

## The Two Factor Theory of Understanding (TFTU): Consciousness and Procedures

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The two factor theory of understanding (TFTU) is based on two fundamental factors. The first posits that consciousness is a necessary condition for understanding. It is not possible to understand an explanation if it is not, or has not been, represented in an individual's consciousness. The second posits that understanding stems from responding to questions in a particular field, which are posed in accordance with procedures of understanding relevant to that field. This is a broad definition that includes two classes of procedures: class (a) includes answers, explanations, and understandings given using scientific procedures that meet the methodological requirements of science; class (b) includes answers, explanations, and understandings given using everyday procedures that do not meet all of these methodological requirements. The two classes provide an individual with understanding when the answers or explanations to questions emerge, or have emerged, in a person's consciousness. This paper discusses the various implications arising from TFTU and compares it with other approaches. The present theory emphasizes that, since a solution to the problem of consciousness has yet to be found within the framework of accepted scientific methodology, it is difficult to reject class (b), the everyday procedures, that provide understanding for very large groups of people.

Keywords: explanation, explanatory procedures (models), consciousness

The accepted approach to the concept of understanding that has been prevalent in the philosophy of science since 1948 — the year that Hempel and Oppenheim published their groundbreaking essay on the logic of explanation — is that this concept (understanding) primarily refers to psychological aspects related to scientific explanation. Indeed, it is the concept of explanation, and not that of understanding, that had been the focus of research until the early 2000s. Since then, the concept of understanding began to receive increasing attention as a central and important concept in philosophy and psychology (see reviews

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I would like to express my gratitude to two anonymous reviewers and to the journal editor, Raymond Russ, for their insightful and useful comments which greatly improved the paper. Correspondence should be addressed to Sam S. Rakover Ph.D., Department of Psychology, Haifa University, Haifa, Israel 31905. Email: rakover@psy.haifa.ac.il

by de Reget, Leonelli, and Eigner, 2009; Gordon, 2020; Horne, Muradoglu, and Cimpian, 2019; Khalifa, 2017; Pritchard, Turri, and Carter, 2018; Rakover, 2018.)

Research efforts up until the 2000s focused on the development of scientific procedures (models) of explanation that were justified according to scientific methodology. Here, it is important to emphasize that a scientific theory per se is not capable of providing an explanation for a studied phenomenon. To do this, an appropriate procedure must be applied to the theory, through which a suitable explanation of the specific phenomenon in question will be obtained (for example, see Rakover, 2018; Salmon, 1990).

In their edited volume *Scientific Understanding: Philosophical Perspectives*, de Regt et al. (2009) include an important and interesting chapter by Lipton (2009) on understanding without explanation. The central idea that Lipton raises in this chapter is as follows. He proposes that understanding should be identified not with explanation, but with a number of cognitive benefits that are created by explanation, such as the apprehension that a particular event E is the cause of the studied phenomenon P, or that E is a necessary condition for P. On the basis of this identification, Lipton argues that understanding can also be reached in various ways, which differ from scientific explanations, such as via visual demonstrations of the occurrence of the studied phenomenon. (Lipton's approach has given rise to a great deal of criticism that I will not dwell on here; see for example, Khalifa, 2013, 2017; Strevens, 2013.)

As an example, consider the following phenomenon. Lipton argues that, using a physical model that demonstrates the motion of the Earth in relation to that of other planets (for example, Saturn), he understood the astronomical phenomenon known as apparent retrograde motion, according to which Saturn displays a very peculiar motion: at first Saturn moves forward, then stops, moves backward, stops, and again moves forward. The understanding of this phenomenon is inherent in the relationship between the speed of the Earth's motion, from which observations of Saturn are made, and the speed of Saturn's motion, when observations of Saturn are made against the night sky. As a result of the Earth's greater speed, a perceptual illusion is created whereby, at certain angles of observation, Saturn appears to move forward, while at other angles it appears to move backward.

The TFTU, which is rooted in the spirit of Lipton's approach, is based on the following idea: it is possible to reach understanding through appropriate, methodologically accepted, explanation procedures; however, explanations can also be given through other means, e.g., using certain procedures that do not meet all of the accepted scientific methodologies. For simplicity's sake, I will refer to the first kind of procedures as scientific procedures, and the second kind of procedures as everyday procedures. (On the distinction between the types of explanation used in the sciences and those used in the humanities, see e.g., Grimm, 2016, 2019; Rakover, 1990, 2018, see also below. The present theory (TFTU) is an extension, and a deepening, of an idea I proposed in Rakover, 2018.)

Before I move on to the development of TFTU, I must make an important distinction between two different approaches to the concept of understanding. The psychological approach seeks to highlight the cognitive–emotional processes that are closely linked to understanding the phenomenon in question. In contrast, the epistemological approach seeks to shed light on the relationship between understanding, explanation, and the conditions for their creation; and between true and false knowledge, for example logical conclusions and hypotheses that are confirmed or refuted by empirical observations (see for example de Regt et al, 2009; Grimm, 2011; Horne et al., 2019). The proposed theory, TFTU, is an empirical theory grounded in these two approaches.

### **The Structure of the TFTU**

The present theory is based on two fundamental factors. The first posits that consciousness is a necessary condition for understanding: it is not possible to understand an explanation if it is not, or has not been, represented in an individual's consciousness. The second factor posits that understanding stems from responding to questions in a particular field, which are posed according to procedures relevant to that field (the procedures are detailed below). These procedures are intended to produce explanations and understanding of phenomena studied in the natural and social sciences.

#### *The First Factor: Consciousness Is a Necessary Condition for Understanding*

The fundamental argument is that an entity that does not possess consciousness is unable to understand what is happening in the world, including its own actions; that is, consciousness is a necessary condition for understanding. The emphasis here is on *necessary condition* and not on sufficient condition, as there are several other factors where, without their normal functioning, there can be no understanding of certain content that appears in consciousness. A brain injury, for example, may interfere with the retrieval processes of information that is necessary for understanding a particular behavior. Thus, consciousness enables understanding of mental states — in normal circumstances (e.g., see Rakover, 2018, 2021).

It could be suggested that riding a bicycle, playing tennis, or playing the piano may occur automatically, without consciousness. However, the learning of these skills does require consciousness. A tennis player would find it hard to explain how it was that he managed to hit the ball into the left corner of his opponent's court as he was sprinting with his eyes fixed on the ball as it flew towards the right of his own court. As a former amateur tennis player, I can say that I have no good or precise explanation for this question. However, I have no doubt that this same question would not be understood by a highly sophisticated robot that did not possess consciousness, even if it had been programmed to play tennis

at a very high level. Moreover, even if it were possible to construct an elaborate, sophisticated robot that was able to answer the question, “What did David do during his 4:00 p.m. break?” with the sentence, “David made himself a cup of tea,” and we were to admire the robot’s cleverness, it would be obvious to all that this robot had understood neither the meaning of the sentence nor the meaning of the question, since it had been merely programmed to respond with specific answers when it detected certain patterns of stimuli. In the final analysis, this also explains the behavior of the tennis-playing robot. Understanding of stimuli, responses, and the relationships between them, is in the minds of humans — that is, in the minds of those who constructed the robot and those who use it for their various needs.

The assumption that consciousness is necessary to engender understanding is very significant, since it proposes a distinction between providing an explanation and understanding the explanation. For example, a sophisticated robot, Robbie, can be programmed to explain any question in classical (Newtonian) physics. Robbie is able to explain, with limitless patience, any question concerning the free fall of bodies, until every single student has a perfect grasp of all the answers to every question. However, although the students have grasped Robbie’s explanations completely, Robbie himself does not understand a single thing of what he explained, because he lacks consciousness. (Here it is worth emphasizing that no one has managed to develop a theory that explains consciousness: e.g., see Rakover, 2018.) For these reasons, I suggest that explanations offered by both scientific procedures and everyday procedures are understood when they are represented in an individual’s consciousness. (Thus, when this paper refers to understanding, it is referring to an explanation, an answer to a question, in consciousness.)

*The Second Factor: Understanding Is Expressed in Answers to Questions Asked According to Knowledge and Procedures Relevant to a Specific Field*

In addition to the assumption that consciousness is a necessary condition for understanding, I propose that further conditions are required to delineate this concept.<sup>1</sup> Here I propose two basic ideas related to understanding: (a) the demarcation of understanding, and (b) the assessment of understanding.

(a) *The demarcation of understanding.* The basic idea is that, in addition to consciousness, which is a necessary condition for understanding, I propose that understanding is limited to cases in which a question arises in a particular field of knowledge, and which is answered in accordance with procedures prevalent in the period in which the question arose. The demarcation of understanding also depends on two factors: the knowledge itself, and the procedures with which one

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<sup>1</sup> This paper will focus mainly on the field of human behavior.

attempts to impart understanding of the phenomenon in question. For understanding to occur, an answer must be given to a question about the phenomenon, such as why or how the phenomenon occurred. The answer suggests new information that sheds light on the occurrence of the phenomenon.

High-level understanding cannot occur when new (an explanation) information does not reconcile with prior knowledge that is rooted in an individual's cognitive system. For example, a person who believes completely in the geocentric approach will have great difficulty understanding Kepler's laws, which are based on the heliocentric approach. For this person to understand these laws correctly, she must uproot the geocentric approach and internalize the heliocentric approach. (Note, however, that in many cases, people experience less dramatic changes while assimilating new knowledge.)

What are the procedures for imparting understanding? These are specific procedures that are designed to provide answers to the following questions: (a) the question *why*? The procedure proposes a cause for the occurrence of the behavioral phenomenon in question; (b) the question *how*? The procedure proposes a mechanism, a process, that results in the occurrence of the phenomenon; (c) the question of *purpose*? The procedure proposes a purpose for which the phenomenon occurred.<sup>2</sup> The procedure for understanding can be characterized as a process in a particular field of knowledge that forms a connection between new, relevant information and information about the phenomenon in question; that is, a process that presents satisfactory answers to questions concerning the occurrence of the phenomenon in question.

(b) *Assessing understanding.* Assessment of understanding will be undertaken through the following assumptions.

1. Every observable behavioral phenomenon (whether external or internal to a person) has an "unknown real process" (URP) that is responsible for its occurrence and for the occurrence of other phenomena ("responsible" is a general term for a cause, a reason, a mechanism, a function, etc.).
2. Theories (models, hypotheses) that provide answers to the questions why, how, and purpose can be rated on a scale of distance from the URP, a distance that can be termed the "Understanding-Distance."

Understanding-Distance = F (Theory – URP)

The 'F' (a function of) may be sketched by reference to the procedure of empirically testing a theory. That is, it is possible to roughly estimate the Understanding-Distance

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<sup>2</sup>Since this paper focuses on behavioral phenomena, I will abstain from addressing the question of which materials the phenomenon is comprised of, a question that is of great importance in the sciences.

through empirical test of a theory that provides answers to these questions. The greater the theoretical success of the explanation, the smaller the Understanding-Distance.<sup>3</sup>

To clarify the two ideas discussed above, I will briefly analyze several examples from various spheres of knowledge.

*Mathematics.* If the question “What is the value of  $x$  in the equation  $2x+1=5$ ?” is asked, and the answer, after consideration, is  $x=2$ , since this is the result obtained by applying a mathematical procedure relevant to the field of first-degree equations, we consider the respondent to have understood the question, the answer, and the process by which he arrived at the current answer.

*Physics.* If the question, “What is the distance that a body in free fall will travel in the first second?” is asked, and the answer, after calculation, is the body in question will fall 4.91 meters in the first second, a result obtained by applying Galileo’s law of free fall for bodies based on the concepts of gravity and acceleration, then we consider the respondent to have understood the question, the answer and the theoretical process required to reach the given answer.

*Transportation.* If the question, “Why did David stop his car when he reached the junction and the traffic lights changed from green to red?” is asked, and the answer, after consideration of the traffic laws in force in the country where David is driving, is that David must stop his car in front of the white line on the road when the traffic light at the junction turns red, we consider the respondent to have understood the question, the answer, and the traffic laws according to which motor vehicles must be driven.

*Medicine.* If the question, “Why, in ancient times, did the village shaman sing and dance around a person complaining of severe abdominal pain?” is asked, and the answer, after consideration, is that according to the medical practices of that time in that particular village, the singing and dancing of the shaman banished the evil spirit that had entered into the patient, we consider the respondent to have understood the question, the answer, and the medical procedures practiced in that particular village.

I consider these four examples sufficient to illustrate the current approach to the concept of understanding. Moreover, these examples raise a number of interesting questions related to the subject under discussion: procedures of understanding.

*Is it possible to propose a general procedure for understanding?* Understanding, as has emerged from the discussion so far, depends on two main factors (in addition to the necessary condition of consciousness): *a procedure of understanding and knowledge that is relevant to a specific domain.* From these examples it is clear that every field has its own explanatory procedure. Thus, for example, knowledge

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<sup>3</sup>The Understanding-Distance can be related to similar attempts for estimating the value of a theory, for example, by Popper’s suggestion of “verisimilitude,” which has been criticized severely (for review see Rakover, 1990), and the generalized-information approach for measuring the values of computer models (Bartlett and Holloway, 2019). The application of the latter approach to Understanding-Distance may encounter a big obstacle, since the URP is not known whereas the computer models handled by the generalized-information approach are known and their sizes can be measured in bits.

and procedure for understanding of the solution to a first-degree equation cannot be used to understand the question that has arisen from the field of transportation. Therefore, the answer to this particular question is negative.

Moreover, explanation models in the sciences — *scientific procedures* — do not converge into a single explanation procedure or single general explanation model (see Rakover, 2018). These procedures are characterized by two basic features: they address the demand for *rationality* and the demand for *empiricism*. For example, procedures should avoid revealing self-contradictions or inconsistencies and they must facilitate a strong connection with reality — in other words, with empirical observations (see for example Hempel, 1965; Rakover, 2018; Salmon, 1990). However, although scientific explanation procedures meet the requirements for rationality and empiricism, it is not easy to propose a general procedure, even in the natural sciences. Different scientific fields have different procedures. For example, in classical physics, it is convenient to use explanation procedures consistent with Hempel's (1965) approach, which provides explanation when a prediction that is deduced logically from a theory (or empirical law) under certain conditions matches the observed phenomenon (or its probability). [If the prediction does not fit the phenomenon, the theory is refuted.] However, in biological and neurophysiological research (and even in physiological and cognitive research), it is convenient to use procedures that propose the construction of a mechanism that comprises numerous elements in such a way that the particular interaction between these elements ultimately produces the phenomenon being studied (see discussions in Bechtel, 2008; Rakover, 2018). For these reasons, I am inclined to suggest that various fields of study have been characterized by a multiplicity of (scientific and everyday) procedures of explanation and understanding.

*Are there different degrees of understanding?* A number of scholars have argued that there are various degrees of understanding (see for example Gordon, 2020; Grimm, 2011, 2019; Khalifa, 2013, 2017). The two-factor theory of understanding is consistent with this view. Accordingly, for understanding to be generated, a question must be asked regarding a particular subject in a particular field. For example, David looks up at the sky and sees that it is blue, with white clouds of various shapes moving at different speeds. If he does not speculate about the meaning of what he sees, and does not ask, for example, “Why is the sky blue? Why are there clouds? Why are they moving and changing shape? Why does it seem as though a cloud shaped like a foot is kicking a cloud shaped like a ball? Why are they white?” but instead continues with his day without asking a single question about what he observed, we cannot say that David has a high-level understanding of what his eyes have observed. However, we may suggest that his degree of understanding is higher than that of a person who has never seen a blue sky with clouds (for example, a person who was unfortunately born blind and who had never learned anything about skies and clouds). Why? Because while David would be able to answer basic questions, such as “do clouds change

shape?” with the correct answer “yes,” the blind person would not understand the question. This example leads me to suggest an ordinal scale of degrees of understanding, which is based on the following two assumptions:

- (a) Understanding begins at the moment that an individual consciously perceives a certain phenomenon.
- (b) The degree of understanding in a particular field never reaches a maximal level, because understanding develops limitlessly.<sup>4</sup>

To illustrate this, let us look at a diagram that represents a white wall that has three letter Xs drawn on it:

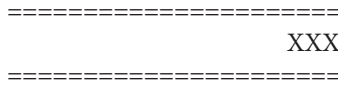


Figure 1: Wall with three letter Xs.

Suppose that every day on his way to his office David passes by this white wall on which, unnoticed by him, three Xs have been painted (Figure 1). One day, he becomes aware that three Xs have been painted on the wall. As he opens the door to his office, he starts to ponder: How is it possible that, until this moment, he had not noticed that three Xs had been painted on the wall? Perhaps they had only been painted there the previous night? Why had three Xs been painted, and not one X? What was the meaning of these Xs? Why had they been painted on the right-hand side of the wall, and not on the left? Could it be possible that the Xs were not a painting, but cracks in the wall that happened to take the form of three Xs?

Based on this example, I propose the following degrees of understanding:

*Degree 0.* Before the three Xs appeared on the wall, David’s level of understanding of them was zero. There was no representation associated with them in his consciousness. Moreover, even after the Xs had appeared on the wall, David passed them by as if they were not there (the Xs entered his visual senses but did not undergo proper information processing), the level of David’s understanding was zero.

*Degree 1.* On the day David noticed that three Xs had appeared on the wall, but before he asked any questions about them, his level of understanding rose above zero, as a result of the fact that he was aware of the Xs (if David were to be asked if he had noticed anything on the wall, he would give a positive answer. This answer indicates a level of understanding greater than if he were to answer in the negative).

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<sup>4</sup>Scientific research never ends and scientific knowledge is constantly evolving. As a result, every scientific theory is provisional and functions correctly until the moment it is refuted and replaced by a better theory (see Popper, 1972).



*Degree 2.* From the moment that David began to ask questions regarding the Xs, his understanding rose by a degree. The very act of asking questions situates the individual at a higher degree of understanding than that of merely drawing attention to a particular phenomenon.

*Degree 3.* At the very moment that David offered answers to the questions that arose in Degree 2, using knowledge he had gained during his lifetime and procedures for proposing explanations relevant to the field of discussion, the degree of his understanding of the phenomenon in question rose above the previous level.

*Degree 4.* Each answer, explanation, and understanding is subject to critique and to theoretical and empirical examination, such that a previous understanding may be revealed to be incorrect and may be supplanted by a more successful understanding. For example, the shaman's understanding of abdominal pain has been replaced in the modern era by more successful explanations, such as an accumulation of gases as a result of extreme sensitivity to dairy products. Development of understanding never reaches a maximal level, since, as stated above, knowledge continues to grow without limitations (Popper, 1972).

Here is another example of the various degrees of understanding: David, who is a teacher of modern literature and has no knowledge of mechanical engineering, is able to provide a functional explanation of how his car drives. He proposes that the car is comprised of several important systems, one of which processes gasoline into energy that drives the engine that turns the wheels. The car accelerates when more gasoline is pumped into the gasoline processor by pressing on the gas pedal. It is clear that this explanation is superior to an explanation suggesting that what causes the car to move is a pony or a demon, a genie that had been released from Aladdin's lamp and which had settled in the front of the car. It is also clear that a mechanical engineer could offer a better explanation than that provided by David.

*Do questions of understanding demarcate different procedures of understanding?* As I suggest above, a number of understanding-questions exist that are related to particular fields of knowledge and specific phenomena: Why did a specific phenomenon occur? How did it occur? For what purpose did it occur? Of what does it consist? These understanding-questions are somewhat similar to the four causes that Aristotle proposed for the occurrences of events (situational changes): the efficient cause, the formal cause, the final cause, and the material cause (see discussion, for example, in Falcon, 2019). I propose that the answers provided to each of these questions employ different procedures of understanding, since they are intended to address different purposes. (In this respect, it is possible to draw certain parallels between Aristotle's pluralistic approach to the problem of causality and the approach I develop here. Aristotle sees in the four causes a complete explanation for the phenomenon in question.) For example, the procedure for understanding the question *why* seeks a factor (or factors) that are responsible for the creation of the phenomenon in question. For example, Uri felt a sharp pain in

his foot, and discovered that his foot had been hit by a large rock that he had not noticed before. This procedure, which seeks a cause for a phenomenon (the blow from the rock), appears to differ in construction from a procedure that seeks the process or the mechanism responsible for the creation of the pain in Uri's leg. In that case, research would focus on the neural network activated by the blow to his leg, including the relevant brain activity.

To these four understanding-questions we can add an additional, practical question: How can we use the phenomenon and exploit it? To illustrate this question, consider the ability of various smartphone users. Young children find it rather easy to make intelligent use of these devices. In contrast, seniors often find it difficult to use smartphones. Whose understanding, then, is greater: that of the child who knows how to use all of the smartphone's functions, or that of the senior, who had previously studied the functional structure of computers, and is able to use two or three functions of a smartphone? I would argue that the child's practical understanding (the understanding of how to use a smartphone) is greater than that of the senior, even though the senior's understanding of the smartphone's construction is greater than that of the child, because the senior has grasped the relationship between the operating systems of the computer and the smartphone. In other words, knowledge of smartphone use does not determine the answer to the question, "How does this device work, and what is its structure?" Here is an additional example: the driving ability of a racing driver, i.e., his understanding of the actual functional abilities of the car, is far superior to that of a mechanical engineer or the owner of a car repair garage, both of whom understand every detail about the structure of the car.

*Are there understanding-procedures that are not compatible with scientific methodology?* The answer that I give below is affirmative, i.e., I assume that the class of procedures for creating explanation and understanding includes not only *scientific procedures*, but also *everyday procedures*, even though the latter do not meet all the requirements of scientific methodology. Below are some examples that illustrate procedures that provide answers to questions, but which do not meet all the requirements of scientific methodology. I will concentrate on two important cases: behavioral rules and private mental processes.<sup>5</sup>

*Behavioral rules.* A large part of human behavior is explained by the fact that people have learned to obey behavioral rules extant in their societies. For example, the following answer to the question of why Gideon stopped his car when

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<sup>5</sup>One may add to these two the example of religious belief, which I will mention here only in brief because it is immensely complicated and emotionally laden. It is reasonable to propose that religion provides the believers with explanations for many questions including questions about natural phenomena (the creation of the world) and human behavior (moral conduct). However, the answers are in many cases inconsistent with scientific explanations (e.g., the age of the Earth). Nevertheless, for believers, religious explanations provide answers to questions of *why* (because it is the will of God); *how* (a description of the creation of the world by God); and *purpose* (the world was created for the glory of the Creator, and the crowning glory of creation is a human being).

the traffic light changed from green to red would be accepted as satisfactory: "Gideon obeyed traffic rules stating that drivers must stop their cars when the traffic light is red." In this case, it is clear that the traffic rules constitute the URP, because people in a particular society are the ones who created the rules. It is worth emphasizing that religious belief also includes appropriate behavioral rules (commandments). The difference between traffic rules and religious commandments lies in the depth of a person's emotional belief in them. Just as an individual takes upon himself to drive according to the traffic rules in a logical and practical way (since if Gideon does not drive according to these rules, he could cause harm to himself or to others, and might have to stand trial), a religious person takes upon himself the burden of religious commandments because his emotional system is intensively and fully activated, and, consequently, he is mentally incapable of behaving otherwise (not to speak of the sanctions that the religious community imposes on those who transgress from the rules). Here, too, explanations grounded in behavioral rules provide answers to the following questions: *why* (because that is how one must drive), *how* (in the way set out in the traffic rules), and *purpose* (the rules were created to enable society to function well and efficiently).

In these cases, a number of questions arise concerning the requirements of scientific methodology. For example, traffic rules can be considered as public rules that have been internalized by individuals. Yet it is unclear how these rules, which become part of an individual's inner world — mental representations solely for individual introspection — are able to act on that person's nervous, muscular, and skeletal systems so as to enable publicly observable behavior, such as stopping a car at a red light. Furthermore, the execution of these rules ultimately depends on individual free will.

*Private mental processes.* Individuals use mental processes as explanations of the behaviors of living creatures. For example, to the following question regarding the behavior of a mailman, "Why did the mailman throw the mail on the doorstep and sprint away from the yard?" we might receive the following satisfactory answer: "Because the mailman was afraid of the dog in the yard that had started to bark and snarl at him angrily." Our understanding of the mailman's behavior, then, addresses the feelings of fear that the barking dog had evoked in him. In other words, we explain the mailman's public behavior by appeal to the internal emotion that arose within him — a fear that he alone and no other person could feel (of course, any person can experience fear of barking dogs, but each one experiences that fear in his or her own way). This is but one example of many where an individual's inner world (i.e., mental states and processes such as sensations, feelings and thoughts), explains her public actions. Here is another example. Thoughts about economic processes explain how it came about that Roni suddenly grew wealthy: she had decided to purchase shares in a certain company, "Vegetarian," which she believed might increase in value on the stock

market, because the media had been flooded recently with shocking images of how animals like chickens, cows, and pigs were farmed by the food industry. Methodologically speaking, a host of complex questions arise here about the mysterious relationship between an individual's inner world, which is subject solely to introspection, and that person's public behavior, which meets the requirements of scientific methodology, such as public accessibility and objectivity.

Here, I will briefly list a number of accepted, popular explanations that are based on the inner world of the individual.

1. *Explanation through [will/belief] purposeful/teleological explanation.* [Will/Belief] is delineated as follows. If an individual desires to achieve a certain goal, and believes that action A will fulfill her desire, then she will perform action A. For example, if Ruth wishes to watch the *Wonder Woman* movie, and she believes that going to the Peer Cinema will fulfill that wish, Ruth will go to that cinema.

2. *Explanation through emotion.* Extraordinary behavior is usually explained by strong emotions that overwhelm an individual. For example, David spent many long hours sitting in his car and surveilling the home of his girlfriend, Ruth, out of jealousy, because he thought that Ruth was dating other people.

3. *Explanation through schemas.* I will illustrate this explanation with the following example. A lifelong New Yorker looked up at the sky and saw a cloud shaped like a car; in contrast, an Inuit man who had lived all his life in the Arctic and who had traveled to New York for a short visit, saw that the same cloud was in the shape of a polar bear similar to those that the men of his tribe often fought. How do we explain this difference? The explanation is that a schema of a car had been established in the New Yorker's mind (because that city is full of cars), while in the Inuit's mind, a schema of a polar bear had formed; and for that reason, the New Yorker saw a shape that looked like a car in the cloud, while the Inuit saw the form of a polar bear.

4. *Explanation from imagination, analogies, abstract ideas, and so forth.* Many children have imaginary friends, with whom they talk and play. Imaginary friends alleviate the child's loneliness and help him cope with conflicts and problems in his life. The use of analogies is an important tool for understanding an individual's behavior. For example, to the question "Why was Dan behaving irrationally?" we might obtain the answer, "Dan is not the brightest bulb in the box." In other words, Dan is rather unintelligent and therefore behaves irrationally. Some social movements can be explained through ideologies that human beings attempt to realize (e.g., socialism, communism, democracy, religious castes).

5. *Explanation from the point of view of another person.* Consider the following example. The cloakroom attendant at the New Year's party hung Oren's heavy coat on a small hanger in the right-hand side of the closet. However, after a while, she realized that it would be better to hang the heavy coats on the large hangers in the left-hand side of the closet. She moved the coat to the left, and then went home at around midnight. And so, at the end of the successful party, right before morning,

where will Oren look for his coat — on the left-hand or the right-hand side of the closet? The correct answer, of course, should derive from the point of view of the knowledge possessed by Oren, and not by the reader.

*The Relationship between the Procedures (Scientific and Everyday) and the URP*

As has emerged from the discussion so far, all of the procedures described above can be evaluated using the formula Understanding-Distance = F (Theory – URP). We can assume that *scientific procedures*, in one form or another, (covertly) assume a URP. For example, the explanation models proposed by Hempel (1965) are based on natural laws or stable empirical (in some cases probabilistic) generalizations that attempt to express latent processes in nature. In another example, Salmon (1984, 1990) proposed a causal explanation model that is based on latent causal processes in the world, which are responsible for the occurrence of the phenomenon under study (see discussions in Rakover, 2018). In all these cases, the degree of Understanding-Distance can be estimated according to the empirical success in explaining a set of natural phenomena: the greater the success, the smaller the Understanding-Distance.

In terms of the two *everyday procedures* of religious belief or behavioral rules, we can assume that the proposed explanation is very close to the URP. According to the rules of religious faith, acts of God are the URP, since, according to religious belief, everything has been created and is ruled over by God. Thus, any answer/explanation to a question regarding a behavioral phenomenon that relies on acts of God, is close to the URP. Nevertheless, it should be emphasized that, when examining religious explanations in the light of reality as conceived by science, the Understanding-Distance is very large.

Likewise, answers/explanations that rely on behavioral rules for drivers in a particular society are also very close to the URP, since these rules were created by the members of the society in question, and they are obliged to abide by them — which is what actually occurs in the vast majority of cases. Regarding private mental processes, I propose, according to the approach set out by Rakover (1983), that introspection operates similarly to the way in which a scientist works: from all of the hypotheses that emerge in an individual's consciousness, the individual will select the one that appears to be the most effective, and thus the size of the Understanding-Distance is estimated according to how successful that hypothesis is in explaining the behavior of the individual.

### Discussion

The main aim of this paper is to propose a novel empirical theory for understanding. According to this theory, understanding is provided by answers/explanations

to questions that arise in a particular field, in accordance with relevant explanation procedures. This is a broad definition that includes two classes of procedures: class (a) includes answers, explanations, and understandings that are provided through *scientific procedures* that meet the requirements of scientific methodology; and class (b) includes answers, explanations, and understandings that are provided using *everyday procedures* that do not fulfill all of the requirements of scientific methodology. These two classes provide an individual with understanding when the answers and explanations to questions appear in consciousness — consciousness is a necessary condition for understanding.

In this discussion, I will focus on four key topics. First, I shall attempt to propose answers to the following question: What justifies the procedures under discussion and makes them the main pathways for providing explanation and understanding? Second, further to these justifications the following question arises: What are the justifications of TFTU? Third, I will attempt to compare this approach with others that appear in the literature. I will focus on Lipton's (2009) approach to understanding without explanation, and on Khalifa's (2013, 2017) critical response to Lipton. I will also make some comments on Bourget's (2017) approach on the importance of consciousness in understanding. Finally, I will briefly discuss the question of whether TFTU offers a novel approach, departing from the perception that explanations of human behavior differ from explanations of natural phenomena.

*Justifications.* I will first discuss *scientific procedures*. Following the publication of Hempel and Oppenheim's (1948) paper on the logic of scientific explanation, and Hempel's (1965, 1966) volumes on the philosophy of science and explanation, all models (procedures) were required to provide scientific explanations that met the requirements of *rationality* and *empiricism*. Meeting these requirements is the main justification for the creation of new models (new procedures) to provide scientific explanations that offer answers to the questions *why* and *how* (see discussion in Rakover, 2018). Rationality requires that the structure of an explanation procedure does not present any internal logical contradictions. Empiricism requires that an explanation procedure enables a clear and direct link with empirical observations. For example, if a procedure handles the link between cause and effect, then the cause and effect must be observable in accordance with the requirements of scientific methodology (see Rakover, 1990).

A further justification for scientific procedures is embedded in the URP. Assuming that a real process exists that is responsible for the phenomenon in question (a process that answers the questions *why* and *how*), and assuming an interpretation by which explanation procedures strive to offer explanations that closely approximate the URP, one may propose that this is considered justification for using these procedures to provide explanation, i.e., for revealing the URP (see Rakover, 2018).

Now I will move on to discuss the justification of the *everyday procedures* for creating explanation — procedures that do not meet every requirement of

scientific methodology. The procedures described above (behavioral rules and private mental processes) do not meet the two requirements of rationality and empiricism in the way that *scientific procedures* do.

Behavioral rules are not judged as right or wrong, but instead are valued according to how they achieve their purpose, in other words, according to how effective they are at regulating human behavior in a given society. Consider the following example: at road intersections, it is often best practice to convert the traffic light system to a roundabout. Although roundabouts slow the flow of traffic, they do not result in the long traffic jams that form when traffic lights are broken. Moreover, roundabouts reduce the number of road accidents that occur as a result of cars that either fail to brake, or do not brake in time, when the lights change from green to red. In these cases, the URP can be considered to be the behavioral rules themselves, and the key question in this case is whether the behavioral rules are the most effective at achieving their purpose.

Justification for *everyday procedures* that are based on a person's internal (mental) processes is particularly complex. While it is difficult to base these procedures on rationality and compliance with the requirements of scientific observation (public accessibility, objectivity, repeatability; see Rakover, 1990), they may, however, be grounded in the actual, everyday conscious experiences that every person has. However, as we shall soon realize, this experience also raises questions that do not yet have solutions (see Rakover, 2018, 2021). From one perspective, each individual is aware of having an inner world that is unique in an ordinary, quotidian way. A person is aware of her desires, beliefs, thoughts, emotions, feelings, and so on, and is well aware that, in many cases, her behavior is merely the realization of this inner world. From another perspective, since each individual is aware only of his own inner world, a person may doubt that an inner world similar to his might exist within another person — this is precisely the well-known problem of other minds — a problem that does not, as yet, have an accepted solution (see Avramides, 2020). In spite of this doubt, in everyday life people conduct themselves out of a clear belief that others do indeed have an inner world that is very similar to their own. For example, a mother tells her daughter, “don't cry, the *pain* in your hand from your fall will soon go away,” a doctor says, “I'll give you a shot, there will be a slight *sting* that will pass quickly,” and everyone at the funeral of Mrs. Levine's husband says that his death caused her to fall into a *deep depression* that will go on for some time, and so on.

And it is in these respects — that a person is aware that her inner world is the cause of her actions — that we can find justification for understanding human behavior. For example: David looked for a good restaurant, because he was *hungry*; Ruth went to the cinema, because she *wanted* to see the new Wonder Woman movie; Ronen burst into bitter tears, because the *disappointment* of rejection was so great, and so on. In all these cases the inner world (hunger, desire, disappointment) is presented naturally as the explanation (cause) of one's behavior.

To illustrate the tremendous problems inherent in justifying *everyday procedures*, consider the example of an explanation based on [will/belief], i.e., a purposive model of explanation. On the one hand, it is difficult to suggest that this explanation completely meets the requirement for rationality, simply because an explanation based on [will/belief] depends on an individual's unique subjective perspective, that is, on his desire and his belief that a particular behavior will satisfy his desire. Moreover, the reliance on an individual's inner world creates a number of problems related to making observations in accordance with scientific requirements: public accessibility, objectivity, and repeatability (see Rakover, 1990). On the other hand, however, reference to an individual's [will/belief] as an explanation for his behavior is so prevalent in everyday life that it has become the most natural method for understanding behavior, and finds expression both in legal judgements (e.g., the motive for the crime was *jealousy*, *hatred*) and in literature (e.g., the reason for the Trojan War was *jealousy* between the goddesses of Olympus that eventually became a *fiery love affair* between Paris and Helen of Troy.)

It is worth noting, however, that Rakover (2011/2012, 2018) demonstrated that an explanation based on the [will/belief] model fulfils several requirements of a scientifically acceptable procedure of explanation/understanding, such as generality and practical rationality, as well as the fact that the procedure itself is indifferent to the results of the empirical test (i.e., the empirical result of confirmation–refutation of the prediction relates only to the explanation theory and not to the procedure itself).

Moreover, everyday mental [will/belief] procedures can also be justified by reference to a URP. Assuming there is some sort of real process responsible for an individual's behavior under certain conditions, and assuming that a description of an individual's [will/belief] closely approaches the URP, use of this model of [will/belief] can be justified through reliance on these assumptions.

*Justifications of TFTU.* The justifications of *everyday procedures* raise the following problem. Ultimately, it seems that the justifications of these procedures are grounded in an individual's inner world (whether they are based on religious beliefs, behavioral rules, or mental processes like thoughts, desires, and feelings). Given this, one can raise the following critique. According to Hempel (1965), these justifications speak to the subjective psychological feeling that accompanies understanding (the so-called “a-ha moment”), while what is required here is a discussion about the model of explanation from a logical and methodological point of view.

My response to this critique is as follows. First, it would be hard to overlook the fact that a number of scholars have raised important and worthy arguments against the idea that understanding is merely a psychological side-effect of explanation (see de Regt et al., 2009). For example, it has been suggested that the number of explanation components should be increased from two — the explanandum and the explanans — to three, since the scientist herself should be added as an important component in explanation/understanding.



Second, it is difficult to ignore the fact that the [will/belief] explanation procedure satisfies an important part of the methodological requirements of science (see Rakover, 2011/2012, 2018). For example, [will/belief] fulfills the requirements of generality and empiricism.

Third, TFTU stands in contradiction to the approach that conceives understanding as a psychological response that accompanies explanation, since, according to TFTU, understanding of the explanation itself requires consciousness. If we do not accept the assumption about the necessity of consciousness, it follows that we must accept, for example, the bizarre conclusion that Robbie the robot does, in fact, understand both the classical physics question and the answer that he himself provides, just as a human being understands these.<sup>6</sup> In other words, the following “methodological” dilemma arises here.

*Possibility (a).* If we accept that explanation should only be discussed objectively, logically, and methodologically and that understanding should be seen as a subjective psychological response to explanation, then we must accept the possibility that Robbie the robot understands the physics explanation just as a human being does. Moreover, it would be very difficult indeed (if not impossible) to explain behavior solely through *scientific procedures* and without using *everyday procedures*.

*Possibility (b).* If we accept that understanding requires consciousness, then a number of methodological problems arise in relation to making observations of the individual inner worlds of each and every person. These problems are related to the requirements for scientific observations.

I am inclined to reject possibility (a) and accept possibility (b) for the following reasons. Considerable efforts have been made within the accepted methodological framework for studying the inner world of the individual. These efforts have found expression, inter alia, in the expanding research on consciousness (see review and discussion in Van Gulick, 2018). Furthermore, I have taken great pains to develop an approach demonstrating that, within this accepted methodology, we can include the development of psychological theories based on two types of explanation procedure (models): mechanistic (scientifically accepted) and mentalistic (concerning one’s inner world). This development is based on the premise that the procedure of purposeful explanation [will/belief], fulfills an important part of the requirements for scientifically acceptable methodology (see Rakover, 2011/2012, 2018).

*Comparisons.* The present theory, TFTU, differs in several aspects from Lipton’s (2009) approach on understanding without explanation. Lipton proposes identifying understanding with cognitive benefits, such as causes and necessary conditions, which are provided by the explanations themselves, and argues that

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<sup>6</sup>Here, I must say that I do not accept a positive answer to the question of whether an advanced, sophisticated computer can develop consciousness similar to that of a human being (see Rakover, 2018).

“it is more natural to identify understanding with the cognitive benefits that an explanation provides rather than with the explanation itself” (p. 43). He continues by stating that, “[f]or by distinguishing explanations from the understanding they provide, we make room for the possibility that understanding may also arise in other ways” (p. 44).

To support this idea, Lipton provides a number of examples to illustrate how understanding of a certain phenomenon can be reached without knowledge of the scientific explanation itself. This approach has provoked controversy. Khalifa (2017), who is critical of Lipton’s approach, argues, *inter alia*, that scientific explanations provide better and more accurate understanding than understanding without scientific explanation. Although this argument appears correct, certain qualifications arise.

Even if we accept Khalifa’s argument that understanding provided by scientific explanation is better than that provided by non-scientific explanation, two possibilities could arise that may be interpreted as supportive of Lipton’s position. The first possibility suggests that another method, like visual demonstration, can be very helpful in understanding scientific explanation; the second possibility suggests that, without this additional method — visual demonstration — scientific explanation may be adversely affected. I believe that it is possible to find examples that support these two possibilities. Consider, for example, planimetry, which is commonly applied in the measurement of distances. The following simple definition — that the sine of an angle is the ratio of the side opposite to that angle to the hypotenuse in a right-angled triangle — is very easy to understand if we draw a right-angled triangle; equally, it would be very difficult to prove congruence between various geometric shapes such as triangles, squares, rectangles, and rhombuses without drawing the shapes themselves.

The fundamental difference between Lipton’s approach and TFTU is as follows. While Lipton limits himself to scientific explanation procedures that answer the question *why*, TFTU offers a wider approach to the concept of understanding, grounded in the differences between two types of procedure: scientific procedures and everyday procedures. The proposed theory, TFTU, shows that, in certain fields, there are justified procedures for reaching understanding that are not consistent with all scientific methodologies. These procedures are accepted within certain cultural traditions as providing explanation. For example, as described above, almost all explanations that appear in literature use procedures that refer to an individual’s inner world as the cause of behavior. In Leo Tolstoy’s novel *Anna Karenina*, for example, all of the troubles and disasters that befall Anna (and which, ultimately, lead her to take her own life) are ascribed to the powerful feelings of love that gripped her and her lover, Vronsky. In other words, if Lipton attempted to ground the possibility of providing explanation not through a particular scientific explanation but through a different method, which can be undertaken *because* of the conceptual gap created by identifying understanding

with cognitive benefits, then TFTU has expanded this approach, and shows that we may refer to two justified types of procedures for creating explanation/understanding: scientific procedures and everyday procedures.

Another important difference between Lipton's approach and TFTU concerns the concept of consciousness. While in TFTU, consciousness is a necessary condition for understanding, it is not an important factor in Lipton's approach. In contrast to Lipton, the concept of consciousness is a central axis in Bourget's (2017) approach. Bourget attempts to elucidate the idea of understanding via the concept of *grasping*, which is bounded by consciousness.<sup>7</sup> According to Bourget, *grasping* a sentence with a certain content (a proposition) is understood when it is experienced in a conscious, phenomenological way. He analyzes a number of cases using this approach, including Jackson's (1982) famous thought-experiment about a visual scientist, Mary, which he interprets as supportive of his hypothesis. Jackson's Mary studied color and knew everything there was to know on the subject. However, she had lived all her life in a black and white surrounding. One day, Mary left her monochromatic surrounding and experienced the color red for the first time, and thus learned something new. Bourget argues that, until the moment Mary left her room, she had been unable to experience redness and thus had not grasped/understood its nature. However, at the moment she experienced the color red, she grasped/understood it.

Bourget's approach is similar to TFTU, which considers consciousness as a necessary condition for understanding. Why? Because according to Bourget's approach, it appears that, until the moment that the stimulus of the color red appears in Mary's consciousness, she does not grasp/understand it. However, there are several points of difference between these two theories. First, although TFTU emphasizes the importance of (scientific and everyday) procedures for understanding, Bourget's phenomenological approach does not address the need for an appropriate, justified procedure in order to arrive at explanation and understanding. (Here it is worth emphasizing once more that a scientific theory does not in itself provide explanation. For it to do so, suitable procedures for obtaining explanation must be applied to it.)

Second, while TFTU emphasizes that degrees of understanding exist, there is no such emphasis in Bourget's approach. (Moreover, Bourget struggles to fit the concept of degrees of understanding within his phenomenological approach of *grasping*.) To emphasize the importance of this difference in degrees of understanding, consider a second woman, Yram. She is identical to Jackson's Mary in every respect, except that she was born blind and has absolutely no knowledge about color vision. Miraculously, as a result of a blow to the head that occurred at precisely the same time as Mary first experienced redness, Yram also gained her

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<sup>7</sup>Note that the concept of grasping is described in the literature as clarifying and defining the concept of understanding; for example, see Gordon (2020) and Grimm (2011).

sight and experienced the same color. Here, the question arises: Which of these two women has a greater understanding of everything concerning redness? There is no doubt that, before they both experienced redness, Mary's understanding of it was immeasurably greater than that of Yram. Mary is able to answer many questions about color vision, to which Yram can only answer "I have no idea." What will be their degree of understanding after they both experience redness? If we assume that both women are identical when they experience redness for the first time, except for their knowledge of color vision, we can also assume that both have similar experiences of the color. However, here, too, it is clear that Mary's degree of understanding of redness is greater than Yram's, since Mary is able to connect her experience of redness with her knowledge of color vision, while Yram is not able to do so.

The following ideas arise from the comparison between Mary and Yram:

(a) Bourget's definition that grasping is a conscious experience of propositional attitudes is only partial, since it does not take into account the knowledge a person possesses. According to TFTU, the cognitive event of grasping occurs when a new mental state becomes well-integrated into relevant knowledge in a person's long-term memory (LTM). In other words, grasping occurs when a new piece of information is integrated with existing knowledge (e.g., when it does not give rise to contradictions and/or does not contrast with existing knowledge). In such cases, a person says to herself, "O.K., I get the point." As stated, this proposition, which I shall call *knowledge accommodation*, is consistent with the central premise of this paper, according to which understanding is constrained to cases where questions arise in a particular field and are answered in accordance with procedures and knowledge current at the time when the questions arose. If the explanation — the answer to the question — is not accommodated with the existing knowledge that a person holds, grasping will not occur. For example, a great many people are not able to grasp Einstein's theory of relativity in depth, because they cannot let go of their ingrained knowledge of absolute time and space and are unable to internalize the new concept of space/time, including the notion that time changes in relation to speed, and that only the speed of light is a constant. From here it emerges that Mary will become adjusted to redness better than Yram, since the latter has no informative background that allows her to accommodate the new experience.

(b) The basis for idea (a) is rooted in the fact that the answer that an individual receives to his question is not like planting a new tree in virgin soil. Rather, the answer is akin to planting a tree in a dense forest; it has to be embedded in a rich collection of existing knowledge in the LTM, including pieces of information, schemas, theories, emotional tendencies, etc.; that is, the person's efforts to understand the answer to his question is conditional on knowledge accommodation, integrating the explanation, and adapting it to the relevant informative background that exists in his memory.

### Understanding Human Behavior Compared with Understanding Natural Phenomena

At the end of the nineteenth century, German philosophers (such as Wilhelm Dilthey) posited a distinction between the comprehension of (a) the natural world (that is, research in the natural sciences) by using the concept of “explanation” and (b) the human world (that is, research in the humanities and social sciences) using the concept of “understanding” (see discussions in Grimm, 2016, 2019; Rakover, 1990, 2018). Although this distinction is no longer accepted, most scholars consider that applying explanation methodologies developed in the natural sciences to human behavioral research is not easy to do (see, for example, Grimm, 2016; Rakover, 2018). The difficulty that prevents the direct, straightforward application of natural science methodology to psychology lies in the fundamental concept of consciousness.

To illustrate just how complex this problem is, consider the general factors on which human behavior depends. As it transpires, some of these factors can easily be treated using scientific methodologies, while there are certain problems inherent in treating other factors. We can propose, in the most general and simplistic way, that an individual’s behavior (primarily meaning her actions, including her self-reported behavior and behavior that is publicly observable) is a function of a number of factors: (i) the state of the stimulus in which the individual finds herself, (ii) the individual’s physiological system (recently, the main focus has been on the brain), (iii) the cognitive system (where the brain is perceived as an information-processing system, similar to a computer); and (iv) the mental system (meaning the unique, subjective, conscious world of the individual, including feelings, emotions, desires, beliefs, thoughts, and so on).

I would not be mistaken if I were to say that the vast majority of psychologists consider that, when natural science methodologies are applied to psychology, no particular difficulties are encountered both with regard to the dependent variable — the behavioral phenomena — and to the following independent variables: (i) the stimulus and (ii) the physiological system. However, when it comes to (iii) the cognitive system, it seems particularly problematic to apply scientific methodologies here. On the one hand, since the human cognitive system is often perceived as analogous to a computer — which can easily be studied through scientific methodologies — it appears that in principle there should not be any obstacles to applying scientific methodologies to psychology. However, on the other hand, in practice it seems that it is particularly difficult to transpose the basic concepts of computer science to cognitive psychology. For example, the boundaries of concepts such as “information” and “information processing,” which are well-defined in science, become blurred and break down when they are applied to psychology (for example, see Palmer and Kimchi, 1986; Rakover, 2018).

It seems, therefore, that the biggest obstacle to the application of scientific methodology to psychology centers on (iv) the mental system. That is, the problem lies

in the inability of scientific methodology to deal with the concept of consciousness — in other words, this is the yet-to-be-solved mind/body or brain/consciousness problem (see the extensive discussion on this topic in Rakover, 1990, 2018).

This particular idea, that employing scientific methodologies to study the mental system is extremely problematic, is in keeping with the concept proposed in this paper, which posits that there are everyday procedures that provide understanding of human behavior. This despite the fact that these everyday procedures do not meet all the requirements of scientific methodology. It is likely that if consciousness is eventually shown to be a physical or chemical trait that is measurable using contemporary scientific techniques, then we will be able to apply scientific methodologies to it. Consequently, at that point, we will be able to accept that scientific procedures also provide explanation/understanding of human behavior. In such a hypothetical situation, however, two possibilities would arise in support of the continued application of everyday procedures. I describe these briefly below.

First, even if scientific procedures did successfully provide an explanation for every behavioral phenomenon, there would still be room for everyday explanations within the frameworks of religious belief or belief in a social ideology. For an individual who believes wholeheartedly in a religion or ideology, the only satisfactory explanation for a phenomenon would be one that suits his belief.

Second, the question arises as to whether everyday procedures would disappear entirely or whether they would persist for various reasons, e.g., because they are convenient to use and provide a satisfactory degree of understanding. This question is complex and is beyond the scope of this current discussion, inasmuch as it belongs to the ongoing, unresolved debate in the philosophy of mind with respect to eliminative materialism. That approach posits that the everyday theoretical conception of states of mind, such as will and belief, as well as explanation based on these concepts, is incorrect, has no place within the modern scientific approach, and will ultimately be superseded by the development of a suitable cognitive theory (see discussion in Ramsey, 2020).

However, this is not currently the status quo. The scientific approach to consciousness has not yet succeeded in addressing the problem of consciousness. Eliminative materialism remains a subject of fierce debate in the professional literature and has yet to become the accepted, dominant approach. Therefore, I suggest that there remains an important role for everyday procedures that attempt to provide explanation and understanding of human behavior by other means, which are not consistent with all scientific methodologies.

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