Explication and Simplicity

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1. Carnap on explication

- Method – project – result (Carnap 1947; 1950)
- Concept revision and construction of scientific language
- Definitions and explications: the difference?
  - Definitions: i) analytic/descriptive (equivalence, identity)
    ii) stipulative/codificatory (prescriptions)
  - Explications: replacement of one concept by another one
    - Explicandum: inexact, a previous stage of language, not fruitful
    - Explicatum: rules or definitions for applying a precise concept, criteria of adequacy (to follow)
    - Tranformation/replacement-relation

1. Carnap on explication

- Criteria of adequacy:
  - Similarity
  - Exactness
  - Fruitfulness
  - Simplicity
- Better and worse explications (or explicata)

2. Elaborations and modifications

- ‘explicandum’ and ‘explicatum’ stand for expressions
- Relation of replacement: irreflexive, asymmetric, semi-transitive
- What is explicandum?
  - A meaning specifier
    - A (meta-)expression which mentions/expresses the meaning (concept) of some (object-)expression either in its a) complete (definitional) form; or in its b) incomplete (too broad or too narrow) form; or in its c) semantically trivial form; or d) which specifies an inexact (fuzzy) meaning by examples

2. Elaborations and modifications

- Meaning specifier: examples
  - “crowd” applies to that group of people, but not to us
  - “truth” means *truth*
  - “truth” means *a kind of correspondence or fit*
  - “A knows that p” means *A has a justified true belief that p*

- Even definitions may be placed in the position of an explicandum

2. Elaborations and modifications

- Criteria of adequacy
  - Similarity condition
    - The problem with typical instances and non-instances (Carnap 1950; Kuipers 2007)
    - Select just those properties/relations of objects denoted by the explicandum without which there would be no explicatum-objects – that is, the properties necessary for the objects of explicatum (minimality condition)
    - In case of H-D confirmation: the relation of entailment between a hypothesis H and an evidence sentence E

2. Elaborations and modifications

- Criteria of adequacy
  - Exactness condition
    - Syntactic transparency (e.g., arity of the predicates)
    - Semantic unabmiguousness/sharpness
    - Explicatum as a stipulative definition or a system of definitions
  - Theoretical fruitfulness
    - Not only the formulation of (non-)empiricial hypotheses, but also an elimination of paradoxes (cf. Kuipers 2007)

2. Elaborations and modifications

- Criteria of adequacy
  - Simplicity condition
    - Syntactic minimality (complexity)
    - Ontological parsimony (cf. Baker 2013)
    - Instrumental simplicity (Frege's notation in *Begrieffsschrift* vs. modern notation)

3. H-D confirmation and the tacking paradoxes

- (HD1) Sentence E HD-confirms T if i) E is contentful ($\nvdash E$); ii) T is consistent; iii) E is true; and iv) $T \vdash E$.

  (Hesse 1970; Schurz 1991)

- (HD2) Hypothesis T is HD-confirmed by E relative to B if and only if i) E is true; ii) $T \wedge B$ is consistent; iii) $T \wedge B \vdash E$; and iv) $B \nvdash E$.

  (Hempel 1945/1965; Glymour 1980; Sprenger 2011)

3. H-D confirmation and the tacking paradoxes

- Tacking by conjunction:
  - If E HD-confirms T relative to B (that is, $[T \wedge B] \vdash E$), then E confirms T and X relative to B ($[(T \wedge X) \wedge B] \vdash E$)

  (Hempel 1945/1965; or Glymour 1980, 322)
- Tacking by disjunction:
  - if E HD-confirms T relative to B (since $[T \wedge B] \vdash E$), then $E \vee E^*$ HD-confirms T relative to B ($[T \wedge B] \vdash E \vee E^*$)

  (cf. Hesse 1970; Schurz 1991; or Sprenger 2011)

4. A case study: Schurz, Gemes, Sprenger

- Schurz's strategy (1991; 1994)
  - Restricting classical deductive inference by some relevance criteria
  - Distinguishing formal validity of arguments and the appropriateness of applied arguments
  - Steps:
    - Definition of conclusion-relevant deduction
    - Definitions of premise-relevant deduction
    - Definition of H-D confirmation

4. A case study: Schurz …

- Schurz's definition of H-D confirmation (1991):

  Sentence E HD-confirms T iff i) E is contentful ($\nvdash E$); ii) T is consistent; iii) E is true; iv) $T \vdash E$; and v) $T \vdash E$ is premise-relevant and conclusion-relevant deduction.

- The tacking paradoxes disappear
- Other applications of the relevant deduction approach
  - The Ross paradox, the Tichý-Miller paradox, …

4. A case study: … Gemes …

- Gemes' strategy (1993; 1994; 1998)
  - Refuting the idea that every contingent consequence of a theory is the part of its content
  - There are natural axiomatizations of theories with respect to which we can define H-D confirmation
  - Steps:
    - Definition of a content part of theory
    - Definition of a natural axiomatization of T(heory)
    - Definition of H-D confirmation

4. A case study: … Gemes …

- Gemes' definition of H-D confirmation:

  Where N(T) is a natural axiomatization of theory T and A is and axiom of N(T), evidence E HD-confirms axiom A of theory T relative to background evidence B iff E and (non-tautologous) B are content part of $(T \wedge B)$, and there is no natural axiomatization N(T)' of T such that for some subset S of the axioms of N(T)', E is a content part of $(S \wedge B)$ and A is not a content part of $(S \wedge B)$. (Gemes 1993, 486; cf. also Gemes 1998, 10)

- Put differently:
  - only those parts (i.e., axioms) of theory T are confirmed by evidence E which are necessary for the derivation of E relative to some background B

4. A case study: … Sprenger

- Sprenger's approach (2011):
  - using the idea of a content part of theory
  - transposition of implication ($T \vdash E$ iff $\neg E \vdash \neg T$)
  - restricting H to the domain of E
- Definition of H-D confirmation:

  Evidence E HD-confirms theory T relative to background knowledge B iff:

  i) E is a content part of $T \wedge B$ (that is $E < [T \wedge B]$ or $[T \wedge B] \vdash_{CP} E$);

  ii) There are wffs $H_1, \ldots, H_n$ such that $H_1, \ldots, H_n \vdash T$ and for all $i \leq n$, H_i is a content part of T and there is a wff E_i such that: a) E_i is a content part of E; and b) $\neg(H_{i\,|\,dom(E)}) \wedge B$ is a content part of $\neg E_i \wedge B$ (that is: $\neg E_i \wedge B \vdash_{CP} \neg(H_{i\,|\,dom(E)}) \wedge B$).

5. Comparison

- Similarity
  - all three equally well
- Exactness
  - all three use explicit definitions
  - minor objection to Gemes and Sprenger: there is no E-is-true-condition;
- Theoretical fruitfulness
  - They all eliminate the tacking paradoxes

5. Comparison

- Simplicity
  - Are concepts used in one of the explications ontologically more parsimonious that those of the others?
  - What about the syntactic/semantic complexity? (We don’t have here the number of parameters and their degrees …)
  - We maybe lack the clear-cut a priori criteria for the evaluation of simplicity of explications.
  - But …

6. Instrumental Simplicity

- What about …
  - We *tend* to prefer the *simpler* solutions to more complex ones (other things being equal).
  - After becoming acquainted with different solutions (theories, hypotheses, explications), we tend to choose that member of a pool that has continuously been proven to be instrumentally simpler (easier) than other elements.

6. Instrumental Simplicity

- Principle of Instrumental Simplicity

  Assume that x and y are potential theoretical solutions of some common problem z. Then other things being equal,

  $p(\text{Survives}(x, y) \mid \text{Simpler}(x, y)) > p(\text{Survives}(x, y) \mid \text{Simpler}(y, x))$

  - What's behind?
    - If what is instrumentally simple is somehow indirectly displayed in the choices we undertake during a course of time, then the simplicity of explicates (and theories) may be indirectly related to their survival.
  - That does not mean that the criteria of syntactic/semantic simplicity and ontological parsimony play no role in the choice of the simpler solutions.

So, which one of the three explicata is the simplest?

Let’s work with them all and we’ll see which would survive!

Thank you!

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Addendum 1

- Schurz's definition of conclusion-relevant deduction:

  Assume $\Gamma \vdash A$. Then A is a *relevant conclusion* of Γ if, and only if (henceforth 'iff') no predicate in A is replaceable on some of its occurrences by any other predicate of the same arity, salva validitate of $\Gamma \vdash A$. Otherwise, A is an *irrelevant* conclusion of Γ. (Schurz 1991, 409)

- Schurz's definition of premise-relevant deduction:

  Assume $\Gamma \vdash A$. Then $\Gamma \vdash A$ is a *premise-relevant* deduction iff (i) there is no single occurrence of a predicate in Γ such that its replacement in Γ by any other predicate of the same arity results in a Γ^* such that $\Gamma^* \vdash A$; and (ii) there are no predicate occurrences in Γ such that they are replaceable by other predicates of the same arity resulting in a Γ^* such that $\Gamma^* \dashv\vdash \Gamma$. (cf. Schurz 1991, 421-422; and Gemes 1998, 4)

Addendum 2

- Gemes' definition of a content part:

  $\alpha < \beta$ iff α and β are contingent, $\beta \vdash \alpha$, and there is no σ such that $\beta \vdash \sigma$, σ is stronger than α, and every atomic wff that occurs in σ occurs in α. (Gemes 1993)

- Gemes' definition of a natural axiomatization of T:

  T' is a natural axiomatization of T iff (i) T' is a finite set of wffs such that T' $\equiv$ T, (ii) every member of T' is a content part of T', and (iii) no content part of any member of T' is entailed by the set of the remaining members of T'. (Gemes 1993, 483; Gemes 1998, 9)