On Existence and Qualities of the Human Soul

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Abstract

In comparing animals and humans, or as put more modernly, comparing humans with *other* animals, the questions of the existence, nature, and necessity of a human soul often come up.

The question of existence of the human soul may be explored from different perspectives. For example, this question may be posed as "is there a human soul?" If so, what is it? why do we need a soul? why not just the brain? Is it needed to explain something, such as "continuation of life after physical death?" If so, is it just a contrivance to answer such peripheral questions?

To attempt a rational treatment of these questions, a two-phase approach is adopted: first, a rational foundation is laid out, and second, the principles established as part of this rational foundation are applied to specific questions, such as those posed above. The overall argument is the result of a modern treatment and integration of several diverse concepts Proclaimed by Bahá'u'lláh and explained by Abdu'l-Bahá. These diverse concepts are presented aided by various quotes from the Bahá'í sacred Writings.

In the first phase, science and rationality are compared and their relationship established. A principle of primacy of logic and rationality is developed that includes science as a subset. Relationships are categorized into two broad classes: physical and rational. A model of thought, human or otherwise, is developed to precisely define what it means to think. The

central role of analogy to cognitive activities is described. The physical world is defined as a realm where the fundamental dimensions of time and space govern over all that is contained therein. Further, a number of realms of existence, or "Kingdoms," including Mineral, Plant, Animal, and Human Kingdoms are described.

In the second phase, a part scientific and part rational methodology is employed to specifically answer the direct and indirect questions about the existence of the human soul. It is argued that no physical system, including the human brain, can comprehend rational relationships because the rational and physical realms do not overlap. This aspect differentiates man from animal. One aspect of spirituality is described as the ability to comprehend rational relationship. However, since computers clearly represent and process rational relationships, additional explanations are appropriate, and indeed, required. Comprehension of rational relationships is not the same as their representation or processing. Comprehension of an abstract or rational relationship is realized only if it is analogically related and successfully applied to a domain different from the one in which it was discovered, when the two domains are materially disjoint.

It is concluded that the mere fact of comprehension of abstract rational relationships necessitates the existence and assistance of a non-physical entity, the human soul, which provides the power of rational comprehension from outside the physical realm. The Kingdoms of existence further explain how the human soul fits in a unified world of God.

Introduction

Here is an exercise for the reader: What holds the earth suspended in space? (a) The *World Turtle*, (b) the *World Elephant*, (c) the *World Serpent*, or (d) something else? This exercise holds several important keys to answering the main question posed by this paper: whether an entity called the

human soul exists. The correct answer is (d): something else, namely, the mutual gravitational pull between the earth and the sun in balance with the centrifugal force acting on the earth due to its orbital motion around the sun. And because no friction exists in the vacuum of space, these balanced forces will continue for a very long time or until other cosmic forces intervene.

In ancient times, when the law of gravity and celestial mechanics were unknown, people had to answer the question: "if everything is ultimately resting on the earth, then what is the earth resting on?!" Hence, different cultures came up with variations of the above (a)-(c) explanations using mythical creatures with magical powers. The main reasons for coming up with these erroneous explanations were lack of knowledge and bad assumptions. We already talked briefly about some of the knowledge they lacked. Some of the bad assumptions included the assumption that space has intrinsic "up" and "down" directions. And that objects, including earth itself, "naturally" fall "down" (rather than being actively pulled towards another object due to the gravitational force between them without regard to an up or a down), as confirmed by their common experiences on earth. Hence, they assumed that the earth has to fall "down" in the absence of something holding it up. Based on these assumptions, they had to devise an explanation about what holds up the earth. So, they did.

The key lessons we learn from the above exercise are as follows. One, unexplained phenomena need an explanation. Two, lack of knowledge and/or the wrong assumptions produce the wrong explanations. And three, alternative explanations must actually explain what is missing from the others. We will apply these key lessons to our question about the existence of soul in the rest of this paper.

A number of related questions come to mind: What is the nature of the soul, if it exists? Is it energy? Is it a force of nature? Is it a contrived and imaginary construct to explain

what we cannot otherwise explain? We will revisit these questions when we have established the necessary foundations.

And why do we even care about the existence, or not, of the human soul? When we define the problem below in more specific terms, we will realize that the current explanations fall short. Hence, we have to come up with another explanation, which happens to have major implications about our nature and our goals and objectives in life.

This paper is structured in two parts. In Part I, we will define and describe several foundational concepts. In Part II, we will set out to use the results from Part I to prove the existence and some of the characteristics of the human soul.

Concept of Soul or Spirit

Knowing what it is that we are discussing is always a good start. So, let us start with examining what we mean by "soul" or "spirit." Spirits are highly abused creatures. These terms and the loose concepts behind them have been used to mean many things, some even contradictory in essence. We only present some anecdotal evidence of these uses here for the purpose of clarifying what is meant by the use of these terms in the present paper.

The terms "soul" and "spirit" are sometimes used interchangeably and sometimes in distinct ways. For example, people talk about "the soul of a nation," meaning the essential qualities that define that nation. Sometimes we talk about a "spiritual experience," meaning a deeply and emotionally gratifying or illuminating experience. Even today, the word "ravani" in the Persian language means both mental/ psychological and spiritual. The reason for this close association is that before the advent of psychology and advancement of medical and biological sciences that shed light on some of the workings of human mind and brain, the mental faculty was believed to be the exclusive domain of the human

soul. So, a psychopath was thought to have a sick soul or spirit. Similarly, soul and/or spirit have had varying associations with the sacred, the mystical, the divine, and the like in different cultural traditions. But probably the most commonly associated concept with these terms is that of essence or core. In many common usages of these terms, including the above examples, the connotation of essence is clearly visible.

However, in this paper we will mainly use the term "soul" and we mean something very specific by it. For our purposes, the soul is defined as a non-physical entity in transcendental communication with the brain, which differentiates humans from animals and is the seat and source of general intelligence.

The Essential Questions

> *And now concerning thy question regarding the soul of man and its survival after death. Know thou of a truth that the soul, after its separation from the body, will continue to progress until it attaineth the presence of God, in a state and condition which neither the revolution of ages and centuries, nor the changes and chances of this world, can alter.* — Bahá'u'lláh[1]

In the passage above, Bahá'u'lláh goes straight to the main question. However, before getting there, we have to contend with more elementary questions first. Now, with the above definition of soul in mind, we can pose some essential questions to guide our analysis.

The main one of these questions is this: Is there a human soul? There are three main types of answers to an existential question like this. A first type of answer is based on direct facts. An example of this type is asking whether a cow has horns. By direct observation of the fact that cows have horns, we can answer this question. Since we have no direct or objective visibility into the spiritual realm, if such realm even

exists, we cannot answer the question of the existence of human soul on this basis.

A second type of answer is based on best explanation. This is also referred to as Ockham's razor, a rational principle attributed to the 14th century British logician, William of Ockham (c. 1287–1347), stating that among competing hypotheses based on known facts the one with the fewest unsupported assumptions is generally the best hypotheses, at least until more facts are known or more assumptions are verified. The "razor" alludes to the operation of cutting away, figuratively speaking, of unnecessary assumptions and explanations to come up with the remaining best explanation. An example of this is two competing hypotheses for explaining a traffic jam by either assuming time of day rush hour or occurrence of an accident. This is a promising path for us.

And a third type of answer to existential questions is based on inherent relationships. An example of this is knowing an energy source must exist if work is observed being performed, because work cannot be performed unless energy is being applied. This is also a promising path for us.

Hence, the analysis that follows is based on a combination of the latter two types of answers.

Other related questions to the question of the existence of soul include: What is the soul? Why is it needed? Why not just the brain to explain higher intelligence? Why would humans have a soul but not animals? Is the soul just a contrivance to explain other things such as immortality or another world? And the questions related to brain can be repeated for computers and processors.

To answer the above questions, we need to define what intelligence is, what thinking means, how physical computing systems, including the brain, work, and how the soul fits into the picture.

PART I: Foundational Concepts

"Make things as simple as *possible*, but not simpler!" This quote, attributed to Albert Einstein, is essentially the flip side of Ockham's razor. While Ockham's razor helps us set the upper limits of complexity in our hypotheses, Einstein's razor, as this quote is sometimes called, helps us set the lower limits. The implication of Einstein's razor for us is that we need at least a certain number of foundational concepts to properly analyze and answer these questions without losing any essential information or knowledge in the process based on which we may come up with the wrong hypotheses.

We surmise that the following foundations will be needed: a definition of our general approach and methodology, a clear model of thinking, a definition of intelligence, a simple model of brain and its operation, a brief description of some of the methods and limitations of Artificial Intelligence (AI), and the central role of analogy in intelligence.

Methodology and Approach

The methodology employed includes a combination of scientific knowledge and rational reasoning, each entailing a number of analytical methods. Several particular analytical tools and/or procedure are essential for any proper and reliable analysis. Sometimes these tools are explicitly defined and laid out and sometimes they are in the form of unwritten or implicit assumptions. No matter explicit or implicit, if one or more of these tools are missing uncertainty and error will creep into the analysis and resulting hypotheses. These procedures and tools include at least a clear statement of the purpose and objectives of the analysis, domain models (partly determined by the objectives), clear definition and/or specification of terms and concepts, and basic domain principles. Other analytical tools and actions, such as determining the right criteria to know success or failure of results, rules of logic that govern all analytical processes, probability and statistics, and many other

procedures are often required, which we have to skip discussing in the interest of brevity and focus. Knowing the purpose and objectives of the analysis allows the determination of an appropriate domain or system model, the applicable principles, and appropriate criteria for the application of the principles.

A model of something in a particular domain generally includes the system components, the relationships between those components, and the domain operating principles. For example, the model of a democratic government may include elected leaders, an electorate or voters, laws governing elections, freedom of speech and assembly, etc. A model is generally not unique and changes with the application. For example, if we want to analyze a democratic government for judicial effectiveness we have to use a certain model of the government and certain set of principles and criteria, while if we want to analyze it for economic productivity, we have to use a different model.

Definition, and more generally, specification of concepts and terms is not only critical to any analysis, but required. Specification is always in the context of a chosen model. That's why the definition of the same thing may be different with respect to different domain models. Without having an adequate specification, we quite literally do not know what we are talking about. Let's see why. The meaning of "definition" is often incompletely understood. More often than not, "definition" is thought to be mere naming or labeling of a concept or a thing. But it is more than that. A "definition" is *a named set of attributes or characteristics*. Like models, definitions are not unique or fixed and change according to the purpose of the definition. For example, if we have the set of attributes: {a frame, two in-line wheels connected to the frame, a handle connected to the frame, a pedal, and a chain connected to the rear wheel}, and we assign a name to it, such as "Bicycle," then we have a definition of a bicycle. Now we can assign a different name, such as "Zebra," but the list of attributes still specify a bicycle as we commonly know it. This point is

important because we cannot change the nature of an entity merely by renaming it, as is sometimes done by unscrupulous politicians or sales people to mislead people by saying one thing but meaning another. Two entities with different sets of attributes are still different even if we call them by the same name. For example, renaming a cow as a "horse," does not make a cow a horse, in spite of some obvious similarities between the two.

All relationships and operations in a particular domain are based on the principles that govern that domain. For example, if we are analyzing a natural eco system, then we must know the important principles that govern eco systems such as food chain, reproduction rates, existence of water, territorial behaviors of animals, etc. Once we know some of the relevant principles, we can apply them to a particular eco system, such as the American Rocky mountains. Similarly, other domains of discourse have their own principles.

The general approach taken here is the identification of a property, a behavior, or other characteristic, which cannot be explained by other than a non-physical soul. But, how do we identify such a characteristic, if one even exists? A good starting point may be the sharp distinction between man and other animals, speaking from a materialistic point of view that considers man as just another animal.

Besides some anatomical and physiological differences, and even though by widespread scientific accounts we share anywhere between 95% and 99% of our DNA with chimpanzees, there is absolutely no comparison between the general intelligence and cognitive abilities of humans and any other animal, including chimps, dolphins, crows, and octopi, as the acknowledged intelligence champions of the wild. What explains this enormous difference? the 1% difference in our DNA? May be. But, this is not an argument for or against. It is merely an observation looking for an explanation. What we want to find out is whether such differences can be explained

by biology alone. Hence, the essential question boils down to the source of our general intelligence.

Science and Rationality

With the ubiquitous success of science and scientific theories, especially over the last couple of centuries or so, many people have come to believe that "scientific" is synonymous with "valid," and even further, that science is the only path to the truth. That is, a theory is only valid if it is scientific and anything that is not scientific is invalid. However, even though science does cover a vast area of human intellectual endeavors and discoveries, based on our brief discussion of the scientific method below, it does not cover all types of analysis. Science chiefly operates using inductive reasoning. A whole class of rational analysis, which is based on deductive reasoning fundamentally lies outside the domain of science. Simply put, science is a subset of the rational analysis, not vice versa. Hence, everything valid is not necessarily scientific and anything that is not scientific is not necessarily invalid. Of course, scientific discovery is a complex business involving all manners of rational activity at different stages, including deductive reasoning. Nevertheless, the central rational component and the overarching method of scientific endeavor is inductive reasoning.

The scientific method may be generally formulated as follows:[2]

1. Make observations
2. Formulate a hypothesis to explain the observations
3. Test or verify the hypothesis using controlled experiments

The scientific method is an inductive process: we go from specific observations to general conclusions. Inductive reasoning is by nature, strictly speaking, inconclusive and evolutionary. The conclusion is only as good as the current

collection of observations allows. The next observation may alter the conclusion or theory. For example, if one observes a sequence of measurements of some quantity (for example, the temperature of an object) such as 2, 4, 6, 8, 10, 12, ..., and is then asked to predict what the next number in the sequence would be, he may present the hypothesis that this pattern is defined by the sequence of even numbers, and thus the next number would be 14. However, if the next number revealed in the observed sequence happens to be 25, then the assumed hypothesis turns out to be wrong and a different hypotheses will be needed. This inductive phenomenon is well known in the history of science and is behind all scientific progress: as new data are discovered, scientific explanations evolve to explain both the old and the new data and correct the deficiencies and errors in the old theories.

It is noteworthy to recognize that error is a built-in feature of science and the driver of scientific progress through a highly intelligent and systematic trial and error process. So, it is rather ironic that what some have elevated to the station of ultimate criterion for discovering and judging the truth, thrives on error as an inherent characteristic.

The inductive process is markedly different from the deductive process. In contrast to the inductive process, the deductive process, which is a main component of rational reasoning, is conclusive and fixed. Once a truth is deductively proven, it will never change, in contrast to scientific discoveries and theories. That's why ancient mathematical theories in geometry and algebra, or other areas of mathematics, once proven, have never been “improved.” The area of a circle, A, represented as $\pi r2$, where r is the radius of the circle and π is a constant (3.14...), was discovered and proven deductively, not scientifically. They did not cut out an assortment of circular discs and measure their areas in a laboratory to come up with this formula. Samples or observed circles, although examined for insight, did not play a pivotal or necessary role in proving this formula; deductive reasoning did.

As a matter of fact, this formula may be derived and proven by dividing a circle into an infinite number of slices, like a pizza. But since no physical object, such as sample discs, can be divided infinitely, the proof is abstract and purely rational, not scientific, strictly speaking.

Going a step further, it can be a rude awakening for some to discover that mathematics itself, the bedrock of all science and scientific endeavors, is not scientific! By its very nature, deductive knowledge is absolute and immutable within the system in which it was proven, while scientific knowledge is inherently evolutionary and constantly changing.

A closely related question is what does it mean to prove something, such as the existence of human soul? How do we know we have proven what we set out to prove? Having a "proof" generally means a valid conclusion is reached about a statement. Mathematically, the proof of a theorem means that the theorem, as defined, is true and that it contains no errors. For example, a theorem in geometry may state that the sum of internal angles of a triangle is 180°. Given the definitions of a triangle, angle, and sum, it can be mathematically proven that this theorem is true. Proof is based on the deductive process. In contrast, a scientific theory is only inductively *verified*, not proved, as discussed above.

The existence of a proof requires two main elements: facts and principles. The process of deduction, also known as reasoning, is the application of known principles or rules, which themselves may be previously proven theorems, to facts to prove a new theorem. Thus, for a proof of the existence of soul, facts related to the supposed properties of the human soul are needed that require an explanation, and principles are needed to show the new theorem is consistent with other known principles. In his many discourses about the soul, Abdul-Bahá did not shy away from propounding rational proofs of the existence of soul based on facts and principles, some of which are briefly recounted here.

As such, because of the obvious limitations of observability and testability, two of the essential components of the scientific method, imposed by a purportedly non-physical soul, the proof of its existence is rational in nature with a good dose of scientific knowledge thrown in the mix to provide the facts for the argument.

A few words are in order about what does not constitute proof. Stories, personal experiences, conjectures, and other similar evidences, even if true, do not rise to the level of proof. This assertion is not meant to belittle such evidence or aver their invalidity, but rather to distinguish them from a logical proof.

The Primacy of Logic

In the analysis of subjects that have strong connections to science, in reality or in our perception, the following discussion is of prime importance because it clarifies the position of logic with respect to science. Logic is the glue that binds together other knowledge to come up with valid conclusions and is the one indispensable tool of rational discourse. As such, logic has priority over science, laws of physics, biology, the brain, and any other area of human endeavor. Let's see why.

Logic is, at its very core, a specification of the existential requirements of any conclusion or result. Mathematically, three necessary and sufficient logical operators exist to specify any logical statement: AND, OR, and NOT. There is a mathematically equivalent single operator, NAND, that may serve the same purpose, but the original set of three operators is more intuitive. The AND operator specifies *all* the requirements (among those elements being considered) for a true conclusion, the OR operator specifies *one or more* of the requirements (that is, all are not necessary) for a true conclusion, and NOT specifies an element that *must not be true* for a conclusion to be true. Simple examples can illustrate the concept: *water* AND *soil* are needed for a flower to grow; you

can go to the store by *bicycle* OR *on foot*; a door that is NOT *locked* can be opened. In each of the foregoing examples, the operator is shown in underlined bold font, the requirements are shown in italics, and the conclusion or effect resulting from the requirements is shown in normal text. Thus, as we initially observed, the logical operators specify the requirements of existence of the result (or a true conclusion, in the context of information processing).

Logic is also like an information pipe, to use a metaphor. It is content-invariant and knowledge-agnostic. Logic is not concerned with what specific subject we are reasoning about. It also is not concerned about the correctness of the knowledge we use in our reasoning. For example, if we state that "an elephant fits in a tea cup; a tea cup fits in my pocket, therefore, an elephant fits in my pocket," we are using perfectly *valid* logic and correct reasoning, but with faulty knowledge. This is known as valid but *unsound* logic (or reasoning) due to the incorrect data or knowledge.

However, logic is not quite as simple as one may be lead to believe from the foregoing examples. What we briefly discussed above is *propositional* logic, dealing with logical constants. Higher order *predicate logic*, such as the first order predicate logic, the second order predicate logic, etc., deal with logical functions and quantifiers and are well-known subjects in the field of mathematical logic. The difference between propositional logic and predicate logic, apart from technical mathematical criteria such as whether or not they are *consistent* and *complete* systems, is that propositional logic is concerned with logical constants whose truth values are fixed. While predicate logic deals with logical variables and functions. This is loosely analogous to arithmetic and algebra, where arithmetic is used to operate on constant numbers and algebra is used to deal with variable numbers and functions of numbers.

Just as the complexity of advanced mathematics does not change the fact that it is basically a study of quantities and how

they are related to each other, the complexity level of logic does not change the fact that it is about existential conditions of rational conclusions.

How does all this show the primacy of logic over science and the laws of physics? It is a question of dependence: for any entities A and B, if B depends on A, then A *must* exist first and B can only exist afterwards. Existence of an entity precedes every property of the entity, because no other property of the entity can exist before the entity itself exists. Since logic defines the existential conditions of any entity, it comes first. That includes all physical phenomena and laws of nature. We may have gotten a bit too abstract here, so let's come back to earth, to a more concrete and practical level. As far as we know at this point of human advancement, the laws of nature, such as the laws of thermodynamics, gravity, quantum physics, and other such fundamental laws clearly underlie the physical reality we perceive. Our understanding of these laws change over time, yet the logical rules we use in our reasoning to rationally understand and analyze these very laws of nature remain unchanged. Conversely, no matter how our scientific understanding of the laws of physics or nature change, our logical methods do not. Thus, as far as our cognition is concerned, our understanding of natural phenomena through science is dependent upon logic, but the rules of logic are not dependent on our understanding of the laws of nature. Hence, the priority and primacy of logic.

Thinking: A Useful Model

Nothing can be understood in vacuum. Understanding requires a frame of reference, or more generally, a model within which a phenomenon can be placed, defined and analyzed. Since we made general intelligence and its source the centerpiece of our discourse and solely a property of the soul (no pun intended), we need to clearly define and characterize the context of intelligence, namely, thinking. Intelligence is the mental tool with which we think. But what is thinking?

We can start with a simple definition of thinking and develop and expand it to provide a rich context to understand intelligence. At the most fundamental and elementary level, thinking is the mental or symbolic counterpart of some external phenomenon, usually, the reality. When you feel thirsty and think to yourself: "I am going to get some water to drink," what are you doing? The mere fact of thinking does not get any water into your body, nor does it quench your thirst. You are simulating reality in advance. The electrochemical impulses and interactions between the neurons in your brain, that is, the thought of drinking water, is not the physical act of drinking water, it is a symbolic or mental prelude to it. But thinking doesn't have to be about some action in the future. Memories of the past or impressions of what may be happening to you now, have similar relationships to reality. They are symbolic representations of something real that happened in the past or is happening now. Nor is thinking limited to actual events. Thinking can also be about *potential* reality, things which may exist or happen later, even if such thinking is pure fantasy and cannot happen in reality, such as thinking about time travel. Put slightly more precisely, thinking is the tracking of reality in time, because everything, including real events and thinking about those events all flow along the axis of time.

We can apply this definition of thinking to all examples of our everyday experiences as well as deeper thoughts. For example, imagine what you do and how it tracks reality when you are planning for shopping: you mentally follow your travel route to the store, visualize market shelves, make payment, and travel back, all in your mind. Similarly, you are mentally tracking reality when you remember a birthday party, or doing an analysis of molecular behavior in a chemical reaction.

What is reality?

According to some, reality is in the eyes of the beholder. And there is a certain amount of truth to this statement. However, something must be there to behold in the first place, even if

different people see the same thing differently. With this notion in mind, we now have to define reality in broad enough terms to allow for different perceptions of it by different people while preserving the integrity of our definition.

If we define thinking in terms of reality, then we must know what reality is or at least how to characterize its important attributes as related to thinking. The real world may be accurately characterized by a model comprising a set of objects and the relationships between those objects. This model may have some grey areas that may be regarded as problematic or awkward, but our purpose here is not to have a discourse about the details of reality but to define what thinking means.

In this model of reality we have two components, which have to be described. Simply put, an object is a "thing," an entity made of matter. This definition of an object is broader than it may look at first glance. Suffice it to say, that all systems, living or inanimate, regardless of form or function are ultimately made of atoms. Even energy, in all its forms and manifestations, by Einstein's theory of special relativity (specifically by $E = mc^2$, where E is energy, m is mass of matter, and c is the speed of light), is equivalent to matter. This latter observation enlists electrical signals, electromagnetic waves, and other such seemingly non-material entities under the banner of "objects."

Relationships constitute a very broad concept indeed, which fully merit their position as one of the two components of reality. Intuitively defined, a relationship is a "connection" of some sort between two entities. Such entities may themselves be objects or other relationships. This connection may be more formally defined as an overlap between two sets that serve as models for the two entities, as shown in Figure 1 below by the white or blank elements. Any entity such as object, system, concept, physical and abstract relationships, thoughts, and the like may be modeled by a set of attributes, the attributes being features, parts, behaviors or any other descriptive parameter

that can describe and specify the entity being modeled by the set. When two such sets overlap, that is, when there are some common attributes in the two sets, the overlap constitutes a relationship between the two. In other words, this overlap is a connection between the two entities, relating the two. Given the above model, we can also conclude and recognize that objects and relationships are interdependent and inherent: you cannot have one without the other.

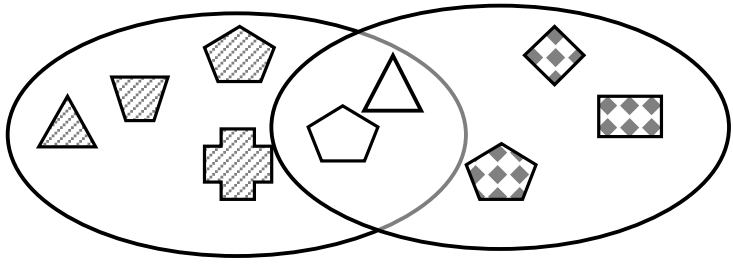

Figure 1: Relationships represented as the overlap of two sets.

As it turns out, relationships, or rather understanding them, play an essential role in intelligence. To begin with, relationships are of two types: material, physical, or observable relationships and abstract or rational ones. Material relationships are those which are observable via some sensory facilities such as vision or other types of sensors. For example, the relationship between the frame and the wheels of a bicycle is readily visible in that the frame is connected to the wheels and is supported by them. The defining property of a material relationship is that it is physical in nature and thus sensible or observable using some physical property, be the property geometric, chemical, mechanical, electrical, thermal, or the like. Other examples of physical/material relationships include those between leaves and a tree, riverbed and river, and the movements of clouds by wind.

Abstract or rational relationships, on the other hand, have no physical manifestation and are entirely intellectual in

essence. To illustrate, returning to our example for the distinction of science and rationality, a circle includes many material as well as abstract relationships. The uniformly curved contour of the perimeter of a physical circular object is a visible and material trait, while the relationship between its radius and its area is abstract ($r2$). Such abstract relationship is not visible; it is not sensible; it is not physically detectable by any means; it has no physical existence. It has only rational existence. That is, no arrangement of matter can manifest a rational relationship in and of itself without the use of rational faculty. Other examples of rational relationships include those embedded in geometric theories, the economic law of supply and demand, and the design of software.

However, the most essential distinction between a physical relationship and a rational one derives from what it means to be physical. Simply put, a physical entity is one that occupies space and is affected by time. Any and all physical entities, be they physical objects or physical relationships, take some space and age with time. Unlike physical relationships, rational relationships occupy no space and are unaffected by passage of time. The formula for the area of a circle is wholly independent of spatial dimensions and does not change or decay with the passage of time; it is today precisely what it was at the age of the dinosaurs. As such, rational relationships are outside the domain of the physical world as characterized by time and space.

Other phenomena are encountered in nature such as energy, force, process, and others. What about these phenomena, which are also encountered in the real world? Can these also be classified as either objects or relationships? Yes. Some of them like energy, are forms of matter as explained above and may thus be considered as objects, broadly defined. Other phenomena like force and process are relationships that result from the interactions of objects. For example, force exerted between two objects results from a difference in energy density levels (Joules of energy per gram of mass) of the two objects. For instance, the force of impact results from objects moving

at different speeds and thus having different kinetic energy density levels.

We have talked about the simple *components* of reality, namely, objects and relationships, but what about reality itself, its model? Equally simple, is the *model* of reality defined as an infinite *mathematical space* (as opposed to our physical three-dimensional space) of objects and relationships represented by a network graph with objects as vertices (circles) and relationships connecting them (lines), as shown in Figure 2.

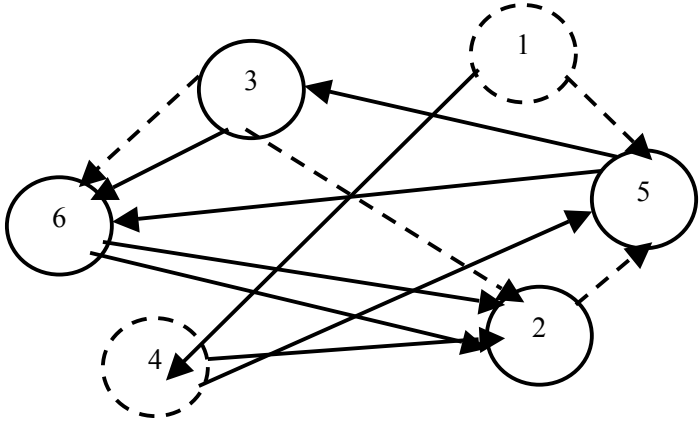

Figure 2: A model of reality: a network graph with objects as vertices and relationships as edges.

As indicated above, both the objects and the relationships may be either physical (shown as solid lines) or abstract (shown as dotted lines).

In this model, anything that exists, an animal, a system, various natural phenomena, atoms, man-made system like economic and legal system, and the like can also be represented as a subset of this space, namely, several objects with the relationships between them. This model has uncountably infinite objects and uncountably infinite relationships between each two objects. The details of these assertions are beyond the scope of this paper, however, recognizing that an object can be created from any combination of other objects, and

relationships are created based on any defined attribute of those objects, it should be apparent that the mathematical space used for modeling reality is infinite.

So, what does all this have to do with thinking and the human soul? Well, let's first continue with the meaning of thinking where we left off above, and search for our souls later.

Thinking is the *process* of traversal of this mathematical space via the relationship pathways and the tools provided by logic, while intelligence is the *ability* to traverse. Any example of common (or uncommon) thinking fits well with these definitions. For instance, *thinking* about navigating objects in a room while walking, an election process, steps in solving a problem, or designing a can opener, all involve traversing this space via various relevant relationships that we observe.

A Model of the Brain

At the most basic level, we can model the brain simply as a system with inputs and outputs, as shown in Figure 3 below. Many systems, no matter how complex or from what field of study, are modeled this way because of its simplicity, accuracy, and clarity.

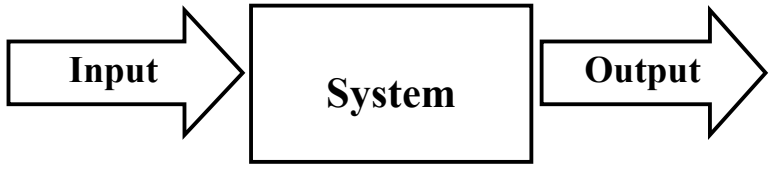

Figure 3: A model of systems also suitable as a basic model of the brain.

Let's apply this model to the brain in more specific terms. The central nervous system, the most important part of which is the brain, is an information processing system with three major *cognitive* functions: information collection, integration, and storage; information processing (thinking); and new

information production (discovery). Brain is also a controller of the body parts and internal systems, but this is not a cognitive function.

Brain's external behavior can be characterized as an input-process-output system, where the inputs are the information provided by the five senses, the process is the processing of information, and output is the behavior of the body and new knowledge.

The input to the brain includes the five senses: sight, hearing, smell, touch, and taste, as schematically shown in Figure 4 below.

Figure 4: The five senses as inputs to the system of brain.

Artificial Intelligence: A Few Notes

A common, but potentially misleading, definition of Artificial Intelligence (AI) is the ability to imitate human intelligence. AI has existed in various forms and incarnations since ancient times. The technological form of AI is only a few decades old. In the old times, AI was not known as "AI," but rather as mythical creatures or wishful objects such as dragons, demons, mirrors, moving statues (in those days they were not called robots), crystal balls, and the like, which could mimic human intelligence in some fashion. Later as human knowledge and capabilities increased, various forms of mechanized intelligence started to emerge.

This brings us to the mid 20th century, really 1960's, when serious AI started with the invention and development of digital computers. Such wishful thinking, which was always "just 20 years away" peaked in the 1980's and 1990's, most notably in the U.S. and Japan, which had developed some of the most powerful supercomputers of the day, such as Cray1, Cray-2, Cray-X-MP, and Cray Y-MP in the U.S., and SX-3/44R and Hitachi SR2201 in Japan. These computers used multiple processors working in parallel to provide many Gigaflops and teraflops (billions or trillions of Floating Point Operations) per second.

Even though to this date computers have continued on their path of ever more processors and teraflops, towards the end of 1990's and early 2000's the wishful dreamers of the human-like artificial intelligence were rudely awakened by a gradual dose of reality. After about 40-50 years of thinking that true AI that could rival or surpass human intelligence was right around the corner, true general intelligence was not forthcoming. Sure enough, success abounded in limited cognitive domains such as chess playing software that defeated even the best of human chess masters; "expert systems," as domain-specific software are known, that could analyze seismic waveforms in oil and gas exploration; speech synthesizers and recognizers with 95% or more accuracy, and the like. But, general intelligence that works in sophisticated new fields, generates new and accurate theories about various phenomena, and displays common-sense reasoning, eluded such age-old AI dreams.

The modern technologically based AI banks on the idea that intelligence is the same as computation and merely having more and more processing power will ensure higher and higher levels of intelligence. Hence, the AI field views thinking purely as information processing. Thus, any system, live or inanimate, that has more processing power can be potentially more intelligent. Thus, the logical conclusion based on this assumption is that computers will inevitably surpass human

intelligence when they amass sufficient processing power. Well, this assumption is a serious and largely unrecognized flaw.

As we shall see later, there is more to general intelligence than processing power or computation. It will require visibility of abstract relationships, and less obviously, life and emotions. However, this paper is more focused on the ability to see abstract relationships than the life and emotional aspects.

Analogy and Cognition: Thinking Model Extended

We started by defining thinking as tracking reality in our minds modeled as traversing the graph in the reality object-relationship space model. But there are other important aspects to thinking within this model. One of the most important aspects of this model is how the traversal is performed. The traversal does not simply start at point A and continue to another point B within the graph. Multiple sub-graphs (subsets in the reality space model) may be traversed in the process of one thought. And these sub-graphs may not be directly connected or adjacent. But how these sub-graphs *are* connected is through analogy. Let's see how.

Analogy plays a central role in abstract thought, as we will see in Part II below. For now, let's see precisely what analogy means and how it is related to the reality space model. At a basic level, analogy is a recognition of abstract similarity (physical or tangible similarity is not analogy) and means applying a particular relationship from one context to another unrelated context. For example, we may analogize the legs on a horse to the wheels on a car. Even though the legs of the horse have no physical similarity (or connection) to the wheels of a car, in substance or in action, but they perform at least some of the same functions, namely, supporting the body and providing motion. hence we see and can apply the same relationship between a horse and its legs to a car and its wheels. However, analogy goes a lot further than this simple I.Q. (Intelligent Quotient) test question.

More precisely, analogy is about categorization. Categorization may seem like a curious concept to occupy such an esteemed position in relation to intelligence. But, what is even more curious is that categorization actually defines a very important type of relationship in the model of reality. To see why this is, we need to first take an excursion from this thread of thought and then come back to it, as we often do.

Trees of Reality

This can be a rather complicated excursion if we get into too much detail, so we will suffice with the general concept. In the object-relationship space model of reality, a graph was described in which objects were connected to each other via relationships. Going one step further, we recognize that there are different kinds of relationships in this model. In a sense we can say those lines representing relationships in the reality model of Figure 2, are not just lines. Each one may have an internal structure of its own, like a sky scraper that from far away may look like a thick line, but up close it has additional features. Two of the most important and general kinds of relationships are best represented by the *System* and *Type* Trees described below.

A very prominent and invariable truth is that the world of creation is characterized by limits. If there were no limits, quite literally nothing could be distinguished from another, nothing could be quantified. Indeed, without limits it would not even be possible to define anything, because defining something requires identifying its boundaries. Given this truth, anything can be considered a system having a number of components, while every component itself may be regarded as a system having its own components, and every system may be regarded as a component in a bigger system. This view logically follows from the concept of limits because a system is a set of entities with a boundary around them and so, everything with a boundary qualifies as a system, and that means *everything*.

A couple of illustrative examples should convince the reader that this system-oriented view is valid and accurate about all things, processes, and phenomena. Consider an object, any object, such as house. It is immediately obvious that a house is composed of rooms as its components, while a room itself is a system with components of its own such as its walls, and the walls are systems in their own rights having bricks as their components, and so on. In the other direction, a house is a component of a system of neighborhood, and the system of neighborhood is itself a component of a system of city, and so on. As another, wholly different kind of example, take a paragraph in a book. It is a system the components of which are the sentences. In turn, the sentences are each a system with words as their components, and the words have letters as their components, and so on. Again, in the other direction, a paragraph may be component in a system of a page, while a page is a component in a chapter, and so on. This concept is equally applicable to any processes the steps of which are its components, and the process itself is but a step in a bigger process. These very different examples illustrate the absolutely general reach and applicability of system structure.

This system structure aspect of reality is illustrated in Figure 5, below with the aid of the System Tree. The System Tree is an upside-down (with root at the top) and Specific-To-General (STG) tree, where its root represents something specific, and as we traverse down the tree towards its leaves, the components become progressively more generic and general. For example, a specific house is distinguished from other houses, but a brick in the wall is the same as any other brick in any other wall. The System Tree is applicable to processes as well, where each process has steps of its own and the whole process may be a step in a bigger process.

Hence, any entity in the world can be represented by a System Tree, which is not unique, incidentally. Many System Trees may be constructed for the same entity depending on what we want to model and what boundaries or aspect of the

entity we are interested in. For example, a car is a component in an industrial system as well as an economic system. Hence a car can be a component in two different system. Actually, any object is a member of infinitely many systems.

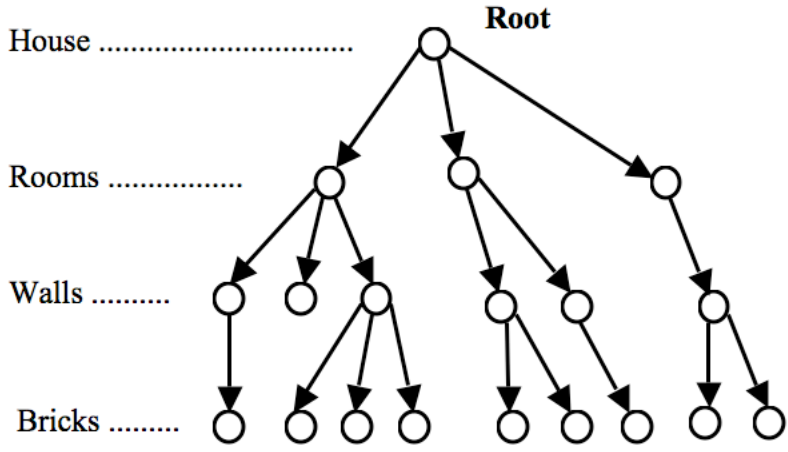

Figure 5: The System Tree - Specific To General (STG)

Just like any entity can be represented by a System Tree, it can also be represented by a Type Tree, simultaneously. But, what is a Type Tree and why is it as general as a System Tree? A Type Tree may be represented by another upside-down tree, this time, General-To-Specific (GTS; root is most general).

Consider a set of properties that define a *type*. It doesn't matter what we call the type, it is the set of properties that matter. Then any other entity that includes the same set of properties belongs to that type. When an entity has the same set of properties plus additional properties, then that entity is of that type, but a more specific version of it. Since *every* entity has some set of properties, then every entity has some type (or is of some type). This concept may be a bit abstract. So, again, we use a couple of examples to illustrate the concept and also show its absolute applicability.

As a first illustration, consider our favorite example, a house. With reference to Figure 6, below, a Structure, which

has some properties such as being rigid, being free-standing, and having a fixed relationship between its parts, is a root type, in this example. Traversing down from the root, we encounter a Building type, which is still a structure with all the properties of a Structure type, but with some added properties such as some facilities for human use and interaction like doors, stairs, lighting, etc. This makes a Building type just a more specific version of a Structure type. Moving further down, we get to a Residential Building type, which is still a more specific Building type and a Structure type, again, with some added properties like having facilities for human habitation, such as a kitchen, a bathroom, heating, etc. And finally a House type is a Residential Building type, a Building type, and a Structure type, albeit, a more specific version of them. Traversing the tree from the root upwards, we observe that a structure can itself be part of a more general type, such as Inanimate Objects type.

For our second illustration, we revert to our literary example. A *Paragraph* can be a root type in some defined Type Tree. An *English Paragraph*, is a more specific version of a Paragraph type with the added property of being in English language, and an *English Introduction Paragraph* is still a more specific type of the above types.

So, it is clear that because every entity has a set of properties, every entity defines a type and by adding or subtracting properties from the set we arrive at more specific or more general versions of the same type. And again, like the System Tree, the Type Tree is not unique and an entity can be part of infinitely many Type Trees depending on what properties we focus on.

Another term for type is *category*, which sometimes has more familiar connotations for our purposes. A rather subtle question that arises is the difference between the *mental act* of categorization of various phenomena based on their abstract properties and the similar *physical effects* those properties. For example, a human may mentally categorize predators, such as

wolves and lions, according to their territorial and pack behaviors. However, a prey animal, such as an antelope, is *affected* by these behaviors without having to understand or mentally categorize them in an abstract manner. Recognizing this distinction is important, lest we forget the abstract nature of categorization.

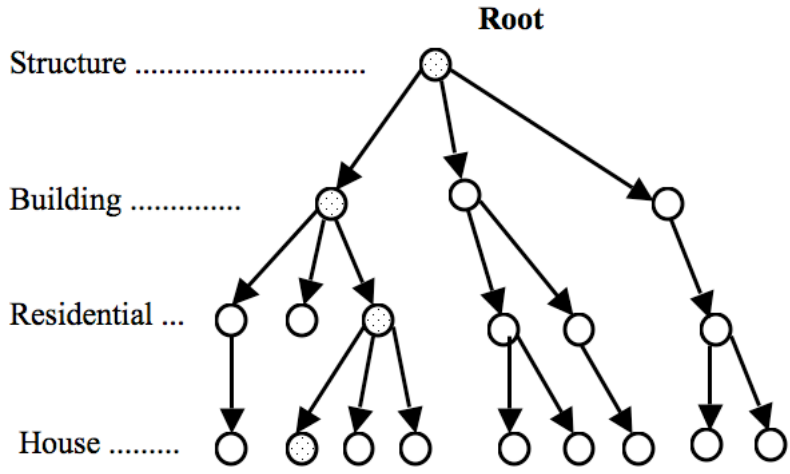

Figure 6: The Type Tree - General To Specific To (GTS)

The categorization or classification in the Type Tree is done based on one or a combination of several parameters. This means for a given parameter, each discrete value can result in a new sub-category. For example, when categorizing animals, if the parameter is habitat, then each different type of habitat results in a different category of animals. This means the category of "sea animals" will include whale (mammal), tuna (fish) and octopus (invertebrate), among others. But if the parameter is being warm- or cold-blooded, then the category of "warm-blooded animals" will include whale and pigeon, among others. This parameter(s) is called a basis. So, different basis result in different categorizations of the same objects or concepts.

Now, let's go back to the relationship between thinking and categorization. When we think about something we actually

think about its properties, which determine its form, behavior, interactions with other things, reaction to various elements, and anything else we want to discuss about that thing. But since properties also define types or categories of things, inevitably we categorize things that we think about, whether implicitly or explicitly. As you might remember, analogy is all about abstract similarity. So, analogy can be expressed in terms of the Type Tree. By definition, two entities that belong to the same category (or Type Tree) share some properties or characteristics. As properties can be highly abstract, so can types. For example, the category of "hard" can include entities as diverse as hammer, water (as in hard water), exam, circumstances, direction (as in making a hard right turn) and many others. Note that none of these entities have any physical or apparent relationship to each other, yet they all belong to the same abstract type of "hard." As such, we can define a Type Tree with the root being the most general understanding of "hard" (say, with the abstract property of having great influence on other things) and the other lower level nodes become progressively more specific types of "hard."

An important result of categorization is that when two entities are determined to belong to the same category, then the known properties of one entity suddenly becomes applicable to the other one, which might hitherto have been unknown. For example, many geometric properties of circles belong to the same category as properties of electrical signals (such as frequency, phase angles, trigonometric relationships, and the like), while the shape "circle" has very little to do with the physical phenomenon of "electricity", outside of their rational or abstract relationships. As such, the geometric properties of a circle are suddenly seen to be applicable to the analysis of electrical signals (or other types of signals like optical ones). This realization greatly facilitates, nay, makes possible, the analysis of signal processing, without which our understanding and application of electrical signals would only be primitive and limited to trivial outward observations.

Categorization is not a mere cognitive tool or trick to make our job of thinking easier. Abstract thought is all but impossible without the use of categorization of everything that we encounter. We use existing categories or modify them or create new ones all the time and then catalog everything accordingly, so, we know what to do with them based on the category they are in. Otherwise, we would have to reinvent every thought every time which, would bring our thoughts, and everything that depends on our thoughts, such as new insights, understandings, theories, discoveries, inventions, etc., to a grinding halt. An equally important function of categories is that they help us filter out things that do not belong to a current category of interest and focus on the task at hand. This is not a trivial benefit given the massive amounts of irrelevant information in our environment that are always at ready to act as noise to the information of interest.

An interesting thing about categories is that all basic categories originate from tangible things because the origin of our knowledge and our initial experience with a particular category starts with our senses. The reason for this origin is that we generalize and build categories starting from the tangible, specific and simple, leading up to the more abstract, general and complex. This observation is in accord with Abdu'l-Bahá's elucidation that: "*A thing cannot be grasped by the intelligence except when it is clothed in an intelligible form; otherwise, it is but an effort of the imagination.*" [SAQ 115]

Another confirmation of the fundamental importance of categorization in cognition and thinking has surfaced recently in a book named *Surfaces and Essences*, by authors and professors Douglas Hofstadter and Emmanuel Sander. In this book, Hofstadter and Sander spend considerable time to lay out a foundation for their thesis. They spend the rest of the book to go through a great deal of detail about the many facets of categorization in the context of human thought.[3] More specifically, Hofstadter and Sander start out by characterization of "Analogy as the Core of Cognition."[4] Then,

they proceed to lay down the foundations for their thesis by regarding "Categorization and Analogy-making as the Roots of Thinking."[5] Interestingly enough, they also use simple drawings, similar to the Type Tree described above, to depict some of these concepts.[6]

And so, our enhanced model of thinking includes not only traversing the object-relationship reality space, but also making our traversal more comprehensive and faster using the power of analogy to connect different subsets of this space together.

PART - II: Proof of The Existence of Soul

We have established some important foundational concepts. Now is time to apply these concepts to prove the existence and immortality of human soul. In this part, we will further complete our model of reality with additional structural refinements as explained by Abdu'l-Bahá. We will also briefly review some of the proofs of the existence of soul by Abdu'l-Bahá. Next, our brain model is upgraded to allow for spiritual activities such as abstract relationship recognition. However, all these will distinguish humans from animals for most part, but what about computers? To answer this question, we will extend our reasoning to show that machines are also excluded from the domain of general intelligence and rational relationships. Finally, we conclude that the human soul is immortal.

Unity of Existence and the four Kingdoms

An ancient philosophical theme is unity. Indeed, even without a precise definition, we can see some form of unity underlying all things in one way or another. A rather practical definition of unity among a number of seemingly diverse things is broad commonality. In that commonality, these diverse things are united. Imagine all the diverse cars in the world which, are all united by sharing the common characteristics of all cars. Without delving too deeply into this concept, as it is

not the subject of our discussion here, let's examine the greatest unity of all: the unity of existence.

> *... this mineral belongs to the mineral kingdom; however far it may rise, it can never comprehend the power of growth. The plants, the trees, whatever progress they may make, cannot conceive of the power of sight or the powers of the other senses; and the animal cannot imagine the condition of man -- that is to say, his spiritual powers.* [SAQ 221]

In several passages in his writings and utterances, including the above, Abdu'l-Bahá divides the world into four concentric "kingdoms" or realms. These kingdoms include the Mineral Kingdom, the Plant Kingdom, the Animal Kingdom, and the Human Kingdom, each with its own special power. The power of the Mineral Kingdom is its physical strength, the power of the Plant Kingdom is growth, the power of Animal Kingdom is senses and integration of information from the senses, and the power of the Human Kingdom is general intelligence.

These kingdoms are further arranged in order from lowest to highest forms and capabilities, where each higher kingdom has the powers of all the lower ones and comprehend them, but not vice versa. So, for example, the Animal Kingdom has the physical strength of minerals and the growth power of plants in addition to its own power of senses and information processing. This is the "concentric" part of these kingdoms, diagrammatically shown below in Figure 8.

We might ask: "what is the basis of this categorization?" At least one parameter in its basis is the strategy or method of survival. Briefly, minerals defend their survival by their physical strength of material, that is, they resist deformation. Their form defines what they are and in a sense is their "life" (a crushed tin box is a dead box). Once a mineral entity loses its form, there is no going back, on its own, that is. We know this because any physical change in an object requires energy. That

is precisely how much the object is resisting its deformation, or "death." For the plants, the survival strategy includes the physical strength of minerals plus the power of growth, which mends them, to some extent, if damage occurs. And they do this on their own. For animals, the survival strategy includes the minerals' and the plants' plus remote sensing and central nervous system for sensory information integration. So, animals can detect danger before it even gets physically close to them. And they also learn from experience. Humans have all these lower survival strategies plus a rational mind that can see "invisible" dangers, not picked up by any physical sense, but by rational reasoning, such as predicting what happens to crops six months later if we have drought today.

Why is this classification of the world and its contents into these four kingdoms significant? For one thing, this structure helps us organize the world into a more understandable and manageable place, at least information-wise. However, for our purposes, this classification gives us an important insight, namely, that all these realms are part of a single unified world, not a fragmented random one. The denizens of each of these kingdoms, however, can only interact and "see" that portion or subset of the whole world that its kingdom is equipped to interact with. For example, a plant can only interact with the subset of the world that plants utilize for growth such as soil, water, sunshine, breeze, and the like. An animal can interact with all these elements in addition to what it can sense via any of its senses. To a flower a car passing by has no existence. The flower is absolutely incapable of seeing or sensing the existence of the car in any shape, way, or form. A dog however, can see, hear, and smell the car from a distance and can further remember and process the information so collected by its sense, for example, recognizing its master's car when coming home. Hence, even though the whole world exists out there, each creature can only see or comprehend the subset it can interact with. The realization that creatures in each kingdom have

visibility to only a limited subset of the universe, is critical to understanding the spiritual realm, as we shall see later.

For the sake of consistency and completeness, the unity of the world is logically not limited to our physical universe. If there are other universes, as the multi-verse theory suggests, all these universes are still part of one unified *existence*, defined as the realm that contains anything that exists including any number of universes, their laws, and their creatures.

A Property of Soul: Intelligence

In many of his tablets and utterances Abdu'l-Bahá explains that the progress of man is because of his spiritual powers. For example, the following passage makes this point clear.

> *Though man has powers and outer senses in common with the animal, yet an extraordinary power exists in him of which the animal is bereft. The sciences, arts, inventions, trades, and discoveries of realities, are the results of this* ***spiritual power****. This is a power which encompasses all things, comprehends their realities, discovers all the hidden mysteries of beings, and through this knowledge controls them: it even* ***perceives things which do not exist outwardly****; that is to say,* ***intellectual realities which are not sensible, and which have no outward existence, because they are invisible****.*

He continues:

> *Moreover, these existing sciences, arts, laws, and* ***endless inventions of man at one time were invisible,*** *mysterious, and hidden secrets; it is only the all-encompassing human power which has discovered and* ***brought them out from the plane of the invisible to the plane of the visible****.* [SAQ 186]

Even more explicitly, Abdu'l-Bahá declares that intelligence ("mental faculties") is a direct emanation of the human soul: "*Now concerning* ***mental faculties, they are in truth of the inherent properties of the soul,*** *even as the radiation of light is the essential property of the sun.*"[7]

These passages, especially the highlighted segments, directly guide our way to a precise proof of the existence of soul and intelligence as one its prominent properties. Before we embark on the main proof, however, let's review some of Abdu'l-Bahá's proofs and elucidations regarding the human soul. These are not always proofs, *per se*, but rather guiding principles and comments that show the way to those who want to research and gain a deeper understanding of his guidance.

Abdu'l-Bahá's Proofs and Commentaries on Existence of Soul: A Brief Survey

Bahá'u'lláh and Abdu'l-Bahá, in numerous tablets, have explained the existence and character of the human soul, to the extent possible to understand such matters in the physical realm. One of Abdu'l-Bahá's proofs that man is different from animal, and the source of the main principle for this paper, is the ability of man to perceive rational relationships while animals are limited to sensed relationships, as explained in the quote above and further elaborated in the quote below:

> *The animal cannot realize the intelligence of a human being, he only knows that which is perceived by his animal senses, he cannot imagine anything in the abstract. An animal could not learn that the world is round, that the earth revolves round the sun, or the construction of the electric telegraph.* [PT 11]

In another tablet, Abdu'l-Bahá draws our attention to the difference between the mind and the soul in the context of sleep and dream. He explains that:

> *The mind is circumscribed, the soul limitless. It is by the aid of such senses as those of sight, hearing, taste, smell and touch, that the mind comprehendeth, whereas the soul is free from all agencies. The soul as thou observest, whether it be in sleep or waking, is in motion and ever active. Possibly it may, whilst in a dream, unravel an intricate problem, incapable of solution in the waking state.*[8]

Some may try to superficially dismiss these explanations by asserting that brain processes associated with cognition can continue during sleep, and there is no reason to appeal to the existence of soul, however, as we'll see, cognition is not just a matter of information processing.

In still another proof, Abdu'l-Bahá explains that the human soul is not dependent on the health of the body, unlike the human mind, which is the functional product of the brain:

> *Consider how the human intellect develops and weakens, and may at times come to naught, whereas the soul changeth not. For the mind to manifest itself, the human body must be whole; and a sound mind cannot be but in a sound body, whereas the soul dependeth not upon the body.*[9]

In numerous tablets, Bahá'u'lláh likens the human soul to a bird and his body to a cage: "*from thy mortal cage wing thy flight unto the paradise of the Placeless*" [HW 36]. He similarly likens the human soul to light and his body to a lamp: "*Thou art My lamp and My light is in thee*" [HW 6]. Bahá'u'lláh uses these metaphors, among others, to reveal and emphasize the independence of the soul from the body.

The Proof: Why Physical Systems Cannot Understand Rational Relationships

At this point, we have spend quite a bit of time defining, developing, and polishing different pieces of the proof. These pieces form a rather extensive list including our part scientific - part rational methodology; the fact that science is not the only or even the main analytical attraction in town; the primacy of logic; a model of reality, its four kingdoms, and important relationships represented by System and Type Trees; definition of physical and rational relationships as overlap between sets of entities; a model of thinking based on the model of reality; definition of intelligence as the ability to think in this model; and general intelligence as (a yet-to-be-proven) property of soul. Now is the time to put these pieces together.

The gist of the proof, the basic thesis is that a physical system, any physical system, brain and computer included, cannot understand a rational relationships because they have no physical existence. Let's now prove this thesis.

We defined a relationship between two entities as a connection (technically, an overlap) between two sets representing the two entities. Hence, for a relationship between two entities to exist, a connection must exist. Understanding something requires having a connection with that something first. If there is no connection there can be no understanding. Let's put this in more concrete terms. All physical relationships are between physical objects. So, a physical system can make a connection with such physical objects and thus, process the information so obtained. But what if the relationship is rational and not physical? Remember that rational relationships have no physical existence because they are outside the domain of time and space, which chiefly characterize the physical world. As explained earlier in Part I, a physical relationship, such as the relationship between a wall and a door in a building, requires space and changes with passage of time. But a rational relationship, such as the formula for the calculation of the area

of a rectangle (area = long side x short side) has no need for space to exist and is not altered or otherwise affected by the passage of time. Hence, it is fundamentally outside the domain of physical existence. In contrast a physical system, by definition, is bound within time and space and is in the physical realm. But, by definition, the realms inside and outside the physical domain are mutually exclusive, have no overlap and no connection. Therefore, a physical system, bound in the physical realm, cannot detect, understand, or process a rational relationship which lies outside the physical realm. In set theory jargon, a set and what lies outside the set (called its complement) have no overlap. A metaphor may serve to crystallize the concept: it is like trying to catch the wind in a net. Wind has no solid body to be caught in the net. In a way it has little material overlap or connection with the net. That's why the net and the wind cannot make effective contact.

Well, this all sounds very interesting, but then how is it that we as humans understand all these rational relationships with our brains quite well, seeing and processing them by the thousands every day? The answer is we don't, not with our brains. The only way we could possibly see and understand any rational and abstract relationships is with a system in the same domain as the rational relationships. We can call this realm the spiritual realm and the system for understanding them the spirit or the soul.

Animals, not being equipped with a spiritual system or soul, can see the physical relationships and aspects in an experience, but not its rational aspects. A chimpanzee can see a circle, can match the shape to another round object, can distinguish a circle from a triangle, because these are all physical relationships and thus, sensible. But it cannot see or understand the concept of multiplication or area calculation. Such concepts and relationships are completely and literally invisible, nay, non-existent to it. Like the net, its brain cannot catch the rational wind. It has no connection with it.

This concludes the core of our proof, but it is not all. We still have to answer other important questions, such as how is this spiritual system in communication with us? If it is in a different realm, then how can we have a connection with it? Where is the overlap? How can our physical brain memory retain the rational relationships and our understanding of them? This is not an exhaustive list of questions and issues, but it is a good start.

Brain Model Extended

Since the above questions revolve around the role of the brain in cognition, the role of the brain seems like a good place to continue with this discussion. With the above arguments and insights regarding the requirements for seeing and understanding rational relationships, we can now extend the brain model described above with respect to Figure 4.

Consistent with the model presented in Figure 4, we can extend the power and vision of the brain, which is a physical system, to see and understand rational relationships. If we model the soul as a rational sense, a true sixth sense that detects rational relationships and relay it to the brain, much the same way the eye detects visual information and the ear detects sound signals, then we have a consistent model that accounts for human brain's capacity to understand rational relationship. This relationship between the soul and the brain is shown schematically in Figure 7 as a little ghost, since physical attributes, such as shape, cannot be associated with the soul. Hence, in this model, the brain, despite being a physical system, is given the capacity, through the instrumentality of the soul, to see the whole of existence not just what is visible at the level of the animal kingdom.

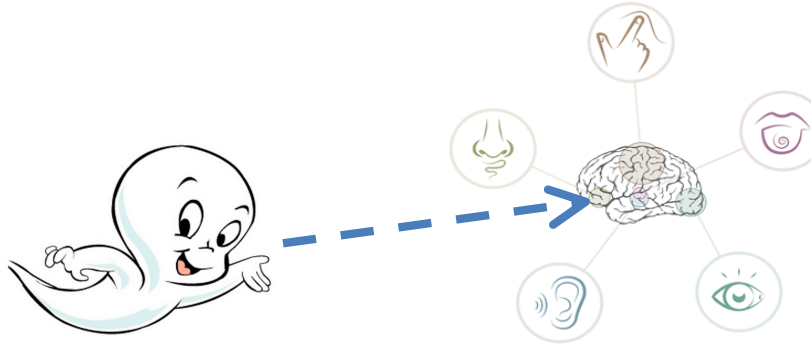

Figure 7: Brain extension: six senses as inputs to the system of brain.

This model explains the external operation of the brain system as a whole. However, it still doesn't seem to explain how the brain can be in contact with this spiritual sense, the soul, the existence of which is limited to the spiritual or non-physical realm.

To explain the connection between the brain and the soul, let's revisit the model of reality and remodel it a little.

Model of Reality: New and Improved

Like the updated model of the brain, the model of reality is augmented with a new set of relationships superimposed on the original ones shown in Figure 2. The model of Figure 2 showed the generic set of relationships between all entities in the world. The System and Type Trees of Figures 5 and 6 introduced new relationships that classified the generic ones. In other words, some of the relationships shown generically in Figure 2 as lines have the additional properties of the System and Type Trees. Continuing with this process of refinement and augmentation, Figure 8 below adds another layer of properties and attributes to the generic relationships. That means while some objects in the model of Figure 2 may be related to one another in particular ways, such as by color or shape, they can further be related to each other by being members of one of the four

kingdoms of Mineral, Plant, Animal, and Human kingdoms, as discussed earlier.

In short, each of the augmentations made to the basic model of reality adds some attributes and refinements rather than changing it altogether. This is like adding layers of new ideas and relationships to the model of reality. But, how does this new model answer our questions regarding the connection between the soul and the brain?

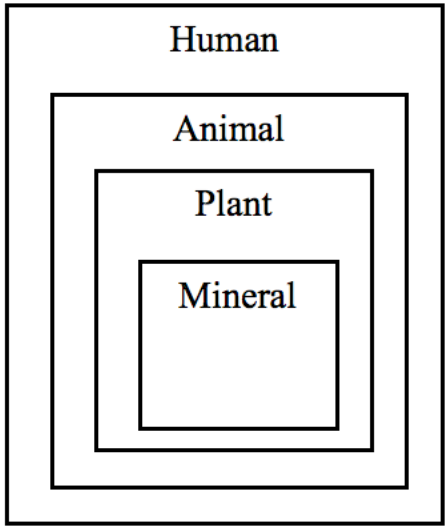

Figure 8: An aspect of the model of reality augmented with the four Kingdoms.

Even though each kingdom is separated from others, but at its boundary the kingdom touches the adjacent ones. This is called an interface. An interface between two domains is a gateway for communicating information (which may be embedded in energy or material such as heat, fluids, chemicals, etc.) between the two without mixing the domains. The concept of an interface is well-known in computers, biology, and other technical circles. As an example, consider the boundary between minerals and plants. A handful of soil is a member of the Mineral Kingdom while a rose bush is a member of the Plant Kingdom. There is no mixing of the two, however, they do have

an interface. The rose bush roots absorbs water and minerals from the soil, which are then integrated with the plant and become part of that kingdom. At the same time the physical presence, such as the size and weight of the plant, is "sensed" or "seen" by the soil without seeing any more of the Plant Kingdom. Thus, there is some form of information exchange between these two kingdoms at the interface.

Applying the interface concept to the boundary between the Human Kingdom (where our brain resides) and the spiritual realm (where the soul resides) can explain how the soul can interface with our brain. The exact nature of this interface is transcendental, by definition, and is largely unknowable because one side of this interface, namely the soul, is invisible in our physical world. However, once our soul sees or detects a rational relationship and relays it across this interface to our brain, then the rational relationship becomes just another piece of information that can be recorded in our memory like the information collected by any other physical sense, such as our eyes and ears. This way, the rational knowledge from the invisible spiritual realm is transmitted to the physical realm.

At this point, it bears emphasis that the augmented model of reality of Figure 8 shows a unified existence and the rational relationships seen by the soul are merely the most general and at the highest level of this existence. Thus, it is not unreal for such spiritually based rational relationships to be transferred to a lower kingdom in some form, as they are all part of the same existence.

Can Machines "Think?"

As much as we may wish, this is not the end of this journey. So far, we have shown that no physical system can possess general intelligence and understand rational relationships, thus, necessitating the existence of a non-physical soul. This theory shows the difference between humans and animals. However, a very important question of modern origins remain: if no

physical system can detect and process rational relationships, then how do computers do it?

Clearly, computers can and do process abstract and rational relationships every day, doing it even as this paper is being written on a modern word processor. What gives? Humans do!

To understand how computers do not violate the requirement that a non-physical system must understand rational relationships, and are not an exception to this rule, we have to go back to the critical role of analogy and categorization in cognition, discussed in Part I. It is important to keep in mind that the core logical reason that animals or computers cannot see nor understand rational relationships is still the fact that rational relationships are outside the bounds of time and space and literally do not exist in the physical realm, and hence, have no connection with animals or computers, as discussed above in detail. But we still need to explain the questions posed above with respect to computer processing of rational relationships.

The key to recognizing that computers do not understand rational relationships any more than a doorstop, is realizing the difference between *understanding* and *representation*. Representation of information basically entails the encoding of information in a symbolic form. For example, computer languages represent information in binary format (a string of 0's and 1's, such as 2 = 010, and 5 = 101), and natural languages, like English and Japanese, represent information using alphabet, logograms, or other symbolic forms. Representation in and of itself does not convey semantics or meaning. A computer no more understands its program than a book understands its contents. Representation is merely an assignment of a symbol to an object or an action. In mathematics, this is called a *mapping*. If the object or action is not understood in the first place, then merely mapping it to a different symbol does not bring about its comprehension. If

one doesn't know what *osmosis* is, then translating it to a different language does not alter his lack of knowledge.

Computers can process abstract information and relationships, in the form of formulas, algorithms, computer languages, and other computing constructs because humans have already encoded these rational relationships in those formulas, algorithms, and languages. In other words, humans already have understood the relationships and have merely encoded them into the computing environment in one form or another as needed. Even computer-based "expert systems," software that are expert in a particular domain such as seismic signal analysis, financial data analysis, voice recognition, game playing, and the like, depend on humans. All such expert systems depend on their internal programming and semantic data files, which are created by humans who encode the necessary abstract relationships. That's why computers with learning algorithms and software are limited in their learning to their specific domains initially encoded by humans. They cannot break out into other unrelated domains and apply what they learn. Many expert systems learn and improve over time. For example, a voice recognition system can learn to understand a new human accent not specifically programmed before. But they are limited in their learning and application to human speech variations, not stock market variations. Such learning can be transferred to other domains but only by human mediators who adapt them.

But, what does it mean to understand? Understanding complex relationships is so second nature to humans that we forget it is more than mere perception or sensing of an object or action. Perhaps it is easier to start with an example. We learn the concept, dynamics, and value of teamwork when we play soccer. But we only truly understand it when we can apply the same concepts and dynamics in a project or in our jobs, which are totally unrelated in practice and purpose to playing soccer.

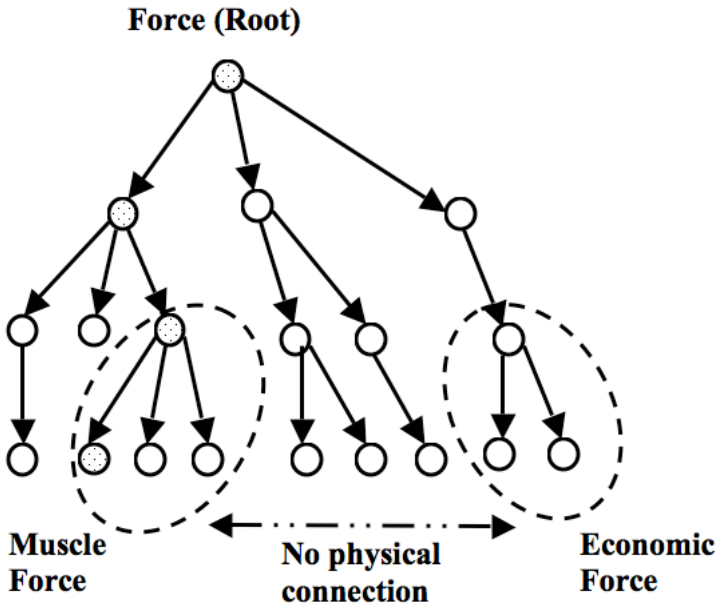

Figure 9: A force Type Tree with disjoint sub-types connected only through abstract relationships.

More formally, understanding means the ability to apply relationships learned from a source sub-type (or sub-category) in a Type Tree (or general category) to a target sub-type that has no physical connection to or relationship with the source sub-type. This definition is less obscure and esoteric than it appears. Once we understand what it means then we recognize how ubiquitous and common it actually is in everyday life.

Figure 9, above, depicts the concept of understanding using another example. The Type Tree shown is for the concept of abstract force and its many incarnations placed in the category of *force*. If we define the root type as the most abstract concept of force having the attributes of magnitude (or quantity), direction, and ability to effect change, then all other sub-categories or sub-types of force include these three attributes plus additional ones. For example, the force of gravity has a magnitude (weight), a direction (downwards or towards earth), and the ability to change things (break a falling

china cup). The force of gravity has the additional attribute of being a function of the mass of the earth and the bodies close to it in a way that the force of a spring isn't. In the example Type Tree of Figure 9, one sub-category of force is muscle force, which is essentially created by molecular action of proteins that chemically combine to shorten the physical length of muscle fibers, thus contracting them. This is a physical force that everybody is familiar with its use. Another sub-type, totally and entirely different in apparent nature and having no relation to muscle force whatsoever, is the economic force. Yet, everybody recognizes the metaphor of economic "force" and its validity instantly and effortlessly. This is because we recognize that economic force has the three attributes of the abstract force (magnitude, direction, ability to effect change) plus additional attributes specific to the economic force, such as the many financial concepts like interest rate and marginal cost.

We say we understand the concept of force because we can successfully apply it to many physically disjoint and unrelated applications, such as the economic force. This is not the case for computers. Even if computers were attached to sensors like cameras and networked to all databases in the world with unimaginable amounts of data, they would fail in understanding anything. As a matter of fact, computers today do have access to such sensors and data, but they only operate in the domains in which they were designed to operate. They simply are not equipped to and cannot bridge the rational gap. And of course, all the data in various databases have been designed and the knowledge contained in them have been encoded by humans. We must bear in mind that the construction of a Type Tree, which was used to explain the meaning of *understanding*, is also an abstract concept that only humans can do. We can enlist the help of computers in this respect, but only if we encode the abstract concepts for them.

Understanding is relative. We can understand things in degrees and in all likelihood there is no end to the depth of

understanding of something because the Type Tree can have an arbitrary depth and breadth. Hence, we can apply our understanding to farther and farther regions of the tree, deepening our understanding. For example, the concept of force may be applied to a new and different context with its own additional characteristics, such as power of faith, psychological force, political force, and the like, each providing a deeper understanding of the concept of force. Relativity of understanding, however, does not change its nature, namely that it is achieved through seeing and traversing the rational relationships in the model of reality. It is like crossing vast divides between different concepts in the physical world using the invisible bridges of rational and abstract relationships. These invisible bridges are only visible to the human soul, not computers or animals.

The inability of computers to see rational relationships and understand them really extends much further and deeper than the analytical picture presented above implies. However, examining this extension is beyond the scope of this paper save a brief mention. With reference to Figure 8, the kingdoms that define the basic categories of creation, computers belong to the Mineral Kingdom, and are literally inferior to and dumber than a mosquito, let alone a human. Even more specifically, emotions, which are fundamental properties of living organisms, play an integral role in intelligence. Emotions create purpose in life, human or animal, and drive the search for new knowledge or new experience. Without emotions, one could ask "what is the *motivation* for seeking new knowledge?" In the absence of motivation, the very quest and search for knowledge, even if programmed in a computer to automatically and perpetually perform, reduces to a mindless, purposeless, and mechanical process of information acquisition and any innate value or meaning assignable to knowledge is stripped away. This mechanical process would be like one of those old toy cars that blindly moved until it hit an object, like a table leg, and then backed up and turned and went in another

direction until it hit another object. At the end, nothing is achieved and no more meaning can be assigned to this search for knowledge than to the tumbling of an uprooted weed randomly driven by the desert wind.

But the answer to the question in the header of this section, "can machines think?" is technically "yes." This is because we defined thinking as the process of traversing the graph in the space model of reality (Figure 2) and machines can do that, but only with respect to the physical relationships, not the rational ones. For example a computer connected to a camera can detect an image and track it across the screen or recognize it as a particular object, a human face, a fingerprint, and the like. All of these are based on physical data or abstract information encoded by humans. So, machines can "think" in a mechanical sense (i.e., no emotional impetus or meaning) and within the bounded subset of reality limited to physical relationships only.

Immortality of the Soul

The existence of the soul is one question, and its immortality another. Abdu'l-Bahá treats the subject of the human soul in *Some Answered Questions* the same way. He first proves its existence and then explains its immortality. He states: "*Having shown that the spirit of man exists, we must prove its immortality.*" [SAQ 223]

Abdu'l-Bahá uses a number of proofs of immortality of soul, some of which are based on the same concepts he uses to prove its existence, such as independence of human spirit from his physical body and its ailments, revelations during sleep, its influence in this world after death, and others. [SAQ 223-229] Furthermore, Abdu'l-Bahá explains:

> *The whole physical creation is perishable. These material bodies are composed of atoms; when these atoms begin to separate decomposition sets in, then comes what we call death. This composition of atoms, which constitutes*

> *the body or mortal element of any created being, is temporary. When the power of attraction, which holds these atoms together, is withdrawn, the body, as such, ceases to exist.*
>
> *With the soul it is different. The* ***soul is not a combination of elements,*** *it is not composed of many atoms, it is of one indivisible substance and therefore eternal. It is entirely out of the order of the physical creation;* ***it is immortal!*** [PT 89]

In this passage Abdu'l-Bahá explains that the soul is immortal because death is nothing but decomposition and the soul is not composed of anything and is, therefore, immortal.

In the context of this paper, we present a proof of the immortality of the soul, which is related but not identical to Abdu'l-Bahá's explanations. In this context, the rational relationships were defined as being in the spiritual domain and as being sensible by the soul because it is in the same domain. The rational relationships were also defined as not being bound by time and space, which implies that the spiritual realm and the soul are also not so bound.

Now, what does immortality mean? Immortality has an inherent time element. Something is immortal only if it lasts forever, that is, for all time. But what happens if time is not a factor that affects an entity, say, the human soul? Then that entity will not change over time, and hence, by definition, is immortal.

Conclusion

Despite popular conceptions of spirituality as an emotional state, spirituality has more to do with rational thinking than emotions, at least directly. A relationship between two entities is defined as the overlap between the sets that represent the entities, and may be classified as rational or physical. Rational

relationships have no physical existence and are not bound by time and space that mainly characterize the physical world. Based on the model of reality as an object-relationship space, the model of thinking as the ability to traverse the relationships in this space, and the model of general intelligence as the ability to traverse rational relationships, it is concluded that no physical system, including the human brain, can have general intelligence. No physical system can sense or understand a rational relationship. This is because a physical system has no overlap with a non-physical entity, and thus, cannot possibly sense or understand it. Hence, only a non-physical system can sense and understand rational relationships. We call this non-physical system the soul and we call the realm it belongs to the spiritual realm.

The computers are no exception to the rule requiring a non-physical entity to perceive rational relationships. But the situation is more complicated because they do process rational information. The key to resolving this apparent contradiction is to recognize the difference between representation and understanding. The former is the encoding of information, while the latter is the ability to apply knowledge gained in one area to another unrelated area. Computers can only process representations of rational relationships encoded by humans. They are bereft of understanding such relationships independently.

Immortality of the soul is also established by the realization that the soul resides in the spiritual domain, which is outside the influence of time and space, and thus, is unaffected by time.

Notes

[1] Adib Taherzadeh, "*The Human Soul*," *Bahá'í Studies* Number 11; Institute for Bahá'í Studies, Dundas, Ontario, Canada, 1996.

[2] Anjam Khursheed, *Science And Religion*, p. 42, Oneworld Publications Ltd., London, Great Britain, 1987.

[3] Douglas Hofstadter and Emmanuel Sander, *Surfaces and Essences: Analogy as the Fuel and Fire of Thinking*; New York, Basic Books, 2013.

[4] *ibid.* p. 3.

[5] *ibid.* p. 19.

[6] *ibid.* pp. 235-238.

[7] John Paul Vader, *For the Good of Mankind: Auguste Forel and the Bahá'í Faith,* George Ronald, Publisher, Kidlington, Oxford, United Kingdom, 1978, p. 8.

[8] *ibid.* p. 8.

[9] *ibid.* p. 8.