The Natural Bases of Neutrosophy

Philippe Schweizer
Independent Researcher, Av. de Lonay 11, 1110 Morges, Switzerland
Correspondence: flippe2@gmail.com

Abstract

Neutrosophy began as a branch of philosophy that considered neutrality in addition to the positive and negative. It consists of the addition consideration of a neutral state to complement the binary approach of true or false. Its creator quickly extended it to the field of mathematics and it was gradually applied to all fields of science. Here, we present a reverse approach that highlights the importance of neutrality in all fields of study and application, citing some revealing examples. Furthermore, we explain that this importance of neutrality is intrinsic to all sciences because it is based on natural foundations. Indeed, neutrality is a forming part first of all of the human conception of things, of our way of thinking, of cognition in general but also of living things, matter and even particles. In addition to these most real-world physical concrete aspects, neutrality is inherent to mathematics, to logic first of all, but also to probabilities and statistics where neutrality which simply results from a large number of objects, the universe. Thus neutrosophy is well adapted to the majority of applied problems because its modeling is inspired by reality and that it allows, in particular, to deal with the component of uncertainty and indeterminacy that the real world comprises intrinsically.

Keywords: Neutrosophy, three-state , neutral state , undetermined , incertitude , natural basis.

1-Introduction

We will first point out that neutrosophy [1] rests on several bases that are natural: these bases result directly from the temporal aspect of the real world. Then, in the second part, we will describe some examples of situations that are intrinsically three-state, and which are therefore areas where the neutrosophic approach is essential.

Neutrosophy is a modeling based on three states and not just two as in classical logic. In addition to the true and false states, which define the classical logic known as Aristotelian [2] or Cartesian (according to Descartes, [3]), neutrosophy introduces a third state: the neutral state (we will see below that it also represents indetermination). This neutral state gives its name to neutrosophy; it extends the dialectic [4] of the the positive and negative by also

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considering neutrality. Neutrosophy is originally a branch of philosophy [5], which was introduced into the various fields of science, especially mathematics with first logic, then sets, [6] probabilities, and statistics [7,13-14], etc.

2.These natural bases derive from the temporality of the real world

Neutrosophy is closely related to reality, the material world, because it is only a reflective representation of reality in its many natural bases, and this is due to the temporal aspect of the world (the most fundamental one). Thus temporality introduces the possibility of change in addition to the constancy that characterizes timelessness. If change is possible, if it can exist, then constancy can also exist. Absence of change (no-change) is often observable at a certain scale and in a certain time interval. In a temporal view of the world, neutrality is this aspect of constancy, of non-change. In that case of constancy, the change is then neutral, there is no change, neither in one direction nor in the opposite. Therefore, neither positive nor negative, it is the neutral state. In neutrosophy this third state can also be seen as indeterminacy, it then also serves to model phenomena that are not perfectly determined or known.

We will come back to this aspect of indeterminacy linked to neutrality, which results from temporality. Before doing so, we wish to mention the other fundamental bases that imply neutrality, and therefore the need to consider this concept. In physical reality, any instantaneous situation is characterized by a set of real values that measure it quantitatively: they are not discrete states, although quantum mechanics has discovered this, but in a first approximation and in a more macroscopic way, continuous values, continuously variable, without discontinuous jumps. In this simplified paradigm, which is that of the usual sciences, the instantaneous value of a descriptive parameter is expressed as a real number. This value can be changing or approximately stable during a time interval. Although everything is constantly changing, at least infinitely, we can consider as a first approximation that there are sometimes more or less long moments of stability.

Mathematically it is customary to model according to the simplest approach by a polynomial representation and from this representation has derived differential and integral mathematics (8). From a temporal signal represented by a polynomial, one can calculate its variation: this is the derivative, i.e. the difference (and therefore the change) it presents in a time interval. Dually, from a derivative we can reconstitute the signal, it is the integration. When the derivative is approximately zero then the signal is approximately constant. The neutral derivative implies the absence of variation of the temporal signal. Accessorily a positive derivative represents an increase of the signal and a negative derivative corresponds to a decrease.

This mathematical basis comes from a physical basis: the notion of the trajectory (in mechanics, 9). Considering a particle, its velocity is the (first) derivative of its temporal position, and so on, its acceleration is its second derivative, and the curvature of the trajectory is linked to it. In the absence of an external force causing an acceleration of the particle, its speed is unchanged (in value and direction), and its trajectory is reduced to its simplest expression: a straight, rectilinear trajectory. This is a physical reality that corresponds to a neutrosophic vision: positive, zero, or negative tangent force corresponding to acceleration, neutrality, deceleration, and also a perpendicular force producing a positive curbature, a straight line, a negative curvature of the trajectory.

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Above all, neutrosophy is a model adapted to human thought (more qualitative than quantitative), which most crudely way will perceive the parameters a situation either as constant, changing in one direction (increasing, positive), or changing in the other direction (decreasing, negative).

Finally, in simple arithmetic, we consider integers. In this discontinuous case the situation can also change or not. For example, to a collection of 5 objects we can add 1, and then we have 6, or on the contrary remove 1 and there are 4 left, or finally be neutral, not acting so that the number does not change (the Brownian motion of the thermal agitation of the molecules gave rise to the theoretical development of Markov chain [12], where the simplest case consists precisely in a variation at each step of -1, 0 or +1, see reference [10]).

In connection with the simple model inspired by human perception of the evolution of a three-state situation, a three-state control can be defined: increment, hold constant or decrement. For example, it was the control lever of the first elevators that either turned on the motor in one direction or the other, or stopped it. This type of control can be found in many devices because it is so intuitive and efficient, like the joysticks in video games. Although only two push-buttons are needed to perform this function, in a human interface design a three-state toggle lever is often preferred as it is more in line with the human three-state apprehension.

3-Transition to situations characterized by 3 states

The real world includes a large number of situations that are characterized by 3 states, and these are therefore advantageously modeled by neutrosophy because of its design around the positive, neutral and negative states.

The bases that we have seen in the previous section are derived from the temporal essence of the physical world, therefore they are characterized by its change but also by the possibility of constancy at some scale of observation and for some duration.

Another fundamental aspect of the physical world is its plurality, at least apparent, it is made up of several objects, together with linked by forces of interaction. This number of objects is large, so a statistical approach can be envisaged. The states of objects, especially those that are similar or close, are often governed by statistical distribution laws, such as the so-called precisely normal (or Gauss') law. In an interpretation of a world seen from a statistical perspective one can then classify the objects in the first approximation among 3 main categories: those whose situation is characterized by a value close to the statistical mean of all these objects, those below the mean and those above the mean. Thus the statistical modeling at its coarsest level is consistent with the simplified human perception of the three states: similar to the average, less and more than the average.
In this way, the physical world as seen through human eyes at the most immediate level is organized into three categories: (in vincinity of the) average, above average, and below average. This basic perception can be applied to any observation. Typically in sociology, one of the basic criteria of (socio-professional) classification is to consider 3 levels of wealth: the middle, upper and lower classes.

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4-Situations characterized by 3 states

Now we can give some examples of situations intrinsically characterized by 3 states, some of which stem from, or are similar to, this elementary statistical vision.

4.1. Perception : temperature

As an example of human-related perception and thus also of this simplistic and qualitative assessment of a reference value, we would like to start with temperature. Human beings generally consider several different situations concerning their body temperature: room (ambient) temperature, food temperature, and water temperature for bathing. These cases come from whether we consider it to be a pleasant temperature or not, and if not, whether the temperature is too hot or too cold. The first case that corresponds to our comfort zone is perceived as neutral. For example, our body temperature is 37°C, and we find the room temperature pleasant when it is between 19 and 22 degrees.

The appreciation of the temperature can vary according to the circumstances, for example the ideal temperature while standing still (21 degrees Celsius) is not the same as for physical activity (18°C), nor is the ideal temperature for a cool drink (8°C) or on the contrary for warming up (50°C), but with more difference. The pleasant, or neutral zone is generally relatively narrow compared to the zones that appear to us to be either too little or too much (before reaching the pain zones). This remark can be made in many situations that we will present as intrinsically three-state, which probably led to the oversimplified two-state representation which then gradually imposed itself as the only one that can be thought of, for example day or night, while there is also twilight which can be quite long (if we are located far from the equator).

4.2.Chemistry: acidity

Also related to life and the conditions it imposes, inorganic chemistry we have the measurement of the pH (hydrogen potential, hydrogen ion concentration) of a solution and its representation in 3 classes, neutral, acidic and basic. Here this is due to the primordial role of water in life, and pH 0, therefore neutral, is defined as that of water.

4.3.Linearization at the working point

Many phenomena in the real world are non-linear, however for simplification we wish to use a linear approximation to make approximate calculations easily. For example, a transistor working with small signals will have its transfer characteristic approximated by a straight line tangent (to the response characteristic curve) at the bias point (operating point).

For slightly larger signals, three linearly approximated zones are then considered: a zone around the operating point with a certain range, a zone below the range and another zone above it.

4.4. Neurons

Another example of a non-linear situation is the neuron of the nervous system or its artificial equivalent, as used in computer science for artificial intelligence, which exhibits strong non-linearity due to its saturation characteristic.

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This characteristic stems from its learning function which proceeds by reinforcement, and symmetrically inhibition (in case of good results, respectively bad results). We will then use a modeling by three zones: lower (negative saturation), central or neutral (transmission), and upper (positive saturation). Reinforcement as a learning method consists in treating the difference between what the neuron produces as an output value from its inputs and what it should do in this situation. If the difference is small, then the neuron has already learned well and only a small adaptation is required, this is the central, linear, and relatively neutral zone. On the other hand if the difference is large either in the right, or in the opposite, directions then the retroaction proper to the reinforcement should be stronger in positive or negative, but easily saturated, i.e. be almost the same in all cases, whether the error is medium or large. Here saturation consists of limiting the correction in case of large deviations in order to progress towards the result in small steps for a large number of successful successive examples, so as not to give too much importance to a single example, to obtain generalized learning of the examples treated.

4.5.Human Conceptions of the World

The real world often consists of 3 categories, or the human being perceives it for a particular area as consisting of objects of three main types.

For example, our capacity for consciousness implies a conception of temporality. We distinguish between the present in which we are and act, the future which is die to come and that we wish to influence by our present actions, and the past which we no longer have control over but that is valuable as information, reusable knowledge to determine our actions. Here the present is only a small thing in the infinite time of both past and future, however it is considered as a specific category. A binary vision of only the existence of a past and the arrival of a future would deprive us of any awareness of a possibility of action on the world.

Our world is made up of physical objects and living beings. Some of these with which we consciously relate are the result of sexual reproduction and so are we. Thus we have a conception of gender that is in three states: neutral for the inanimate, and male and female for the living. Note that the French language gives very little importance to the neutral gender compared to English and German, perhaps as a result of a more anthropomorphic conception of the world.

Finally, conditioning all our cognition, and therefore our way of thinking, we attach to people, living beings, objects and even abstract concepts an affective coloration, and this in a typical three-state way: we appreciate, like love, something or on the contrary we consider it negatively or for less known things we are relatively indifferent to it. Concerning a large part of things, we affect them, often unconscious, which can be of varying degrees of intensity and which influences all our thoughts about them. As a result, our cognition is weighted by the effects of the three-state type. Moreover, it would seem that the very mechanism of reflection is three-state, particularly in the rationality used to decide on a choice and to seek solutions, which is done step by step. Either a partial solution is seen as positive or negative and then tends to end the reflection, or it is rather neutral and then allows the reflection to continue.

An emblematic case of choice is that of voting where, for a subject as well as for a candidate, one will have in addition to the rational aspects a positive, negative or neutral attraction, and also one will vote accordingly respectively either yes, no or blank (for example by abstention) if rational considerations are not clearly not preponderant.

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A concrete application is the technique of sentiment analysis, which is used in political science and also in finance to determine the positive, negative or neutral content of e.g. speeches of politicians or financial news for investors in a computerized way.

When a person has to make a decision, often in addition to accepting or rejecting what is proposed he may also decide to postpone his decision, to prefer to wait, which corresponds to a third state, in a certain neutral way (and expressing his uncertainty).

Another area where human conceptions are naturally in three states is that of evaluation, one can also speak of appreciation, and which therefore relates to effects and feelings, and even, as a result, to accounting. For example, the budget consumed by a project or the time allotted to carry it out can be: exceeded, within acceptable limits, or the forecasts were too pessimistic. A project can be judged as qualitatively good, satisfactory, or bad. Similarly, an objective may be exceeded, achieved, or not achieved. The result of a learning outcome is considered according to the first approach in a classical way, but according to the second in an approach by objectives.

For example, the cost of a project may be within the forecasts, or it may exceed or fall short of the forecasts. In a not-for-profit association one will try to balance income and expenditure, whereas in a commercial company one will aim at a profit, fearing the deficit, the alarm of which is the appearance of relatively balanced accounts.

4.6.Chemistry: phase change

In each discipline many examples can be found, here is another in chemistry. During the phenomenon of phase change, as between solid and liquid, matter does not only have two states, the original and the final one, but also a transition state (viscous matter infusion).

4.7. Physics: electrical charges

Any particle in quantum physics has an electric charge or not, and this charge can be positive or negative. This produces 3 states for the electric charge characteristic of particles: positive, neutral, negative.

Similarly molecules also have a charge that is likewise either positive, neutral or negative. If they are charged then they are called ions, subdivided into positively charged cations and negatively charged anions.

4.8 Neutral or indetermination

In the introduction, we explained that neutrosophy is characterized by the addition of a third state to allow a better (comprehensive and qualitative) representation of reality. This additional state is generally considered as a neutral state. It can also be given other meanings, leading to other fields of application. This state is often considered to represent uncertain information. Then neutrosophy will be used to treat in a better way real-world situations where uncertainty exists and is not negligible. For example, several simultaneous measurements of the same quantity generally produce different values when the sensors are sensitive. Or different measurement procedures with different accuracies have to be combined, which implies considering the uncertainty (here the measurement uncertainty). Many phenomena are inherently uncertain, especially at the atomic level, because they are governed by probabilistic laws.

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For example, the radioactivity of a radioactive isotope decreases with time at the macroscopic level according to an exponential law characterized by a halving in a constant period, called the half-life. However, each atom during a time interval decays or not, independently of the others and only in a probable manner. All atoms are taken together, however, follow the macroscopic statistical law of exponential decay,

Already with logical information, such a problem arises. When a large number of facts have been manipulated for different questions, for example in an expert system, some facts will be irrelevant for certain questions and therefore have to be considered neutraly. This corresponds to the neutrosophic logic mentioned at the beginning, which is more flexible in dealing with large numbers of facts than a classical logic that knows only true or false. Thus, composition with a non-relevant or neutral value will not change the value of a fact, whereas composition in classical logic can only be done with true or false, which in either case will not consider the other information. Typically, a counterexample is enough to cancel a law in classical logic, but it can be a bad counterexample, not very relevant, not very frequent, obtained by oversimplification in true or false. Or a counterexample that is impressive but misleading. Such binary logic is easier to handle for humans: it is black or white, and for computers; but it often goes too fast. The brain manipulates preferences very well, so why not consider them more. In any case, the best of reasons will remain ours: we ultimately think about what we desire to think.

Let's end this section with another example, taken from meteorology, which brings out the concepts of uncertainty and neutral zone: a prognosis of future weather conditions may be that the weather will be uncertain and not just good or bad. In a simplified forecast, for example, the air pressure will be considered to be either rising, stable or falling. Figure 1 of the weather station shows that the same indication, depending on the context, can mean the opposite: it says that in summer a rising temperature indicates an improvement in the weather, while it also says that in winter a rising temperature indicates a deterioration in the weather. If the indications of the three types of sensors agree then the forecast is more plausible.

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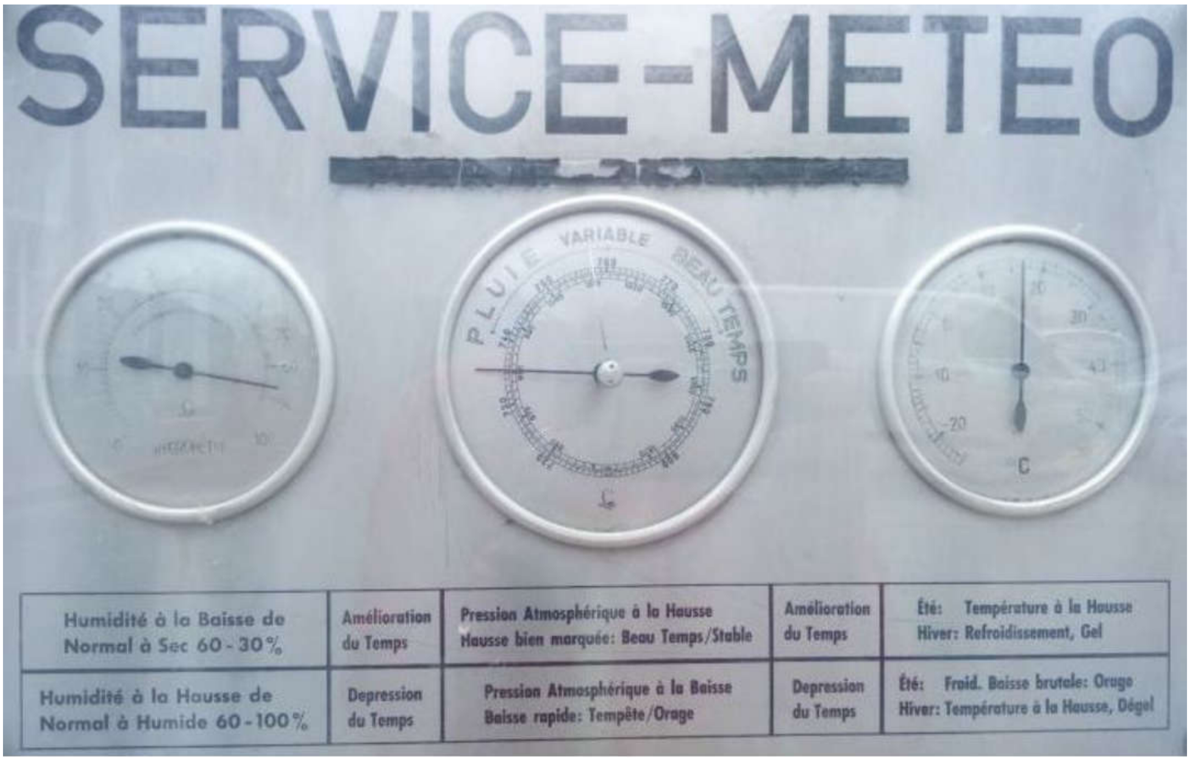

Figure 1 : Weather station

For information at the time of the photo it was almost the beginning of summer, and there was a big storm half an hour later, which lasted only three minutes. It would have been good to have taken a second photograph a few minutes apart to be able to determine the changes in the measurements, because according to the written indications it is the upward or downward variation that is indicative and not the current value. It is not explicitly stated that if, for example, the pressure is stable, then this information is neutral, non-relevant. Thus it appears that in this example we are considering 3 cases: rising, stable, falling.

4.9. Communications: bipolar coding

This may seem paradoxical that bipolar coding is actually in three states. On a simple electrical wire, such as the telegraph wire, a message can be sent using Morse code: with a switch, a current can be sent or not (in fact by imposing a voltage, coming for example from a battery, connected to earth on the other pole). It is a unipolar coding: voltage or nothing. You can also flip the battery, thus inverting its poles, so you have the opposite voltage, negative if it was positive before. So instead of transmitting two states 0 and 1, we can now transmit three: -1, 0 and +1, using the two poles of the battery, one after the other. By working at the same speed it is now possible to transmit more information, so this coding with two polarities voltage is more efficient. The receiver can be made with a device consisting of a magnetized needle that deflects when a current passes through the wire wound in a coil (forming an electromagnet), and it deflects in the opposite direction when the current is reversed. A spring is used to return the needle to its rest

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(neutral) position when there is no current. A cable is usually limited or defined by its insulation, so it can also work as a bipolar cable.

5. Conclusion

We have given some examples of situations where it is usual to consider three states in very different fields. These situations appear to us first of all because of the habit of naturally having three states, and therefore neutrosophy is well suited to model them.

By considering these cases, which are numerous, become perceptible some rather deep reasons that make us consider these situations as intrinsically of three-state type. The most apparent reason is subjective, we see such a situation according to our intellectual perception as having three states. It is in a way a privileged way for humans to see the world and to conceive a representation of it.

Then similarities between these situations show that more profoundly they are of a three-state nature, following the more general way of functioning, by increasing degrees of universality and decreasing degrees of evidence: first of cognition, then of living beings and finally of the physical world with its temporal aspect in particular. According to the first approach, a reflection is a progression of stages ending in success or failure. Each stage is colored by our preferences in positive, negative or neutral. If it is neutral, then we must evaluate other stages, otherwise our preferences will lead us to a conclusion. Our motivation for satisfying needs or for pleasure implies that some things are irrelevant, unimportant, some positive and some negative. The physical world is also governed by laws of attraction and repulsion, as with the electric charges of ions, atoms and particles: positive, neutral, or negative.

Finally, we find the three great universal categories of perception or representation: increase, relative stability, decrease that derive from the existence of time, intrinsically made of the present but which produces the past and consumes the future, inexorably. This time allows variation and also relative constancy over a certain time. More abstractly, any phenomenon, any collection, has an average value, and any situation or element can be approximately in the average, above or below it. Everything is thus essentially of a three-state type and not binary, a too limited mode of representation, considering only that something exists or not: static whereas everything is dynamic, a too over-simplifying view and therefore a misleading one.

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