De Theatro Motivarum, Motivation: In Search of Essentials. Research on a Theoretical Model of the Process of Motivation and on Critical Determinants of Interference

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Chapter 1
Pre-Fundamentals of the Study

1.1. Introduction

As stated in the Preamble to the study, this dissertation refers in a condensed version to an extensive research Project, with a principal objective to add to our knowledge on processes conceptualized as 'motivation'.

In defining the elementary concepts of motivation, the dissertation follows an approach taken in the research Project that differs from a current scientific tradition in obtaining and validating its theoretical fundamentals.

Preceding a formal presentation of the Problem Statement in Chapter 2, this Chapter provides a background rationale for the principal scientific approach chosen for the study, with reference to an extensive overview in Mennes (2016), in press, with reference to Chapter 1.

1.2. Traditional Scientific Inference: A Shorter Overview

In recent scientific tradition a quest for knowledge proceeds in small steps, where new areas are mapped on a small scale with a restricted scope rather than by covering large areas with broad theoretics[1]. The approach seems to be inspired by a theory of logic commonly known as 'deductive reasoning'. From the first occurrence of scientific thought with Aristotle, Socrates and Plato in ancient Greece until the emergence of modern science following the Renaissance, rationalism was the dominant philosophy. "This method of causal reasoning emphasized deductive reasoning with propositions consisting of premises and a conclusion. (...) In the sixteenth and seventeenth centuries, Francis Bacon, John Locke, and other skeptics of rationalism developed a competing doctrine, known as empiricism, where perceptions of natural phenomena were considered the ultimate source and judge of knowledge for assessing causality" (Kyriacou, 2004, p. 670). Bacon is considered to be the founder of modern inductive method (Russel, 1989)[2], where inductive reasoning was used "(...) to create causal inferences from observed instances to future instances" (Kyriacou, 2004, p. 670).

[1] For an overview of Western scientific tradition reference is made to following standard reviews: Bronowski, & Mazlish, 1970; Clagett, 1969; Gower, 1997; Lindberg, 2007; Suppe, 1977. Within a more general context of philosophy: Russell, 1989; Copleston, 1994.

[2] Inductive reasoning had already been introduced by Aristotle as *επαγωγη* (epagogè)(Milton, 2011; Upton, 1981).

With Hume, a modern philosophy of causation began in the eighteenth century (Russel, 1989). Hume challenged the validity of inductive logic. In addressing validity in defining natural laws, he found a contradiction, defined as Hume's 'problem of induction' (Lange, 2011)[1]: if experience alone can decide upon the truth or falsity of scientific statements, which is "the fundamental thesis of empiricism" (Popper, 1959, 2002, p. 20), an inductive logic could not be used as a means of verification, "because it could not establish an unassailable connection between cause and effect" (Kyriacou, 2004, p. 670). The new doctrine of an inductive logic proved to be insufficient as a fundament for scientific knowledge.

In the early thirties of the twentieth century, Karl Popper developed a form of deductive reasoning to counteract Hume's 'problem of induction' in the observation that hypotheses could never be proven or verified, but only refuted. The thought was both simple and brilliant: the "(...) contradiction arises only if it is assumed that all empirical scientific statements must be 'conclusively decidable', i.e. that their verification and their falsification must both in principle be possible. If we renounce this requirement and admit as empirical also statements which are decidable in one sense only – unilaterally decidable and, more especially, falsifiable – (...), the contradiction disappears: the method of falsification presupposes no inductive inference, but only (...) deductive logic whose validity is not in dispute" (Popper, 1959, 2002, p. 20; see also Popper's exposé, 1963, p. 45, 46) [2] [3].

Inductive reasoning was to be replaced by deductive reasoning. From a theoretical construct, a hypothesis is formulated and verified through observation. Data collection and analysis enables verification. A conclusion either confirms or rejects the hypothesis, which, in turn, reflects on the theory. The approach has the advantage of being robust: it gradually progresses on verified and validated knowledge that is often being replicated, further adding to the strength of its findings. Where there is debate, it focuses on distinct and precisely formulated issues, with commonality in concepts that are being propagated.

The approach seems to hold all the virtues of a '*Logic of Scientific Discovery*'. And ever since Popper's falsification thesis emerged for a broader audience in the early sixties, the approach has prospered. *But there is a serious threat in the approach that has profoundly affected a tradition of scientific inference.*

[1] Although Hume rarely used the word 'induction', "and never in the passages where his inductive scepticism has been located" (Milton, 2011, p. 1)(Milton, 1987). One of the earliest uses of the phrasing of the 'problem of induction' was in J.S. Mill's *'System of Logic',* III. Iii. 3 (Milton, 2011).

[2] Sir Karl Popper's classic, '*The Logic of Scientific Discovery*' first appeared translated into English in 1959, although it had already been published in Vienna as early as 1934 as 'Logik der Forschung' in one of the Vienna Schriften, later published by Springer Verlag in 1935 (Popper, 1935, 1959).

[3] By the approach Popper meant to demarcate science from non-science, which was in his view, the central problem in the philosophy of science (Popper, 1959; Thornton, 2014).

1.3. Deductive-Inductive Inferences

1.3.1. The Acquisition of Scientific Knowledge

At the time Popper presented his thesis in response to Hume's 'problem of induction', the debate aimed primarily at the philosophical foundations of logic. A gradual confusion arose where fundamental philosophical issues on logical reasoning shifted towards a broader arena in acquiring scientific knowledge[1]. As the inductive-deductive notion varies in its manifestation in differing areas in the acquisition of knowledge, a brief overview is provided, restricted only to the acquisition of scientific knowledge[2].

The distinction in differing areas of the inductive-deductive notion is to determine the approach taken in this study and is referred to in Chapter 1.6. in defining its overall structure.

1. Logic of Reasoning

The Inductive-Deductive discussion in acquiring knowledge appears to consist of several areas that are involved in generating scientific knowledge. A first area consists of the *logic of reasoning.* Reasoning is the activity of evaluating arguments. "All arguments involve the claim that one or more propositions (the premise) provide some grounds for accepting another proposition (the conclusion)" (Goel, Gold, Kapur & Houle, 1997, p. 1305). Based on the relation between premise and conclusion, two categories can be observed within a logic of reasoning: induction and deduction.

Inductive reasoning aims at the finding of a rule of principle (Thurstone, 1938). A causal inference is made from an observed instance to a future instance. Or rather, from an observed instance, a generalization, or induction, is made towards the probability of an occurrence in the future. "Ordinarily, it is not practical to examine every member of a class. For one thing, many classes have unlimited numbers of

[1] At the time, induction was referred to as 'generalization from particulars' (Guildford, 1967; Sternberg & Gardner, 1983), Inductive reasoning was referred to as the ability to infer rules from a set of particular instances. Deduction, then, was associated with reasoning from general to particular (Ekstrom, French & Harman, 1976; French, Ekstrom & Price, 1963). However, the differentiation led to controversy (Guilford, 1967; Coldberg, Nester & Cormier, 1982), as instances of inductive inferences from general to particular, from particular to general, from particular to particular and from general to general were reported (Colberg, Nester & Trattner, 1985, Shye, 1988; Skyrms, 1975), or even convergence of both models (Carnap, 1971; Colberg, Nester & Trattner, 1985).

[2] An important area of research has been on the psychological study of acquiring knowledge. Heit (2007) defines the area as the 'process view', or the cognitive psychological processes involved in acquiring knowledge, as opposed to the 'problem view' covering the philosophy of acquiring scientific knowledge. For overviews: Evans, 2008; Feeney & Heit, 2007; Goel & Dolan, 2004; Heit & Rotello, 2008, 2010; Parsons & Osherson, 2001; Rips, 1994; Rotello & Heit, 2009. For a comprehensive overview of psychometric studies: Colberg, Nester & Cormier, 1982.

members. Consequently, induction is ordinarily based on the study of a part of the class membership" (Bright Wilson, 1952, p. 154). As such, induction is reasoning from particular to general. But so is deduction (Colberg, Nester & Trattner, 1985). However, the essential difference with deductive reasoning is that induction is "a type of argument in which the conclusion follows from the premises only with a degree of probability" (Colberg, Nester & Trattner, 1985, p. 682). As such, "the truth of an inductive conclusion is never certain. Even if the premises are assumed to be true, and the inference is a valid inference, the conclusion may be false" (Carnap, 1974, p.20)[1].

In contrast, deductive reasoning aims at establishing 'truth'. "(...) In a deductive argument, the conclusion follows necessarily from the premises: if the premises are true, the conclusion must be true" (Colberg, Nester & Trattner, 1985, p. 682). Therefore, "in deductive logic, inference leads from a set of premises to a conclusion just as certain as the premises (...). If the premises are true, the conclusion cannot be false" (Carnap, 1974, p. 20).

Thus, inductive logic deals with arguments where the premises provide only limited grounds for accepting the conclusion, deductive logic deals with arguments claiming the premises provide absolute grounds for accepting the conclusion (Goel, Gold, Kapur & Houle, 1997).

2. Establishing Proof

In establishing proof of theorems of inductive logic, the "range of evidence" (Carnap, 1971, p. 297) is not contained to its full range. As a consequence, the ability to predict is limited. As such, the aim of induction is "to render the observed phenomena maximally predictable" (Feigl, 1954, p. 24)(Feigl, 1950; Salmon, 1957)[2]. In proofs of theorems of deductive logic, the issue is less complex. As the premises in deductive logic provide absolute grounds for accepting a conclusion, the "range of evidence" is entirely covered to its full range (Carnap, 1971). The

[1] Colberg, Nester & Trattner (1985) refer to this definition, as a definition that is "(...) reiterated by every philosopher and logician who has ever written about induction. It is *the* definition of induction in logic" (p. 682). In the article, reference is made to: Ayer, 1972; Barker, 1967; Black, 1970; Rescher, 1980; Salmon, 1963, 1967; Skyrms, 1975. A complete bibliography is provided: Feigl & Morris, 1969. A formal definition of the rule of induction is provided by Reichenbach, 1944, p. 446-447.

[2] Nonetheless, within philosophy a number of so-called 'Practicalists' (a concept first mentioned by Black, 1954) advocate the view that "statements about the unobserved (...) cannot be known to be true when asserted – or even *probably* true (...)" (Black, 1959, p. 5)(Reichenbach, 1944; Feigl, 1954, 1956). For an overview of the issue: Salmon, 1957 and Lenz, 1958.

conclusion *always* follows given the premises are true[1]. As a consequence, one is assumed one can predict with certainty the occurrence of a future event.

However, the form of inference, or the approach, used in both kinds of proof is the same: "Not only in proofs of theorems of deductive logic but also in those of inductive logic we apply the implicit *deductive* procedures (...). Thus any procedure of proof in any field, also in inductive logic, is ultimately a deductive procedure" (Carnap, 1971, p. 200). As such, establishing proof in an argument can be visualized as a continuum that ranges in degrees of inductive strength (Skyrms, 1975). At one extreme the strength is absolute, or "deductively valid", gradually reducing through "degrees of inductive strength" towards a "worthless" minimum (Skyrms, 1975, p. 12) [2] [3].

3. Establishing Hypotheses

Where hypotheses are meant to capture observations they are the fundament on which scientific knowledge can progress through logic of reasoning and establishing proof: "when a hypothesis has been devised to fit the observed facts, it becomes possible to apply the rules of formal logic and deduce various consequences. Logic does not enter science until this stage is reached" (Bright Wilson, 1952, p. 27).

In establishing hypotheses, the above concept of continuum can be applied according to Carnap (1971). In capturing an observation by means of a hypothesis, in an inductive model *most* of the "range of evidence" is contained in the range of the hypothesis, whereas in a deductive model the "range of evidence" is completely contained in the range of the hypothesis: "deductive logic deals with the relation of total inclusion between ranges. Inductive logic deals with the relation of partial inclusion between ranges" (Carnap, 1971, p. 297).

[1] The modus ponens for a deductive form is formulated: "For any object x, if x has the property P, then x has the property Q. Particular object *a* has the property P. Therefore, particular *a* has the property Q" (Colberg, Nester & Trattner, 1985, p. 683).

[2] *Ibid.,* the modus ponens for an inductive form, differs only in that a probabilistic conclusion is reached regarding object *a*, whereas in the deductive form a necessary conclusion is reached regarding *a*. As such, the so-called 'truth value' of a deductive conclusion "(...) is necessary, whereas that of an inductive conclusion is merely probabilistic" (Colberg, Nester & Trattner, 1985, p. 684).

[3] In a further step towards establishing proof, philosophy also observes approaches to establish proof in both methods that are themselves aimed at establishing truth in an argument. The issue has led to profound debate, initiated by Hume's 'problem of induction', in response to which Popper developed his philosophy of refutationism. The issue was briefly summarized by Haack (1976): "Hume presented us with a dilemma: we cannot justify induction deductively (...), and we cannot justify induction inductively, either, because such a 'justification' would be *circular*" (p. 112).

In essence, then, in devising hypotheses and initiating formal logic towards obtaining scientific knowledge, an attempt is to be made at reaching a highest level of inclusion between ranges.

1.3.2. The Hypothetico-Deductive Approach

In the acquisition of scientific knowledge through a logic of reasoning, establishing proof and establishing hypotheses, this leads to two important implications. In establishing proof, only a highest level of inclusion provides certainty, but at the same time one can never be certain if the observations that have led to a hypothesis cover all possible instances: "despite confirming instances, a hypothesis of a causal relationship between two factors (can) never be completely verified since a single contradictory instance would constitute falsification" (Kyriacou, 2004, p. 670).

To solve this asymmetry between verifiability and falsifiability Popper introduced a philosophy consisting of a continuous generation, elimination, and regeneration of new hypotheses used as explanations for natural phenomena. The 'hypothetico-deductive' approach, as it is commonly referred to (Sankey, 2013; Salkind, 2010), consists of a continuous process of falsification. As visualized in Fig. 1.1., hypotheses, described as "provisional conjectures" (Popper, 1959, 2002, p. 264) are tested, where a null-hypothesis reflects that no observable effects of a test, or treatment condition, will emerge and an alternative hypothesis, that observable effects will occur, and subsequently following the empirical evidence, either confirmed or rejected, or "refuted" as Popper states (Popper, 1959, 2002, p. 24). So long as a hypothesis withstands subsequent tests and is not replaced by another hypothesis, a "degree of corroboration" is gradually established (Popper, 1959, 2002, p. 265). Whereupon subsequent tests in subsequent research further corroborate the findings: "repeated observations and experiments function in science as *tests* of our conjectures or hypotheses, i.e. as attempted refutations" (Popper, 1963, p. 71).

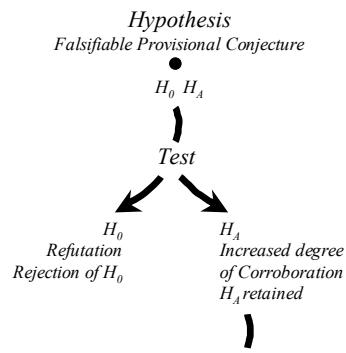

Fig. 1.1.
A Visualized Overview of a hypothetico-deductive approach according to Popper.

1.3.3. *Conclusions*

There are two approaches in the acquisition of scientific knowledge: an inductive

and a deductive logic of reasoning. In establishing proof, a deductive approach prevails, as only a deductive logic provides absolute grounds for accepting a conclusion, given the premises are true. In establishing hypotheses, however, of a causal relationship between two factors a complete verification can never be obtained since a single contradictory instance would constitute a falsification.

To solve this asymmetry between verifiability and falsifiability Popper introduced a philosophy consisting of a continuous generation, elimination, and regeneration of new hypotheses used as explanations for natural phenomena.

1.4. A Divergence in Scientific Method

Thus, in initiating formal logic towards obtaining scientific knowledge, Popper rejected an inductive logic of reasoning, substituting falsifiability in its place (Popper, 1959; Thornton, 2014). However, in his attempt at demarcating science[1], a method of scientific thinking, or theory formation, was introduced that extended far beyond the area's of logic reasoning, establishing proof and establishing hypotheses. Empirical falsifiability became the criterion of the scientific character of theories (Suppe, 1977). A brilliant approach to scientific thought became a scientific approach in itself.

The expansion from a 'scientific philosophy' towards a 'scientific methodology' has had a profound impact. And where the attempt at demarcation of science was aimed at an emerging development of politics and psychology[2], it appears to have affected the social sciences in particular[3].

Based on a 'scientific philosophy', Popper introduced a 'scientific methodology', where the logic of reasoning in establishing proof through hypotheses was expanded towards theory-construction as well[4].

[1] According to Suppe (1977), the development of this doctrine is the central task of Popper's *Logik der Forschung* (1935, 1959). Popper referred to the progress of scientific knowledge as an explicit thesis propounded in his preface to *'The Logic of Scientific Discovery'* (1959, p. xix).

[2] Reference is made to Popper's exposé in *Conjectures and Refutations*, 1963, p. 34-37.

[3] As stated by Thornton (2014): "The dominance of the critical spirit in Einstein, and its total absence in Marx, Freud and Adler, struck Popper as being of fundamental importance: the pioneers of psychoanalysis, he came to think, couched their theories in terms which made them amenable only to confirmation, while Einstein's theory, crucially, had testable implications which, if false, would have falsified the theory itself" (p. 3). Extensive overviews on the impact on social sciences are provided in Simkin, 1993.

[4] As stated by Popper: "systems of theories are tested by deducing from them statements of a lesser level of universality. These statements in their turn, (...) must be testable in like manner – and so *ad infinitum"* (Popper, 1959, 2002, p. 25).

1.5. Foundations for a Divergence in the Approach to the Dissertation

Where the formulation of a hypothesis demarcates the start of the scientific method[1], it is from the formulation of hypotheses that new scientific knowledge emerges. Although the 'scientific methodology' of a hypothetico-deductive approach is firmly rooted in a 'scientific philosophy', it has been extended towards a formulation of hypotheses, for which there is no apparent justification within the restricted boundaries of 'scientific philosophy'.

In generating hypotheses, both inductive and deductive logic can be applied. In fact, it had been a dictum in the first half of the twentieth century, to proceed through inductive reasoning towards a formulation of hypotheses[2]. The approach lacks the supremacy of a repeated empirical validation and depends heavily on the premises and argumentations used to substantiate the theoretical construct it infers. But the inductive approach has a characteristic that is almost lacking in deductive reasoning following the theories of falsification: by its nature it has the potential to provide a complete and comprehensive coverage. In addition, and much in line with scientific tradition in the first half of the twentieth century where theories followed the logic of inductive reasoning as a rule of principle and were inferred from repetitive, often personal observations[3], it adds a personal and creative uniqueness to scientific thinking.

Where 'scientific philosophy' has expanded beyond its boundaries towards a restricted 'scientific approach', this study proclaims a reintroduction of inductive inference in the generation of theoretical constructs, or theoretical 'Models'. Where these theoretical Models lead to clearly defined and constrained hypotheses, they constitute not a departure from, but rather a re-enrichment of hypothetico-deductive tradition[4].

[1] As such, the formulation and identification of hypotheses, is extremely challenging. Bertrand Russell states in the standard reference '*a History of Western Philosophy*': "As a rule, the framing of hypotheses is the most difficult part of scientific work, and the part where great ability is indispensable" (Russel, 1989, p. 529).

[2] As was summarized by Bright Wilson: "hypotheses differ in their subtlety and consequently in the obscurity of their origins. A simple one may be a mere generalization of the observations. More complex hypotheses may postulate connections between events, or elaborate chains of cause and effect" (1952, p. 26).

[3] At the start of the twentieth century, hypotheses were seen as a reflection or approximation of a surrounding world: "the most important feature about a hypothesis is that it is a mere trial idea, a tentative suggestion concerning the nature of things" (Bright Wilson, 1952, p. 26). See also: Cohen & Nagel, 1934; Conant, 1947; Wolf, 1925.

[4] This is, in a different phrasing, the essence of Kuhn's objection to Popper (Kuhn, 1962). As stated by Thornton (2014): "Popper came under philosophical criticism for his prescriptive approach to science and his emphasis on the logic of falsification. This was superseded in the eyes of many by the socio-historical approach taken by Kuhn (...), who – in arguing for the incommensurability of rival (Continued)

Nowhere does Popper's philosophy of refutationism oppose a generation of hypotheses through inductive theoretization, as long as a clear demarcation exists between the theoretical Model and the hypothesis, between theory formation and hypothesis formulation: "The initial stage, the act of conceiving or inventing a theory, seems to me neither to call for logical analysis nor to be susceptible of it. The question how it happens that a new idea occurs to a man – whether it is a musical theme, a dramatic conflict, or a scientific theory – may be of great interest to empirical psychology; but it is irrelevant to the logical analysis of scientific knowledge. (...) Accordingly, I shall distinguish sharply between the process of conceiving a new idea, and the methods and results of examining it logically" (Popper, 1959, 2002, p. 7, 8) [1].

By re-introducing an inductive inference into the process of acquiring scientific knowledge, a number of issues emerge that are to be addressed, notably two closely related concerns referred to as 'immunity to falsification' and 'ad hoc hypothesizing' [2]. A clear demarcation, however, between an inductively inferred theoretical Model and a falsifiable hypothesis within a hypothetico-deductive tradition, serves to address these concerns.

In lieu of observing isolated hypotheses, then, as emphasized in a traditional hypothetico-deductive approach where empirical falsifiability based uniquely on hypotheses has become the criterion of the scientific character of theories, this study proposes a foundation, or embedment, of hypotheses in an inductively inferred theoretical Model, which provides an explanatory framework for phenomena these hypotheses seek to validate. Support from empirical research for an embedded hypothesis thus reflects on the robustness of the explanatory framework or Model. Multiple hypotheses, within multiple empirical studies, embedded in a common explanatory Model further add to its authority.

scientific paradigms – reintroduced the idea that change in science is essentially dialectical (...)" (p. 5, 6).

[1] In two aspects Popper appears to have been, at least partly, responsible for the confusion that arose following *'The Logic of Scientific Discovery'.* First, he was unclear about the distinction between the concepts of 'theory' and 'hypothesis', and appeared to use both concepts interchangingly. E.g. Popper states a few pages further: "(...) the method of critically testing *theories* (my italics), and selecting them according to the results of tests, always proceeds on the following lines. From a new idea, put up tentatively, and not yet justified in any way – an anticipation, *a hypothesis, a theoretical system* (my italics), or what you will – conclusions are drawn by means of logical deduction (Popper, 1959, 2002, p. 9). Second, as stated by Simkin (1993): "It was not until 1959 that *'The Logic of Scientific Discovery'* was published as an English translation (...). The twenty-four year delay was unfortunate in that it gave time for much indirect and garbled reporting of Popper's basic ideas (...) (p. 3).

[2] Immunity to falsification refers to theories that accommodate and explain every possible form of human behavior and are therefore to evade falsification (Popper, 1959, 2002; Thornton, 2014). *Ad hoc hypothesizing,* deals with predictive attributes of theories. When predictions are not in fact borne out, the theory might be "(...) saved from falsification by the addition of ad hoc hypotheses which make it compatible with the facts" (Thornton, 2014, p. 7).

The approach combines the strengths of the inductive and deductive strategies in obtaining knowledge through scientific inference. The deductive strategy with its emphasis on empirical hypothesis-testing appears to be characterized by a restricted approach, often accompanied by attempts at reducing complex phenomena into isolated, fragmentary components. The inductive approach lacks the supremacy of a repeated empirical validation and depends heavily on premises and argumentations, but it has the potential to provide a complete and comprehensive coverage of phenomena.

In a combined approach we thus obtain four clearly differentiated stages:

1) *A theoretical Model ex ante:* a stage demarcating *theory-formation* (following a logic of inductive inference, with reference to Chapter 1.3.1.1.), from a formulation of *hypotheses* prior to testing (that is to follow a deductive logic). Inductive generalizations proposed in a theoretical Model are differentiated from empirically tested deductive findings. *Essential in the theoretical Model is that it provides an explanatory context from which elementary hypotheses, critical to the Model, can be are derived.*
2) *Literature:* from the assumption that theory and research obtained from current literature are derivatives from establishing proof within a mainly deductive tradition, as referred to in Chapter 1.3.1.2., a second stage consists of an embedment of the theoretical Model in literature.
   A two-fold verification:
   - *In Theory:* a verification of the Model with an existing body of knowledge produced by theories that are derived from a mainly deductive tradition, by observing similarities and dissimilarities between those theories and the proposed theoretical Model.
   - *In Research:* a verification of the Model with an existing body of knowledge generated by empirical research that is rooted within a mainly hypothetico-deductive tradition. As such, an embedment is obtained of an inductively inferred Model within a deductively inferred empirical validation.

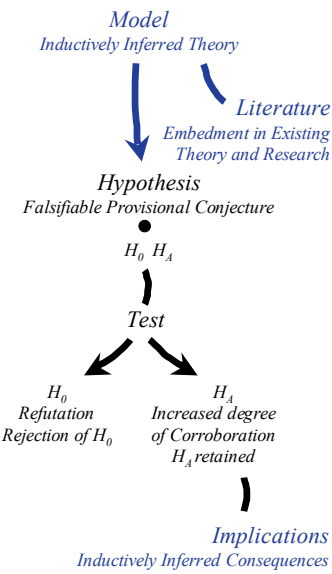

Fig. 1.2.
Foundations for an inductive approach embedded within a hypothetico-deductive approach according to Popper.

3) *Hypothetico-deductive testing:* a stage where hypotheses derived from the theoretical Model are tested according to a traditional hypothetico-deductive approach. *Given that in establishing relevant hypotheses within a deductive context, the "range of evidence" is to be completely contained in the range of the hypothesis, as elaborated on in Chapter 1.3.1.3., only a limited number of hypotheses can be formulated, thus targeting only a limited number of elements from a comprehensive theoretical Model. However, as stated at the start of the present paragraph, multiple hypotheses, within multiple empirical studies, are assumed to reflect on the robustness of the explanatory theoretical Model.*
   In testing, three distinct stages are observed:
   - Hypothesis-formulation,
   - Testing in empirical research,
   - Hypothesis-rejection (Refutation) or acceptance (Corroboration).
4) *Implications ex post:* inductive inferences following deductive testing, and inferred from the theoretical Model upon acceptance of derived hypotheses.

Thus, in the approach taken in this dissertation, the hypothetico-deductive approach is maintained, and 'embedded' within an inductive approach, defined by clearly separated stages, demarcating a transition from inductive to deductive logic[1].

The approach is visualized within the context of a hypothetico-deductive approach in Fig. 1.2.

1.6. The Approach to the Dissertation

This dissertation seeks to integrate the strengths of the inductive and deductive strategies in obtaining knowledge through scientific inference.

These Pre-Fundamental observations, where an 'embedment' is proposed of an inductive approach within a traditional hypothetico-deductive approach, are to determine the overall structure of the study:

[1] By demarcating theory-formation and a formulation of hypotheses a major concern in establishing proof can be eliminated. By separating both stages in the acquisition of scientific knowledge as elaborated on in Chapter 1.3.1., the approach avoids to justify induction inductively as this would create circularity. Referring to Chapter 1.3.1.1., the inductive logic of reasoning producing a theoretical Model cannot establish proof in itself. In establishing hypotheses aimed at establishing proof an attempt is to be made at reaching a highest level of inclusion between a 'range of evidence' and the range of the hypothesis, as indicated Chapter 1.3.1.3., which is not obtained when a theory-formation and a formulation of hypotheses 'coincide'. By demarcating both stages in the acquisition of scientific knowledge, the formulation of a hypothesis becomes a 'statement' whose proof is not affected by its provenance, or the theory-formation that instigated the statement. The issue of establishing proof has led to profound debate, and has been summarized briefly by Haack (1976).

- *A theoretical Model of Motivation: theory-formation, following a logic of inductive inference, is to produce an explanatory theoretical Model of Motivation providing an adequate context from which hypotheses can be derived. The theoretical Model of Motivation is to provide a basis to fulfill the objective of this dissertation, to be defined in Chapter 2, notably Chapter 2.2. and Chapter 2.5.*

  To this end,
  - *The Model is to be explanatory, providing insights in relevant elements, or concepts, and their relations. A separate Chapter is to contain a summarizing overview.*
  - *The Model is to be comprehensive, covering a full overview of elements it contains. Within constraints set to the size of the study, a comprehensive coverage is to be provided in a separate Appendix.*

  In initiating the inductive inference that is to lead to the Model,
  - *A number of so-called 'Fundamental Assumptions' are to be provided, restricting the content of the inductive inference. To this end, an initial Chapter leading to the final Problem Statement of the study is to contain a clear Problem Demarcation.*
  - *Attributes are to be defined, restricting the logic of reasoning in the inductive inference. Summaries are provided in a series of so-called 'Assumptions' preceding the inductive inference. Due to constraints set to the size of the study these Assumptions are to be provided in a separate Appendix, with reference to extensive overviews provided in literature.*
- *Literature: the theoretical Model derived from this process is embedded in an existing body of knowledge obtained from literature. In this manner, the strength of repeated empirical validation, assumed to be produced within a mainly deductive tradition, is connected to the theoretical Model, or elements from the Model, obtained through inductive inference.*

  To this end, in a separate Chapter,
  - *The Model is to be embedded in current theories from literature. The Chapter is to provide a verification of the Model with an existing body of knowledge produced by theories, by observing similarities and dissimilarities between those theories and the proposed theoretical Model.*
  - *The Model is to be embedded in current research from literature. The Chapter is to provide a verification of the Model with an existing body of knowledge generated by empirical research, by observing findings obtained mainly through hypothetico-deductive testing.*
- *Hypothetico-deductive testing: a third phase consists of an empirical validation of hypotheses derived from the theoretical Model following standard statistical procedures within a traditional hypothetico-deductive approach.*
- *Implications: implications are provided separately to segregate the inductive inferences made from the findings obtained from the empirical research.*

1.7. Summary

This study seeks to obtain insights into the concepts that are essential in human motivation. In defining motivation, this dissertation follows an approach that differs from a current scientific tradition in obtaining and validating its theoretical fundamentals. This introductory Chapter aimed at providing the 'Pre-Fundamentals' for the principal scientific approach chosen for the study.

In the second half of the twentieth century, a hypothetico-deductive approach has prevailed to solve an asymmetry between verifiability and falsifiability, consisting of a continuous generation, elimination, and regeneration of new hypotheses used as explanations for natural phenomena. However, in the attempt at clearly demarcating science and scientific practice, a method of scientific thinking was introduced that extended far beyond the area's of logic reasoning, establishing proof and establishing hypotheses. Empirical falsifiability became the criterion of the scientific character of theories. Where 'scientific philosophy' expanded beyond its boundaries towards a restricted 'scientific methodology', deductive inference became predominant and inductive theory-formation was gradually abandoned from scientific practice.

In a departure from a traditional scientific approach this dissertation seeks to integrate inductive and deductive strategies. The study proclaims a reintroduction of inductive inference in the generation of explanatory theoretical constructs, or theoretical 'Models'. Where these theoretical Models lead to clearly defined and constrained hypotheses, they constitute not a departure from, but rather a re-enrichment of hypothetico-deductive tradition. In lieu of observing isolated hypotheses, as emphasized in a traditional hypothetico-deductive approach, this study proposes a foundation, or embedment, of hypotheses in an inductively inferred theoretical Model, which provides an explanatory framework for phenomena these hypotheses seek to validate. Support from empirical research for an embedded hypothesis thus reflects on the robustness of the explanatory framework or Model. Multiple hypotheses, within multiple empirical studies, embedded in a common explanatory Model further add to its authority.

In the combined approach we thus obtain four clearly differentiated stages that are to determine the overall structure of the dissertation:

1) *A theoretical Model ex ante: theory-formation, following a logic of inductive inference, producing an explanatory theoretical Model of Motivation. The Model is to provide a basis to fulfill the objective of this dissertation.*
2) *Literature: from the assumption that theory and research obtained from current literature are derivatives from establishing proof within a mainly deductive tradition, a second stage consists of an embedment of the theoretical Model in literature, both in theory and research.*
3) *Hypothetico-deductive testing: a stage where hypotheses derived from the theoretical Model are tested according to a traditional hypothetico-deductive approach.*
4) *Implications ex post: inductive inferences following deductive testing, and inferred from the theoretical Model upon acceptance of derived hypotheses.*