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Chapter 4: Section I, subsections 1 - 4

In chapter 1, Lonegan had set out to present some general features of insights, as he notes, in somewhat of a static manner, identifying some of the key terms and relationships. Insight, questions, images were presented, along with higher viewpoints, inverse insights, and the empirical residue. In the second chapter, he starts to examine the dynamic emergence of insights within modern science and to highlight distinct "heuristic structures", classical and statistical. In the third, he then turns to self-mediating canons that guide a scientist in deliberately expanding the classical and statistical views or horizons of this universe. The fourth takes a further step by relating the classical and statistical heuristic structures and the "world" that such structures anticipate. In chapter two, he contrasts these heuristic structure but really does not say much about the relationship between these, at least explicitly. In early sessions, we have discussed these relationships at points.

Hence, on to the complementarity of these heuristic structures and "ways of knowing."

I.1.1 Complementary Heuristic Structures

Complementary in what these two heuristic structures anticipate.

Lonergan relates structures via noting that the processes in this universe which each regards is a bit different. Classical heuristic structures anticipate those events in our universe that are related, that are "systematic", that are related via "correlations" (or functions). Statistical heuristic structures anticipate those events in our universe that are unrelated.

Now, the point here is NOT that some events are relation-less, but rather that an event though related to one or two or more, is not necessarily related to all others. Lonergan will argue that no event is absolutely without relation. Notice the whole meaning of direct insights has been to discover a correlation or function. Thus, an event is what it is by some kind of relation or set of relations. And thus, if something were absolutely relation-less, then no understanding would be possible. But just because it requires some relation, it does not have to be related to everything else in this universe, and if not, then it has a non-relation to these other events, and thus there is the non-systematic in this universe.

The key in this is the anticipatory element in these heuristic structures, and what these two structures anticipate are two different facets in our universe, the related and the non-related. Furthermore, one cannot say ahead of time which anticipation will be correct. Hence one cannot determine ahead of time, apriori, whether this or that set of events in the universe is either systematic or non-systematic. Research will need to be done. As a note, this means that, apriori, one cannot really be a mechanistic determinist or an absolute chaos theorist.

I.1.2 Complementary Procedures

Complementary in how these two heuristic structures actually discover this universe.

> "For they separate systematically and non-systematically related data, and the isolation of either type is a step towards the determination of the other."

The development of a laboratory experiment to test a hypothetical law or correlation requires that the scientist try to eliminate the "non-systematic", that which would confuse the data because it introduces "events" and relationships that would not allow for clear verification of a particular law.

Generally, a field of study has to hit upon that which can be first physically isolated. This is why I think one starts with certain gases in initiating chemical laws, and one starts only with a few descriptively known physical traits in Mendel. Once one hits upon these initial steps, then one can move in a "thought manner" to more complex situations in which one can presume the prior laws that had been verified.

At the same time, because it is usually not possible to develop the perfect experiment that eliminates all "outside" factors save the laws either already known or the law being test, science has built into it the "experimental way" the non-systematic. The law of probable errors gets at this point. This anticipation of "error" is itself a way for sorting out the non-systematic from the systematic, and thus a way for reaching the validity of a hypothetical law/correlation and even the validity of the experiment as an experiment.

Beyond the use of statistics in experiments, it can also be used as an anticipated part of the environment or situation itself. Then, just as the classical scientist will allow for experiments to be setup that presume other known laws, such the scientist might incorporate statistical probabilities that set ranges of possible outcomes that should not diverge systematically from the expected outcomes, unless some unknown systematic factor is at work. And once one hits upon a possible systematic factor, it can be used in an experiment that then includes expected statistical outcomes in light of this factor.

A good example of this is Gregory Mendel. Descriptive, one might expect that heredity would be a blend of the parents. But then, one might notice that this is not true, at least for some traits, such as is found in pea plants. Height, features of the pods, etc., are not blended, but rather match either one or the other of the "parents." This unexpected statistical distribution of the descriptively understood traits raises a question. What is the reason? It is really a search for some systematic factor or factors that would account for this statistical anomaly. Mendel had to do some investigation, crossing various types of pea plants with each other, and tallying up the actual ratios of progeny with the different traits. Eventually, he came to recognize the patterns (3:1 ratios, etc). This in turn lead him to think through what might be taking place. Assuming that both parents contribute something, what and how do these contributions mix and thus result in the statistical outcomes? So notice, the statistical outcomes presume a non-systematic relationship between the actual events (the phenotypic traits) to each other. He will need to introduce this non-systematic element into his account. He will also need to introduce a systematic element. This will eventually be the "hereditary units" and the dominant or recessive alleles. Thus, the discovery of the statistical patterns resulted in the proposal of some systematic hypothesis as part of the explanation. As Lonergan then wrote "it is the discovery of the statistical law that grounds the mental separation and that can lead to the discovery no less of classical than statistical laws."

[a note on quantum physics]

1.3 Complementary Formulations

"Classical formulations regard conjugates which are verified only in events."
"Statistical formulations regard events, which are defined only by conjugates."

Every event has its conditions for existence, and those conditions are defined by the classical laws. If those conditions are fulfilled, then the classical law is operative. If not, then not. The event thus only comes to be when the conditions are right such that these converge to bring into realization some law, and thus an event takes place. In the reverse direction from this convergence, the conditions diverge. Lonergan had discussed the meaning of the diverging series of conditions in chapter 3, section 6.5.2 ("The Diverging Series of Conditions"). So how often do these conditions converge? The statistical formulation is that of a probability/ideal frequency that indicates how often such conditions do converge (or how often conditions are fulfilled for event X to take place).

Let us return to the example of Mendel. Notice what he is doing. He is asking the question at first about how often certain pea plant traits arise when parents with certain types of these traits are mated. At first, his "conjugates" are experiential conjugates, defined descriptively (tall/short, rough/smooth, etc.). At first his "statistical" understanding of the breeding of pea plants would have been descriptive as well, using terms such as "it never happens" or "it happens once in awhile" or "it always happens." This in turn leads him to the more precise statistical formulations that require actual counting of events, and the discernment of probabilities in the actual frequencies of the traits. Notice that the experiential conjugates identify the events, the statistical probabilities identify how often these events take place. This then drives Mendel to search out the conditions that converged to result in these experiential conjugates, and his search led him to the random combination of hereditary alleles that are either dominant or recessive. Hence he begins to introduce explanatory definitions which (to recall Lonergan's earlier account of them) combine descriptive nominal definitions with some explanatory terms. Future studies in genetics are going to have to nuance to a greater extent, and eventually turn from phenotypes to protein formation, and thus from explanatory definitions to implicit definitions, and thus to "pure conjugates." Then the statistics would be based not only on experiential but on pure conjugates, and thus the science begins to reach maturity.

1.4 Complementary Modes of Abstraction

Correlations are abstract. Probabilities are abstract. Both are enriching. They both complement each other in understanding this universe.

This section provides a sentence that I have always thought interesting. Lonergan writes "what concerns the statistical inquirer is, then, neither the purely systematic, nor the purely non-systematic, but the systematic as setting the ideal limits from which the non-systematic cannot diverge systematically." He raises it in the midst of contrasting the different ways in which classical laws and statistical probabilities are abstract. Classical assumes the systematic and is abstract from the non-systematic. Statistical assumes the non-systematic yet is abstract from the non-systematic as well. So what is it about? It is concerned with "the systematic as setting ideal limits from which the non-systematic cannot diverge systematically." How does the systematic set the ideal limits? I would say that it does so because it sets the possible ranges of kinds of events within a particular framework. Thus, the dominant and recessive alleles in Mendel set the "ideal limits" for particular phenotypic ideal frequencies from which actual frequencies do not systematically diverge. If systematic divergence did take place, such as getting 100 short pea plants after breeding two tall plants (tall is dominant), then some unknown factors have entered the scene.

So probabilities for Lonergan are understood as the systematic "moderating" the non-systematic. Hence statistics is not just about the non-systematic, but is a complementary mode of abstracting from the non-systematic that is rooted in the abstraction of the classical laws. Only the two together give a more complete "view" of the situation.

Lonergan also notes that classical laws and probabilities are also complementary types of invariance. He had treated of the invariance of these laws in earlier chapters. Classical laws are invariant because what is important is the similarity of data, not the space-time differences between data. Whether one is examining a particular set of data on Earth or the same set or kinds of data on Mars does not matter. In the case of probabilities, the invariance arises because of "ideal norms from which events diverge in a non-systematic fashion." Invariance in the classical case results from similar systematic patterns in the data, invariance in the second results from similar ways that the systematic sets "ideal limits" from which actual frequencies cannot diverge systematically, unless of course some additional relation(s) brings this about.