Ben-Alexander Bohnke: What is Integral Logic? (2017, April 19)

1) Definition
In my model, Integral Logic is an approach that
• on the one hand, the logic *extends*, especially with regard to quantification,
• on the other hand, the logic *unifies*, integrates different logics into a whole.

2) Object level
• There are mainly the following object areas (or interpretations) of the logic: *ontical* (eg facts), *linguistic* (eg sentences, propositions), *psychological* (eg judgments).
• From the point of view of the Integral logic, these distinctions are not relevant for the primary logic; one can go out neutrally or uniformly from *relations*. (Also, sentences with a 1-digit predicator correspond to deep-structural relations.) I therefore give a neutral statement as to whether a relation is occupied / valid (+) or not occupied / invalid (-), so also in the "truth tables". The linguistic *truth values* (true, false) I only use in special cases.

3) Objects versus relations
• It usually makes sense to distinguish between *objects* and *relations*. Only relations are occupied ("true") or not occupied ("wrong"), for objects one does not specify this.
• In a more general theory, you can also specify whether objects are occupied or not for objects. For example, “Socrates is occupied”: the object Socrates exists (or the name "Socrates" has an extension). The same applies to “not occupied”.

4) Relators
• The perhaps most important logical relation is the *copula*. This is represented by very different relators: in propositional logic the implicator A ® B, in predicate logic – without sign – Fx (x has the property F), in set-theory as element relation x Î F or as a subset-relation F Ì G.
• These different approaches can be standardized. The following is recommended:
Either a functional, implicative representation A ® B, x ® F, F ® G
Or a set-theoretic representation A Ì B, x Ì F, F Ì G.
Functionally, for example, "Socrates is a philosopher" is interpreted as "If Socrates exists, the class of philosophers is not empty." (Also *intensional* is a functional as well as a set-relational interpretation possible, since one can grasp properties as union of partial properties.)

5) Synthetic and analytical
• Normally, only a distinction is made between synthetic relations (propositions) such as X ® Y and analytic relations (propositions), tautological as well as X Þ X or contradictory ones X ÙØX. M. E., however, is to be extended to include partially analytic (or partially synthetic) relations such as (X ÚY) ¾® Y.
• In principle one could define the difference between synthetic and (partial) analytic sentences quantitatively, not as here qualitatively, but this has not proved itself.

6) Propositional Logic and Predicate Logic
• From the point of view of the integral logic, the primary difference between propositional

logic and predicate logic lies in its *quantitative structure*. The propositional logic only distinguishes between two values: *position* (X), *negation* (ØX). In contrast, the predicate logic differentiates four values: L, LØ, V and VØ.

• The propositional-logical F ® G corresponds to the predicate-logical Lx(Fx ® Gx), F ® ØG corresponds to Lx(Fx ® ØGx) etc.

7) Quantitative structure of different logics

• The quantifier-logical distinction between "all" and "some" is found in other logics or linguistic opposites.

All, necessary, offered, must, always
Some, possible, lawful, may, sometimes

• Thus, a *modal logic* can be completely derived from the *predicate logic*, which in turn leads to a simplification. For example, "Fx_i is necessary" can usually be returned to Lx(Fx), "Fx_i is possible" to Vx(Fx). And, as Lx(Fx) Þ Vx(Fx) holds, "Fx_i is necessary" Þ "Fx_i is possible".

8) Empirical Probability of Synthetic Relations

• Logical relations implicitly contain a quantitative (numerical) determination, namely the *empirical* (or statistical) probability p.

Thus, for the 2-valued propositional logic, the position has the value p = 1, the negation has the value p = 0. Hence X ® Y stands for p(X ® Y) = 1, Ø(X ® Y) stands for p(X ® Y) = 0.

• For the predicate logic (with quantifiers): L: p = 1, LØ: p = 0, V: p > 0, VØ: p < 1

9) General quantitative (synthetic) logic

• On the other hand, a general quantitative logic can also be conceived, by means of the empirical probability p. Where "a" is the *absolute frequency* q(X ÙY) etc.

a = q(X ÙØY), b = q(X ÙØY), c = q(ØX ÙY), d = q(ØX ÙØY)

Here, for the *implication* p(X ® Y) = r/n. Where p(X ® Y) = $\frac{a+c+d}{a+b+c+d}$

p is calculated by the number of real cases (r) in the possible worlds (n).

If p = 1 or p = 0, the relation is *deterministic,* if 0 < p <1 it is *statistical*.

• Thus the propositional logic is a borderline case of the predicate logic, the predicate logic is a borderline case of a general quantitative logic.

10) Theoretical probability

• The theoretical probability p^T indicates how likely a relation is according to the rules of combinatorics, that is, under random conditions. – The inverse of the theoretical probability 1 - p^T is the *information content* of a relation.

• The theoretical probability, however, also indicates the degree of tautology, that is, the degree of theoretical truth.

11) Theoretical probability of synthetic relations

• For synthetic relations: 0 < p^T <1. For example, p^T[X ® Y] = 3/4. However, it is also possible to calculate p^T for quantitative synthetic relations. E.g.

p^T[p(X ® Y) = r/n] = $\binom{n}{r}(3/4)^{r}(1/4)^{n-r}$

• Thus, a *tautology degree* is also given to synthetic relations.

12) Theoretical truth of analytic relations

• For analytical relations: tautological: $p^T = 1$, contradictory: $p^T = 0$.

• For semi-analytic relations: $0 < p^T < 1$. For example, $p^T[X \vee Y \rightarrow Y] = 3/4$.

It is also possible to calculate p^T for quantitative semi-analytic relations. In 2 steps:
(Here I use the *positive implication* introduced by me, $*\rightarrow$ instead of the normal $\rightarrow$.)

1): $p(X \vee Y) = r/n \; * \!\!\longrightarrow p(Y) \leq r/n$. If $p(X \vee Y) > 0$, there are different solutions for p(Y).
To calculate p^T for one of these solutions $p(Y) = s/n$, one proceeds as follows.

2): $p(X \vee Y) = r/n \; * \!\!\longrightarrow p(Y) = s/n \quad p^T = \binom{r}{r-s}(1/3)^s(2/3)^{r-s}$

Literature:

Ben-Alexander Bohnke: INTEGRALE LOGIK
Ein neues Modell philosophischer und mathematischer Logik
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