Course C.6-4: Elements of Methodology

General overview

This course forms the final part of the series on thinking and the theory of thought, and deals with methodology as applied logic and epistemology.

Where pure logic focuses exclusively on the formal validity of reasoning, methodology examines the goal-oriented procedures (methodoi) and presuppositions through which the human mind, in concrete scientific research and argumentation, arrives at reliable knowledge of reality.

The course analyses how sciences are demarcated through their material (uninterpreted) and formal (perspectivally interpreted) objects; how theories develop between deductive axiomatics and inductively drawn samples; and how scientific communities are influenced by social and political factors.

It also examines the fundamental distinction between direct methods - in particular phenomenology, which describes phenomena through intentionality and reductions, returning to the things themselves (zu den Sachen selbst) - and indirect methods, represented by formalism and the computational method, which use graphical representation, syntactic rules and algorithms to process signs automatically.

Summary

1: Methodology as Applied Logic and the Demarcation of Science

The concept of method originates etymologically from the Greek *methodos*, which literally means “the path towards a goal”. Every rational method is governed by purposefulness and the principle of economy or efficiency: achieving an optimal result with a minimum of resources.

The course draws a sharp distinction between pure formal logic and methodology. Pure logic is concerned exclusively with the valid form of implication (“if/then”), whereas methodology is epistemological in nature: it examines the collection and system of procedures that the mind must apply in order to attain truth about reality through research (*historiè*) and argumentation (*logos*).

According to the textbook, the sciences can be classified into formal sciences (mathematics, logistic logic), empirical natural sciences (physics, biology), human or social sciences (psychology, sociology, history), and applied technologies.

To demarcate a specific academic discipline, scholastic methodology uses the pair of concepts *material object* and *formal object*. The material object is

raw, as-yet-uninterpreted reality (such as an apple), whereas the formal object represents the specific, selective perspective from which the researcher approaches that reality (for example, as a hungry pupil, a dendrologist or a painter).

Science is also an intersubjective activity: the formal object is determined not only by the individual observer, but also by the "scientific community". As the Starnberger Gruppe demonstrates, external social, economic and political factors often play a decisive role in directing scientific research.

2: Theory Formation, Types of Science and Critique of Ideology

A scientific theory is a coherent system of propositions that makes facts and data understandable and explains them. Theories reflect fundamental types of reasoning and can be divided into two broad categories:

- *Deductive theories*: these start from previously posited initial propositions or axioms and develop their implications from them. This includes both formalized systems (such as Peano's axiomatic arithmetic) and dialectical systems (such as Hegelian or Marxist thought).
- *Inductive theories*: these begin with empirical laboratory results and samples, then proceed analytically or regressively to identify the explanatory presuppositions (as in modern chaology).

Within the philosophy of science, the distinction between "hard" and "soft" science is central. Bridgman's Operationalism holds that physical concepts should be defined exclusively by the series of measurement and laboratory operations through which they are established. This is intended to eliminate entirely the disturbing "human factor" or subjective noise.

Popper's Falsificationism, in turn, emphasizes that scientific progress does not depend on the search for confirmation (verification), but on attempts to refute a hypothesis (falsification). This is illustrated by medical trials in which medication that has been prescribed for a long time is found to be harmful after rigorous testing.

In contrast to the classical "architectural metaphor", in which thought rests on firm, eternal foundations, Postmodernism introduces the "network metaphor". Knowledge is understood as a dynamic, floating web of theories and views that continually change.

The course reconciles these perspectives through inductivism, or sample-based thinking: human observations and reasoning are always samples drawn

from an infinite reality. Knowledge is therefore both a constructed edifice and a continually adaptable network.

Finally, the critique of ideology (through thinkers such as Bachelard and Canguilhem) analyses how pre-scientific views and ideological assumptions repeatedly seep into rigorous scientific practice.

3: Direct and Indirect Methods, Metatheory and Historical Roots

Methodology divides all processes of knowledge acquisition into two main paths: direct and indirect methods. This recalls Blaise Pascal's distinction between *esprit de finesse* (the ability to perceive and intuitively grasp data directly in a single, clear insight) and *esprit de géométrie* (the reasoning, deductive intellect).

Francis Bacon illustrated this distinction through his well-known allegory of the ants (mere empiricists who collect facts), the spiders (a priorists who weave theories from their own minds), and the bees (true experimentalists who combine observation and reasoning).

- *Direct methods* are based on the mind's direct apprehension of reality and its intuitive description.
- *Indirect methods* take a detour: either through linguistic analysis and semiotics, or through methods of reasoning such as deduction (deriving conclusions forward from premises) and reduction/induction (looking backwards for the conditions).

Both methods make extensive use of the comparative method, involving internal and external comparison.

When the human mind not only investigates reality but also makes its own theories the object of study through reflection, metatheory emerges. This is grounded in the scholastic doctrine of intentionality (*intentio prima, secunda, tertia*) and the three semantic levels:

- *Semantic zero level*: the phenomenon directly perceived in reality.
- *First level* (object language): the language and signs used to designate that phenomenon.
- *Second level* (metalanguage/metatheory): theoretical reflection on the language and theories themselves.

These methodological classifications have deep historical roots in ancient Greek thought. Pre-Socratic thinkers such as Xenophanes of Colophon already distinguished direct knowledge (*eidenai*, based on direct

apprehension) from mere opinion (*dokos*). Alcmaeon of Croton, in turn, distinguished direct sensory knowledge (*aisthanesthai*) from indirect intellectual knowledge (*xunienai*). As a physician, he laid the foundations for semiology: interpreting invisible diseases on the basis of observable symptoms (*tekmeria*).

4: The Phenomenological Method: Intuition and Reduction

The principal path among direct methods is phenomenology, as developed by Franz Brentano and Edmund Husserl. Phenomenology rejects the Cartesian idea that an artificial "bridge" must be built between the inner mind and the external world. It upholds immediatism: through consciousness, human beings are always in an immediate, direct encounter with things. The central concept here is intentionality: consciousness is never an empty space, but is always characteristically directed towards an object (*cogitata qua cogitata*).

Phenomenology is the practice of a rigorous egology: describing and articulating phenomena as they immediately appear to the conscious "I". To reach pure reality, *zu den Sachen selbst*, Husserl applies two fundamental reductions (eliminations or suspensions):

- *The phenomenological reduction (epochè)*: placing in brackets (*einklammern*) the question of whether the object really exists outside our consciousness, while also suspending prevailing prejudices, historical traditions and scientific theories. What remains is the pure, unprejudiced phenomenon in the mind.

- *The eidetic reduction*: mentally removing all accidental, individual or singular characteristics of the phenomenon in order to reach its essential form or universal concept (*eidos*).

5: The Computational or Formalist Method

In contrast to phenomenological description stands the principal indirect approach: the computational or formalist method. Whereas phenomenology rests on meaningful apprehension and intuition, formalism rests exclusively on the manipulation of signs at the syntactic level. Formalism has a threefold foundation:

- *A semiotic foundation:* it isolates pure syntax (the relations among signs) and provisionally places semantics (meaning) and pragmatics (purpose) in brackets.

- *A combinatorial foundation:* rearranging and combining separate elements within a configuration (*stoicheiosis*), following the tradition of Anaximenes, Empedocles, Archytas and Leibniz's *mathesis universalis*.

- *A logical foundation:* applying the Cartesian step-by-step method (algorithms and hypothetical “if/then” implications).

Formalization proceeds in two successive steps:

1. Graphism: reducing language to purely material, visual signs on paper or a screen (signs stripped of meaning).

2. Logification: processing and transforming these graphic signs according to unambiguous logical-syntactic rules (establishing a calculus or formal system).

The course distinguishes four major applications of formalism:

- *Mental arithmetic:* mentally breaking numbers down and recombining them through summative induction (as demonstrated by calculation prodigies such as Wim Klein).

- *Written arithmetic:* arranging units and tens in writing according to strict positional syntax.

- *Literal calculation* (algebra): introducing letters (Viète, Descartes) as variables or lemmas for unknown numerical values.

- *Logistic logic* and computational calculation: formalized logic (Peano, Russell) and computer programming, in which instructions, algorithms and simulation games are executed mechanically without any human ambiguity