenclature.

SECT. VII.—*Diagnosis.*

20. German Naturalists speak of a part of the general method which they call the *Characteristik* of Natural History, and which is distinguished from the *Systematik* of the science. The *Systematick* arranges the objects by means of all their resemblances, the *Characteristick* enables us to detect their place in the arrangement by means of a few of their characters. What these characters are to be, must be discovered by observation of the groups and divisions of the system when they are formed. To construct a collection of such as shall be clear and fixed, is a useful, and generally a difficult task; for there is usually no apparent connexion between the marks which are used in discriminating the groups, and

the nature of the groups themselves. They are assumed only because the Naturalist, extensively and exactly acquainted with the groups and the properties of the objects which compose them, sees, by a survey of the field, that these marks divide it properly.

The Characteristick has been termed by some English Botanists the *Diagnosis* of plants; a word which we may conveniently adopt. The Diagnosis of any genus or species is different according to the system we follow. Thus in the Linnæan System the Diagnosis of the Rose is in the first place given by its Class and Order: it is Icosandrous, and Polygynous; and then the Generic Distinction is that the calyx is five-cleft, the tube urceolate, including many hairy achenia, the receptacle villous*. In the Natural System the Rose-Tribe are distinguished as being† "Polypetalous dicotyledons, with lateral styles, superior simple ovaria, regular perigynous stamens, exalbuminous definite seeds, and alternate stipulate leaves." And the true Roses are further distinguished by having "Nuts, numerous, hairy, terminated by the persistent lateral style and inclosed within the fleshy tube of the calyx," &c.

It will be observed that in a rigorous Artificial System the *Systematick* coincides with the *Characteristick*; the *Diataxis* with the *Diagnosis*; the reason why a plant is put in a division is identical with the mode by which it is known to be in the division. The Rose is in the class *icosandria*, because it has many stamens inserted in the calyx; and when we see such a set of stamens we immediately know the class. But this is not the case with the Diagnosis of Natural Families. Thus the genera *Lamium* and *Galeopsis* (Dead Nettle and Hemp Nettle), are each formed into a separate group in virtue of their general resemblances and differences, and not because

* Lindley, *Nat. Syst.*, p. 149. † *Ib.*, p. 81. 3.

the former has one tooth on each side of the lower lip, and the latter a notch in its upper lip, though they are distinguished by these marks.

Thus so far as our Systems are natural, (which, as we have shown, all systems to a certain extent must be), the Characteristick is distinct both from a Natural and an Artificial System; and is, in fact, an Artificial Key to a Natural System. As being Artificial, it takes as few characters as possible; as being Natural, its characters are not selected by any general or prescribed rule, but follow the natural affinities. The Botanists who have made any steps in the formation of a natural method of plants since Linnæus, have all attempted to give a Diagnosis corresponding to the Diataxis of their method.

Chapter III.

APPLICATION OF THE NATURAL HISTORY METHOD TO MINERALOGY.

1. The philosophy of the Sciences of Classification has had great light thrown upon it by discussions concerning the methods which are used in Botany: for that science is one of the most complete examples which can be conceived of the consistent and successful application of the principles and ideas of Classification; and this application has been made in general without giving rise to any very startling paradoxes, or disclosing any insurmountable difficulties. But the discussions concerning methods of Mineralogical Classification have been instructive for quite a different reason: they have brought into view the boundaries and the difficulties of the process of Classification; and have presented examples in which every possible mode of classifying appeared to involve inextricable contradictions. I will notice some of the points of this kind which demand our attention, referring to the works published recently by several mineralogists.

In the History of Mineralogy we noticed the attempt made by Mohs and other Germans to apply to minerals a method of arrangement similar to that which has been so successfully employed for plants. The survey which we have now taken of the grounds of that method will point out some of the reasons of the very imperfect success of this attempt. We have already said that the *Terminology* of Mineralogy was materially reformed by Werner; and including in this branch of the subject (as we must do) the Crystallography of later writers, it may be considered as to a great extent complete. Of the attempts at a Natural arrangement, that of Mohs appears to proceed by the method of *blind trial*, the undefinable perception of relationship, by which the earliest attempts at a Natural Arrangement of plants were made. Breithaupt, however, has made (though I do not know that he has published) an essay in a mode which corresponds very nearly to Adanson's process of *multiplied comparisons*. Having ascertained the specific gravity and hardness of all the species of minerals, he arranged them in a table, representing by two lines at right angles to each other these two numerical quantities. Thus all minerals were distributed according to two co-ordinates representing specific gravity and hardness. He conceived that the groups which were thus brought together were natural groups. On both these methods, and on all similar ones, we might observe, that in minerals as in plants, the mere general notion of Likeness cannot lead us to a real arrangement: this notion requires to have precision and aim given it by some other relation;—by the relation of Chemical Composition in minerals, as by the relation of Organic Function in vegetables. The physical and