ABSTRACT
Colour is architecture, object, painting, image, research, music, poetry, prose, city, landscape: it possesses physicalness, a body which requires to be analyzed both in its full shape as res extensa and in its inner being. It appears as a fundamental element in the representation of the nature and the territory, in its double immanent and becoming aspect. Colour is radiation, energy acting positively or negatively on us, even if we are not aware of it, and its action has to be felt and understood not only as an optical event, but as a psychic and symbolic action as well: indeed, man perceives the colour and plans it, giving it in both activities a visible and (in)visible dimension. The limit between visible and (in)visible is just where the colour takes shape and what the observer perceives, with distinction, both as a recognition and as an inescapable destiny which connect him with what he observes or creates. Therefore, the challenge is to proceed, through the colour, through the various stages of opposite concepts, visible/invisible, identity/misinterpretation, present/future, representing a lived place, that is a picture of life as a whole of organization forms of the elements surrounding us and it is examined through the prism of a society.
Keywords: Network, Multicriter@, multidimensional colour, (in)visible colour

The landscape today, as it unfolds before our eyes, is complex and divided. It is difficult to represent and describe as it is articulated and disassembled on a complex network of semantic fields characterized by the coexistence of heterogeneous elements and overlapping signs and traces. This makes it difficult to display a synthetic image that can express its meaning in a clear and readable manner. The local networks that describe reality for us and are themselves networks of information overlap and create sometimes unexpected visual and symbolic relationships between objects directly produced by man and traces of natural processes preserved in the ground. The secrets, signs of the passage of time and interpretive schemes that originate from fragments of history are layered and overlap, and, over time, each new element overlaps the other without completely erasing the earlier signs. This landscape, understood as a complex system of spaces, forms, signs, sounds, colors, symbols and traces, is the link through which we access the history and memory of places, environmental and cultural values and their inherent
dynamism. Through a careful multidimensional analysis and interpretation of the elements discovered, understood as reflecting the material culture of the territory, the past, present and future unfold before our eyes: in fact the traces of past and present events give us a glimpse of the possible futures of the places.

The earth reveals itself every day with an endless array of colors, signs, symbols and nuances. It enthralls and catches our eye daily: and what our senses perceive is a mixture of feelings and emotions that are nothing more than the harmony and balance created between artifice and nature, both past and present. What we observe in fact is not a simple summation of natural, architectural and symbolic elements, but a comprehensive package of all the constituent units in our territory. Man and nature have contributed to the ongoing definition of reality, pursuing a delicate balance that has led to the articulation of the scenarios as we perceive them. This synergy between man and nature has often led to the definition of images and views as articulated and detached as frames of a single narrative; identifying and representing a very specific place.: The many aspects of a territory or a location that we investigate therefore define the identity of a place and at the same time jealously guard its memory.

The tools available to individuals for communicating and interacting within the tribes and primitive forms of civilization, have always been among the most important aspects of human life and the primary requirement for survival. Even before the invention of the alphabet, primitive peoples and civilizations expressed themselves through images, signs, symbols and signals, usually with the help and support of colors, to which they attached precise meanings. Color is a means of connection between the world and its meaning, between the individual and the culture he belongs to and, according to the use made of it, transmits cultural and anthropological differences as well as codes and symbolism.

Man has always used color as a symbol and in ancient times, the more a society was strong and organized the more color was used and its symbolic meanings were defined.

The indelible traces of the communication links established between individuals went beyond physical locations. They spanned geographical boundaries and established spatial-temporal relationships between seemingly distant generations. All these apparently unrelated signs, shapes, colors and these graphic traces to be collected and re-established belong to the DNA of the territory. They were created in a particular environment and assume a semantic value in accordance with the evolution of the place to which they belong. They are mainly the product of a sometimes
contradictory usage of land by very different social groups.
Every place is in fact an expression of a particular society that is strong there and that strongly identifies with the
context in which it has evolved: this context has an identity, a material and immaterial order and symbolic meanings
that reflect its norms.
Measurement, therefore, is at the root of all knowledge and representation of the physical and intangible values and
the recorded traces of the location and its biological evolution based on its environmental context. Measuring and
capitalizing on the infinite reasons of nature, as Leonardo suggested, is to recognize the genetic heritage, the names
of places, the foundation of this continuous process of restoration and regeneration as a modification against any
prospect of change. To understand, therefore, the general organization of places, but especially also to prefigure
their protection and regeneration, requires an innovative methodology to study the area that, starting with the identity
of places, returns to them and represents them as a homogeneous set of elements in order to restore them with a
meticulous representation or discretization and measurement, capable of expressing tangible and intangible values.

Human beings have always regarded colours as symbols, associated as they were to the natural elements lying at
the heart of the primeval conception of the universe. Ever since prehistoric times, human beings have manipulated
what they were given by nature every day, mixing clays, squeezing plants, grinding stones, in the attempt to leave a
coloured trace testifying their presence on earth, recording moments of their lives. The remains discovered in Altamira
(Spain) and Lascaux (France) together with the parietal paintings in Hierakonpolis (Egypt) prove that ancient paint-
ers were skilful and clever at finding and blending colours. At the beginning they only collected them from the places
where they settled down, but afterwards they managed to achieve a wider and wider range of colours thanks to accurate
researches and experiments that slowly led to a scrupulous and refined chemical composition of pigments.
From these early experiences of the individual with nature and the environment around him, the concept of color was
conceived and developed in our mind and created an image of itself. Each color adheres to unconscious themes, acting
on emotion with attraction and repulsion, expressing mental and emotional attitudes in preferences or in rejection, it
displays intense and ambivalent language, reflecting the individual and the image of the world and becomes a place of
real and unreal. And its understanding is born of conventions dictated by experience, that the color is between two poles
and stems from the tension that is generated between identity and misunderstanding. Color, in fact, originates in a par-
ticular environment and becomes a semantic value in accordance with its evolutionary process. Depending on different
cultures, the symbolic meaning of color changes on the basis of different religious philosophies and on socio-cultural
factors. For this reason, based on our experience and our evolutionary process, certain colors do correspond to certain
names and characteristics that endow them with a precise identity and inevitably cause misunderstanding, because in
another setting, in a different context, or in different time-space conditions, our assumptions may prove invalid.
An example of how color conveys in tangible form the heritage of the past and at the same time is a living place or a part
of life - a whole of organized forms of the elements that surround us examined through the prism of a civilization - is of-
erred by the city of Pompeii (Campania, Italy), the object of our study, part of the main project conducted by the Faculty
of Architecture (Second University of Naples) and Benecon Centre for Cultural Heritage, Ecology and Economy.
The city buried by Vesuvius in 79 AD, has continued for centuries and millennia in an excellent state of preser-
Pompeian colors, an extraordinary testimony of civilization, came slowly back to light: bright colors, covered suddenly with lava and ash until they completely lost the visible component, gradually emerge moving silently along the streets of stone excavated by skilled hands. These colors reveal the location, but also the conditions and characteristics of the context in which they occur, the topos of a lived in place or a part of life as a whole of organized forms of the elements that surround us examined through the prism of a civilization.

By revealing the truth they then give us a picture. And where is the image formed, in which topos if not in the mind/soul where knowledge is fertile humus of that model that orders and compares a mass of information with a series of reports, defining the objects as a matter of perception merely designed and judged by the mind itself? And to understand and comprehend the world around us better, with the colors and shapes that are its own, we must measure and represent it in its $n$ dimensions; for a knowledge of that which exists and that which will be, beginning from the complex and proceeding through the discretization and measurement of all components that constitute reality itself, in order to put it back inside of a whole new reality, to date.

Going through city streets, passing by places where artificiality and nature get mixed up, we gaze upon more or less details depending on the level of our attention; in doing so, our gaze turns into an act meant to acquire some knowledge of the urban sceneries that surround us. In fact, at first we tend to notice the appearance of the things that catch our eye, the “skin” of buildings and objects, and then we further and skillfully analyze the beauties created by nature and human beings. Colours, like a thin veil that seems to hide objects and artefacts and is often ignored and underestimated by observers, actually contain a great deal of material and immaterial information. We are unconsciously used to believing that colours cover objects,
thus concealing their essence, their core, and then fade away slowly beyond appearance (the word “colour” – “colore” in Italian from the Latin “colos” – has the same etymological root of the Italian verb “celare” meaning “to hide, conceal, cover”). Nonetheless, colours do not conceal, they actually unveil and reveal what is sometimes apparently invisible.

In order to uncover the many facets of colours, we need to view them as complex systems to be represented in their n dimensions [1]. Therefore, while regarding colours as complex systems, we also need to take into consideration every science in which they are involved: when dealing with physics, optics, chemistry, acoustics, anthropology, etymology, symbolism, psychology, digital, a methodological approach is necessary to fully understand such an articulated world.

In fact, within each colour, many different semantic levels and languages coexist and interact, which we do not generally find in other visual variables: material/immaterial, analogical/digital, anthropological/biological, material/symbolic, physical/metaphysical. These elements seem to be in contrast with each other, but their interaction determines both the intrinsic and extrinsic qualities of the colour itself, in the infinitesimal space on the border between the physical and the psychical where sensations and perceptions merge into one another.

Still today, walking along the insulae in Pompeii, through the bricks, the cocciopesto (variable ground terracotta) and the remains of decorated plaster, is a unique and evocative experience. You can almost experience life as it was in ancient times, you are ravished by the beauty of the surfaces and of the chromatisms invading and pervading urban and architectural spaces.

With the AD 79 eruption of Mount Vesuvius, time stopped and a wave of heat hit the town with temperatures probably ranging from 300° to 400° (degrees centigrade) that bluntly interrupted the life of people and, at the same time, the life of the whole town like in a freeze frame shot. The colours that you can see nowadays in Pompeii are consequently the (biological, physical, perceptive, chemical, etc.) result of the passing of time; they were slowly allowed to re-emerge, gradually unveiling the visible and invisible, whereas the invisible stands for something that only a skillful and wise gaze can grasp. The Vesuvius’ red lava covered the town and, once it got in contact with the paintings of the frescoes, it triggered a series of reactions involving the pigments and the powdered minerals contained in the clouds of ashes and lapilli which possibly changed the original colours. However, the same process did not occur in the colours kept at the many shops scattered in the town that were found as they originally appeared thanks to the protection of the materials containing them: after more than two hundred years of excavations, several colours were discovered in the same conditions in which they were sold at the time, and such samples are currently preserved at the “Antiquarium” of the “Museo Nazionale” in Naples and at warehouses in Pompeii. What came to light was a town blocked at the very last moment: you could still perceive life as it was in ancient times, with the shops and their goods, their profits, and the colours and jewels remained almost unchanged that seemed to rise again. These findings enabled scholars to carefully and accurately analyze perfectly-preserved fragments of real life, and they also allowed an examination of samples that were no longer directly drawn from wall paintings, as they used to be, but rather examined as they were soon after mining – when natural – or after manufacturing – when artificial.

Selim Augusti [2] elaborates a complete survey and catalogue of the colours discovered, identifying their nature and composition, highlighting their correspondence to the colours mentioned in classical texts and recognizing manufacturing means and methods. The goods sold in Pompeii in those times, and later discovered during excavations, were catalogued, analyzed and classified by the author thanks to some analytical techniques such as: microscopic
examination, microchemical analysis, mineralogic examination, spectographic examination, infrared spectographic examination, x-ray diffraction spectograms.

Among the colours that were found in Pompeii, shades of red are certainly the largest group offering a wide range of different nuances from bright red to brown-red, from orange-red to dark red, light red, and pink, going through all the nuances in-between. One of the most well-known pigments since antiquity is cinnabar that is chemically constituted by mercury sulphide (HgS) and corresponds to a colour that was then called minium. This pigment used in ancient Pompeii features a colour going from scarlet red to brown-red, with an adamantine brightness.

In ancient times pigments were used very often to colour several different vehicles: many were used to embellish and decorate houses, as it happened in Pompeii where this dark red was usually employed to cover the background of paintings and achieve a uniform red colour for drawings. Pigments are coloured substances, insoluble in the vehicle they are applied to, whose colouring function derives from the mechanical dispersion in the pigment itself. Therefore, their characteristics are different from those of colourings that, instead, are soluble when applied and are fixed afterwards by a process that makes them insoluble. Another difference is linked to application methods: colourings dye, while pigments colour. Moreover, pigments tend to adhere to the vehicle to be coloured and they sometimes form real chemical bonds, whereas colourings, on the other hand, tend to penetrate the vehicle with which they normally form real chemical bonds.

The structure of cinnabar, in particular, is that of a crystal, similar to salt sodium chloride (NaCl) but it is also different from it due to a strong distortion of the crystalline structure. The cinnabar’s structure has a trigonal-trapezohedron shape, with low temperatures and low pressure; it turns into metacinnabar with high temperatures (344°) and an
atmosphere: cinnabar is red, metacinnabar is black.

From such assumptions, in some specific situations - like those that occurred in Pompeii, in the Roman Age, during the great eruptions of the Vesuvius - the pristine scarlet red colour is supposed to have turned into a brown-red colour featuring several intensities according to the different conditions. To this regard, many classic authors often focused their works on the behaviour of some substances when exposed to heat: Vitruvius himself describes the minium as a beautiful but subtle colour and writes that, when it was used to paint externally, for example peristyles and exedras or other objects subject to atmospheric agents, it got modified and became black. Consequently, when it was to be employed for wall painting, some punic wax tempered with oil was necessary in order to avoid changes. Such expedient was of fundamental importance since wax, and especially the oil that was added to it, prevented lime from affecting the cinnabar thus modifying it, and at the same time it formed a waterproof external wrapping preserving the colour from atmospheric agents.

On the whole, as a consequence of the massive impact of the lavic mass and its high temperatures on the walls of houses in Pompeii that were often coloured with the pigment of cinnabar, there was a significant increase of the pressure in the interfaces between walls and lava, together with a thermal increase that favoured the partial turning from cinnabar into metacinnabar, with a simultaneous and gradual colour change from red to brown-red. Such a modification is supposed to derive from the partial change of the crystalline structure of the mercury sulphide. However, a team of Italo-French researchers has studied four samples of the frescoed walls of Villa Sora near Torre del Greco by using the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, in order to monitor the chemical processes taking place on the walls, and they excluded the presence of small quantities of distorted crystalline structure associated to metacinnabar.

Although researchers confuted the classic explanation concerning the blackening of cinnabar, researches on the ancient red pigment are far from being complete, and scientists keep on investigating the reasons why red walls in Pompeii became black.

In order to distinguish a colour, we need to see it close to other colours and other elements within the visual field, but, above all, we need to view it on a(n) (in)visible conceptual background where all immaterial components converge. Indeed, colours only exist insofar as they are viewed and experienced by human beings. They originate from the synergy and synthesis between natural and physical components, the physical and
material properties of objects, the observer’s mood, the general conditions, the cultural context, the social status, the biological conditions, experiences and aspirations, which jointly affect the way you see and represent the world. As a matter of fact, all objects, even those that are apparently monochrome, never feature just one colour, but rather multiple colours, as many as viewpoints and spatio-temporal conditions.

The town of Pompeii offers heterogeneous scenarios and linguistic codes that highlight the chromatic flattening of present-day languages when compared to the chromatic harmony of ancient times. The Holy Pompeii is opposed to the contemporary town for its shapes, colours, and symbols, something that clearly depends on the different techniques and purposes in applying colours on surfaces: in fact, colouring the surface of an object, namely painting, enamelling, varnishing, etc., is different from depicting an image on a surface: these two activities greatly differ [3]. A number of elements, like the passing of time, the coloured substance of pigments, solvents, the spreading modes, the quantity and quality of the light hitting the surfaces, the background and both material and immaterial contexts, have all contributed to achieve the final outcome in the Holy town of Pompeii. In order to deeply understand them, we need to investigate our objects of enquiry with a comprehensive and integrated approach.

A careful study of the heritage of Pompeii signs and de-signs which tell at the same time contemporary stories as well as stories of times gone by, help in rendering our territory competitive, with the objective to live it to the full and be actors and spectators contemporaneously.

The natural and constructed environment, before becoming a physical entity, is the knowledge of our expertise to date, which, when integrated, form the heritage to show, bearing the shape produced by man as well as the thought that originated this shape, in a word, the culture of the place. The genome, the complex of inherited characteristics contained in the DNA of the territory, expressed a sediment, an archetype that sometimes the desires and needs of man widen, lengthen and recompose.