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1. There are two main reasons to use a metalanguage, when we analyse a given informal language (a) of science. The first reason is to avoid semantic antinomies of the liar type. The concept of a metalanguage, widely used since Tarski (1956: 152-268), proposed to split up the normal informal scientific language (a) into an object language (b) and a metalanguage (c). Only within the metalanguage (c) we can speak about the object language (b). Ordinary informal languages are according to Tarski "closed languages." Closed languages make no differences between semantic expressions such as "true," which refer to expressions of the object language. If, for example, we assume the statement "all decision makers are liars" within the informal language (a) then whatever a decision maker says, a contradiction will follow. If he says the truth according to the earlier statement he lies and if he lies, then he says the truth. Semantic expressions belong therefore in such a stratified language system to the metalanguage, which contains two parts: the critical one by Tarski called the semantical and the translational part in which the object language or object theory is repeated solely by terms of the metalanguage. Thus the first reason to introduce a metalanguage was given by the definition of truth, or the truth of a statement or proposition S.

Similar difficulties arose within metamathematics, when Hilbert tried to analyse the concept of provability. This second reason is more a syntactic one, notwithstanding the fact that any semantic definition of truth demands the definition of proofs. If a statement asserts its own unprovability, then it follows, that this statement is provable if unprovable, and if unprovable then it is provable. Since this holds for any richer formal system according to Godel (1931: 176), we have to use a metalanguage, when 'provable' belongs to his metalanguage. The results of Tarski's and Hilbert's introduction of metalanguages show clearly (i) that any analysis of especially scientific languages which uses critical expressions has to use a metalanguage. Critical expressions are linguistic expressions, which refer to other linguistic expressions, such as true, false, provable (ii) that the separation of the object theory as well as its formalization and axiomatization is from the beginning a highly artificial procedure. The object language (b) can preserve only approximatively all the characteristic features of the informal theory (a), is therefore not an exact mapping of the informal theory (a) into the object theory (b), hence a more arbitrarily and artificially reconstructed object theory (b). This is important to understand the difference between mathematical object theories or between cognitive axiomatized object theories (b) and the actual

informal theories (a) of mathematical textbooks or of informal cognitive scientific theories (a). In most cases the analyst does not look back any longer at the informal theory (a) if he builds up his object theory (b). Therefore philosophy of science cannot analyse the factual given form of science (a) but rather a highly idealized, formalized and by axiomatization separated paradigm. (iii) The most important result of any metatheoretical analysis of science, is, that according to Tarski's remarks, there are far more critical expressions in our language, than true, provable (Leinfellner, 1973).

In fact all intensional expressions such as alethic, modal, deontic, normative, belief-expressions can be defined only by means of stratified language, which will be called epilanguage. An epilanguage is an extended metalanguage. The metalanguage contained in the epilanguage analyses the syntactic and pure semantic properties of an object theory; this can be regarded as the first fundamental step of an analysis which has to be complemented by cognitive or descriptive-semantic aspects of the object theory (b) to approximate the real informal science (a) under consideration. This can be achieved by adding the modal aspect in case of social theories (modal complementation), by the realization-complement in the case of technological theories, by the normative-aspect in the case of action, decision, value-theories and by the deontic-aspect in the case of juridical, moral-theories of social sciences. Thus all the necessary aspects build up step by step the so called "background knowledge" of a theory or science. (iv) It is clear that such an epilanguage is "beyond the unbridgeable gap between extensional and intensional logic (Quine, 1953: 157), since once the syntactic and pure semantic features have been analysed in a first step, then in a next step, independent of it the deontic analysis provides the "ought" aspect, seen from the sole point of view of obligations how to use certain theorems, axioms. Therefore, an epilanguage guarantees that the object language is value free, whereas the epilanguage itself may contain certain binding norms admitting evaluations of scientific sentences of the object language.

This and similar questions have been discussed recently in the author's book (Leinfellner, 1973). Here a specific question is raised, which could be called the normative incompleteness of theoretical especially social sciences. Maybe the most important action theory, the statistical decision theory under uncertainty and risk will be analysed epitheoretically and it will be shown that a normal action theory of E-St type is incomplete from a normative point of view and how it can be complemented by means of the epilanguage.

2. Epitheoretical definition of the structure of a decision theory T^D under risk and uncertainty (statistical decision theory; see Chernoff-Moses (1959) and Menges (1969)).

2.1. The structure $(A,E;P,L,R,R^R)$ is called the kernel of the statistical decision theory under risk and uncertainty and at the same time the translation into the epitheory

ETD if following conditions are fulfilled.

2.1.1. A is a Boolean field of sets forming with w, a probability measure P, a finite additive probability space (A;P), where $w \in P$.

2.1.2. E is a Boolean field of sets forming with p_e, a probability measure P, a finite additive probability space (e,P), where $p_e \in P$.

2.1.3. X is a Boolean field of sets forming with p_X, a probability measure P, a finite additive probability space (X,P), where $p_X \in P$.

2.1.4. A is a finite set, the elements of A, a_i form n-tuples S, strategies.

2.1.5. L is a real valued function, defined on the set E and the set A $L(e_i,a_j)$ where $e_i \in E$ and $a_i \in A$, the values are the a_{ij}^1.

2.1.6. R is a real valued function, defined on the set S and the set E, where

$$R(e_i,s_j) = \sum_{i-1}^{m} L(e_i,a_j).p_{x_i},$$

and $s_i \in S, e_j \in E, a_i \in A$, and i = 1,2,...n

j + 1,2, m. The values of the function R are the a_{ij}^r

2.1.7. R^R is a real valued function, obtained from the function R by multiplying each value a_{ij}^r by the corresponding value p_{ei}. Thus

$$R^R(s_j) = \sum_{i=1}^{1=m} R(e_i,S_j)p_{ei}$$

2.1.8. The L,R-functions are twice differentiable.

2.1.9. D1: A strategy is admissible if there are no strategies which dominate it. A strategy s dominates a strategy s* if $R(e_i s) \geqslant R(e_i,s^*)$ and if it is not equivalent to any other: $R(e_i,s) \neq R(e_i,s^*)$.

2.1.10. There exists a minimum of the values of R, such that

$$R^*(S_j^*) = \min \left(\sum_{i=1}^{m} R(e_i,s_j)p_{ei}\right)$$

2.1.11. T2: There exists a minimum of the maxima: $\min \max (p_{ei},a_{ij}^r)$

This highly formal axiomatization can be regarded as the set-theoretical or conceptual framework of our theory, it serves for defining the structure of a part D of the world (Leinfellner, 1965; Leinfellner, 1967), defines the underlying logic epitheoretically and the system of inference, either deductively or probabilistically.

2.2. Epitheoretical definitions of underlying logic and inferential system:

2.2.1. The underlying logic is a Bourbakian type set theory (Bourbaki, 1968).

2.2.2. The underlying inferential system is a mixed classical probabilistic one.

The axiomatization together with the theorems (or consequences in the probabilistic case) have to be complemented by a cognitive or descriptive sematic interpretation. Generally any interpretation (representation) is done by rules of representations. Representation rules are composed of rules of interpretation or correspondence plus designation-rules. Representation is divided into classical and statistical, both decompose into effective or possible ones. Use of possible designation yields the modal aspect of theories, i.e. such a theory refers to a possible, future world. For more details see the authors publications (Leinfellner, 1973: 4.6; Leinfellner, 1968: 196-210; Leinfellner, 1964: 195-213, 238-278).

2.2.3. Example of an interpretation by means of possible C-rules. (the designation rules are omitted here. ". . . / - - -" should be read: ". . . (belonging to the epitheoretical kernel (L_T) is interpreted by –-", (belonging to an epitheoretically defined empirical

language L_o), contrary to the common opinion and following recent criticism (Suppe, 1972: 1-20) each complementation creates its own empirical language, therefore L_o has not the "absolute" character of Carnap-Hempel's observational language. Following correspondence rules are important: A/possible actions of decision maker; E/random events of the world; X/possible events of a chosen sample; W/frequencies of possible events; p_e/a-priori frequencies; p_x/frequency of occurrence of x within the sample events; S/possible strategies of the decision maker, series of actions; L/possible loss of the decision maker as consequence of the actions a_i;R/expected loss as consequences of arbitrarily chosen strategies s_j and of the events e_i; and finally R^r/the risk of L or the risk of the expected losses of the sample.

Since this decision theory deals with possible alternative decisions, called the conflict, out of which the decision maker has to choose the optimal, called the solution of the conflict the modal-cognitive aspect has been presented elsewhere by the author (Leinfellner, 1973).

2.2.4. The above interpreted theory belongs to the E-St type of behavioristic social theories. Generally, there are S-R, E-St, St-St types of social theories. In the first case interpretation uses the stimulus(S)-response (R) interpretation, in the second case the random-event (E)-strategy interpretation and in the third case the strategy (St)-strategy (St) interpretation. What we may observe in our case is therefore, given a random event (e), the decision maker may react by a strategy (St).

3. The normative complementation.

Normally a decision theory, as outlined in chapter 2 is regarded to be complete. But if we apply such a theory we have to add "oughts" i.e. obligations for the decision maker f.e. he has to minimize his losses etc. This we want to do epitheoretically. Such an epitheoretical complementation can be regarded not only as a normative complementation, but as a moral foundation of decision making. A short comparison of physics and social sciences will illustrate why we should use epitheoretical obligations within social sciences.

The fundamental empirical situation in classical physics is, that f.e. motion of rigid bodies can always be predicted in a classical deterministic sense, since the empirical course of motion is a constant one and the only variables are location and impulse. Exact deterministic prediction is possible because of the constant kinematic "behavior" of rigid bodies under consideration. The cognitive aspect of such a theory is a mere predictive one. The situation changes completely if human beings and their acts St as well as chance events E from which their acts are dependent are the basis D of a theory of the type E-St. Beside the random events E we have random factors such as the unforseeable random generator of human decision makers called free will and the organic wholistic character of social systems which introduce a fundamental instability, inconstancy and unrepeatability in D of a social theory of E-St type. That is exactly the empirical or ontic situation, which has to get under control by the moral commitment. Thus we have to introduce a stability and constancy via our deontic or moral commitments.

There is another reason for it. All physical classical as well as all cognitive sciences are strict cognitive in the sense that they gain knowledge of constantly occurring processes, which are endless repeatable given the same conditions, but social sciences together with all technological sciences possess a different aspect, they are creative realizing sciences. A decision theory creates norms and standards of future rational and moral decision behavior just in the same sense as we create technical aretefacts by our technology. Thus realization of a future societal order by a social theory is completely different from recognizing an outbalanced and in the same manner constantly occurring classical physical process. Only from outside of science f.e. by epitheoretically moral commitments (3.1-3.4) we may impose stability and constancy on future human behavior, thus introducing a new dimension of responsibility for social scientists.

3.1. Minimal normative complement. The decision maker has to obey by a binding predecision following neoutilitarian obligations, if he wants to justify his decision making.

3.2. Every person partaking in a (public) evaluation or decision procedure is obliged to use during the decision procedure a well formulated (epitheoretically expressed decision framework (f.e. the theory ETD) consisting at least of rules how to use and apply it (Rational insight commitment)

3.3. Each person participating in a (public) evaluation-procedure has to accommodate its evaluation (scale) to the evaluation (scale) of the rest, that means has to establish an interpersonal utility comparison, in form at least of an ordinal scale. (Interpersonal utility committment)

3.4. Each person partaking in a (public) evaluation or decision procedure has at the same time to maximize its utility and expectations and to be prepared for any possible compromise admitted by the rules of the decision procedure between best and worst expectations (compromise or minimax commitment i.e. Pareto optimality-demand).

These commitments 3.1-3.4 belong to the epitheory, they enable us to formulate decision rules or better advice from the point of view of the theory T^D, which are free of the objections and paradoxes usually attributed to them. It makes no difference what decision rules we want to use f.e. Bayes' solution to minimize the expected losses (see theorem 2.1.10) or Wald's solution to minimax it. (th. 2.1.11) We may express all these decision rules by using deontic operators put before the corresponding theorems. f.e. The decision maker is obliged to act according to theorem 2.1.9. By using the epitheoretical commitments following results can be achieved and following problems be solved (i) the problem of rationality, widely discussed in game, decision and action theory which can not be solved by axiomatization alone (Harsanyi, 1955: 321; Waldner, 1972: 87-103). (ii) The application of utility, game-, decision-and action-theory to solve social decision procedures (iv) Arrows impossibility theorem (Schwartz, 1970: 89-106) does not affect our theory, the theory presented here is Arrow-immune, (v) Allais paradox can be

resolved within this normatively complemented system (Booth, 1974). (vi) Any epitheoretically based decision theory can be considered as a moral foundation of social sciences. Thus we have shown that the introduction of an epilanguage (-theory) is an ideal mean to complete scientific theories, to add to i.e. an extensional metatheoretical aspect an intensional deontic, without getting into the well known difficulties (Quine, 1953: 157).

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