Real space, Digital Perception: Formation of Spatial Experience Beyond Materiality

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Abstract. Space is perceived by cognitive operations in which particular elements are assigned spatial significance. Such operations are relatively similar to digitalization processes. An element's attributes are translated to numerical data according to measuring systems and scales, so that they can be evaluated comparatively. Similarly, elements of the given world are perceptible as sensory stimulations that are registered to the sensory organs and then translated to data, which is comparable to the data of other elements. Sensory stimulators may derive from any element that is registered to the sensory organs, even those which we call as "virtual", "artificial" and "fake," for example the elements that are rendered digitally in the computer. With such a premise, the paper examines how such elements may also contribute in the formation of spatial perception. Consequently, the meaning as well as our common interaction with space is contested, along with the limits of reality itself.

Keywords: spatial perception, digitalization, architecture, psychology of space, psychophysics, media, real/virtual, Vilem Flusser, Einstein, Aristotle, Matrix.

1 Introduction: Experience of the Physical and the Digital Worlds

More than two decades of precipitated technological evolution have passed and we have finally surpassed any of the shock of the first contact with the computer. In fact, navigating in the digital worlds has become more and more natural. The digital worlds are to a large extent recognizable, as many of their characteristics refer to the given world, such as the computer terminology, the formed relationships and the hierarchical order among the elements of the computer. As a consequence, we have gradually become familiar with the idea of digital worlds as alternative ones supporting regular activities, most often related to communication and frequent transactions. In order to transfer information fast, the email is probably the most suitable option, as manuscripts or typed letters were in the past. Similarly, a virtual visit to online shops, museums and Internet sites would give information that can be also found with one's physical visit to a given place. Such remarks do not aim to overlook the fact that virtual experience is generally different from any physical one, as experience is particularly framed in each case by additional information and factors: for example, the color and the quality of the ink of a manuscript, the writing character, the fonts of a typed text, even the typing software used in the computer,

also the background music playing at a museum, art gallery or merchandize store, the places to which a physical or virtual site "neighbors" or "links" into the urban and the Internet milieu and so on. In general, although experience of the digital world is different from that of the physical world, it may be also claimed as truthful. Why then we often hesitate to claim the digital worlds and their elements as real ones?

The related judgments most often depend strongly on the elements' material state, especially in cases when elements of the digital world resemble those of the given one, as we call them "virtual," "artificial" and "fake," even stigmatizing them as immaterial, illusionary and deceiving ones. We would almost instantly characterize a table made of wood or steel as a real one because we recognize in it materials of which tables are often made, rather than a table composed of digital points in the computer screen, in which do not see other than a "phantom" of a table. However, we may also realize that attributing materiality to elements is not always adequate to claim their validity in the real world: in fact, we might equally question a table made of polyurethane, which, compared to a wooden one, would be the one that is fake. Moreover, materiality may be also attributed to digital elements – being apparently different from materiality of elements of the physical world – specifically to the electrons flowing into the microchips and the pixels of the computer screen. Still, it becomes clear that materiality is not reliable as sole criterion to declare whether an element belongs to the given world or to any of the alternative ones, as we have to call upon its other attributes.

In response, we may consider the four causes defining substance according to Aristotle, that is, *matter*, *form*, *energy* and *purpose*. According to Aristotle, *matter* is the raw material; the amorphous mass an element is made of. *Form* give shape to the amorphous mass and is responsible for any particular significance that mass will take, as it is being promoted to a real being. For such a transformation of the mass, *energy* needs to be invested to it, towards a specific *purpose*, utilitarian one as well as of any other kind. In respect to the Aristotelian definition of substance, we may declare the status of an element in regards to reality by examining some of its properties. In reference to other attributes of an element, such as color and size, none of them consists of an adequate criterion. For example, although the green color indicates that a tree leaf is real, from our experience we also know that in nature there can also be found leaves that are red or yellow. Meanwhile, a leaf made of plastic or one rendered on the computer screen may be also given a green color, but as we compare it to leaves found in nature we would not give it equal significance in regards to the real world. The same is also true about the property of size, as we may not assign any leaf or table of usual size to the real world, especially if it is made of materials that are particularly uncommon for the specific element, also if it is an artifact, a reflection, a two dimensional image or painting. For example, we would hesitate to claim the validity of a wooden table to the real world, if it is too big or small to be used as a common table. Even more, if the name "table" or "leaf" is given to an element, still it would not be enough to assume that this element belongs to the given world, as it could be a digitally rendered one. Thus, naming an element would be even more confusing, as we may give a name such as "leaf" to any element, whether it is a box, an animal or human, in clear disagreement to common experience. Consequently, neither materiality nor any other attribute about an element is adequate as a sole criterion in order to claim the validity of that element into reality.

Habitually, claiming an element as a real one is rather the outcome of comparative evaluation of some of its attributes that are considered to be significant for this purpose. Such a process would be similar to typical characterization ones: first, characterizing an element would group that element with other ones that are also characterized the same, as they present common attributes. For instance, naming an element as "table" would group that element to other tables. It may be noticed that up to this point it is irrelevant whether these tables are rectangular or circular, small or big, wooden or plastic, digital or physical and so on. Accordingly, the naming act of an element as "table" may be claimed either as correct or false, based on the comparative evaluation of its attributes in relation to those of other tables. Moreover, the significance of an attribute about an element over its other attributes over the characterization process is accredited in reference to other elements and particularly for each case. For example, we may follow the characterization of an element as "red" that is given to it in regards to its color. If the element's color is within the color range of the color "red," then attributing the color "red" to that element is respectively correct. In reference to a particular characteristic, for example "red" as a color, various elements may be grouped together, being generally different in regards to their name (table, chair, leaf), their size (small, big), the state of their realness (real, not real, hypothetical), their materiality (material, immaterial), or to any other attribute. In general, whether it is about the characterization as "real," or "red" or "big," or "table" and so on, any element is given characterizations as it is compared and evaluated along with other elements sharing the same characterization, as for the moment these elements are used as referents outlining the range of normality for that characterization.

From a general perspective, any of the different characterizations of an element is dependent upon the conditions in which it is taking place. The color characterization is a typical case: information about an object's color refers actually to the optical stimulation caused by the rays of light that are reflected onto the object's surface. For any color characterization process the general assumption is that the element is lighted with "neutral" light, being defined to be white. If the properties of the light change, such as its intensity or its color, even if there is a change in the surrounding objects reflecting their color, then the color of the examined element appears as different. Such an effect is even registered permanently onto the element, as intense light causes the colored surfaces – especially bright ones – to gradually fade towards the color of the light. Moreover, some of the attributes of elements may be suggestive of other ones, but such assumptions are often questionable. Hence, the surface texture of a table might be suggestive of the material it is made of and accordingly of its weight, but these assumptions may be also related to other information, such as whether the table is painted or coated with other material, its size, or if it is internally hollow, as in each case the table would be much lighter. What becomes most important is that any characterization is dependent upon certain conditions, as we might also call upon the degree of awareness and preciseness towards them, as any lack of the information that is needed results that the related characterizations are often unreliable and unpractical. Additionally, we may notice that various characterizations of an element are often related to each other, forming hierarchical orders as long as that element is described more precisely. For example, first we may name an element as "table," then we may call upon the material it is made of, for

example that it is a metal one, then we may specify the kind of metal, such as steel, then we may add that it is galvanized, also that it is color painted, or we may describe the parts composing it and their profile shape and so on. The progressively specified descriptions may also delineate hierarchical branches of characteristics under which more elaborate ones may be anchored, as descriptions might gradually be less empirical and more scientifically complete. However, assigning characterizations to elements depends closely upon the observer's capacity to identify them at a given moment. As a consequence, as the characterization process elaborates and evolves historically, at a given moment former characterizations may be declared as imprecise ones, even if they were scientifically developed, as they are being substituted by the ones that are mostly current.

In summary, any of the characterizations about an element may result from the comparative evaluation of its attributes, also in relation to other elements. Along the characterization process, some attributes are assumed to be more significant than others, whereas for a different element and for the same characterization, the attributes that are more significant may be ones that are different. Any of the various characterizations about an element may be compared in relation to each other and grouped into hierarchical orders. Moreover, comparative evaluation presupposes experience with other elements, upon which any comparison is established. Different elements are compared in regards to the similarities and differences that are noticed. In turn, the comparison of different elements builds up experience, as well as a sense of normality about a particular characterization. Finally, any characterization process is bounded to specific conditions and it is important that these are allocated adequately and accurately in order to claim validity about any judgment.

On behalf of such realizations, the paper examines the characterization process about elements as *real*, especially in the formation of spatial experience. The characterization process that is mentioned above may describe cognitive processes in general and may be related to similar ones with the computer. In brief, the computer is programmed to render information about elements as digital data through processes that are parametrically controlled. Digital data is organized into hierarchies, so that any characterization or significance about digital elements is assigned comparatively to them. Similarly, the elements of the given world may be described as collects of information that is initially registered as sensory stimulations to the applicable sensory organs. Information is then intellectually elaborated though processes of comparative evaluation and categorization in hierarchies and in relation to information about other elements, also to measuring systems and scales, so that each element is being identified and assigned significances in that order. Respectively, each element is assigned spatial significance towards spatial perception. In turn, the notion of the *real* may be particularly defined in regards to the spatial significance assigned to all elements composing spatial experience, in comparison to other characterizations that may be relevant, such as the hypothetical, the existing and the nonexistent, the material and the immaterial.

2.1 Digital Worlds: Real, or Apparitions?

The screenplay of the Science Fiction film *The Matrix* by the Wachowski brothers transfers us roughly two hundred years ahead. It presents the reality of the 1999 (the year the film was released) as an absolutely true-looking, yet virtual world. Soon, the terrifying secret is revealed to the characters of the film, as well as to the audience, that is, everything within the given world is in fact a deception: streets, buildings, people, daily objects, even activities and transactions, are just numerical data composing reality as one out of the infinite possible combinations that has gradually obtained "flesh and bones" in the world of Matrix and was rendered so convincingly that seems as totally real, whilst it could equally be any other different one.

As digital technology progresses, the Matrix scenario appears more and more as a noteworthy possibility. The hypothesis is terrifying and at the same time exciting, as the worlds made digitally are often exceptionally attractive. Currently, any information flowing into the advanced media networks either is altogether constructed digitally, or at some point it was converted to digital. Media infrastructure, namely, the media devices, the networks of distribution and the binary code bit (binary digit) of the digits 0 and 1 to which information is converted, interferes between information of any kind and the audience. As a consequence, information is always mediated.[1] The digital media tools have gradually become so advanced that the human eye in front of an image rendered and manipulated digitally is often incapable to distinguish between the elements that are digitally constructed and those that are not. Most importantly, any element or phenomenon of the given world can be described in extensive detail by digital data. Thus, we may speculate a future moment in which it will be possible to describe the entire world with digital data, even more, to reconstruct the entire world directly from this data.[2]

– But, could it ever be possible at all that the given world we take for granted as real is nothing different than an apparition, a reality that is so meticulously rendered and true-looking, yet it is virtual, that is, similar to the Matrix?

In order to respond to the question above, first we may assume that an apparition can be distinguished from the real world. The term *real* would characterize anything that is generally truthful, objective and original. Respectively, the notion of *reality* would encompass any substance or condition that is real, or the so-called objective world.[3] On the other hand, the term *apparition* would describe anything that is phenomenal, illusive and fictitious, also related to imagination and any of its

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[1] Such a remark may also be extended in relation to the circulation of information with analog media. In general, for the circulation of information a medium is needed. Whether the medium is analog or digital, in any case it reproduces and transfers information, in other words it records and emits information. Along any circulation process, information is represented by a recorded document of it, which in turn will be reproduced possible in another medium as a new document and so on. Documents are being reproduced each time in consent to the specialized way that is reinforced by the medium. In effect, experience with information is always mediated.

[2] Up to now, such a hypothesis is a speculation and not a valid scientific prediction, as the possibility it describes hasn't been determined yet in time.

[3] Related source: Vas. D. Anagnostopoulos, Writing and Interpretive Lexicon of Greek Language (Athens: Euth. D. Christopoulos, 1969), p.750.

creations, being artificial, nonexistent and unnatural.[4] Thus, the examined hypothesis that elements of the given world set up apparitions may be reduced to the seamless conjunction between anything truthful and anything fictitious, setting up reality.

The theorist Vilem Flusser expresses such a probability as he compares the worlds that are digitally rendered to the experience of the real world:

> *"Before our doubting eyes, alternative worlds begin to emerge from the computers: lines, surfaces, and soon also bodies and moving bodies, made up of point elements. These worlds are colourful and emit sounds, and in the near future they will probably also be touched, smelled, and tasted. But that isn't all, because the moving bodies that will soon be realized through calculation and which are beginning to emerge from computation, will be equipped with the artificial intelligence of Turing's man, so that we will be able to enter into dialogical relationships with them."*[5]

This description foresees a moment where elements of alternative worlds will be so tangibly around us that their separation from elements of the real world would be practically impossible. In that case, Flusser remarks, "either the alternative worlds are as real as the given one, or the given reality is as ghostly as the alternative ones."[6]

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[4] Related source: Vas. D. Anagnostopoulos, Writing and Interpretive Lexicon of Greek Language (Athens: Euth. D. Christopoulos, 1969), p.963.

[5] Vilem Flusser, "Digital Apparition," *Electronic Culture: Technology and Visual Representation*, Timothy Druckry ed., London: Aperture, 1996, p. 242. Today, such a hypothesis is still a speculation, which may be supported scientifically to some extent, being technically feasible. However, any technological discovery, even radical ones, is not sufficient one to shape anew any broadly accepted consciousness. Consciousness is being shaped along time and if other variants are also present, such as social, economic, or broader cultural ones. In other words, along the historical path of humankind, any shifting of ideas, beliefs, even any discovery or ideology, emerges in parallel to various disciplines and issues, as it is grounded and supported by subordinate changes in regards to other human activities and beliefs. For the social aspect of technological evolution, you may also read: Trevor J. Pinch and Wiebe E. Bijker, "The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," *The Social Construction of Technological Systems*, W. Bijker, T. Hugles, T. Pinch eds., (Cambridge: The MIT Press, USA, 1989), p. 28-39.

[6] The hypothesis above also belongs to Flusser and is more of a speculation, rather than a scientifically valid prediction. Any of the confusion between the real world and an apparition may be attributed to a phase or technological evolution in which everything will be reproduced and presented in total with the fidelity and truthfulness of direct experience with reality. In reference to such a hypothesis, it may be argued that for the reproduction of information a medium is needed. Along with the appearance and evolution of a medium, being either analog or digital, in general the experience with a new technology undergoes the advancement of the expertise of the user, in regards to the development of techniques and of the ability to recognize the special qualities of the new technology. The experience with a new technology leads to the gradual familiarization with the special knowledge, the specifications and the limitations of that medium. In order to achieve expertise some time is generally needed, during which the medium itself often becomes more advanced, or even another one with more advanced features is developed. Such a phase difference may result to the impression that we move towards an integrated fusion between the real world and any apparition being developed with the most advanced media of information reproduction, whereas such an end is neither reached yet, nor it can be scientifically predicted.

Any inability to distinguish between elements of the real world and of any apparition may be attributed to the realization that materiality cannot be a sole criterion for such a purpose. The criterion of materiality may be related to the Aristotelian principle in regards to substance. According to this, any element may be described in regards to its material structure. As we implement the Aristotelian principle as it is currently expressed in Physics, any known element can be either classified to one of the three generally recognized material states, as solid, liquid or gas, or it can be described as a material with the minimum possible structure related to fire, or even as one with a structure in constant transformation.[7] Elements with material structure in constant transformation would be described by any of the material transformations that are known, specifically between mass and energy, as stated by Relativity Theory.[8] Consequently, an element would be considered as real if it can be classified to any of the material structures that are known. The classification of any element either as solid, liquid or gas, or as one that can be identified by any of the scientific methods in the lab, would put in order any of the intermediate material states between the material elements and those being almost intangible, still known ones. Such an array would be meaningful specifically for the purpose of distinguishing elements with recognizable material structure from those of which attesting any material structure would be completely impossible. For this reason, any of the immaterial elements may be also described as being practically nonexistent, also belonging exclusively to fictitious worlds. But any element of fictitious worlds cannot be defined in any other way than in reference to something that currently exists or existed at some point in the past.[9] Thus, an apparition can only refer to worlds that are clearly fictitious, still they remain recognizable. Therefore, any inability to distinguish between the elements of the real world and of an apparition reveals the probability that all elements will be equally recognizable and also inseparable, as the real world will be diffused into any apparition and vice versa.

Flusser extends such a remark towards the world of a future that is now foreseeable:

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[7] The theorist Manuel De Landa suggests such a categorization of matter, in reference to the Aristotelian principle: "Aristotle's famous four elements – fire, earth, water and air – may reflect his awareness … of what today we know as the three main states of aggregation of matter – the solid, liquid and gas states – plus the state with least structure, the plasma state represented by an open flame." De Landa, M., "Philosophies of Design, the Case of Modeling Software," *Verb Processing Architecture* Boogazine, (Barcelona: ACTAR, 2001), p.135.

[8] The equivalence between mass and energy is grounded to Special Theory of Relativity, which was proven by Albert Einstein in 1905 and is described by the equation $E=mc^2$.

[9] In a similar way we may identify the case of an apparition that is developed exclusively by internal operations of the mind, that is, without any external stimulation. In fact, the subject experiences an apparition through intellectual operations in which he/she attaches meaning to elements either being present, or he/she imagines them to be. As a result, external stimulations may cause the development of an apparition. The opposite may happen too, that an apparition is developed upon the thought of elements that are actually absent. In such a case, the subject envisages that he/she actually receives stimulations and that the elements these stimulations derive from are actually present. Thus, in any apparition, the subject experiences with certainty stimulations and the related elements.

"If everything is delusive, if everything is a digital apparition – not only the synthetic image on the computer screen, but also this typewriter, these typing fingers and these thoughts being expressed by the typing fingers – then the world 'apparition' itself has become meaningless."[10]

The inability to distinguish between the elements of the real world and those of apparitions would equally refer to incapacity to evaluate respectively their attributes. Still, it may be recalled, an element is perceived by stimulations that are registered to the sensory organs. Thus, being able to express whether an element belongs to the real world or to any apparition may be reduced to an equal capacity to evaluate the sensory stimulations by which it is perceived, in general as true or false. If either evaluation about a sensory stimulation refers back to the attributes of the element it derives from, then such any of the judgments would not be intrinsic to the stimulation it describes. Accordingly, distinguishing between elements of the real world to those of apparitions would be the outcome of comparative evaluation among the attributes of different elements, for example in regards to material structure. Moreover, any characterization would be inevitably grounded on overall experience, thus it would be framed by the general conditions and restrictions in which it takes place.[11] In other words, evaluating sensory stimulations as true or false, also elements as real, material, existing on the one hand, or as immaterial, hypothetical, fictitious and nonexistent on the other, also worlds as real or apparitions, would be proven as impossible to be undisputable.

The above hypothesis may be expressed to the following question:

– Is it possible to reduce any of the characterizations about elements of the given world and of any apparition exclusively to the sensory stimulations by which any element becomes perceptible?

In response to this question, the paper examines *space* and the elements making up spatial experience. Specifically, it attempts to reduce spatial experience, also any significance that is appointed to space, such as its properties, its limits, even its duration over time, to the stimulations with which any of the elements composing space are being perceived. Accordingly, characterizing an element as real or fictitious, also assigning any other significance to it would be the result of processes of intellectual elaboration and comparative evaluation of the sensory stimulations by

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[10] Vilem Flusser, "Digital Apparition," *Electronic Culture: Technology and Visual Representation*, Timothy Druckry ed., London: Aperture, 1996, p. 244. As he examines the hypothesis above, Flusser interprets the elements composing reality as follows: "everything is digital, i.e., that everything has to be looked at as a more or less dense distribution of point elements, of bits. Hence, it becomes possible to relativize the term 'real' in the sense that something is more real the denser the distribution is, and more potential the more scattered it is. What we call 'real,' and also perceive and experience as such, are those areas, those curvatures and convexities, in which the particles are distributed more densely and in which potentialities realize themselves." In this passage, Flusser avoids declaring material or other significance to the point, possibly because otherwise the meaning of point would be confined to specialized scientific definitions. With his choice, Flusser preserves the potential that the significances point can take are not confined by its material or other substance, even being scientifically justified.

[11] Such conditions depend on the scientific context in which registration of matter takes place, such as the scientific definition of matter, the available empirical or laboratory methods or registration, or the precision of such methods.

which it becomes perceptible, similarly of its other attributes, characteristics and properties, also in relation to other elements.

The following process may be applied: Firstly, any element will be reduced to the stimulations by which it is registered to the sensory organs. This method may be used to describe the perception of any of the so-called primary elements structuring space, such as walls, floors, ceilings and columns, as it may be equally extended to describe elements of any other material structure. It will become evident that spatial significance may be assigned to any element that is perceptible under specific conditions, as spatial, timely, and mass/energy phenomenon;[12] moreover, space may be outlined for every element, as a field in which that element is perceptible. Reversely, the properties of space may be reduced to the stimulations with which every element, the so-called primary spatial ones as well as any other, is registered to the sensory organs. Hence, elements that cannot be characterized as real ones at a certain moment may still be assigned spatial significance, as they are also registered as stimulations to the sensory organs. Such elements may be noticed through reflections, mirages, optical deceptions and illusions and they may even belong to the digital worlds of the computer, the computer games, the Internet, the holograms and to all other sorts of virtual, alternative, abstract or fictitious worlds, composing what we call generally as "apparition."

Respectively, the notion of "space" may be reconsidered, so that its meaning would preserve the potential of assigning spatial significance also to elements which do not have a material structure that is recognizable at a given moment, that is to say, elements that are still considered as immaterial, nonexistent and hypothetical, even elements that are currently being unidentified. Such elements would compose worlds that are still purely imaginative, yet they may be discovered in the future. Such a view would be supported by the realization that every definition is bounded to the limits of empirical and scientific knowledge at the moment it is expressed. In regards to the notion of space, the limits of reasoning about any ideal definition would also constitute drives for further exploration of reality towards the worlds of the far-reached imagination.

2.2 Formation of Spatial Experience in Relation to Materiality

Spatial experience is constituted through interpretive operations in which the elements composing space are given significance respectively. Initially, an element is identified by sensory stimulations that are registered to the applicable sensory organs. The sensory organs act essentially as recording devices of the sensory stimulations, reductively of the elements stimulations derive. The perception of space is developed

[12] In General Theory of Relativity in 1915, Einstein developed the idea that space, time, mass and energy are in fact one unity, as each one is related to the other. Specifically, the presence of mater defines the geometry of space/time, as the field in which any phenomenon takes place, even mass itself: in other words, matter produces space/time in which matter takes place. General Theory of Relativity deals with space/time as a phenomenon that is equal to matter. In doing so, Einstein's Relativity Theory abolished the conviction of previous theories that space/time is presupposition of other events, generally of other phenomena occurring in it.

as the spatial outlining of the generic property of elements to be registered to any applicable sensory organ. Any of the attributes of space, either they are being instantly perceived or they are more intellectual, depend accordingly on the stimulations and the elements that are being perceived.

Any element is perceptible within certain distance, thus it may be attributed spatial significance in regards to the area within that distance. Spatial significance may be assigned to elements with solid material structure, particularly those so-called as primary spatial elements, as they are registered to the sensory organs. For example, a *wall* is mostly perceptible by the senses of vision and touch. Each of the wall's sides defines the areas in which it is perceived; in turn, the properties of these areas may be related to the sensory stimulations with which the wall is perceived. In fact, the wall suspends the free circulation of air as of any other element by telling apart the areas it defines. That would include people, animate and inanimate objects, odors, temperature, sound and light, generally of any sort of mass or energy. As a result, the spatial properties of these areas, either being perceived empirically or being more intellectual ones, at any point in these areas – in other words, in relation to an observer's position – depend on that wall. Hence, the view is directed towards the wall's one side as it is blocked to the other, as the wall also acts as referent to orientation. Respectively, the attributes of the areas defined by a semi-transparent wall may be somewhat related and meanwhile generally different to those of opaque walls, as the semi-transparent wall permits to some extent the optical communication of the areas it separates. A slab floor may define areas above and below it, which are perceived primarily by the senses of touch and vision. The ground floor has some properties that are quite special, for example that it is often capable to support a structure and also that by digging deep into it, a void area is created below its initial surface. Moreover, an area may be assigned respectfully to any other element that is perceptible. Such an observation would not be limited to the primary solid elements structuring space, such as a wall, a slab or a column, but it may be extended to include any other secondary element too, such as a billboard, a seat or a piece of furniture, in general every solid object, for example a cup or a pencil, as areas may be defined above, below, around, into or in any orientation in relation to that object, setting up the spatial properties accordingly.

Even more, the observation above may be extended to elements of any material structure, also to any sort of mass and energy. A gas for example occupies a particular area and is perceptible in that area by the senses of smell and occasionally of vision. Similarly, an odor defines an area; for instance, the space of kitchen or of bathroom may be defined in respect to its smell. A particular sound may also define space as the particular area in which it is audible, even being perceptible by any sound sensitive organ. In turn, the spatial properties depend on that sound, as the particular area actually extends to a distance in which the signal can be noticed. As with the case of sounds, light signals define the area it lights. In return, elements that are perceived by any sensory stimulation in a particular area also characterize that area. For example, elements perceived by touch may define the area in which they are touchable, including solids (a surface or a handrail), liquids (the water of a swimming pool), even gas, especially if it is thick enough. The same may be even argued about elements mainly perceptible by taste. This may not be a common case, but in fact it is possible to distinguish between two pools filled respectfully with chlorinated and

salty water, by examining the taste of the water in particular. As a typical paradigm, we may bring to mind how blind people actually perceive space, primarily by hearing, touch and smell, similarly to anyone in case of absolute darkness. In general, any space and its properties may be reduced to the sensory stimulations by which elements of any material structure are being registered to the applicable sensory organs.

Respectively, an element may be attributed spatial significance in relation to its potential to influence the properties of the particular area in which it is perceptible. Thus, a wall may be assigned spatial significance, given that it influences the properties of the areas of its two sides. As we move closer to the wall, its spatial significance increases along with the intensification of the stimulations it is perceived and with the increasing of its influence to the properties of the spaces it defines. Accordingly, the wall's spatial significance diminishes as we move away from it and is practically ignored as the wall is outside of our sensory field or if it disappears. In this case, the spaces that were once separated are now vanished, joined, or replaced by a different space that is defined by other elements. Hence, spatial significance may be assigned to sonic signals as to any other ones, as the properties of the emerging spaces depend upon the intensity, the duration and the distance from the source of emission. Therefore, an element may be assigned spatial significance as long as the properties of the specific area in which it is perceived are influenced by the sensory stimulations it incites.

The perception of space at any of its points is constituted as the aggregate of the spatial significances of all of the elements perceived in that point. For example, spatial significance is assigned to a wall with an opening. When a window or door is opened, then the areas separated by the wall begin to communicate through that opening. The opening gives the potential to unify the two areas to some extent. On the other hand, when the opening is shut, the two areas are being separated, as if it did not exist in the first place. Thus, the opening acts temporarily, periodically and contrary to the primary functioning of the wall. The counter functioning between the wall and the opening may be explained with the observation that volumetrically the making of the opening equals to the subtraction of part of the wall, in other words to the local absence of the wall in the place of the opening. For the perception of space, various elements acting simultaneously are considered, for example in case a wall intervenes in the field of power of a sonic, light or other signal. If there isn't any obstacle, then the properties of space as the field defined by a signal weaken gradually by moving away from its source, along with the gradual diminishing of the signal's intensity. By inserting an opaque wall in that space, the signal is abruptly interrupted, as any of the spatial properties due to the signal are significantly extinguished in the wall's shadow field. If the wall is semi-transparent, then one may observe sudden variation of the intensity of light and respectively of the spatial properties due to light, at the other side of the wall. In fact, as the light goes through a semi-transparent wall it gets filtered, but it still influences the properties of the spaces of the wall's both sides. Any element generally influences the intensity with which other elements are perceived. In consequence, the spatial significance of any element also depends on other elements that are perceived at specific point of space. The perception of space at any point is constituted as the aggregate of the spatial significances being distributed to each

element that is perceptible, as an element may influence the intensity with which other ones are also noticed.

As it follows, any of the properties of space at specific point may be related to the spatial significance assigned to each element that is perceptible. For example, we may call upon the duration of space, i.e. its significance in relation to time, as the aggregate of the distributed significances of the elements from which it depends in regards to the time these are actively present. We may claim that any element affects varyingly the properties of space and is responsible for their change. In a similar manner, we may also describe various technological devices, such as a television set, a sound system or even an illuminated billboard. Any technological device may be assigned spatial significance primarily in regards to the visual and sonic signals it emits. Specifically, technological devices affect the properties of space temporarily and periodically, depending on whether they are switched on or off. We may call any element operating temporarily or periodically as spatial substructure; such a term would generally refer to the capability of specific elements to reveal, vanish, or transform space, accordingly to influence temporarily some of the spatial properties when they are in operation. The spatial properties would return to a previous condition if any of the elements that were responsible for a spatial transformation is no longer active, or if it disappears: for example when a wall is demolished, or an opening is shut off, also when a light or sonic source no longer emits signals, or a technological device is switched off. Therefore, the properties at specific point of space depend on the sensory stimulations that are registered in that point, respectively on every element that is perceived.[13]

Any element affecting any of the spatial properties may be called as a "spatial generator." Such a term would describe an element in regards to its spatial significance. As spatial generators we may call any of the solid elements, for example walls, floors, roofs, columns, semi-transparent walls and every other object. Additionally, as spatial generators we may call all kinds of liquid and gas and also the elements describing electromagnetic phenomena, for example sonic, light and electrical signals. The spatial significance of electromagnetic signals may be related to their capability to influence the properties of space as they transfer energy from the source of emission to the applicable sensory organs. In particular, any solid object may be described in similar to liquids, gasses and electromagnetic fields, as it also defines space with its volume. Hence, a solid object yields to its volumetric space distinctive attributes in relation to the properties of its material, also affecting the

[13] In an attempt to attribute to space significance in regards to time, we may deduce that perceptions of space and time constitute the unified perception of space/time. Any of the properties of space/time, such as the distance it is extended and its duration, depend on the sensory stimulations that are registered in it. In fact, beyond, before and after the specific space/time in which stimulation is perceived, no change is registered, thus any limit or distinction about space and time in reference to that stimulation becomes impossible. Evidently, in order to make such observations no other measuring system of space and time is in charge, as such systems presume other elements as referent ones. Space/time in which matter is distributed is being outlined exclusively by the potential to register matter as mass or energy, in accordance with Relativity Theory. For simplifying purposes, the present inquiry focuses on the issue of spatial experience, whereas we may keep in mind that a similar approach may be applied towards the experience of time.

properties of sonic, thermal and other waves that are transmitted through its mass. Thus, the perception of space may be described in relation to the sensory registration of elements of any material state, as a mass/energy phenomenon, in analogy to the Special Theory of Relativity. Therefore, elements of any material state may be called as spatial generators, as they influence the properties of space, also contributing to spatial experience.

In summary, we may describe overall spatial experience in relation to the registration of all perceptible material elements to the applicable sensory organs, as we assign spatial significance to them. Any of the properties and meanings of space, its transformations, even the duration it exists, may be reduced to the stimulations with which every element of it registers to the sensory organs. For the perception of space, at any of its points all elements that are perceptible are compared to each other and are assigned relative spatial significance. Specifically, any characterization of elements, such as primary or secondary, depends on the relative intensity by which it influences the properties of space over other elements. Thus, the spatial properties may be described as resultants of the interaction among the elements that are perceptible, in regards to the spatial significance that they may be assigned. Such a description of perception about space would underline the basic attribute of any sensory stimulation to refer back to the element it derives from. Any element that is perceptible contributes in the formation of spatial experience and for this reason it can be called as spatial generator. Such a term would describe the rather self-evident attribute of any element to be registered to the applicable sensory organs. In conclusion, any element is perceptible within specific area and also influences the properties of that area, thus a specific space may be outlined in relation to the influence of its properties due to an element. With the proper sensors, measuring systems and scales, it would be generally possible to approximate the degree of influence about an element in regards to the properties of space at specific point, also in relation to other elements; hence any element may be assigned spatial significance comparatively. The perception of space at any point may be described as the aggregate of the spatial significance distributed comparatively to every element that is perceptible in that point.

3 Extending the Meaning of Reality Beyond the Capability of Recognition of Material State

The idea that any element contributes in the formation of spatial experience may also influence our general understanding on spatial elements and more importantly on the notion of *space*: how we perceive space, how we assign spatial significance to elements, also how we distribute our activities, communicate and interact in relation to and within space. Spatial experience is formed intellectually as the outcome of interrelation among various sensory stimulations, in respect to the elements they derive from, which may be any of the so-called primary spatial ones, such as walls, floors, roofs, openings and columns, as well as elements of any material structure, even identified as mass/energy phenomena. Moreover, the formed relationships among various elements may be organized in hierarchical orders. In regards to their spatial significance, some elements may appear to be more active, permanent,

primary, dominant and subversive, whereas other ones appear as more discrete ones, also temporary, periodical and secondary. The perception of space is being developed accordingly as an especially complex, fluid, dynamic and constantly re-evaluated phenomenon setting up spatial experience.

In reverse, the perception of space may be reduced exclusively to the stimulations with which every element is registered to the sensory organs. The event of registration of stimulation to a sensory organ, the retina of the eye, the membrane of the ear, the mechanisms of touch, the addends of taste and smell, also to any natural or artificial organ, may be described as the moment of exchanging with the world, in which matter in any of its form is being transferred from the element source to the applicable organ. Any subsequent characterizing of elements, as assigning significances to them is the result of interpretive, comparative and evaluative operations, being varyingly conscious ones, as they may be founded upon definitions, common agreements and hypotheses, establishing general criteria. For the characterization of an element as real, such criteria may be ascended to the Aristotelian principle about material substance. An element's material substance is defined along with the classification of its material state according to the known ones as a mass/energy phenomenon, also indirectly through space-time transformations, even as a material state in constant transformation. The perception of space may be developed respectively, in consent to the Aristotelian principle about material substance. In Physics, the Aristotelian principle is adapted particularly in regards to the inseparable relationship and dependency among space, time, mass and energy, also expressed by the General Theory or Relativity. Therefore, also in reference to the relationship between spatial experience and the sensory stimulations, spatial significance may be assigned to elements of any material structure, as long as these elements are empirically or scientifically recognized.

The notion of "space" may be extended respectively, so that space would not be defined only by solid elements, especially by those often described as primary structural ones. Descriptions of space as a vessel that carries, facilitates and shelters any activity, also as a presupposition upon or into which life is being performed, are clearly inadequate ones. To the elements making up space we also ought to include generally anything that is registered to the senses, such as any reflection, mirroring, mirage, hallucination and illusion, additionally anything belonging to virtual, digital, interactive and alternative worlds, also to holograms, films and any narration or games of all kinds; in short, anything that may be called as an apparition.

Accordingly, characterizing space as real is the outcome of evaluation of the related attributes of the elements composing it, including but not limited to materiality. The capability to recognize the material state of elements is supported by empirical and scientific methods. Any of the common scientific methods would generally be founded upon descriptive and comparative evaluation of the elements' properties. During a scientific evaluation process, an element would essentially be reduced to numerical data according to preset measuring systems and scales. Scientific evaluation would add validity to proclamations about elements on whether they belong to the given world or to an apparition in regards to their material state; in effect, scientific evaluation would offer a generalized description about reality, being composed by elements of any material state.

Recognition of materiality is essentially grounded on the Aristotelian principle, as it has been expressed and updated according to any scientific significance it has been given in Physics. Specifically, along with the evolution of scientific research, at some point it has become possible to register new phenomena whose physical behavior was similar to that of elements with recognizable material structure. In effect, it was possible to describe new phenomena, as for example new material states in constant transformation; meanwhile related theories have been developed to describe these new materials in Physics, such as Relativity Theory. Thus, the capability to recognize the materiality of any element at a given moment was extended in response to new scientific discoveries, which in turn contributed to scientific evolution. Such a remark underlines the undeniable fact that evolution in Science presupposes that at certain point, timely current beliefs are proven to be inadequate or limited.[14]

By projecting the remark above in the future, by experience it is very likely that along with scientific progress new elements as new phenomena will be discovered, so that none of the scientific definitions of today describes them adequately. It is reasonable to claim that up to a future moment, it would have been impossible to describe such elements in regards to their materiality as anything else than immaterial ones, thus being nonexistent. Meanwhile, it is common that materiality cannot be found in abstract elements with varying significance, such as in concepts and ideas. It is also common that only part of the overall experience is scientifically explained. In general, experience is scientifically described only to some extent by theories, which are being formulated and extended accordingly to meet with any discovery. Thus, we may generally observe that scientific knowledge is being constantly challenged by processes of scientific, empirical and intellectual examination. As it follows, the process of explaining anything new is framed by the prevalent beliefs of the specific moment in which such they take place. In other words, at any moment any definition, significance, meaning, belief, or view, even those being scientifically complete, is still likely to be reconsidered; in general, everything man believes even with overmuch confirm in a given moment, due to new data, facts, precise measurements and advanced methods, is subject to be extended, supplemented, even updated.

The perception of space is respectively developed under processes of intellectual elaboration, comparative evaluation and assigning spatial significance to all elements that are perceptible. Along with scientific advancement in Physics, from time to time new elements have been registered to any sensory organ, so that it would have been impossible before. Up to a certain moment, such elements would only be characterized as immaterial ones. Then, in order to attribute spatial significance to these elements too, for the formation of spatial experience we also have to consider

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[14] Such an inadequacy is often manifested as deficiency initially upon a belief that is currently dominant in the broader social setting, as later on it is expressed within the related scientific domain. Accordingly, within the scientific domain new discoveries and innovations may emerge, which in turn are distributed back to the social setting and gradually cultivate a new belief as response to the initial inadequacy. Bijker, Hugles and Pinch analyze the specific issue, thus attributing to the content, the causes and aspirations of Natural Sciences social significance. See Trevor J. Pinch and Wiebe E. Bijker, "The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," *The Social Construction of Technological Systems*, W. Bijker, T. Hugles, T. Pinch eds., (Cambridge: The MIT Press, USA, 1989), p.20-28.

stimulations currently being characterized as false ones. But, characterizing any stimulation refers to the properties of the element it may derive from, including characterizations of elements such as real, material, immaterial, nonexistent and hypothetical. In other words, characterization of stimulations is the outcome of intellectual elaboration, comparative evaluation and assigning significance to elements these stimulations may derive from. As it becomes evident, any characterization of stimulation depends on the characterization of elements and vice versa, as characterization is no inherent to either stimulations or elements.

In conclusion, it can be argued that whether it is about the world we call to be material, real and existing one, or about the worlds which are currently limited in the computer and the Internet due to the present phase of technological evolution, or even about the hypothetical worlds of the far-reached imagination, for the characterization of elements as real ones and independently from any of the criteria that may be used for such a purpose, we may point at certain conditions of confusion that are still present and active. By extending the meaning of space in accordance with the defining of materiality in Physics – in relation to Relativity Theory and its applications, as at certain moments it becomes possible to register elements that up to then could only be considered as hypothetical ones – it may be claimed that what is considered as *reality* in a particular moment, in a future moment it will be considered as a deception. In reference to any of the common beliefs about reality, it becomes necessary to reexamine the following ambiguities:

Deception is likely to occur during the sensory registration of stimulations to the sensory organs. The event of sensory registration may be considered to be distinct from the characterization processes of stimulations and likewise of elements. Characterizations about an element are not inherent to it, being based overall on judgments upon comparing its attributes to those of other elements. Thus it is likely that in regards to materiality an element is characterized differently in respect to different moments, based upon other judgments, criteria and methods of evaluation. Deception may also be at stake due to beliefs upon materiality that are being established empirically over time, meanwhile having scientifically been declared as outdated. Deception may be completed upon our silent aversion towards a realization that is now common; that is, any belief, even the most prevalent ones, is still framed by the scientific, historical and social context in which it is developed. In other words, the limits of expansion about a belief are at the same time ones of restrain, as they inevitably expel everything that is outside of human's capability to predict up to the moment a belief is being crystallized. As a consequence, deception may be ratified by the establishment of general beliefs, whose validity is mostly often fortified by scientific and empirical knowledge, meanwhile falling inevitably to the restrictions of any activity of humankind.

If the hypothesis that today we are experiencing a deceptive reality appears to be impossible, then we ought to reconsider that in any attempt to describe reality it is inevitable to emphasize on certain significances referring to commonly accepted definitions, meanwhile debasing other ones. As it follows, out of the overall experience, upon which the signifying range about reality is being set in total, materiality is often presumed to be a major criterion. However, such a hypothesis is improper for the following reasons:

Firstly, the possibility that reality also contains elements with material state that is currently unknown is not dismissed. The fact that pleads to the contrary is that due to scientific research it has often become possible to register new mass/energy phenomena bringing about new material states and extensions of the notion of materiality. In other words, as much the registration of mass/energy phenomena leads to an element's recognition, meanwhile it is grounded to the capability to register such phenomena in Physics at a given moment, a fact showing that scientific judgments are historically contingent. Moreover, referring to materiality as the sole criterion to define reality outlines results that are in principal restricted within the domain of Physics. Meanwhile, in a linguistic approach, although the adjectives *real* and *material* carry certain meanings that are similar, they are still etymologically and interpretively different. Besides, upon the assumption that any of the complex and multidimensional relationships of reality can be described in regards to materiality, then reality would be generally different, based on the capability to register materials in Physics at different moments. Hence, it is strictly acceptable that any significance to reality in reference to specialized definitions has validity in principle within the scientific domain in which that significance is given. Although transferring significances among different sciences and their applications is often useful, meanwhile the validity of any outcome is not guaranteed by it.

In contrast, if for the broader definition of reality materiality were the sole criterion, then such a view would silently adopt the proverb that the variety of meanings of reality ought to be restricted by any of the definitions that is timely current in Physics. At the margins of such a statement, at least one would compensate with the fact that it is still possible to describe reality in various ways, with certain ones being particularly convincing. Thus, it is currently possible to describe reality in full extent – including every object, idea and activity of it, even our own selves – by converting all of its elements to data. For example, reality may be described as one possibility out of infinite numerical combinations, which has gradually given "flesh and bones" due to digitalization processes. Such processes would include the assigning of significances to all elements, respectively by their deduction to numerical data and comparative evaluation. Additionally, we may verify similarities between such complex cognitive processes of the human mind on the one hand and those with which we made the computer "renders" the elements of the digital worlds; thereby we may even consider the reality in and with which we cohabit, as being digital.

– Besides, isn't the hypothesis above similar to the one presenting the given world as being totally unfamiliar, still so meticulously rendered, also true looking, but virtual, that is, the world of *The Matrix*?

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