

VERIFICATION AND FALSIFICATION: A REVIEW

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ABSTRACT

For centuries, science has been searching for a unique conceptual framework whose standards has already been established. However, to find such a universal guide sounds like a utopia. Nevertheless, there are numerous epistemologies help to those who aim at generating and evaluating scientific statements, hypotheses, and theories. Apart from those strategies, verification and falsification are scrutinised throughout this study.

Verification, rooted by the emergence of positivist approach, based on induction, is a process actualised through observations and experience. If considered within the borders of confirmation, it is associated with absolute truth.

As there are severe criticism for positivist and inductivist approaches of science, the term falsification was put forward. Falsification finds its grounds on deductive reasoning claiming that a theory is fallible where there is lack of support of the theory. According to the falsificationist approach, all the claims and rulings of a scientific process must be so designed that they do not defend science against falsification. By focusing on the borders of this design steadily, degrees of falsifiability, sophisticated falsification, can be increased.

Although the falsificationist approach is a superior one when compared to the verificationist approach, falsification has its own problems, too, namely, logical and historical problems and falsificationist demarcation.

When comparing those two terms one can claim that verification is based on induction, searches for the certain truth, and positioning truth as objective, whereas falsification is deductive, approximates the truth through conjectures, and positioning truth as subjective.

There is also another notion called multiplism that advocates adopting multiple approaches when conducting any research. So, one can achieve verisimilitude through multiplication of combining different but linked methodologies. However, it has also its own problems, such as a constant bias, and malfunction of multiple sources together.

To pave the way for more critical studies, one may choose a combination of those theories. For instance, one may take a sophisticated falsificationist approach alongside multiplism, which can improve the degree of falsifiability further by making situations and studies more appealing.

Keywords: Verification, Falsification, Sophisticated Falsification, Falsifiability, Multiplism.

1. INTRODUCTION

One of the major issues that science deals with from ancient times, namely -at the latest- from Descartes, is whether there is any common conceptual framework appealed in the presence of scientific enquiries; that is, in terms of assessing, or criticising scientific theories. In other words, science seeks for a unique methodology whose standards have already been set up. However, at least for now, this search is not more than a utopia, universally (Bernstein, 1983). Nevertheless, there are several scientific epistemologies, one or some of those are appealed to understand, generate and evaluate scientific statements, hypotheses, and theories. Moreover, considering these techniques, one can decide how to design observations and empirical tests.

The two strategies of scientific research this study aims at scrutinising are verification and falsification. This critique is organised as following: First, I briefly attempted to identify the meanings of those notions. Then, I concentrated more on them and comprehensively examined them considering their pros and contras. Next, I compared those terms and slightly mentioned about multiplism as a comprehensive approach. Finally, I concluded this study including my own thoughts.

2. VERIFICATION AND FALSIFICATION: DEFINITIONS

To discern the meaning of verification, one is recommended first look at the categorisation of proof. As stated by Huang (2005), there are five meanings of proof: verification tool for the truth of a statement / a theory, explanation tool for the truth of a statement / a theory, the tool to convey mathematical knowledge, the tool to unlock new mathematical models and the tool to organise statements into axioms. This paper is mainly interested in the first one among them.

According to Popper (1985), verification search for the match between observations and theories. Moreover, what is also inferred from the previous passage is, verification seeks for the correspondence to the facts, truth. So, the survival of a theory is heavily dependent upon its justifiability by positive proof, namely by absolute truth or highly probable truth. At this point, Basford and Slevin (2003) distinguished between certain truth, which verification attempts to form, and probable truth established by falsification.

Throughout this paper, confirmation and verification are used interchangeably as Popper (1963, 1985), Chalmers (2013) and Losee (2001) did frequently. It is attention-grabbing that Bernstein (1983) uses those terms distinct from each other. Carnap (1936) as cited in Testability and Meaning by Caldwell (1994) concluded that a universal statement could never be verified, provided that verification is accepted as a thorough and definitive foundation of truth. That is why because there are instances infinite in number and limited observations. Provided that the number of positive instances rises, and there are no negative instances, then this case is attributed to gradually ascending confirmation of the law.

Regarding falsification, one may ask to distinguish between falsification and falsifiability. Falsifiability is a criterion for the empirical trait of a system of statements, whilst falsification is defined as a system of rules determining the circumstances of a system to be assumed as falsified (Popper, 1985). A theory is

falsified on condition that we have accepted contradictory basic statements, and we find a reproducible effect for refuting the theory.

Moreover, as opposed to verification, falsification deals with falsified conclusions, and thereby, falsified theories (Popper, 1985).

After giving a couple of insights related to definitions, it is time to examine those terms closely.

3. VERIFICATION & FALSIFICATION: A COMPREHENSIVE EXAMINATION

This part aims at analysing both notions in a separate format: It begins with verification and its details. It follows with the problems can be attributed to verification. Then, falsification is carefully scrutinised accompanied by a focus on degrees of falsifiability and criticisms of falsification.

3.1. The Term ‘Verification’

The emergence of the term ‘verification’ encounters in the beginnings of twentieth century, when logical positivist movement, as a sub-branch of empiricism, took place by the Vienna Circle of Philosophers, comprised of Carnap, Schlick, Feigl, and some others (2011). As Hempel suggested, the evaluation of a scientific process is comprised of three stages: accumulation of observation reports, ascertaining whether these observation reports confirm the hypothesis, and decision whether to accept the hypothesis when the (dis-)confirming evidence is considered. Hempel proposed a programme of research for the second and third phases of this process, where the second process is denominated as ‘problem of confirmation’ (Losee, 2001). Kuhn (1996) claimed that there is not a process for confirmation, but for epistemological theories derived from other resources. It is not surprising one to accept exemplary applications for theoretical discussions in science pedagogy to prove the validity of the theorem in question. However, the acceptance of theories for science students is provided by the authority of their instructors and written hermeneutics and explanations rather than that of evidence. Latour and Woolgar (1986) also observed the same attitude: Laboratory life defines the process of verification as a negotiation process. Here, the laboratory copes with inscription devices and constructions that make realities. These devices and constructions are introduced by groups of researchers. Verification process is here also self-verification, which means that it generates its own truth.

According to Popper (1963), the world is fully covered with confirmations of theories. People do not believe already confirmed theories are seen as people that refuse to see the truth. For example, Marxists attempted to find evidence to confirm instances via interpretations and news, whereas Freudian analysts verified through clinical observations and Adlerians through personal experience. According to Wittgenstein, there is an embedded truth function of observation statements within every genuine proposition, and all other propositions are called ‘pseudo-propositions’ (Popper, 1963).

From the nature of positivist approach, verification is based on induction where one can observe phenomena by appealing to senses, and from these observations, he / she can obtain general laws (Cook, 1985). To put it in a clearer way, as Chalmers (2013) mentioned science was derived by facts arrived at by

observation. Kuhn (1996) on the other hand, replied that it is meaningless to advocate that verification aims at establishing the harmony between facts and theories, particularly on the part of historians, as facts and theories that are significant in terms of history are in an almost perfect harmony. However, provided that theories are considered in pairs, such a comparison can be made, and it seems more sensible to ask whether one theory is more compatible with phenomena than the other one. Carnap also attempted to measure the degree of confirmation of a hypothesis to formulate the theory conditional on evidence (Losee, 2001). This process encompasses designing the structure and vocabulary of a language where the hypothesis is defined, appealing to probability theorem to nominate values to k and measuring the consistency between computed values and initial intuitions.

Within the empirical context, Tarski sees the truth also as ‘correspondence to the facts’ (Popper, 1985, p. 182). Moreover, he added that to speak of the truth, one must use a meta-language comprised of statements and the referred facts. Thus, this theory of truth can be also called ‘objectivist’ theory. According to the objectivist theory of truth, a theory can be true, although there is nobody to believe it, and although there is no reason to accept it or to believe its truth, and another theory can be false, even though there are handful motivations to accept it. Objectivists, here, further believe that theory-neutral observations could be made no matter how the characteristics of observers are shaped (Cook, 1985).

In a similar sense, the term “objective”, in verification, has also used in lieu of intersubjective verifiability, testability. To explain intersubjective verifiability, Bernstein (1983) distinguished between an object and a subject. Here, the object is what is out there and not connected to subjects, individuals. That is, the phenomena exist independent of social actors. In terms of objectivism, true knowledge can be obtained provided that subject properly reflects objective reality out there. Subject, in that sense, is completely free of bias (Bernstein, 1983) (Matthews & Ross, 2010).

According to Popper (1985), there are two types of knowledge: knowledge in the subjective sense and knowledge in the objective sense. The former is comprised of consciousness or a state of mind, whereas the second one includes problems, and theories, and it is independent from human beings. Knowledge in the second sense is knowledge without a subject. In that sense, we can only be informed about knowledge regarding facts through observations. However, this information does not justify any truth of any premises.

Intersubjective testability is the correspondence of our observations with those of others. In other words, observations are objective to the extent that they can be publicly tested by straightforward principles (Chalmers, 2013). For example, in a scientific study, intersubjective verifiability of our own work can be achieved through replications (Noble & Arranz, 2012). According to Marshall (1990), the degree of goodness of a research depends on to what extent it is reliable, replicable and valid. A good research is anticipated to include not just current truths, but also past truths. Moreover, a good research examines not just one’s own belief about truth, it also attempts to uncover what others believe to be true. In this sense, a good research is objective. The problem related to intersubjective verifiability is there may be phenomena observed by just one person, which disconfirms a theory.

Such a case, it is almost impossible to trust this sole experience (Noble & Arranz, 2012).

To sum up, verification, found its roots by the emergence of positivist approach, is realised through observations and experience. Verification, in the sense of confirmation, is already associated with absolute truth.

Verification, as just mentioned, is realised through accumulation of observations, which is an inductivist approach. Doing so, one can derive theories from facts. However, there is also a view that claims that there is an absolute harmony between theories and facts. Nevertheless, considering theories in pairs, one can measure the degree of confirmation any hypotheses.

In positivist approach, the term “intersubjective testability” also refers to verification, as it claims that verification entails observation to be confirmed by more than a single observer so that a theory is widely recognised as a good theory.

The upcoming subsection is regarding the issues related to verification.

3.1.1. The Problems attributable to Verification

There is no doubt that positivist and inductivist approaches of science are repeatedly attacked (Popper, 1985) (Popper, 1963) (Kuhn, 1996) (Cook, 1985) (Losee, 2001) (Chalmers, 2013). This part of the paper addresses issues related to verification considering those approaches, as well, but not necessarily examine them under further subtitles.

It is already mentioned that verification mainly attempts to reach the certain truth. However, truth is relative more than being objective, as, particularly, relativists stated (Bernstein, 1983). It means that truth is subjective, and there is not a sole meaning of truth. Thus, truth cannot even serve as a regulative principle, which is suggested by Tarski (Popper, 1985).

One of the main characteristics of verification is the observability of facts subject to verifications. However, there is no room for unobservable in terms of verification (Chalmers, 2013). For example, taken those characteristics of verification into account, and calling it as a property of all scientific theories possess, then psychology cannot be accepted as a science (Kuhn, 1996). Furthermore, regarding observations, perceptions are not constant; that is to say, they are spatiotemporal. Perceptions for the same phenomenon can vary from observer to observer depending on their cultural background, expectations, and experience (Chalmers, 2013) (Kuhn, 1996).

Theory-ladenness of observations is another issue related to the verificationist approach. Although people advocating verifications claim that there is a thing called theory-neutral knowledge, it is impossible, since there are too many subjective elements hidden in observations (Cook, 1985). According to Kuhn, scientists sharing similar values may also share the identical set of assumptions embedded in observations (Cook, 1985). One can here also attribute to some assumptions of the Quine-Duhem Thesis. According to it, (1) one cannot talk about the empirical content of individual statements, (2) being true requires dramatic adjustments within the system, and (3) there is no strict distinction between statements depending upon and not depending upon empirical evidence.

If this thesis is correct, observations have no meaning in terms of supporting a theory, and thereby, verifying the truth (Losee, 2001).

It is commonly said that the dogmatic attitude, accepted as the pseudo-scientific approach, is related to propensity for verifying laws. However, as Popper (1963) said, dogmatism is necessary to the extent that they can be used to deal with a situation in which conjectures, guesses, are forced to conform to the real world. What is more, this dogmatic attitude is necessary in the phase of the very beginning of any scientific process.

Verifications are said problematic in the sense of logic, when its inductivist account is considered. This problem is well scrutinised by Hume as impossibility of justifying a law by appealing to observations and experiments, as it exceeds limits of experience, spatiotemporal characteristic of science and the empiricism principle where only observation and experiment are authority to accept or reject scientific statements and theories (Popper, 1985).

To summarise, the problems of verification are regarding its misunderstanding of the truth content, not considering the unobservable, the lack of theory-neutral language in terms of observations, the dogmatism related to it, and its logic.

Next part of this study is related to the term falsification, degrees of falsifiability and problems related to the falsificationist approach.

3.2. The Term 'Falsification'

Popper was educated in Vienna when the Vienna Circle of logical positivists prevails there. He, as resembling verification to “an empty bucket of induction”, in a symposium in 1961 held in Tübingen, proposed the method of falsification (Cook, 1985). As Popper thought, Freud’s and Marx’s theories could never be wrong, since they were flexible in terms of making adjustments to arrive at the truth. Popper, moreover, compared those theories with Einstein’s relativity theory conducted by Eddington. He noticed that there were testable predictions related to this theory, and the theory was at risk. So, the idea of falsifiability, falsification, was borne out (Chalmers, 2013).

As rejecting the inductive verification attitude of logical positivism, Popper’s falsificationism is based upon deductive reasoning that a general law is fallible in case of the lack of support of the hypothesis concerned. He further claimed that what science seeks for is bold hypotheses resisting to falsifications (Christensen, Johnson, & Turner, 2011). This boldness can be interpreted as science aims at theories having a great deal of informative content. If a theory cannot explain its claims, then it can resist to falsifications in a bad way, and they are unfalsifiable. Politicians and fortune-tellers are good instances for this category. What falsification demands are precise and clear expressions (Chalmers, 2013).

As Popper (1963) stated, falsification approach involves being criticisable. We have already talked about ‘dogmatic approach’ in science. Other approach in science, which is highly necessary, is the critical attitude entailing adaptability to alterations of laws by testing, refuting, and even falsifying them. In this sense, Popper labelled falsification as the method of science. Moreover, Popper stated

that this critical approach can be coined as ‘the Method of Conjecture and Refutation’.

To sum up, falsification was born out of the shortage of verificationist approach as a method of science. It grounds upon deductive reasoning, which claims that a theory is fallible in case of scarcity of any support of the theory. Moreover, according to this approach, science searches for hypotheses that are rich in informative content.

Next subsection scrutinises more closely how scientific propositions can become more informative. In other words, it is about degrees of falsifiability, sophisticated falsification.

3.2.1. Degrees of Falsifiability

When falsification is said to be the method of science, all the claims and rules of a scientific process must be so organised that they do not defend science against falsification (Losee, 2001). By paying the attention to the borders of this organisation and by keeping doing so, degrees of falsifiability can be increased. Degrees of falsifiability also refer to the term of ‘sophisticated falsification’ seeking for more falsifiable, but also, more resistant to being falsifiable new theories than the old ones replaced (Chalmers, 2013).

There are number of ways how degrees of falsifiability can be augmented. To begin with, independent auxiliary hypotheses can increase the degree of falsifiability (Popper, 1985). By ‘independent testability’ it is inferred that a new theory is expected to make testable predictions that are independent from the predictions by its predecessors (Hands, 1993). Auxiliary hypotheses refer to hypotheses, which can increase the degree of falsifiability of a theory. Auxiliary hypotheses can be perceived as attempts to build a new system that is well able to add a remarkable advance in our knowledge. So, it can be inferred that falsifications are also interested in historical movements. Whilst seeking for auxiliary hypotheses, one needs also avoiding ad hoc hypotheses. Ad hoc hypotheses are untestable auxiliary hypothesis, at least for the time being (Popper, 1985).

The degree of boldness is also sufficient to measure the falsifiability content. It is said that impressive progress in science can be achieved when bold conjectures regarding the discovery of new phenomena are confirmed and cautious conjectures previously regarded as to be true are falsified (Chalmers, 2013). As Popper (1985) said, (sophisticated) falsificationists would rather bold conjectures, even if they turn out to be false. Moreover, falsificationists fail to acknowledge that the notion of boldness is spatiotemporal. However, in case of sophisticated falsificationists, since they accept theories by looking at the increasing falsifying extent of new theories, boldness of a theory can be tracked (Anderson, 1986).

Sophisticated falsification supports bold hypotheses as promising improvements, which lead to the confirmation of novel predictions measured by not formerly used tests (Chalmers, 2013). Novelty claims, disconfirming evidence and theoretical usefulness are building stones of originality, and thereby, interestingness (Alvesson & Sandberg, 2011) (Locke & Golden-Biddle, 1997). Nonetheless, Davis (1971) suggests that interestingness increases the impact of a

theory rather than the degree of its truth or falsity content. What is more, according to him, a new theory can be noticeable through denying an old truth. Consequently, interesting theories are interesting as they attack the already accepted assumption-ground of their audience.

Furthermore, science advances by trial and error. The ones to survive are fittest theories. We can advance as learning from our mistakes (Chalmers, 2013) (Popper, Popper Selections, 1985). Eliminations by trials and error are realised through severest empirical investigations of tests to find the fittest theories. In other words, best-tested theories are the ones resisting to be falsified (Popper, Popper Selections, 1985). Conclusions resisting falsification are preserved in scientific documents up until better evidence arrives (Shadish, Cook, & Campbell, 2002). Moreover, apart from spatiotemporal conditions, technology can also modify the meanings of trial and error with respect to theories. Thus, scientists are also anticipated to devote attention for the technological advances (Chalmers, 2013) (Kuhn, 1996).

As already said, for the falsificationists, there is not such a notion called ‘the certain truth’. Scientific progress can be made as soon as a theory can the most closely approximate to the truth. As Shadish, Cook and Campbell (2002) state that validity can be used in lieu of verisimilitude, truthlikeness. Once the term “validity” is used, it means that a judgment about to what degree evidence coming from empirical findings and their consistency with other forms of knowledge supports approximation to the truth. Evaluating validity is thus exposed to subjective judgments. That is why validity judgments are solely approximations in preference to being absolute truth. By not rejecting that science searches for truth, Popper (1985) argued that by mistakes, one might get nearer to truth.

To put it in a nutshell, increasing the degree of falsifiability is gained through finding more falsifiable and more resistant to be falsified theories. That is also how falsification becomes more sophisticated. Adding independent hypotheses to a theory, confirming bold conjectures and falsifying cautious conjectures, making novel predictions, and enjoying trial and error can lead to increase the degree of falsifiability, and thereby, to approximate to the truth.

Next subsection criticises falsification.

3.2.2. Critiques of Falsification

Even though falsification can overcome a large number of issues associated with verification, it also has its own problems.

First, Chalmers (2013) categorises the problems related falsification into three parts as logical problem of falsification, inadequacy of falsification on a historical basis and inadequacy of the falsificationist demarcation principle.

The initial logical problem Chalmers (2013) refers to is the Quine-Duhem Thesis. It refers to the statement “All swans are white.” If one can observe a non-white swan, this theory is certainly falsified. However, the world of scientific theories includes a mammoth number of complex universal statements, initial conditions,

and so on and so forth. If there is a falsity with regard to predictions, there must be a problem at least with one of the premises.

Lakatos (1970), regarding the Duhem-Quine Thesis, criticised Popper as being three different Popper: dogmatic, naïve methodological and sophisticated falsificationist. The first one admits the fallibility of all theories in science without qualification; however, it maintains a kind of infallible empirical ground. The second one refers to the importance of substituting a falsified hypothesis by a better hypothesis. Here, science advances by reiterated experimental overthrow of hypotheses. Lakatos thinks that Kuhn is a naïve falsificationist with his paradigm approach, where science is mainly comprised of normal science, crisis and revolution periods. Whilst normal science is seen as puzzle-solving activities to explain and enhance the present paradigm, in which puzzles are seen as anomalies rather than falsifications, crisis period deals with complexities regarding the current paradigm, and a revolution happens when the paradigm is changed by a new one (Kuhn, 1996). He is criticised as being irrational since he pays more respect to communities instead of scientific rationality in terms of paradigm shifts (Popper, 1963) (Losee, 2001) (Lakatos, 1970). The third approach, sophisticated one, has just been explained in detail. It emphasises the necessity of any hypothesis by a better hypothesis.

According to Lakatos (1970), with sophisticated falsificationist approach; by adding independent testability, and thereby, leading some of those tests to produce corroborations, verifications, Popper resists to the Duhem-Quine Thesis. However, the problem still is that Popper never leaves the naïve falsificationist approach at all.

Lakatos, as very similar to sophisticated falsificationist approach, introduced research programmes, by distinguishing between fundamental, “hard core” principles, which cannot be falsified, and supplementary hypotheses of a theory, coined as “protective belt”, whose assumptions can be modified to enhance the coherence between a programme’s predictions and outcomes. Unlike Kuhn, he also stressed the significance of continuity in scientific process. Lakatos’s research programmes have been essentially criticised in terms of the subjectivity of reality in the sense whilst, for example, determining hard core principles, and in terms of his shortage on determining characteristics of scientific knowledge and that on determining the progress in science (Chalmers, 2013).

One further logical problem might be that related to Popper (1985), by saying that all knowledge and all the theories are fallible, Popper contradicts himself through claiming that the final point one can reach is a basic statement to accept, at the time being, or completely disregard all the tests done yet. Although he advocates that the basic statements accepted might be fallible one day, he may attempt to save the day.

Regarding historical inadequacy, there is a danger for infant theories to be easily falsified, particularly when it adopts a falsificationist methodology. Moreover, as Kuhn (1996) stated that once falsified, the written documents related to falsified theory, which may have immense value, vanish easily. One further critique he uttered is that falsifications must not occur instantaneously, and they are

anticipated to follow a gradual process. The inconsistencies between theory and experiments may be solved by time.

Considering the demarcation principle of science, according to which a theory is scientific if it is testable, falsifiable, it can be claimed that astrological explanations also have the property of being scientific. One can reply that a theory may attempt to falsify other theories, whilst, on the other hand, resisting to be falsified, which may weed claims of astrology to be scientific out. However, it is difficult to obtain this view, since one, taken this statement, is led to also remove the scientific label of genuinely scientific theories (Chalmers, 2013).

It may be seen not as a problem, but a limitation that Popper was mistaken when claiming bold, highly falsifiable guesses as the reasons for significant advances in science. According to Chalmers (2013), spectacular advances can be made through the confirmation of bold guesses and the falsification of cautious guesses. Consequently, although Popper (1985) was first opposed to, there is also a falsificationist view of confirmation. When taken new theories into account, they are substantial, since they justify the priority of the new theory compared to the old one (Chalmers, 2013). In a similar sense, Popper (1985) also ran counter to probabilistic truth and claimed that what falsificationists are interested in is criticising and testing theories to learning from mistakes and constitute better theories.

To sum up, according to Chalmers (2013), there are three kinds of problems related to the falsificationist approach: logical problems, historical problems and falsificationist demarcation. First one generally refers to the Quine-Duhem Thesis, which claims that falsification does not provide any hint about which part of the falsified theory is problematic. By considering the sophisticated falsificationist view, which adds independent testability to hypotheses, and thereby, lead some of those tests to produce corroborations, verifications, one can overcome the issues related to the Quine-Duhem Thesis. That is, although first Popper was opposed to it, he then admits that there is a falsificationist view of confirmation. Research programmes, rather similar to the sophisticated approach, also produced to deal with the problems about the Quine-Duhem Thesis by distinguishing hard core principles, cannot be falsified, and protective belt, having modifiable assumptions, of a theory. The main historical problem of falsification is infant theories being easily falsified whilst the demarcation principle is seen as inadequate as it is inferred that astrological claims have also the property of being scientific.

Although we carefully scrutinise the terms verification and falsification accompanied by problems associated to them, it is time to compare and contrast in order to provide a better understanding the similarities and the differences between verification and falsification.

4. COMPARE AND CONTRAST

Verification and falsification are two rather distinct, but somewhat similar methods of scientific research.

To start with, verification, often associated with positivism and empiricism schools, rests upon induction where phenomena is observed through senses, and

thereby, general laws can be achieved. On the other hand, falsification mainly hinges upon deductive reasoning where general laws are fallible, that is, there is no absolute truth. One can only talk about probabilities. In that sense, Popper (1985) admits that the main aim of science is the search for truth. However, one can just approximate to the truth through falsifications. In that sense, verification seeks for absolute truth, whereas falsification searches for probabilities.

According to Popper (1985) and Chalmers (2013), verification cannot be the method of science as all of the observation statements forming the verificationist approach, like theories, are fallible. Popper (1985) also denied that one could just infer falsity of the theory from empirical evidence, not the truth. By claiming so, he also renders falsifications fallible.

Although positivism is criticised by falsificationists, falsification is also accepted as a subsection of positivism. That is, positivism is comprised of logical empiricism, logical positivism and falsificationism (1986). One can also see falsification as the hypothetico-deductive version of positivism. Here, as Lakatos (1970) did, one can distinguish among dogmatic, naïve methodological and sophisticated falsificationist approaches. The first one is accepted as the weakest kind of verification, whereas the second one refers to replacing a falsified theory by a better one and the last one to substituting a theory by a better one. The first and the last ones can be associated with positivism. Unlike the first form, last one is so strong by leading some of independent tests to generate corroborations that increase the degree of falsifiability of the theory concerned.

Dogmatic falsification, the weak form of the verificationist approach, is also necessary at the very beginning of a scientific inquiry. However, it is usually regarded as a non-scientific approach. However, one is expected to take a critical approach throughout the scientific inquiry (Popper, 1963).

In verification, there is an accumulation of observations. However, in naïve methodological falsification, there is no accumulated evidence of phenomena; a theory is tested by negative instances. On the other hand, there is also an accumulation in case of sophisticated falsification as it attempts to find the best theories.

Verification approach also adopts the intersubjective, objective, testability approach where there is a distinction between object testable and subject. Moreover, it means that a theory can be tested by multiple researchers. However, falsificationists think that science is subjective and spatiotemporal, and one cannot see the same stuff by examining the same phenomena.

Although Popper (1985) claimed that the falsificationist approach is logically valid, when compared to the logical problem of induction, verification, it also has its own logical problem, so called “Quine-Duhem Thesis”, already detailed mentioned.

This part mainly based on similarities and differences between verification and falsification. The fundamental similarities between them can be categorised as following: They have the same aim of science; verification, and hypothetico-deductive and dogmatic falsification can be examined under positivism; they both have different kinds of logical problems. The main differences between them, on

the other hand can be categorised as following: Verification is based on induction, whereas falsification based on deduction; verification searches for the certain truth, whereas falsification seeks for verisimilitude through conjectures; in verification, truth is generally accepted to be objective, whereas in falsification, truth is subjective.

Next subsection is regarding post-positivist multiplism, which is established due to the problems embedded in positivism. Since it relates both the verificationist and falsificationist approaches, it seems more reasonable to examine it as a subsection of this part.

4.1. Multiplism

Cook, (1985), to eschew problems related to positivism, introduced the post-positivist critical multiplism. The fundamental idea of multiplism is that if the veracity of multiple alternatives for the generation of research question and / or methodology is vague, one is anticipated to choose all of them with the intention of triangulating on the most beneficial and most accurate one. So, one can approximate to the truth through multiplication as combining different, but conceptually connected alternatives.

Since multiplism is to be found in operationalism, research programmes, models, hypotheses, frameworks, measures, and stakeholders, multiple forms of verification and falsification of well-recognised alternative interpretations fully support multiplism.

However, multiplism has also its own problems. First, a constant bias issue is connected to multiplism. For instance, it is impossible to render commonly shared biases heterogeneous. Furthermore, provided that there are multiple sources not functioning idiosyncratically, previous studies have been obliged to be revised.

To conclude, the main idea behind multiplism is that one can approximate to the truth considering alternative programmes, models, hypotheses, stakeholders, and interpretations rather than considering an only method of science, or producing a sole hypothesis to test a theory. However, multiplism has also some problems, such as constant bias issue.

5. Concluding Remarks

As already said in introduction, science seeks for a common methodology for theories to be applied. Throughout this paper, I have attempted to provide insights for two of the -mainly- conflicting strategies of science: verification and falsification.

Verification is based on inductive and empiricist inferences. Since induction is based on observations, and observations are fallible, induction cannot be the method of science. Thus, falsificationism was established, which is a deductive method.

Falsificationism can be divided into three parts as dogmatic, naïve methodological and sophisticated falsificationism. Dogmatic refers to the simplest form of verification. Naïve methodological is about replacing a falsified theory by a better one. The last is regarding replacing a theory, no matter it is falsified or not, by a

better one. There are logical, historical and demarcation-related problems embedded in second kind of falsificationism. In that sense, sophisticated falsificationism can overcome both the problems of the falsification.

In terms of sophisticated falsificationism, as bolder the conjectures of falsification get, as resistant the theories to falsifications become. Sophisticated falsificationism can be obtained through more resistant theories to falsifications and more falsifiable theories. This “more” word also refers to the degrees of falsifiability. In order to increase the degrees of falsifiability, one can also consider the significance of multiplism.

There is no universally accepted single approach of science. All approaches have their own problems. However, a combination of methodologies, no matter they examined here or not, can lead to more critical and attention-grabbing studies. By doing that, theories and hypotheses can be more able to be falsified.

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