University of the Aegean

Department of Product & Systems Design Engineering

Object inspired by natural environment for use in the domestic space in urban centers

Diploma Thesis

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CONTENTS

ΠΕΡΙΛΗΨΗ

Ο σύγχρονος τρόπος ζωής στις αστικοποιημένες περιοχές περιορίζει σημαντικά τη δυνατότητα για άμεση επαφή με το φυσικό περιβάλλον, με αποτέλεσμα οι άνθρωποι να αποξενώνονται από τη φύση. Η αποξένωση αποτελεί πρόβλημα και πολλές επιστημονικές έρευνες στοχεύουν στην επίλυσή του. Σύμφωνα με σχετική έρευνα, έχει συνειδητοποιηθεί ότι η επαφή με τη φύση δρα θεραπευτικά και ευεργετικά καθώς έχει τη δύναμη, μέσα από την οικοθεραπεία, να δίνει τη δυνατότητα στον άνθρωπο να διαχειρίζεται τα σωματικά και ιδίως τα ψυχικά προβλήματα υγείας.

Η οικοψυχολογία απευθύνεται σε ευρύ κοινό και στοχεύει στην ενίσχυση των δεσμών του ανθρώπου με τη φύση. Διατυπώθηκαν διάφορες θεωρίες με πολύ αξιόλογη αυτήν της βιοφιλίας, η οποία με την άμεση και έμμεση εμπειρία ενσωματώνει στοιχεία της φύσης σε τεχνητό περιβάλλον, τα οποία γίνονται αντιληπτά μέσω της ενεργοποίησης των αισθήσεων.

Στόχος της εργασίας είναι η κατασκευή αντικειμένων, σύμφωνα με τις αρχές της οικοψυχολογίας, που θα μεταφέρουν στοιχεία της φύσης στον προσωπικό χώρο, τα οποία θα βοηθήσουν το χρήστη να επανενταχθεί στο φυσικό περιβάλλον. Η επαφή του χρήστη με το αντικείμενο δημιουργεί αλληλεπίδραση με το φυσικό περιβάλλον μέσα στους θορυβώδεις και αγχώδεις ρυθμούς των αστικών κέντρων και λειτουργεί ως παρωθητική δύναμη για να βιώσει ο χρήστης την ανάγκη να ανακτήσει δια ζώσης, μέσω δραστηριοτήτων, την επαφή του με τη ζωογόνο φύση.

Πιο συγκεκριμένα, η διπλωματική χωρίζεται σε δύο μέρη. Το πρώτο αφορά στη θεωρητική προσέγγιση και στο δεύτερο εξειδικεύεται η εργασία σε στοχευμένα αντικείμενα -κατασκευές για τη μεταφορά της φύσης στους μικροχώρους του αστικού περιβάλλοντος.

Σχετικά με το πρώτο μέρος και πιο συγκεκριμένα στο πρώτο κεφάλαιο παρουσιάζονται οι έννοιες ψυχολογία, περιβάλλον, αίσθηση. Η ψυχολογία ως επιστήμη στοχεύει στη βελτίωση της ζωής του ανθρώπου μέσα από τη βοήθεια που του παρέχει ώστε να έχει τον έλεγχο των συναισθημάτων και της συμπεριφοράς του. Οι ψυχικές ασθένειες δημιουργούν δυσαρμονία στη ζωή του και ψυχική διαταραχή. Οι κατηγορίες των ψυχικών ασθενειών ταξινομούνται ως διαταραχές αγχώδεις, διατροφικές, ψυχωτικές, δραστηριότητας, ιδεοψυχαναγκαστικές, μετατραυματικού

στρες και άλλα. Τα ποσοστά εμφάνισής τους είναι ανησυχητικά και ευθύνονται σε μεγάλο βαθμό για την επιβάρυνση της υγείας σε παγκόσμιο επίπεδο, με το στρες αναπτυγμένο ιδιαίτερα στο δυτικό κόσμο, καθώς οι στρεσογόνοι παράγοντες του αστικού περιβάλλοντος και ο μεγάλος όγκος πληροφοριών και ερεθισμάτων οδηγούν στην ψυχική υπερφόρτωση. Η ψυχική ανισορροπία οδηγεί στην απομόνωση και στην αποξένωση από το κοινωνικό και φυσικό περιβάλλον. Η επαφή με την φύση, το υγιές περιβάλλον, φυσικό και κοινωνικό, μπορεί να επαναφέρει το άτομο στις αρχικές του ισορροπίες, ασκώντας θετική επίδραση στη συμπεριφορά και στις διαπροσωπικές του σχέσεις.

Το δεύτερο κεφάλαιο επικεντρώνεται στη «φύση», που αλληλοκαλύπτεται στην έννοια του φυσικού περιβάλλοντος και που προσφέρει ωφέλειες στην υγεία του σώματος και της ψυχής.

Η σύγχρονη τάση της ψυχολογίας, η οικοψυχολογία διερευνά πώς η έλλειψη της επαφής του ανθρώπου με τη φύση και η επανένταξή του σε αυτήν επηρεάζει την ψυχική του ισορροπία. Με ατομικές και ομαδικές συνεδρίες αποβλέπει στη θεραπεία της αποξένωσης του ανθρώπου από τη φύση και απευθύνεται στο ευρύ κοινό σε όλες τις ηλικίες. Μέσω οικοθεραπευτικών τεχνικών και μεθόδων ενισχύονται οι δεσμοί του ανθρώπου -φύσης με σημαντική θετική επίδραση στην υγεία του ανθρώπου, ψυχική και σωματική.

Οι θεωρίες για την ευεργετική επίδραση της φύσης στην ψυχική ευεξία είναι γνωστές ως ART, SRT και Βιοφιλία. Η θεωρία αποκατάστασης προσοχής (ART) στοχεύει στην αποκατάσταση της προσοχής με βασικά στοιχεία της αποκαταστασιακής ιδιότητας της φύσης στα εξής: απόσταση, απαλή γοητεία, έκταση, συμβατότητα και άλλα. Σύμφωνα με τη θεωρία ανάκαμψης από το στρες (SRT) η σύσταση του περιεχομένου της φύσης είναι συγκεκριμένη και περιλαμβάνει συγκεκριμένους τύπους φυσικών ιδιοτήτων ή χαρακτηριστικών που υποτίθεται ότι διευκολύνουν τη μείωση του στρες.

Τέλος, η θεωρία της Βιοφιλίας στηρίζεται στην υπόθεση ότι οι άνθρωποι έχουν εγγενή τάση να συνδέονται με τη φύση καθώς εκφράζουν κληρονομικά πρωτόγονες προσαρμογές. Οι ειδικές στρατηγικές εφαρμογής του βιοφιλικού σχεδιασμού σε τεχνητό περιβάλλον στηρίζονται στην άμεση εμπειρία με τη φύση, όπου επιδιώκεται φυσική επαφή με στοιχεία όπως: φυσικό φως, αέρας, νερό, φυτά, ζώα, φωτιά και τα

λοιπά. Η έμμεση εμπειρία με τη φύση είναι ιδιαίτερα αποτελεσματική στη σύγχρονη εποχή που την χαρακτηρίζει η αδυναμία των κατοίκων στα αστικά κέντρα να απολαύσουν το φυσικό περιβάλλον. Σ΄ αυτήν, ενσωματώνονται στο αστικό περιβάλλον στοιχεία όπως εικόνες της φύσης, φυσικά υλικά, χρώματα, σχήματα, μορφές και άλλα.

Όλα τα στοιχεία της φύσης γίνονται αντιληπτά μέσω των αισθήσεων, στις οποίες πέρα των πέντε βασικών προστίθενται και οι εσωτερικές αισθήσεις π.χ. του πόνου. Επικρατέστερη των αισθήσεων φαίνεται η όραση, καθώς ανάμεσα σε ανθρώπους με κοινές αναφορές αναπτύχθηκε ένας κοινός κώδικας των αντικειμένων μέσω της όρασης.

Είναι επιβεβλημένη η επένδυση σε μία σχεδιαστική παιδεία που δεν θα προάγει αποκλειστικά την οπτικότητα αλλά θα επιβραβεύει καινοτόμες προτάσεις που απευθύνονται σε όλες τις αισθήσεις, μία σχεδιαστική παιδεία που προϋποθέτει τον πολυαισθητηριακό σχεδιασμό και ανασχεδιασμό. Αυτή η διαδικασία υπηρετεί σε μεγάλο βαθμό την οικοπεριβαλλοντική ψυχολογία.

Στη συνέχεια εξετάζεται ο αστικός τρόπος ζωής και παρατίθενται στατιστικά στοιχεία αλλά και τα χαρακτηριστικά των χρηστών για τους οποίους προορίζονται τα συγκεκριμένα προϊόντα.

Στο δεύτερο μέρος εργασίας καταγράφονται αντικείμενα, ως συγκεκριμένες προτάσεις που στηρίζονται στον πολυαισθητηριακό σχεδιασμό (όπως καταγράφονται στο θεωρητικό μέρος), καθώς αυτή η διαδικασία στηρίζεται στην οικοπεριβαλλοντική ψυχολογία. Εκτενώς, πέρα από την οπτικότητα, δίνεται έμφαση στην ακοή με τη θεραπευτική και ευεργετική επίδραση των ήχων της φύσης.

Η παρούσα εργασία ολοκληρώθηκε με το τελευταίο κεφάλαιο, το οποίο περιλαμβάνει το στάδιο της σχεδίασης. Εδώ καταγράφηκαν βήμα-βήμα τα στάδια υλοποίησης, εμπλουτισμένα με παρατηρήσεις και επεξηγήσεις για τις σχεδιαστικές αποφάσεις και με οπτικό υλικό. Ξεκινώντας από τον βασικό ιδεασμό δημιουργήθηκαν τα concepts. Στη συνέχεια μελετήθηκαν και επανασχεδιάστηκαν σύμφωνα με τις παρατηρήσεις ώστε να είναι τεχνικά λειτουργικά και αποδόθηκαν όλα τα οπτικά στοιχεία που απαιτούνταν. Παρουσιάζονται τεχνικά ζητήματα που προέκυψαν καθ΄ όλη τη διάρκεια και πώς αντιμετωπίστηκαν. Στο τέλος, αξιολογήθηκαν τα concepts και

επιλέχθηκε το τελικό, με το οποίο προχωρήσαμε και στο οποίο έγινε και η τελική βελτιστοποίηση.

Introduction

The modern way of life in urbanized areas significantly reduces the possibility of direct contact with the natural environment, resulting in people becoming alienated from nature. Alienation is a problem and many scientific studies aim to solve it. According to research, it has been realized that contact with nature has a therapeutic and beneficial effect as it has the power, through ecotherapy, to enable people to manage physical and, in particular, mental health problems.

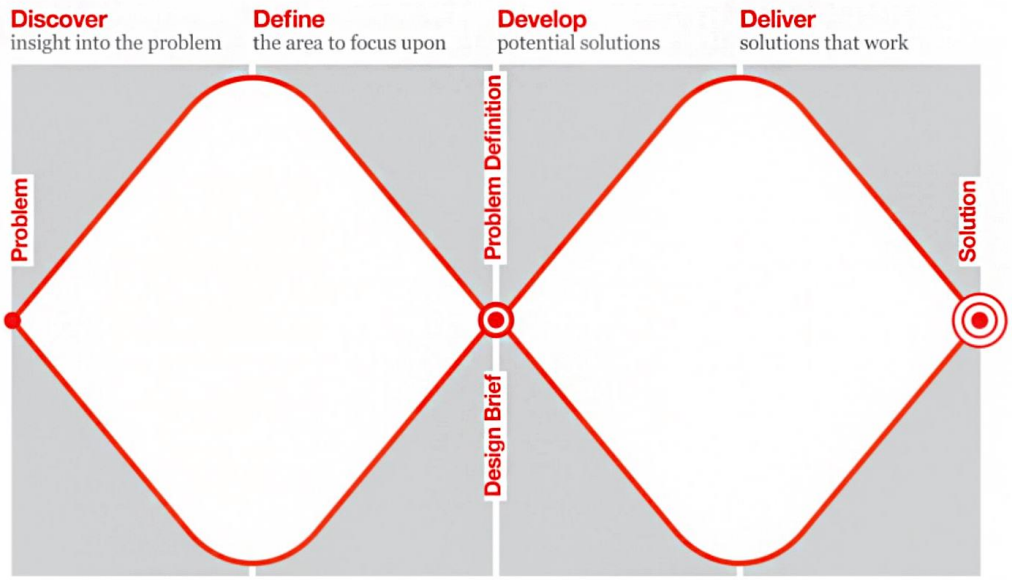
Ecopsychology is aimed at a wide audience and aims to strengthen man's links with nature. Various theories have been formulated, the most notable being that of biophilia, which, through direct and indirect experience, incorporates elements of nature into an artificial environment, which are perceived through the activation of the senses.

The aim of this thesis is to construct objects, according to the principles of ecopsychology, that will bring elements of nature into the personal space, which will help the user to reintegrate into the natural environment. The user's contact with the object creates interaction with the natural environment in the noisy and stressful rhythms of urban centers and acts as a driving force for the user to experience the need to regain contact with life-giving nature through activities.

Methodology

The methodology used to conduct this thesis is the double diamond model. This model is broken down into four phases which are:

- Discover data collection and research that will lead to the definition of the design problem.
- Define organize this information in order to define the problem space accurately.
- Develop test and select ideas and possible solutions.
- Deliver final stage of the design process where the solution is selected and tested. Delivering the final object.



In the first phase of the research process, information about the topic was collected through literature and observations. According to the methodology, an attempt was made to keep the information collection expanded to have an in-depth understanding of the various issues related to the central theme.

In the next part of the diamond area which is the define stage the most important elements of the preceding research was identified and we began to become more and

more specific on the design framework and the final purpose of the objects that would be designed.

So, in the next stage of development and delivery, ideation was done at the beginning to begin to identify the functions and specific characteristics of the objects that will be designed and then these ideas were concretized and began to take more and more complete form, in order to reach a very satisfactory point to be able to be evaluated in their effectiveness to meet our objective. Afterwards through this evaluation, the best item emerged with which we reached the final stage of delivery.

CHAPTER 1 Mental health and natural environment

1.1 Psychology

The term psychology is derived from the words soul and reason and can be analyzed as "the reason of the soul" or "the science of the soul". Although psychology is often presented as a new science, it has actually existed since ancient times in the sense of philosophy. Psychology, according to Foukis (2019), is the science that studies the thoughts, feelings, habits, relationships, behavior, dispositions, motivation, and creative action and functioning of a person in his or her environment. In other words, the research conducted by psychologists is based on observations made on human beings and results in laws that have general application. This means that the aim of the science of psychology is to improve man's life through the systematic observation of his behavior, gathering the necessary information that will help him to have control over his emotions and behavior towards himself and those around him. This system operates with a focus on the individual, including all those characteristics that have room for improvement in order to develop healthy relationships (personal, social, family, etc.) and to learn to live in harmony with oneself and one's environment. The search for the "artifacts" of the human soul and their importance has occupied humanity since ancient times, which we can see in Aristotle's rhetoric, "On the Soul" A 402a, 1-, *"In principle, we are of the opinion that knowledge is one of the fine and precious things, and that one science differs from another either for its accuracy or because its object is one of the highest and most admirable things. Psychology, however, for both these reasons, we may reasonably rank it among the first sciences. Next, it seems that the knowledge of the soul contributes very much also to the search for truth in general and, above all, for truth concerning nature. For the soul is in some sense the beginning of living beings."*

1.2 Types of Mental Illness

Mental illness is an abnormality in a person's psyche that causes pain or disability. It is a behavioral or thought pattern that is characterized by a peculiarity. This

specificity is determined by the type of mental illness. A mental illness may be related to a brain dysfunction or even a central nervous system impairment.

A mental illness affects not only the way a person feels, but also the way he or she thinks, behaves, socializes and perceives the world. In other words, the way he or she experiences everyday life.

A big step - a catalyst in the treatment of mental illness - is help from the person's familiar environment. Recognition and understanding of a mental disorder, as well as timely & proper guidance from a specialist, can improve the "burden" the person experiences and enhance their daily life.

Diagnosis is not always easy, and the patient usually experiences intense denial about what is happening to them, and as a result they refuse any help. According to the WHO (World Health Organization), the percentage of people who now experience a mental disorder of this nature is over 30 % of the world's population. Of course, the vast majority of cases occur in the advanced western world, which is understandably thought-provoking!

1.2.1 Basic Categories of Mental Illnesses

There are many different categories of mental illnesses, which are related to both the causes of the disorder and its manifestation. Some of the most important and widespread types of disorders are the following :

- *Anxiety Disorders*

Usually people who manifest anxiety disorder are characterized by excessive tension and stress in their daily life. They tend to respond to most situations with hesitation, fear, panic and suspicion.

An anxiety attack usually tends to be accompanied by physical symptoms that make its existence much more obvious. Intense sweating, palpitations, sleep disturbances, difficulty breathing or even panting. The anxiety attacks that affect this person can appear either in the form of panic attacks in everyday life, or even with specific phobias or anti-social behavior.

The main emotions that overwhelm a person with an anxiety disorder are intense sadness for long periods of time (even clinical depression), mood swings (from joy to sadness ... and vice versa), fear and insecurity.

- Eating Disorders

Eating disorders are all too common in the advanced western world and in people of all ages (from young children to adults). Like most types of disorders, eating disorders are not as harmless as most people think. On the contrary, they are just as serious as any other type of mental disorder and can even lead to the death of the individual. They manifest themselves with extreme emotions, behaviors and reactions that are somehow related to food. The disorder sometimes manifests itself in the form of bulimia and sometimes in the form of anorexia. The person is said to have absolutely no control over his or her emotions and thus over his or her eating impulses, which usually try to fill emotional voids. These people are obviously addicted to a particular way of thinking about food and try to remain completely faithful to it. Any discrepancy is a cause for intense feelings of guilt, guilt, shame, anger, aversion and low self-esteem. The most common types of eating disorders are anorexia nervosa, bulimia nervosa, orthorexia and opportunistic blameless disorder.

But that's not all. Usually people who manifest an eating disorder tend to be prone to more general addictions (gambling, sex addiction, kleptomania, drugs, alcohol, pyromania). They are unable to control their impulses at every level and in every area. They lack a sense of responsibility and have difficulty in interpersonal relationships.

- *Psychotic Disorders*

People with a psychotic disorder are characterized by a distorted view of the world and reality. They display extreme reactions and complex thinking. Usually this complex way of thinking and perceiving reality is enriched by hallucinations and fantasies. Non-existent and insubstantial images and sounds haunt these individuals, which they believe to be real and real situations.

Basically what we need to understand is what psychosis really is. A well-known psychotic disorder is schizophrenia. I am sure we have all seen movies related to it and have in our minds an image of how a psychotic person deals with the world. However, the symptoms that a person can manifest are many and varied. It is the

variation in symptoms that initially makes it difficult to diagnose the disorder. Sometimes the person seems to understand the absurdity of their beliefs, while at other times they accept this imaginary world that they perceive as completely real and existent.

Self-diagnosis is extremely difficult in a person with this kind of disorder. For this reason, monitoring by a specialist is highly recommended. The doctor will be able to guide the patient in the right way in order to control his compulsions and manifested hallucinations, and of course to reduce the symptoms that he manifests and make his daily life difficult. A trusting relationship with a specialist psychiatrist is a very important first step in dealing with the problem. This will eventually prompt the patient to seek appointments with his trusted doctor himself (on his own initiative).

- *Post Traumatic Disorders (PTSD)*

Post-traumatic stress disorder is a condition that occurs after (within a relatively short or long period of time) a strong shock, a traumatic episode, an intense psychological and emotional situation. Often this type of disorder is experienced by people who have been abused (sexually or verbally), people who have returned from a war zone, people who have suddenly lost a loved one or people who have survived an accident/robbery/natural disaster. The emotion that characterizes these individuals is usually the absence of any emotion, numbness, freezing and lack of interest in anything.

- *Obsessive-Compulsive Disorders (OCD)*

People suffering from an obsessive-compulsive disorder are overwhelmed by constant and persistent thoughts. Their fears overwhelm them and they seem unable to control their influence on their daily routine. Even their way of thinking is influenced by these phobias and directed by them. These persistent thoughts are always negative and impose special rituals (so-called compulsions) on the person. These obsessions do not allow the person to be calm, so that he is constantly possessed by an irrational fear that consumes him. Microbiophobia is a typical example of a compulsion that leads the person to constantly wash his hands, to be afraid to touch any surface in public, and even to fear contact with other people. Antisociality is a common symptom of OCD.

- *Personality Disorders (PD)*

A person with a personality disorder usually causes problems and episodes at school (if a child) or at work (if an adult) and in their environment and interpersonal relationships in general. It is a typical example of a person with antisocial behavior and usually paranoid personality. This is because the person's pattern of thought and reactions is in complete contradiction with the impositions of society. This results in an extreme and abnormal reaction of the individual, with behavior that resists what is imposed.

- *Mood Disorders*

Of course there are mood disorders, which is another very common category of mental disorders. This disorder is directly related to the emotional world of the individual. The most common disorders in this category are depression, bipolar disorder and cyanotic disorder. The dominant emotions are sadness and resignation. Very often a person may experience extreme joy-sadness alternation (characteristic of bipolar disorder).

1.2.2 Secondary Categories of Mental Disorders

- *Adjustment Disorders (ADHD)*

These types of mental disorders develop in the form of intense emotional or behavioral symptoms in response to a stressful event or a very intense situation. The situations that may trigger such a disorder may be exogenous and involve a car accident or a natural disaster, or they may be interpersonal in nature and manifest as a reaction to a divorce, a sudden death, a significant loss or even an addiction problem.

- *Dissociative Disorders*

Formerly known as multiple personality disorder. The person suffering from this disorder has severe identity and memory problems. He is not aware of his true self and also not aware of his environment. The disorder is usually associated with intense anxiety as a result of a traumatic event.

- *Somatic Symptom Disorders (Somatic Symptom Disorders)*

A condition otherwise defined as a psychosomatic disorder and manifested by high intensity physical symptoms. These symptoms are caused by an emotional or psychological factor and cannot be medically explained.

- *Tic Disorders*

These are rapid and repetitive movements or sounds that occur uncontrollably and naturally involuntarily.

1.3 Mental Health Status

Based on the predictions of the scientific community, an increase in the prevalence of psychiatric problems and difficulties is expected in the future. Based on the available epidemiological data from the World Health Organization on the prevalence of mental disorders (Elfeddali, 2014; WHO, 2017):

a) 1 in 4 will experience a mental disorder at some point in their lives.

b) It is estimated that 4.4% of the world's population suffer from a depressive disorder and 3.6% from an anxiety disorder. The total number of people of all ages living with depression in the world is 322 million (increased by 18.4% between 2005- 2015). Depression is one of the leading causes of disability in the world.

c) Anxiety disorders are ranked as the sixth largest cause of health loss worldwide. The total estimated number of people with anxiety disorders in the world is 264,000,000 (increased by 14.9% from 2005 to 2015).

d) In the year 2015, an estimated 800,000 people lost their lives due to suicide and many more attempted suicide. This represents about 1.5% of all 17 deaths worldwide (the leading cause of death in 2015). It was the second leading cause of death of 15-29 year olds globally in 2015. Prevalence rates of mental disorders globally hover around 12% (one in ten people experience a mental disorder).

1.4 Why is stress increasing in the developed western world

Today we know, as the scientist Chrousos (2020), Professor Emeritus of Pediatrics and Endocrinology at the Medical School of the University of Athens, states that when stress is limited in quantity and time, it does not have negative effects on the body and, if anything, it may have positive effects. However, when stress, quantitatively or temporally exceeds a certain limit, which is different for each person, then it starts to affect the body negatively, causing a morbid condition that varies in each person, depending on their genetic and epigenetic predisposition and their environment. Referring to today, he said that two important components of civilization, science and technology, have radically changed the conditions that surround us, adding:

"*Food is plentiful, hunger, dehydration and infections have been largely controlled, violence and injuries have diminished, and beasts and savage enemies do not exist in daily life. Physical exercise is no longer a necessary part of everyday life. The modern stress of the western developed world is more of a psychosocial and less of a physical nature. However, the last huge change in the conditions of human life, clearly for the better, has taken place in a very short time, with the result that our non-adapted genetic make-up is partly unsuited to living in the modern environment. Let us not forget that we know today that the difference between our genome and that of the chimpanzee is less than 3%. This marked disharmony between our "primitive" genetics and the modern environment leads to the frequent present-day malignant morbidity of advanced societies, the so-called chronic non-communicable diseases. Understanding the mechanisms of this morbidity requires a rudimentary knowledge of the functioning of the stress system."*

In today's environment, the ability to cope with food shortages, dehydration, infections, injuries, as well as to anticipate movements and avoid or aggressively deal with enemies, have become the most common modern diseases, including obesity/metabolic syndrome, arterial hypertension, allergic and autoimmune inflammatory diseases, chronic pain and fatigue syndromes, as well as stress and depression. In all these conditions, which are literally endemic in modern society, the stress system plays a central pathogenic role, he pointed out.

Indeed, there are currently malignant pathological conditions, such as chronic anxiety neurosis/melancholic depression, associated with chronic over activity of the stress system, in combination with the expected changes in behavior, neuroendocrine function, metabolism and immunity. Conversely, there are malignant pathological conditions, such as atypical depression, postpartum or menopausal depression and fibromyalgia/chronic fatigue syndromes, which are associated with chronic underactivity of the stress system, again in combination with the expected changes in behavior, neuroendocrine function, metabolism and immunity. In both conditions, physical damage, such as metabolic syndrome, is generated in the body, increasing morbidity and mortality in these populations.

Chronic macaostasis is very common. It is responsible for over 50% of current morbidity, and affects both the quality and duration of a person's life. Efforts must be made in two directions, so that both the disease environment is changed for the better, and the individual is trained to handle stress in a way that leads to the development of the body's resistance to disease stimuli. The Aristotelian dictum that the components of man are "nature, ethos and reason", i.e. genetics, environment and reason, is verified every day.

According to Chrousos (2020), *"In our body there are parts in the brain and periphery of the body, as well as substances, the stress mediators that help it respond to stressful stimuli and restore healthy homeostasis or estrus. The stress system in the brain coordinates the body's adaptive responses to stressful stimuli with some degree of modulation depending on the stimulus. The stress system plays a huge role in the survival of the individual. But the same system has also played a similar role in the survival of man as a species over the centuries, allowing him to change genetically and adapt under stressful selective pressures during evolution. These pressures were mainly prolonged food shortages, dehydration, infections, and injuries, as well as anticipating movements and avoiding or aggressively dealing with enemies. During the evolution of the species, the individuals with the most successful adaptive responses to these stresses survived, and we, today's humans, carry the genome of those ancestors who survived and were able to reproduce. But those pressures no longer exist."*

1.5 Stress factors in the urban environment

An urban environment is undoubtedly the reference point, where physical properties such as noise, air pollution, high density in population distribution, promote conditions of intense environmental stress. This situation prevailing in the psychology of the person living in the city gives him a feeling of inadequacy and inefficiency in his every action, resulting in anxiety along with an attitude of resignation. These situations tend to be adopted in the person's daily life, resulting in a decrease in self-confidence and a feeling of inability to change situations. Urban stressors, and most of all disturbing noise, increase the aggressive behaviors, the levels of depression experienced by individuals and their tendency to distance themselves from interpersonal and personal relationships. In addition, from research that has been conducted, the prevailing view is that the study of individual moods arising from environmental problems that affect a large group of individuals enables us to predict the individual's behavior/attitude/ethics towards the environment. Environmental attitudes as presented by Stokols (1978) indicate the tendencies to respond favorably/unfavorably to environmental characteristics, i.e. firstly it examines the degree of satisfaction or dissatisfaction with the attitudes held by the individual and secondly it approximates these attitudes to the position taken on major environmental problems (such as air pollution, noise pollution, depletion of natural resources, environmental hazards).

The presence of elements of nature within an urban environment has been shown to be beneficial to the mental health of people of all ages. Many researchers argue that our frequent contact with nature creates a sense of responsibility towards it (environmental responsibility), which is very important for understanding and solving the environmental problems that accompany us and often disrupt our daily lives. At the same time, they value this contact as an essential tool for creating positive feelings towards our fellow human beings and the natural environment. For this reason, experts recommend that children from an early age become familiar with nature, in order to shape their personality through the positive stimuli they receive from it. For example, the sight of a green hill combined with the rustling of tree foliage, colored and fragrant flowers or the touch of a small animal will enhance cognitive functions, creating a feeling of interest, euphoria and creativity. On the other hand, it is a

common phenomenon that individuals and young children who are cut off from their natural environment and permanently trapped in the urban fabric, exhibit violent behavior, are more introverted, and suffer from anxiety and nervousness due to the fast pace of life.

1.6 General Adjustment Syndrome (GAS)

It is a fact that human evolution began centuries ago and was achieved because of the ability of the human species to adapt to changing conditions. However, the extreme environmental conditions that we are increasingly confronted with are now an integral part of and directly linked to modern reality, increasing the degree of difficulty in adapting to these changes. In particular, large urban centers, which are the reference point of the given environmental conditions, since they have all the factors to create a climate of changes with negative consequences for human beings. Due to the complexity that we identify in the multidimensional ecosystems of large and small cities, in the event that a situation arises that requires us to exceed our capacities to deal with it, then immediately it creates a stress factor.

The stress factors involved in an urban environment are clearly many more than those faced by people living in smaller centers or in the countryside. These factors can be noise, pollution, overcrowding and many others that cause various physical and psychological effects on people while they make efforts to adapt to them in order to avoid the consequences. This effort of adapting to new conditions is like the homeostasis function of our organism, which makes a constant effort to keep our interior stable or balanced. The person who is permanently exposed to stressors, his body undergoes a process of returning to homeostasis through the use of his hormones. This process has been termed the General Adaptation Syndrome (GAS) and is a theory developed by endocrinologist Hans Selye (1956) on the stress response and is divided into three phases. The first is the alarm reaction stage, where the body is exposed to a stressful situation, followed by the resistance stage where the human body tries to cope or adapt to the stressor and finally the exhaustion stage. The last stage is the most damaging (harmful) for our body because it occurs after years of exposure to stressors. When this happens, the body is constantly struggling to fight the stress in order to return to its original homeostatic state, which depletes the body's

bodily resources (i.e. nutrients) causing damage to the human system, negatively affecting the well-being/pathogenicity relationship, inhibiting the activity of the immune system. According to Hans Selye's (1956) research carried out at Mc Gill University in Montreal, Canada, the symptoms of GAS are as follows:

- Gastritis
- Ulcerative colitis
- Irritable bowel syndrome
- High blood pressure
- Asthma
- Rheumatoid arthritis
- Migraines
- Phobias
- Depression
- Anxiety
- Fatigue
- Weakness
- Poor memory
- Severe premenstrual syndrome
- Difficulty concentrating
- Craving for carbohydrates
- Allergies (hay fever, asthma)
- Intolerance to alcohol
- Muscle aches and pains
- Joint pains (arthritis)
- Palpitations
- Abdominal discomfort
- Alternating diarrhea and constipation
- Obesity
- Poor wound healing
- Glucose intolerance
- Loss of bone density

All the aforementioned in-depth research evidence allows us to assume that the symptoms affect both our mental and physical health, which proves that these two variables (mind and body) are interdependent and inextricably linked. However, not all stressors clearly affect us in the same way as they are not all created in the same way and not every individual reacts in the same way to the 'disturbing' situations they are subjected to.

1.7 Mental overload in the urban environment

One of the main problems faced by people living in urban environments is mental overload. This theory was first presented by Simmel (1903) and other scholars, who managed to adapt this theory to the new requirements of modern society. Based on Simmel's hypothesis, they investigated a phenomenon that takes place in large and small urban centers and affects a large number of people living in densely populated areas compared to those living in sparsely populated ones. According to this theory, the former are at a disadvantage and this is due to the large amount of information and stimuli they receive on a daily basis. The constant contact between people (in the first category) and other people and the daily stressful situations in the city, together with the effects of these stressful situations (e.g. noise, dense construction, which restricts the freedom of the eye in a beautiful natural landscape, pollution, over-information, overcrowding), have the effect of reducing people's perceptual capacity. This is due to the fact that the individual has to make a great and constant effort to assimilate and evaluate the information he receives, while at the same time his attention is most often limited due to the many stimuli he has to respond to in order to cope with the fast pace of the city. At this point the human body starts to enter a process of adaptation in order to be able to respond to the situations, thus erasing all the information that it has received and considers not so useful and because of all the above mentioned stressors, its mental balance is altered. As a result, the stressors of the urban environment have a negative effect on his psychology and, combined with his efforts to adapt and acquire as much information as possible, the individual is driven into a state of intense mental stress. In turn, stress often leads to intense physical fatigue and the person's abandonment of any activity (e.g. social activities, sports) that can improve his or her mood. Moreover, the effects created by such a mental imbalance cause the individual

to become isolated and alienated from his social environment and from contact with the natural environment.

It is therefore reasonable to wonder why we most often choose to spend the free time we have at our disposal by making an excursion to places where the beautiful natural features of the environment prevail. Man, like every living organism in the ecosystem, is connected to nature and is naturally derived from it. His need for contact with the natural environment may sometimes be conscious and sometimes unconscious, but it never ceases to exist, because this contact is the only thing that can restore him to his original equilibrium. Of course, at this point we will ask ourselves if man has such a need to be close to nature why he has chosen to concentrate so many people in urban centers. Surely, an urban environment nowadays offers more opportunities than suburban areas. However, here too we understand that the natural characteristics of a city can strengthen and develop it in every area. These environmental features are the geomorphology of the area, the residential development, the presence of natural resources (such as water resources, coastline, forests), the climatic conditions prevailing during most of the year, the green open spaces in the urban fabric that can contribute to the formation of a healthy microclimate. There are many times that we realize on a personal level that a healthy environment, whether physical or social, let alone both, has a positive effect on our behavior and relationships with others. This lifestyle is the focus of the new science of Psychology, Ecopsychology, with various actions that bring the individual closer to nature and train him/her to respond to the advantages brought by the properties of its natural elements (Korfiatis, 2020).

CHAPTER 2 Nature and theories of nature and human relations

2.1 The concept of natural environment

The term environment has been echoing strongly in our daily lives in recent years, representing the modern reality of each of us and the general picture of the whole. This is achieved by the way it is perceived by each individual as well as by the performance of the general perception represented by the environment, a concept that is rich, multidimensional and complex. This is the reason why we often try to "define" the use of the concept, defining it in relation to the space (natural or artificial environment, urban environment, aquatic or terrestrial environment), to the social, political and economic factors, to the species included in it (man-made environment, animal, plant) and many other definitions used to assign the appropriate value to the environment we are referring to. A generally accepted definition that has been given for the concept of environment has been given by Professor of Environmental Education Eugenia Flogoiti (2006). *"Environment is the set of natural and social systems in which humanity and other organisms live and from which they derive their sustainability"*. In other words, the concept of the environment includes the way we perceive it, the way we interact with and meet our needs in it, and the way we behave towards it and the organisms that live in it. Humans, as an element of the environment, go through the process of consciously or unconsciously adapting to the constant changes that the environment undergoes in order to integrate into it. In order to integrate humans more smoothly into the environment, we often divide it into two main categories:

1. *The natural environment*, which is made up of all living organisms (living matter) and the inanimate matter found naturally on earth (natural systems).

2. *The man-made environment*, which is the environment that is made by humans themselves, i.e. made up of systems created by human intervention.

2.2 What is nature

"Nature", as it is often used, refers to natural features and processes of non-human origin that humans can usually perceive, including the "living nature" of flora and fauna, together with water and running water, air and weather properties, and the landscapes that include them and show the influence of geological processes (Hartig, at all 2014).

Therefore, "nature" as a concept is overlapping with the concept of "natural environment", where human presence or intervention is very limited or non-existent and the two terms are used interchangeably for each other (McMahan, 2018).

A basic common characteristic of natural environments is the existence of living systems, of which flora and fauna are elements. Although they share this common element, natural environments are heterogeneous and differ in many important dimensions. Natural environments differ in the degree of human intervention in them, in the degree of management and influence, with some of them (e.g. deserts) lacking human intervention and impact and others being created and managed to a significant degree by humans (e.g. urban parks) (McMahan, Cloud, Josh & Scott, 2016). Furthermore, with the presence of natural elements within built spaces (e.g. potted plants in an indoor space), even man-made environments can be considered natural. In order to manage this multifaceted and heterogeneous concept of natural space, many studies adopt a broader definition of natural environments. Natural environments are defined as those that are characterized by a relatively high concentration of living systems, whether or not they result from human intervention (McMahan, 2018).

"Natural environments" could be located in urban areas (for example, city parks) or rural areas. They could include things like plants and animals (native or non-native), physical geography (e.g., hills, mountains, deserts, beaches, marshlands), natural waters and seascapes (e.g., rivers, streams, lakes, ponds, ocean). This consideration does not seem to exclude the so-called "built environment" of houses, buildings, roads and all those urban structures that have a high degree of human intervention. Given this lack of a clear definition, the majority of the research undertaken avoids explicitly distinguishing environments as natural versus man-made and instead adopts a comparative approach, with the result that in practice one environment is compared with another, resulting in one environment being considered more natural in the

context of a survey (e.g., protected nature versus urban center). "Naturality" as a trait is usually defined functionally rather than categorically, considering nature as areas where the enclosed living systems are characterized by elements such as plants and animals that vary in their scale of composition and degree of human intervention, from a small urban park to a savannah landscape (Bratman, Hamilton & Daily, 2012).

In many studies the definition of the natural environment is not based on the exclusion of the artificial. The object of research is often built environments, enriched with natural elements such as houseplants and street trees. Similarly, public spaces and urban parks contain natural features even though they are constructed and maintained, and people have opportunities to participate and experience nature through these spaces as well. It has also been established through research that an individual can experience nature by viewing natural features or landscapes from a building window or through a vehicle, and even as a virtual reality such as through photographs and films (Hartig, at all 2014). Often these conditions are experienced and considered urban nature depending on personal representations, experiences and cultural beliefs that prevail and influence the perception of what is natural environment.

It is certain that history, culture, personal perception are decisive elements for the definition of the concept of "natural" environment even for the narrowest definition. A widely accepted definition of nature may not be possible in this way, as very often what is natural is subject to subjective perception and consideration. The concept of "natural" and the narrowest definition of what makes a natural environment varies according to history, culture and the individual making the definition. Evidence suggests that what is considered natural is largely subjectively determined and there is no widely agreed definition of this construct (Bratman, Hamilton & Daily, 2012).

Natural landscapes are described as *"symbolic environments created by human actions that give meaning to nature and the environment, giving the environment definition and form from a particular perspective and through a specific filter of values and beliefs"* (Cleary, 2017).

Comparing the considerations of Western culture with that of man of a different cultural context such as the East, it is accepted that according to the second cultural view, man is seen as part of the organic whole of nature and not just an existence

separate from his environment, with the direct experience of the natural world being overemphasized, without the need to use scientific models to explain this world.

The above conceptions may be able to provide some explanation for the different ways in which people treat nature and what is a natural environment. *"Modern scientific interpretations may leave no room for natural spirits, and the universe may be measured and understood without the invocation of magic or religion, but in its own way, modern man feels a respect for nature. We often speak of 'communion' with nature or connection or immersion in the natural environment"* (Sygollitou, 1997).

2.2.1 The positive effects of nature on humans

Brien (2011) says that, the term nature includes people's interactions with the environment outdoors in rural areas, in urban green spaces, in densely populated areas and in gardens within school grounds. According to Vink et al. (2016), the environment has been shown to have positive effects on the human body. Also, the sounds of nature and the view of nature from windows increase attention and improve the health of people who have undergone surgery (Kuo, 2015). Observing and evaluating the environment can lead us to two different perceptions (Fytianos & Samara-Konstantinou, 2009):

- According to the first one the anthropocentric one, the environment is useful for humans and therefore should be protected. In other words, the necessity to protect the environment is based on the utility that humans derive from it.
- According to the second concept, the ecological one, the environment is a valuable asset and regardless of its importance to humans it should be protected. Moreover, it tends to be adopted and may be the main means of protecting the environment. In any case, the acceptance on a global basis of this principle also requires the acceptance of related concepts, e.g. the notion that the importance of the conservation of natural and living goods, the diversity of species, should not be in competition with utilitarian measures.

It has also been found that after exposure to nature, the positive effects generated are improved performance, well-being, relaxation and experience (Vink et all, 2016). According to Kuo (2015), blood analyses of research participants before and after

walking in different environments found that dihydroepiandrosterone (DHEA) increased after walking in forest areas rather than in urban areas. Dihydroepiandrosterone protects individuals from developing obesity and diabetes. In addition adiponectin increases only after walking in wooded areas, which protects individuals from atherosclerosis. Also NK cells are important for protection against cancer and viral infections. In addition, walking in forest areas reduced health risk levels, i.e. reduced diabetes, cardiovascular disease and depression. It was also found that chronic high blood glucose poses health risks to individuals, for example, blindness and kidney failure can occur. Other research conducted according to Vink et all (2016) showed that, people who spend most of their time in nature have better physical, emotional, psychological and social health. This exposure to nature has many positive effects on human health such as relaxation, stress reduction, improved sleep and boosting immune function. Chawla (2015) cites a study of pregnant mothers in which it was found that less time in nature can affect them negatively as newborns are born with low birth weight, increasing subsequent risks and mortality risks. Also less air pollution, less noise, lower temperature and outdoor physical activities have positive effects on the health of pregnant mothers and fetuses. They also help to cope with stress during pregnancy. Some research in the United States and Canada has studied the risks of pesticides. They found that herbicides, insecticides and other pesticides should be avoided in places frequented by children. Also, if a pregnant mother comes in contact with them, there is a possibility of adverse effects, i.e. miscarriages, low birth weight, birth defects, childhood cancers, respiratory and lung diseases, reduced IQ, attention deficit disorder, etc.

According to Soga & Gaston (2016), in recent decades more and more people, especially children, have become disconnected from the environment. This is due to urbanization and technological development due to which people spend more time watching television or engaging in web activities. Moreover, the environment is vital for creating pleasant emotions that cannot be replaced. Since people have moved to urban centers, opportunities for direct contact with nature have decreased. Their activities are now restricted around urban environments. Still people who are emotionally attached to nature will find a way to spend time in it even if they live in an urban environment.

Furthermore, the most important thing is for people to have experiences with nature as this will enable them to connect emotionally with it and at the same time adopt environmental behaviors. Finally, it has been shown that it is easier for people living near rural areas to have such experiences. But for people living in urban environments it is also easier for the state to take care and create green spaces where necessary that are accessible to citizens. The characteristics of the environment which are air quality, temperature, sound and light affect the environment and public health (Vink et all, 2016).

Kuo (2015) states that the less green a person's environment is, the more the person is at risk of morbidity and mortality while exposure to nature brings positive health effects. For example, it reduces anxiety disorders, reduces acute urinary tract infection, increases attention and reduces the symptoms of children suffering from attention deficit hyperactivity disorder (ADHD). It also fights various infectious diseases, diabetes mellitus, cancer, obesity, cardiovascular diseases, musculoskeletal problems, depression, migraines, vertigo, allergies, asthma, eczema and respiratory diseases. It also increases life expectancy and reduces mortality in people. Also, activities in nature have positive effects on the psychological and physical health of individuals as it has also helped people suffering from heart disease and diabetes, but also offer longevity to the elderly (Soga & Gaston, 2016).

Christou & Bellos (2009) highlight the positive influence of the natural environment in improving health compared to urban landscapes even by simple observation, which was examined through a closed field survey. Thus in one study twelve people from Japan aged between 20-23 years, participating in a three-day experiment from 11-13 July 2005, were instructed to stay in a hotel in identical single rooms and eat identical meals during the experiment to minimize individual differences. In this study, the consumption of alcohol and tobacco products was prohibited and caffeine consumption was controlled. There were two study sites one forest and one urban environment (hotel). Four times a day each subject was monitored: 1) saliva cortisol concentration (a marker of stress), 2) blood pressure dilation and 3) pulse (Physiological and Psychological Data Indicators). Significantly lower values were found among the measurements after exposure to the forest than in the urban environment. Furthermore, subjects felt more comfortable and refreshed thus

supporting the view that contact with a forest landscape can reduce stress, enhance the autonomic nervous system and increase positive emotion.

2.3 Ecopsychology

According to Clio Apostolaki (2019), Psychologist, representative of the European Association of Ecopsychology (EES) in Greece, the science of psychology from its first steps investigated the anatomy of the psyche to understand human personality and behavior, with the basic factors of formation being the evolutionary stages from childhood and the role of the family and the wider social environment in its formation. However, one shaping factor that was not received significantly was the physical environment and how the individual's mental equilibrium is influenced and affected by it. This was probably because the anthropocentric nature of psychology could not find any connection with this area, although leading psychoanalysts, with Jung being the primary one, have referred to the role of nature in their writings in the past.

In recent years, especially with the development of urban centers and the Western way of life, modern man has been characterized by his alienation from nature and his perception of his dominance over it. The result has to do not only with the morbidity of the planet, but also with the alienation of humans from their natural functions on a physical and mental level. The modern needs of today's people, therefore, have led the field of psychology to additional considerations and research as to how the physical environment and how the mental balance of the individual is affected and influenced by it.

It is within this context that Ecopsychology was born. Research from other sciences such as biology and sociology converged on how the lack of nature can change human behavior in cities and today courses in ecopsychology are even taught at Harvard and other top universities. Scientists at Harvard University argue that humans have an innate affinity with the natural world, apparently an internal biological need that is useful for our development. The view is based on a body of research into how people respond to open green landscapes, scattered trees, meadows, water, and elevated landscapes.

2.3.1 What is Ecopsychology

Ecopsychology is the modern trend in psychology to investigate whether our lack of contact with nature and our reintroduction to natural activities and techniques affects our mental balance. Ecopsychology has many roots: in Buddhist philosophy, the romantic movement in Europe, various mystical traditions in different tribes, etc. Jung, James, Freud, Skinner and other psychotherapists along with Leopold, Muir and other ecologists developed views on the human-nature relationship. Behaviorists and social psychologists tried to see how humans behave in a respectful way towards their environment. For example, contact with wildlife had been used in psychotherapy for over thirty years under the name of "psychoecology" by Robert Grennway & Art Warmoth (Greenway, 1999) or "nature connection work" by Cohen (1997).

The term Ecopsychology - from the Greek words ecology and psychology - was first used by Theodore Roszak, professor of history at the University of California and author of the book "The Voice of the Earth". He argues that modern psychology has separated inner from outer life and we have suppressed our "ecological unconscious" that connects us to the development of the earth. However, many of the central ideas of ecopsychology can be found in his earlier 1979 writing and in work by Paul Shepard in 1982.

The science of psychology offers the possibility of deepening the contact with nature, taking the practitioner out of the office of the session and making the wisdom of nature, co-therapist in the psychic balance of the human being.

2.3.2 How does Ecopsychology work

Practical Ecopsychology is a theoretical and practical approach that aims to balance the human soul through the achievement of a planetary balance that will in turn benefit human balance.

Awakening the awareness of a larger earthly identity allows us to approach the environment with spontaneous respect, feeling an active part of ecosystems that are larger and more complex. Moreover, it promotes the ability to work in teams with

creative and constructive synergies, essential for the future of the human species. On a theoretical level, awakening follows consciousness and consciousness is cultivated through knowledge through education in the form of seminars, conferences and study. On a practical level this is achieved through experiential workshops that utilize the tools of psychotherapy from the different schools in a holistic approach. It includes direct experience with the elements of nature, techniques of relaxation and awakening of the senses, projection and transference found in the tools of psychoanalysis as well as exercises in expressing emotions and deepening experiences.

Theodore Roszak (1992) states: *"Just as the goal of earlier therapies was to recover the repressed contents of the unconscious, so the goal of ecopsychology is to awaken the innate sense of environmental reciprocity that lies within the ecological unconscious. Other therapies seek to heal the alienation between person and person, person and family, person and society. Ecopsychology seeks to heal the most fundamental alienation between the person and the physical environment."*

2.3.3 Techniques of Ecopsychology

Ecopsychology uses psychotherapy tools from the different schools of thought in a holistic approach. It includes direct experience with the elements of nature, techniques of relaxation and awakening of the senses, projection and transference found in the tools of psychoanalysis, as well as exercises for expressing feelings and deepening experiences. In individual sessions, which are usually therapeutic in nature, an individual history is taken and adapted to the needs of the person being treated. In group sessions, the psychologist selects the members of the groups and the program takes a broader form of contact with nature where the communication part with oneself and the group is included. The duration of the sessions is determined according to the goals and needs of the individual or group. The space where the sessions take place is mainly in an open environment, easily accessible and all the participant needs to bring is comfortable clothing.

2.3.4 To whom is it addressed to

The practice of Ecopsychology is addressed to adults who want to awaken their natural functions on a mental and physical level and to seek their inner balance by reuniting with their own nature and the natural environment, the modern person who lives situations of stress and emotional difficulties as well as to the therapists with mental illnesses, assisted by the guidance of their therapist. In addition, it is also addressed to children and adolescents, giving them the opportunity to engage in multidimensional educational and experiential activities aimed at building healthy personalities.

The scientific training of a qualified psychologist or psychiatrist in Ecopsychology offers the possibility of understanding and deepening this experience with the maximum possible benefits in a safe context.

2.4 The concept of ecotherapy

Chaudhury & Banerjee (2020) highlight that ecotherapy is a new psychotherapeutic technique based on ecological and environmental interventions. Chalquist (2009) states that ecotherapy is about bringing together techniques and practices that contribute to healing people through nature. Cultural therapy, wilderness excursions, stress and time management and animal-assisted therapy are some of these techniques. Chaudhury & Banerjee (2020) emphasize that, ecotherapy is a term that tries to create a human nature relationship through which psychological healing will come. Moreover, ecotherapy is one of the services of the natural ecosystem.

According to ecotherapy, the health of humans is dependent on the health of the earth. It helps people to connect with nature and help in dealing with natural disasters. At the same time people are part of the ecosystem. At the same time, ecotherapy is considered by many approaches as green exercise, green views, gardening therapy, wilderness therapy, body healing through movement, art therapy and animal assisted therapy. Also from the practices of ecotherapy are carried out in gardens, forests and beaches. Finally in each form of ecotherapy people act as healers for each other (Summers & Vivian, 2018).

Finally, according to Tudor (2013), ecotherapy is linked to the natural environment and the people who live in it, aims to connect people with nature and is about personal healing and healing the earth.

2.4.1 Benefits of ecotherapy in humans

Brien (2011) states that, in the last three decades, some research and experiments have been conducted that have shown health and wellness benefits through nature. According to Kamitsis & Simmonds (2017) there is a lot of evidence of the positive effects of nature and the environment that create feelings of well-being. It has been shown that the nervous system calms down through nature and there is a reduction in physiological stress. However, because people now spend most of their day at work and at home there is an increase in stress. At the same time policy developments aim to effectively use greenery to improve mental health. On the other hand, nature alone does not cure depression or stress but can help us to manage them and find our well-being. Also, walks in nature and parks, the breeze from the leaves of the trees, the chirping of birds, butterflies and flowers have a calming effect and lift our mood. Every time one observes nature one may discover something new. Like a new kind of bird, tree, flower that will create new feelings of joy and excitement. According to Keniger et al. (2013) the types of interactions between people and nature are as follows:

- Indirect, when individuals experience nature, but not with their physical presence there.
- Accidental, when individuals are accidentally in nature to carry out another activity.
- Intentional, when individuals are in nature with their own intention.

Based on Kras (2019), ecotherapy provides many benefits, such as improved cognitive function, overall well-being, and improved physical and mental health. In addition, there are several examples of ecotherapy activities. Such examples include meditation in nature, creating ecological arts, gardening therapy and animal therapy. The benefits of these activities have been shown to improve physical and mental health, reduce stress, improve cognitive function and increase overall well-being. It

has even been shown that people living in urban areas have mental health disorders, anxiety disorders and schizophrenia.

Still, Sackett (2010) states that ecotherapy promotes mental, physical, and social health. Ecotherapy additionally applies interventions that are designed to improve the psychological functioning of each individual. Specifically, it examined the relationship between physical activity and self-esteem along with health belief factors and sedentary lifestyle. This research showed that children spend 75.5% of their day without any activity, while the remaining 1.4% are engaged in some kind of activity in nature. In another study by Sackett (2010) conducted to identify problems in people who have mental health problems it was revealed that 75% of people who walked in nature had less depression, while 22% of people who walked in a shopping mall had increased depression. Also 71% of people walking in nature had less tension, while 50% of people walking in a shopping mall had increased tension. Finally, 90% of people walking in nature had increased self-esteem, while 44% of people walking in a shopping mall had decreased self-esteem. Also according to Chaudhury & Banerjee (2020) nature-based sessions such as aesthetic focus were conducted by various psychologists. They had found them to be effective and have helped people with depression. Based on the above, aesthetic focus aims through sensation to make the person feel pleasure, for example by smelling a rose they experience pleasure. Thus it was concluded that ecotherapy has sensory contact with nature to improve human health. Many participants clarified that for ecotherapy to work, not all of its activities necessarily need to take place in natural environments. That is, even in the city you can observe elements of nature such as trees, flowers, birds. Anywhere a person can observe elements of nature and reconnect with it.

Ibes et al. (2018) report that mental health issues on campuses is one of the most serious public health problems. Specifically, mental health affects students. To control student psychology, campuses are acting in several ways, such as mental health programming and increasing counseling staff. The most common cause of mental health is stress, which decreases immune system functions, increases blood pressure and heart rate. We investigated the psychological impact of two rapid interventions incorporating two mind-body skills approaches, stress reduction and nature exposure. In addition, it reports on the interventions, which are part of a developing collection of ecotherapy exercises called RESET (Release Everyday Stress and Enjoy Trails). This

research found alarming levels of anxiety and depression among 80,000 students. These results showed that 62% have overwhelming anxiety, 40.2% have difficult body functioning, 49.8% have difficulty handling stress, and over 11% have been driven to suicide. The author analyzed another survey of 25,000 people who are office workers and work more than 5 hours a day at a monitor. In this survey it was shown that the employees developed mental health problems. Based on the above, it is concluded that green spaces on campuses enhance mental health. At the same time RESET interventions in green space are low cost and are a welcome method to achieve these benefits. Finally, RESET offers an effective means of positive psychological effects, particularly for alleviating excessive stress.

Bayley (2019) highlights that the combination of exercise, fresh air, a change of scenery and doing something you enjoy is beneficial to people's mental health. Any form of contact with nature helps patients to regain their well-being for example the view of the landscape, plants and potted plants. Even images depicting greenery have benefits to patients. In addition, people taking walks in parks and forests with dogs feel safer. However, people who have grown up in green landscapes and the beauty of nature, who were born in the countryside, have learned to care for and respect the environment. They have also discovered how to make the most of their time in nature away from technology.

In the 1990s environmentalists and psychologists linked rising levels of mental illness to the increasing degradation of the planet. When the health of the earth is destroyed then the health of people is destroyed. In the last 20 years environmental awareness has grown and ecotherapy has gained momentum. According to another research by Bayley (2019) reconnecting with the natural world increases self-esteem, joy, social togetherness and therefore improves mental health. The author then talks about a study that showed that ecotherapy can improve mental health and increase physical well-being. An ecotherapy center has also been set up where young people who are unable to attend school lessons or display challenging behavior in the classroom can participate. In this way the young people learn to work, keep calm and relaxed in the open air and in the outdoor environment. At the same time a 16-year-old boy spoke about his experience at the ecotherapy center. The center helped him to be open-minded and to try new things. He considered the center a safe place where he can listen and talk about his own problems with other people. Finally, ecotherapy offers

security because nature itself offers this feeling of security. Initially, everyone has a sense of freedom when they are in an open space and can leave at any time either to walk or because they feel threatened. Thus individuals begin to get used to the space, to exploit it and use it to protect themselves. There are individuals who feel isolated from society or feel insecure at home, at the center they learned to be freer and manage it through the activities of the program.

Husk (2013) highlights that environmental activities have an impact on people's health and physical well-being. For example, through physical activity everyone can relieve stress and socialize with people through the cooperation of activities. It is argued that physical activity in natural environments has greater benefits than that of physical activity indoors. Finally, it is important to enhance activity in natural spaces as this can reduce medication.

Franco (2017) states that experiences of nature provide people with many benefits for their health and well-being. A study he analyzed showed that a virtual nature environment reduced participants' anxiety. However, they expressed that not all of the real senses were involved. It was shown that seeing nature has benefits for people such as reduced anxiety, better heart rate, better health and well-being, and recovery of hospitalized patients. Specifically, it was found that hospitals that have paintings with various nature paintings such as trees, flowers, and water had positive effects on hospital patients and reduced their anxiety. It was also found that sounds of nature (such as wind, water and animals) were pleasant and reduced anxiety and agitation. Smell is an additional sensation that we have in nature. Smells are everywhere in both urban and natural environments. Nature has many smells from flowers, trees, bushes and grasses. It is interesting how these smells affect the health and well-being of individuals. The smell of nature has been shown to have positive effects on mood, behavior and cognition. They also evoke feelings of pleasure. More specifically, the smell of summer air and the smell of beeswax brought feelings of happiness to the participants of this study. The author mentions another study in which participants went to a garden full of flowers and pleasant smells, it was found that the natural smells coming from the blooming flowers increased the participants' calmness and mood. It was also found that it is the olfactory system that positively influences mood, behavior, health and well-being through nature. Plant essential oils have been shown to have positive effects on health, mood and psychology, as well as reducing

depression, anxiety and blood pressure. In a further study analyzed by the author, essential oils were found to have a positive effect on cognitive function and independence of daily activities in elderly patients with dementia. Based on these studies, the author concluded that taste has positive effects on health because it improves positive affect, reduces anxiety and other unwanted emotions. In addition, organic foods are those that make the consumer feel better while eating them causing comfort and safety.

Also, Gennadevna (2018) says that interaction with the natural environment helps to prevent the development of physical and mental illnesses, but if they exist, it also helps to cure them. Many argue that ecotherapy is a scientific and disciplined one that aims to strengthen human-nature bonds by treating and preventing mental and physical illnesses.

Ecotherapeutic techniques and methods attach particular importance to restructuring behavioral patterns, attitudes and value orientations in one's relationship with nature. Summers & Vivian (2018) state that the increase in technology has distanced people from the environment, and as a result, people are beginning to lose their mental health. In terms of mental health in the late 1970s the psychology of students was examined to prove that flowers and trees can bring about mental health wellbeing.

Students suffering from anxiety after observing natural images related to the environment increased their positive emotions such as friendliness, affection and joy. At the same time, they also observed urban images which created negative emotions such as anger and aggression. They measured brain activity in healthy adults and it turned out that seeing landscapes depicting nature increased their serotonin levels. Some elements of nature, whether they are in a city park or a forest, make people feel young again. Additional studies by the above authors have shown that a simple walk in the woods or just looking at pictures of greenery for less than a minute can reduce stress and lift mood.

Natural environments and plants could be useful in healthcare facilities as they have been shown to reduce the pain of coronary heart disease. They have also helped patients with PTSD (post-traumatic stress disorder) whose treatment is based on natural environments as people are fascinated by the beauty of nature and manage to escape from their problems. In particular, green space and wilderness therapy are

some of the forms of ecotherapy. Green space is important for physical and mental well-being. Engagement with green space results in increased life expectancy in people with mental illness. In addition, wilderness therapy is mainly carried out on adolescents who are experiencing behavioral problems so that they can deal with psychological problems. It has even helped people suffering from coronary artery disease and ADHD (attention deficit hyperactivity disorder). Nature games in particular have been able to reduce attention deficit. Garden therapy has helped people, especially elderly people suffering from dementia. It has also helped people with obesity and people suffering from vitamin D deficiency.

People who have grown up in nature from an early age have gained a better quality of life as they have learned to interact with the environment. That is, they engage with nature, eat healthily, have higher self-esteem, better mood and reduced stress. Ebata & Izenstark (2016) state that it is difficult to define what nature is because there are differences in what everyone understands nature to be. That is, nature can be defined as a local neighborhood park in an urban area while in contrast, in a rural area nature can be defined as a forest. So nature is defined as being close to places where there is a lot of greenery and where other natural organisms such as birds and animals can be found. Families in such areas spend their free time doing various activities such as camping or fishing. Nature helps individuals to restore their attention and according to environmental psychology, it enhances the psychology of individuals and reduces their mental fatigue. By observing the images of nature they are helped to relax and reduce their mental fatigue. In order for individuals to be able to rest they need to eliminate their thoughts and relax. This can be done either by looking out of the window at the trees, the wind but can also be done by changing the environment, i.e. going for a walk in a nearby park. The natural environment manages to fascinate people and pleasantly distract them with the sound of the leaves in the wind and the sounds of waterfalls and rain. Also nature walks and gardening therapy has helped women with breast cancer as the natural environment pleasantly distracts them and helps them in their recovery from surgery. In a study conducted on students who walked in the park the result was that they became more efficient in their classes. Family activities that take place mainly on weekends in nature such as camping helps them to communicate more with each other as they are away from technology and have time to do creative things together. Also children during childhood visiting

natural areas have adopted environmental behavior and have been helped in their adult life to be more sensitive to the environment.

Still according to Kamitsis & Simmonds (2017) in a study conducted on 17 people, who as participants took part in various activities that took place in nature such as walking and gardening. These studies showed that these activities reduce anxiety and treat depression. They were also helped by the various sensations they had in nature such as the sounds of birds singing, the color of flowers and the feel of the wind on their skin. All these had the effect of combating loneliness and stress. The authors go on to report on a study of 4 people related to animal therapy, in which it was shown that when people have unpleasant memories the best treatment is to spend time with their pets. It has been shown that the goal of ecotherapy is to enhance human health through contact with nature. It was also found that physical exercise and animal therapy treated anxiety, depression, distress and interpersonal difficulties of each individual. Finally, arts and crafts in nature helped the individuals in reducing their stress and anxiety.

Gennadevna (2018) also emphasizes that the mechanism of environmental impact greatly influences individual psychological processes. For example, it was shown that those who live near green spaces enhance well-being and reduce stress. In contrast, in areas where pathogenic conditions prevailed and greenery was absent, individuals showed depressive and nervous behavior.

Sackett (2010) finds it important to mention an ecotherapy course that was conducted at Appalachian State University. The purpose of this program is to make the connection between nature and personal healing. This program involved 9 participants from the same area, one of them, who is a prime example, is Sam who had a sedentary life, few friends and low self-esteem. n the program they participated in, there was a five-day trip, in which various ecotherapy activities were carried out, for example they went to waterfalls where they swam and spent several hours of fun in nature. Another activity which was a group activity, they had to choose different flags and paint them all together. Finally they followed other such ecotherapy activities by spending time in nature as much as possible, this helped the participants a lot and especially Sam, who after the ecotherapy trip became more social, lost some extra pounds that he had due to his sedentary life, his confidence increased and also spent

more time in nature. All this change that he gained was due to the positives of ecotherapy spending time in nature without modern amenities. Sam's example above was used to demonstrate the positive effects that ecotherapy has on an individual's life.

According to Chaudhury & Banerjee (2020) ecotherapy activities are used to have better mental health and they are gardening therapy, animal therapy, green exercise and wilderness therapy in nature. Ecotherapy related techniques have been found to be effective in hypertension, obesity, recovery after surgery, depression, anxiety reduction in post-traumatic stress disorder and attention deficit hyperactivity disorder (ADHD).

Chalquist (2009) reports studies in workplaces showed that both office noise and the printer laser, combined with the fact that the areas were not sufficiently ventilated, reduced employee performance. While in a study conducted in Texas where A&M University took part, a 15% increase in productivity was observed due to the placement of plants and flowers in a workplace. This was because employees, specifically teachers, were more positive about working in an indoor environment that resembled the outdoor environment. In a two-year study by Chalquist (2009) in New York City, street lighting showed that people aged 65 years who started taking regular walks in the now-lit neighborhood were able to significantly reduce their levels of depression.

The UK's Foreign Office launched the Community Forests Program in 2006 to bring at least half of the population closer to forests. Their idea is to create woodlands in urban environments. In this way they involve residents in planting trees, restore local ponds and rely on renewable energy to reduce carbon use. Two studies were carried out at the ESSEX University, involving 108 participants. They ran, walked and participated in activities. 94% of them reported benefits to their mental health. The 44% who walked inside an indoor shopping center showed reduced self-esteem while those who were in outdoor activities showed a reduction in anger and better mental health.

2.5 Theoretical bases of the beneficial effect of nature on mental well-being (ART, SRT, Biophilia)

One barrier to achieving urban sustainability is formed by psychological factors. Urban life in general and city stressors such as traffic noise, fear of crime and crowds in particular can motivate people to seek more natural environments in the suburbs. Research on restorative environments suggests that this search involves more than just a romantic idealization of nature (Kaplan & Kaplan, 1989). It may even reflect an evolutionary legacy.

The human preference for contact with nature may in part be the result of the primordial conditions under which early humans evolved. In the world they inhabited, it was vital to approach objects and situations that did not pose a threat, which provided shelter, food and other basic needs, and the ability to derive information for basic functions such as wayfinding. As a result of these primitive processes, modern humans are still born with a predisposition to like or prefer certain features common in natural but not in urban or other built environments. This preference for nature has remained adaptive even for individuals living in cities (Kaplan & Kaplan, 1989; Urlich, 1993).

Many studies have shown that contact with natural environments offers a relatively effective way of achieving recovery from stress and mental fatigue compared to ordinary urban environments. With the continued expansion of cities, residents may suffer from progressively reduced access to nature and diminished natural landscape experiences (Van Den Berg, 2007).

Urbanites often struggle to meet the demands of work, family, and other responsibilities, living in an environment that can contribute to a chronic experience of stress. Seeking contact with nature may provide some immediate relief from the demands and stress of city life, providing opportunities to renew cognitive resources and reduce the intensity of the psychophysiological response that accompanies stress (Hartig, 2004; Kaplan & Kaplan, 1989; Ulrich, 1983, 1993).

Recovery is a central theme of environmental psychology, a field of psychology that links to environmental domains to explore the dynamic interactions between individuals and their environment. An important interaction between individual and

environment is the restoration of our attention, energy, and psychoemotional self by experiencing or viewing nature (Clay, 2001).

Interest in the subject is growing as we spend more time indoors and less time in natural environments. As the pace of life becomes faster and more intense, environmental psychologists are looking for ways in which we can achieve more and more restoration in our lives. To this end, expert researchers have carried out studies and surveys providing useful information to help us understand how to take advantage of the opportunities nature provides for recovery.

In the following, three dominant theories, the attention recovery theory, the stress recovery theory and the biophilia theory, are presented, shedding light on the beneficial effect of the natural environment on the psychological state and well-being of humans, providing theoretical causal models of this relationship, which are confirmed by contemporary research studies.

2.5.1 Attention restoration theory – ART

Attention Restoration Theory (Kaplan & Kaplan, 1989; Kaplan, 1995) provides an illuminating explanation for the restorative properties of nature observed in many studies. This theory was developed and popularized by Stephen and Rachel Kaplan in the late 1980s and early 1990s, a time period of rapid technological advances and indoor entertainment. As people - and especially children - spend more and more time indoors, concerns about the lack of time in nature are consistently and strongly highlighted. In the introduction to ART in a general context, Stephen and Rachel Kaplan describe the theory and the evidence supporting it. The book describes their twenty-year exploration that they conducted, arguing in a scientific way, for the importance of nature and the impact of the natural environment on mood, state of mind and health.

The authors had attempted to answer some key questions on the subject, such as:

1. Are the effects of nature on people as strong as they intuitively appear?

2. What makes natural landscapes so fascinating?

3. What might be ways of designing, managing and interpreting natural environments to enhance the benefits of their impact?

ART assumes that nature has the ability to renew attention after mental strain, for example, after one has gone through periods of mental fatigue as required by studies and exams or when working long hours on a project or task.

Kaplans (1989) argue that an individual's ability to direct attention depends on a central mechanism of attentional inhibition capacity. Focusing ones attention on something that is not intrinsically interesting to the individual, means that he or she must inhibit competing stimuli that are more interesting. It takes effort to do this, which causes strain and loss of the individual's ability to inhibit, prolonged or intensively, competing stimuli. Loss or impairment of inhibitory capacity has a variety of negative consequences. Typically these consequences include irritability, decreased self-control, difficulty concentrating, increased irritability, and increased likelihood of error in performing tasks requiring directed attention (Hartig et all, 2011).

Kaplan (1995) described these conditions as a situation that increases the likelihood of feeling anxious because one is forced to use less than one cognitive resource needed to manage daily demands (Lepore & Evans, 1996). Staying in a natural environment is beneficial because it does not require increased levels of directed attention, and additionally allows the inhibitory mechanism on which directed attention depends to rest and thus regain the ability to direct attention (Van de Berg et all, 2007). In short, Attention Restoration Theory, or ART, argues that exposure to nature is not only enjoyable, but may also be the most effective way in which we can improve our focus and ability to concentrate (Ohly et all, 2016).

Stephen and Rachel Kaplan (1989) argue for the existence of four cognitive states, on the path to recovery:

1. Clearer concentration
2. Clearer mental fatigue recovery
3. Gentle charm or interest
4. Reflection and restoration

The first stage is characterized by a purification of the mind. In this stage, thoughts, worries, concerns, concerns, and the other elements and information of whatever was demanding one's attention can be passed through the mind and disappear. This is not accomplished by pushing thoughts away, but simply by allowing them to flow in and out of the mind naturally.

The second stage marks the beginning of the actual recovery. After a task or activity that requires focused and directed attention, we usually feel exhausted and down. The recovery stage of mental fatigue facilitates the recovery of attention and allows it to be restored to normal levels. In the third stage, the person is allowed to effortlessly distract himself in nature and engage in a low-stimulation activity, which reduces internal tension and allows for relaxation. The final stage is the deepest and most restorative stage. This is where the most impactful and dynamic recovery takes place, as the person spends a long period of time in an environment that meets all four essential elements of a recovery environment (listed below), can restore attention, relax and reflect on priorities, actions and life goals (Han, 2003).

2.5.1.1 Key elements of nature's restorative property

According to ART theory, natural environments provide favorable conditions for psychological recovery, because natural environments themselves, and especially our contact with them, bring out many qualities that, when combined, promote a restorative capacity that occurs less frequently in other types of environments. ART states that aspects of recovery from contact with natural environments have four specific properties:

1. *Distance - Being far away*. Being in nature gives the person a sense of being away from the daily schedules and routine that increase the demands on directed attention. "Being away" refers to the sense of being at a distance from the usual concerns and worries. The first aspect of ART is the sense of *"being away from daily routines, thoughts, and worries"* (Herzog et al., 2003). The theory at this point refers to the importance of gaining psychological distance from tasks, goal pursuits, and preoccupations to which one needs to direct attention (Harting et al., 2011).

A person does not have to be away as a physical presence to satisfy this element, but certainly contact with nature can facilitate this perspective. It is often more restorative to have a cognitive change rather than a physical change. For example, the sense of "being away" can be acquired by reading a novel. While reading about another setting that includes people one does not know or have around them, it is easy to feel as if one is participating in the story. While it is not necessary for a person to be in a new environment to experience the effects of being away, it is necessary for the person to be away mentally from the environment that is causing the distraction (either physically or mentally). The restorative aspect of a physical environment that helps facilitate recovery includes the induced change in one's thoughts, distance from the stress and obligations of daily activity. Being away helps to psychologically detach oneself from daily concerns and demands and distract oneself from the environment and thoughts that reduce one's attention and energy as an experience of mental disengagement from demands during leisure time, and this involves distraction from work-related thoughts through and participation in activities that differ from our normal schedule or demands (Daniel, 2014).

2. *Gentle charm*. Natural environments contain many aesthetic stimuli that are pleasurable and encourage exploration and reasoning processes, and these stimuli attract and hold a person's attention effortlessly and to some extent involuntarily (Van de Berg et al., 2007). In other words, restorative environments attract attention without having to focus or direct it in a specific way. Engaging in exciting activities that do not require effort or the inhibition of competing stimuli allow for a rest of directed attention. This experience evoked by nature's stimuli, which is thought to be based on the evolutionary trajectory of humans, is referred to by Kaplan as soft fascination.

Kaplan (1995) argues that there are two types of fascination: hard fascination and soft fascination. Hard charm is usually embedded in an activity that involves high arousal and these activities often rivet a person's attention without giving them the opportunity to reflect. They generally do not provide an opportunity for reflection or introspection, as we are fully absorbed in the high arousal activity. In soft fascination attention is held back by a less active or stimulating activity (Daniel, 2014).

Soft charm is a property that usually comes from viewing pleasant stimuli (such as nature) and provides an opportunity for reflection, which further enhances the restoration of attention. An individual can restore a diminished capacity to voluntarily direct attention when experiencing this soft fascination-based fascination in a way that Kaplan hypothesizes is involuntary, requires no effort, and has no capacity constraints. When an individual has ongoing activity and cognitive fatigue they may rely on the fascination and reduce demands on central inhibitory capacity and eventually renew the ability to direct attention (Hartig et al., 2011).

According to Kaplan (2001), it is important for an individual to identify and seek out supportive environments that may be conducive to personal cognitive recovery. Natural environments (e.g., gardens, forests, beaches) have been shown to have the simplest and most effortless way to attract attention and captivate. This suggests that these environments provide us with good opportunities for introspection and restoration (Herzog et al., 2003).

3. *Extent.* The natural environment evokes a sense of expanse, offering the experience of coherence with the environment and the need for constant exploration. This element refers to the quality of restorative environments that encourage us to feel fully immersed and engaged and assumes that the environment has no unusual or unexpected features and in doing so we feel comfortable (Kaplan, 2001). An environment must be at least somewhat familiar and cohesive to be restorative. In this context, familiarity with the environment does not necessarily mean that we have been in the exact environment in the past, but that it is similar enough to the places we have visited that we do not feel uncomfortable, confused or out of place, so that things happen in a relatively simple, smooth and predictable way. An example might be a favorite hiking trail. In this particular situation, an individual knows the morphology, difficulty level, direction, and all other important information related to the environment (Kaplan, 2001) suggests that the extent of an environment as a beneficial property can be explained on the basis of using cognitive maps. Cognitive maps are mental structures that represent concepts or traits and experiences that we have experienced at some point in our lives. Cognitive maps help us make predictions about things that are going to happen and thus help us to be better prepared for new situations. As soon as a person is presented with some kind of unfamiliar stimulus or experience, it is necessary to use a different cognitive map, through and by focusing

attention, to be able to inhibit cognitive maps that are not related to the current situation, but thereby removing the possibility of recovery from the environment. This focusing or inhibition of other cognitive maps (not related to the current state) requires the use of directed attention and therefore can lead to directed attention fatigue (Daniel, 2014).

4. *Compatibility*. Finally, experiences in natural environments usually involve a high degree of compatibility. That is, what the individual seeks to do is compatible with what the environment offers or requires. It is important that there is a convergence between the individual's tendencies - plans at the given time, the demands imposed by the environment, and the supportive capacity that the environment provides for the intended activities (Hartig et al., 2011). The compatibility component facilitates a sense of enjoyment in the environment. To be restorative, an environment is useful to match intrinsic motivation and personal preferences. If we are in it for extrinsic or external reasons, restoration is not likely to be achieved. Compatibility is highest when the activity we are engaged in is familiar to us. When we are engaged in a new activity and learning a new skill or set of skills, we are unlikely to feel relaxed and attentional restoration and calmness is likely to occur (Daniel, 2014).

Kaplan also notes six other dimensions or aspects that determine the existence or lack of compatibility of the environment:

α) Distraction: distraction to the environment facilitates recovery when the environment is not very stimulating, but instead one can easily become immersed in it. A highly stimulating environment requires a lot of attention focus and effort in order to achieve goals, leading to Directed Attention Fatigue -DAF.

b) Lack of information: a restorative environment does not require the individual to seek information to understand e.g. how to regulate their behavior, how to achieve goals they set. It is useful for the individual to have all the necessary information from the outset to understand and enjoy the environment. Many people avoid places that are unfamiliar and therefore require running multiple cognitive maps at the same time, as this expends more energy to understand the new environment.

c) Danger: the environment cannot be dangerous in any sense: either objectively or because of fear, mentally. A mild danger (e.g. climbing) can make the action exciting, whereas chronic and uncontrollable danger can be exhausting. A hazardous

environment causes high levels of vigilance, therefore requiring high use of sustained attention (like a soldier in a war zone). There can also be a sense of danger characterized by fear and this can act as a burden. This is the perception of perceived danger that is separate from facing actual danger, yet causes a sense of incompatibility in an individual, thus hindering the restorative experience.

d) Absence of a specific task: the individual achieves "immersion" and connection with the environment not from a sense of task or obligation, but from a desire for pleasure and restoration.

e) Contradiction - discrepancy: for rehabilitation to occur there must be no discrepancy between the action the person is called upon to do and his true thoughts and feelings about performing it. For example, one can behave kindly towards a person while still thinking how much one does not like him.

f) Difficulty: it is useful that the environment does not require people to prepare or anticipate difficult situations for their tour. Difficulty is a key factor of incompatibility, as the lack of preparation or the need to anticipate a difficult situation causes the use of multiple cognitive maps (Daniel, 2014).

It should be emphasized here that, attentional restoration theory - ART - does not argue that restorative experiences only occur in natural environments, nor does research on restorative environments in general assume that all urban public places lack restorative quality. Rather, it is appreciated that natural and built environments may have different restorative potential defined by the presence of restorative qualities combined with personal needs and characteristics (Van de Berg et al., 2007).

2.5.2 The stress recovery theory - SRT

Since the 1970s, researchers have been experimentally studying the effect of nature on human behavior and function. One of the main findings, based on a large body of empirical evidence, is that natural (green) environments are consistently preferred over non-green urban environments or over built environments (Ulrich, 1993). Another important observation is that nature can have a "beneficial" effect on humans. An illustrative study on this is Ulrich's scientific study, which demonstrates that hospital patients who had undergone gallbladder surgery recovered faster and felt

better when they had a view of trees than when their only view was the inside of their room (Ulrich, 1984).

Ulrich argues that physical and social environments promote well-being if they are designed to promote: a) a sense of control over the physical-social environment, b) access to social support, and c) distraction to positive elements of the environment. This theory is well established scientifically and is often used to describe and interpret patients' needs or to suggest strategies or approaches to achieve supportive design (Arcadea, 2015).

Roger Ulrich's psycho-evolutionary theory deals with recovery from psycho-physiological stress. Stress is a process of responding to a situation that we perceive as too demanding or even threatening to our well-being (Hartig et al., 2014).

As argued by Ulrich (1983): *"For individuals experiencing stress or anxiety, non-threatening natural environments may reduce arousal more and tend to elicit more positive emotional responses than the vast majority of urban images, and are therefore more restorative in a psychophysiological sense"*. Indeed, it is widely accepted that, following an episode of anxiety, returning to initial levels of arousal may not be easily achievable and this can have detrimental health consequences and reduce the chances of well-being (Joye, 2010). In this regard, Ulrich (1999) argues that *"... modern humans, as a partly genetic residue of their evolution, possess a biologically primed capacity to acquire and maintain restorative responses to certain elements and features of nature (vegetation, flowers, water), but lack such a predisposition for most built environments and their materials"*. Thus, the theory attributes a restorative advantage to the natural environment and nature features over the artificial environment (Hartig et al., 2011).

According to SRT, the restorative property can essentially be seen as the result of direct positive emotional responses evoked by (non-threatening) physical environments. The content of the beneficial effect of the environment in SRT marks an important difference with the other major theory about restorative environments, attentional restoration theory (ART), which assumes that the potential cause of restoration lies in the replenishment of depleted cognitive resources (Kaplan & Kaplan, 1989). SRT assumes that the cause of positive affect and restorative responses is specific to natural environments: *"...modern humans, as a partly genetic*

remnant of evolution, have a biologically primed capacity for acquiring and maintaining restorative responses in certain natural environments and contexts... but have no such disposition for most built environments and their materials" (Ulrich, 1999).

Ulrich describes stress as *"... the process by which an individual responds psychologically, physiologically and often behaviorally, to a situation that causes or threatens well-being"* (Ulrich, 1991, 1993). On the basis of this interpretation, it seems that 'threat' already presupposes the relative presence of potential stressors, i.e. situations that threaten well-being. It is quite obvious that individuals who have experienced stress will recover from stress more quickly when they are in environments that do not evoke feelings of threat, rather than in threatening environments simply because the latter still evoke stress (i.e., threatening elements or situations), whereas the former do not (Joye, 2010).

Ulrich suggests the operation of a system, an outgrowth of species evolution that directs survival-driven behavior in the face of stressful situations. This adaptive system involves the "automatic" emotional response to the choice of a behavioral strategy (approach or avoidance) and the accompanying physiological bodily responses required to execute that strategy. Stress, in these situations, becomes evident as increased negative emotion (anxiety) and increased stimulation of the autonomic nervous system, among other changes. For someone experiencing stress and in need of replenishing resources for further activity, it could be an adaptive choice to continue focusing or immersing oneself in an image of nature, especially if that stimulus does not bring one to alertness. This initially depends on the visual features of that image that can quickly elicit a generalized emotional response, including interest.

The recovery process can be described as follows: an image with a moderately structured complexity, moderate depth of field, focal point and natural content such as vegetation and water quickly evoke interest and positive emotions, attract attention and, therefore, remove or reduce negative thoughts and allow the autonomic physiological arousal triggered by anxiety to subside. Recovery is expressed, for example, by more positive emotions and lower levels of physiological parameters such as blood pressure, heart rate and muscle tension, which increase under stress.

This response is believed to be "automatic" and not a conscious judgment and choice about the stimulus image, and indeed occurs before a person can make such a decision. Image characteristics that may trigger the response include mixed structure, moderate depth properties, and some general environmental features (Hartig et al., 2011).

According to SRT theory, the composition of the content of nature is specific, and includes certain types of physical properties or attributes that are assumed to facilitate stress reduction. Joye, (2010) points out that these can include elements and features such as *"calm or slow moving waters, lush vegetation, flowers, savannah-like or park-like qualities"*.

However, the question largely remains as to what it is about natural environments that makes them more relaxing, reducing stress beyond the simple fact that they contain fewer threats. Some authors suggest that this question can be answered based on the psycho-evolutionary framework theory on which SRT is based, suggesting that responses to greenery were shaped as nature was instrumental in the survival and reproduction of our species, providing us with food and shelter (Frumkin, 2001).

Experiments designed on the basis of SRT theory have documented the clear change in emotion and physiological parameters of the body measured during or immediately after viewing real or simulated physical and urban environments. For example, Ulrich et al. (1991) in an experiment with a sample of university students, first asked them to watch a film showing an industrial accident that caused the students high anxiety, followed by a 10-minute video of scenes of natural environments, urban traffic or an open-air shopping mall. The students' measurements of muscle tension, skin conductance, heart rate and pulse showed a sharp downward trend while watching nature simulations. The changes recorded in self-reported emotion converge with the physiological results in the occurrence of a greater degree of recovery with nature video viewing (Hartig et al., 2011).

2.5.3 The theory of Biophilia

The assumption that humans have an inherent tendency to connect with Nature has been referred to as biophilia (Wilson, 1984). Biophilia suggests a love for plants and

other living things. Cities and indoor environments are dominated by handmade objects. The question is whether the simultaneous depletion of natural elements from our environment has a negative impact on the human mind.

In most cultures, present and past, one can observe behavior that reflects a love of Nature. For example, frescoes from ancient Egypt, as well as the remains found in the ruins of Pompeii, document that people brought plants into their homes and gardens more than 2,000 years ago. In addition, in most cities, trees are planted and parks are created to improve the environment. The tendency to add elements of nature seems to be a universal human trait. It is evident where man-made environments tend to remove people from a natural environment and where people are wealthy enough to do something about it. The behavior is, presumably, a response to the biophilic quality of the human mind (Grinde & Patil, 2009).

The basic instinct that guides the development and maturation of a well-coordinated relationship with the living world seems to be biophilia, our innate tendency to focus on life and life-like forms and, in some cases, to connect with them emotionally. In their hypothesis of biophilia, Wilson and Kellert argue that we, as human beings, have an innate love of the natural world, universally felt by all, and arising at least in part from our genetic makeup and evolutionary history (Bratman et al., 2012).

The word "biophilia" was first introduced by Erich Fromm (1964) to describe the attraction to the various spheres of life, to the process of life, and to all that is alive and vital. The term was subsequently popularized by Edward O. Wilson (1984)), who defines biophilia in terms of *"the connections that humans subconsciously seek with the rest of life"*. The idea or assumption that everyone has an innate effort to connect with other life forms has since attracted considerable attention from researchers (Kellert & Wilson, 1993).

According to E. Wilson, biophilia is innate and embedded in our evolutionary history in which we developed a set of genetically determined learning rules (Wilson, 1984). Biophilia guides our relationship with nature, including environmental preferences. Although wild animals and human beings are guided by instinct in choosing their own habitat, there are some differences. For wild animals, habitat search is guided by a genetically determined and very little modifiable instinct. In our species, our habitat search is guided by instinct, but the human instinct consists mostly of learning rules.

For this reason, the relationship between humans and natural environments is also shaped, to some extent, by cultural and individual factors, based on empirical experiences and land cultivation (Berto et al., 2018).

The main conception of the biophilia hypothesis is that humans have an affinity for life and life-like processes that encourage interactions with plants, animals, and natural landscapes. This orientation for connection to other life forms is also based on genetically determined factors. A biological evolution where it is a process of continuous genetic adaptation of organisms or species to the environment through which they integrate environmental data with advantageous genetic changes. Organisms that are better adapted to specific environmental conditions have a higher survival rate and achieve greater reproductive success. Consequently, they are more likely to contribute their genetic material to the genetic pool of the population and, in the long run, increase the environmental fitness of the entire population. According to this view, the process of evolution of species by natural selection is the slow and isolated adaptive changes that can take hundreds of thousands of years (Hartig et al., 2011).

Humanity, over the course of our evolution, has developed a set of phylogenetically adaptive learning rules that shape our relationships with the natural world, even today (Wilson, 1993). The biophilia hypothesis is therefore based on the observation that, for most of the millions of years during which our species evolved, humans coexisted in close relationship with the natural environment. Therefore, most adaptations in the human organism, including those of the brain and associated behavioral responses, developed as an evolutionary response to the needs imposed by that environment. In contrast, the history of human civilization is relatively short. Humans have been concentrated in settlement agriculture for about 10,000 years, and in urban areas for a much shorter period. It is considered unlikely that evolution could have changed existing adaptations during the period that humans have been shaping artificial environmental conditions. Therefore, according to the biophilia hypothesis, humans tend to express inherited primitive adaptations and thus like or prefer natural environments where they can function well. According to Wilson (1984), the biophilic instinct emerges unconsciously and is *"embedded in recurring patterns of culture in most or all societies"* (Hartig et al., 2011).

In our species, environmental preference is related to the aesthetic quality of the natural environment. Biophilia implies a love of animals, plants and all other living organisms, as well as an innate preference for natural environments because of our evolutionary past. Although not all aesthetic traits can be traced back to evolutionary adaptations, among them it is not difficult to identify those that were originally rules of survival. Humans have been evolving over the last 200,000 years in natural environments, developing and adapting with their responses to natural environments and, indeed, becoming fascinated by them. The existence of an apparent "connection to Nature" reflects the degree to which individuals believe they are part of the natural world, i.e. the belief that we belong to it as much as it belongs to us (Schultz, 2002).

Studies on the connection or relationship that people experience with Nature have intensified in recent years. These studies suggest that the ability to "connect" with Nature is a positive personality trait that improves cognitive ability, emotional well-being, positive mood and happiness. This is because humans are genetically programmed to function effectively in natural environments because there is evidence of genetically determined biases that influence environmental preference. Biophilia is also embedded in our evolutionary history and is influenced by the ability to focus on natural stimuli effortlessly, i.e., the ability to be fascinated by Nature, and by asymmetrical empathy, i.e., our ability to engage emotionally with various life forms and be influenced by this perception. Research shows that the more time people spend in natural environments creating greater asymmetrical empathy with Nature, the more they feel an increasing sense of connection with it. Individuals who have greater experiences of the natural environment may express greater emotional connection than those with less experience.

2.5.3.1 The biophilic quality of the environment

According to Berto et al. (2018) the perceived restoration quality of an environment depends on the specific characteristics of the environment. In contrast, connection to Nature has been proposed as a characteristic of the individual and is not determined by the visual stimulus. The level at which an individual feels connected to Nature may determine the individual's "ability" to perceive the restorative value of a natural environment. Thus, we implicitly assume that restoration may depend on a person's

connection to Nature, and this relationship may vary according to the biophilic quality of the environment, its biophilic attractiveness. The biophilic quality is the set of characteristics that makes the environment "objectively" restorative according to the rules of evolutionary adaptation of humans, determining the degree of a person's restoration. Biophilic quality and perceived restorability are expected, to some extent, to match. However, this relationship may vary depending on an individual's sense of connection, which appears to be an emergent property of people who interact with physical environments that are pleasant aesthetically and functionally, i.e., endowed with biophilic quality. This attachment facilitates the vision of an interaction between "form" and "function" because together they progressively stimulate stronger feelings toward the environment. As one becomes more and more attached to the biophilic quality of an environment, one can be said to be engaged with it. It is not necessarily true that we know the reasons for our attachment (genetic predisposition) but we undoubtedly become effortlessly and unconsciously connected to environments that support our needs (meaning, exploring solutions for adaptation) and are directed towards psychological benefits (e.g. stress recovery and careful rehabilitation).

Despite our individual differences, we share a similar mental model that recognizes which physical environments are supportive and restorative. From an evolutionary perspective, biophilia is the shared mental model, and humans' predisposition to recognize the biophilic quality of a particular habitat reflects adaptations designed by natural selection to help us choose where to live (Berto et al., 2018).

The biophilic hypothesis emphasizes positive human responses to nature. However, nature can also elicit negative, fearful - biophobic - responses (Van den Berg & Heijne, 2005). Some researchers believe that the extensive body of findings on biophobia may provide support for the biophilia hypothesis (Ulrich, 1993). The ability to respond to positive elements of the environment (e.g. potential food and water sources, shelter) as well as negative ones (e.g. danger from predators, poisonous snakes or poisonous plants) seems to have had adaptive value in human evolution. Biophilia and biophobia can be seen as examples of adaptive learning (Seligman, 1970), reflecting a predisposition "for easy and rapid learning, and stable maintenance of those associations or responses that promote survival when confronted with certain objects or situations" (Ulrich, 1993). Bites and stings of insects, snakes and other

animals cause intense aversion or fear in many people. This is true even for people who have had no previous contact with these animals, perhaps as a result of learning by observing other people's reactions (Hartig et al., 2011).

2.5.3.2 Strategies for applying biophilic design

The strategies (experiences and attributes) of biophilic design have been formulated and analyzed by researchers pioneered by Stephen Kellert and Elizabeth Calabrese. Specifically, these strategies are categorized into three groups based on the type of nature experience humans receive and constitute the primary framework for implementing biophilic design. These are direct experience of nature, indirect experience of nature and experience of space and place. Direct experience of nature includes practices that promote real contact with natural elements in the artificial environment, such as: light, air, water, plants, animals, weather, natural landscapes and ecosystems, fire. Indirect experience with nature involves the incorporation of elements that represent the natural world, simulate the natural world or imitate processes of nature. Practices included are: images of nature, natural materials, natural colors, simulation of natural air and light, natural shapes and forms, nature suggestion, information richness, natural geometries, biomimicry. Finally, the experience of space and place considers the critical and effective integration in design of the spatial characteristics of the natural environment that have influenced the formation of the human profile, and includes the following strategies: perspective and shelter, organized complexity, integration of parts into the whole, transitional spaces, mobility and wayfinding, and connection to place.

It is worth emphasizing that biophilic strategies respond to the senses of the human body and its relation to a space. Sight, hearing, touch, taste and smell, as well as posture and body movement, are the means by which man perceives and recognizes the environment around him. Although vision is the dominant sense, the other senses play an important role in the perception and understanding of various stimuli and in the response to them. The stimuli that humans receive on a daily basis affect their physical, mental and psychological state and, accordingly, their positive or negative reception. In particular, tasteful and attractive stimuli from the natural world arouse interest and curiosity and stimulate imagination and creativity. On the contrary, in

places where there is not an abundance of sensory stimuli, humans respond with feelings of fatigue, boredom, dullness, psychosomatic pain and indifference. In conclusion, the integration of biophilic strategies into the built environment enhances the integration of physical stimuli into it and fosters multisensory experience and perception of space (Kellert & Calabrese, 2015; Gillis & Gatersleben, 2015; Gillis, 2018; Olmsted, 1865).

2.6 Direct experience with nature

1) Natural light

It is common knowledge that natural light is essential for the survival and growth of organisms, including humans, and the continuation of life on the planet. As humans have evolved in the natural environment, the presence or absence of natural light during the day cycle, the change in its intensity, brightness and colors, and the change in its source with the changing position of the sun, have become ingrained in human physiology and have influenced human behavior (as is evident from the study of circadian rhythms, the vitamin D production cycle and the change in behavior and perception depending on the amount and quality of light in an environment). Through these changes, humans perceive the length of the day and maintain a balanced perception of the flow of time, orient themselves temporally in terms of the seasons and spatially in terms of understanding the environment, movement and wayfinding in it. Consequently, the exposure of modern humans to natural light has positive effects on their health, psychology and spatial behavior and can contribute to improving their quality of life. It is necessary when designing to critically consider the factors that affect the integration of natural light into the space and to choose the effective combination of these factors based not only on the needs of the human being but also on the impact on the environment(Kellert & Calabrese, 2015; Dolan & Smith, 2016; Gloede, 2015).

2) Air

Ensuring the quality of the air in an enclosed space is linked to human psychosomatic health and a feeling of refreshment, with natural ventilation being considered preferable to that achieved by mechanical means. Variations in flow, temperature,

volume, humidity and barometric pressure and control of inlet and outlet provide a natural sense of airflow in an artificial environment that keeps people alert and prevents frequent feelings of fatigue. Natural odors (flowers, grass, soil, water) can introduce nature into the artificial environment, enhance the multisensory perception of a space or object and have a positive impact on the psychological state of a person.

3) Water

Like natural light and air, water is necessary for human survival and is inextricably linked to the human psyche. Mankind instinctively seeks the presence of water and is attracted to it, because during his evolution in the natural environment, securing a source of clean, potable water was crucial to his survival. The presence of water in space is considered charming and invigorating when water is presented clear, in motion and can be perceived with multiple senses. Apart from the sight of running water, the splashing and various sounds of it are beneficial for humans and restoring a sense of peace. At the same time, experiencing water through touch and smell enhances the understanding of the environment through the activation of the senses.

4) Plants

One of the most talked about and efficient biophilic strategies is the integration of plants into the interior space. Incorporating vegetation into the artificial environment is a direct and effective way to create a sense of the natural environment for people and reconnect them with the land and nature. Although during the design process plants may be treated as objects (as part of the furnishing of the space with certain quantitative and qualitative characteristics), it is not fair to overlook the fact that they are living organisms that carry out certain processes and therefore have specific needs and requirements (appropriate exposure to natural light, provision of adequate amounts of water and nutrients, care to attract unwanted insects). It should be stressed that particular attention needs to be paid to the decisions taken during the design phase with regard to the plants themselves and the way in which they are integrated into the site. First of all, it is important to consider the type of plants to be used (rhododendrons, shrubs, trees and, in particular, flowering, aromatic, succulent, climbing, edible, etc.). It is well established that the characteristics of the plants and the benefits they offer (color, scent, size, origin, longevity, use, properties such as air

purification) influence the design and use of the object, the economic specifications and, ultimately, the user himself. Another factor that seems necessary to consider is their relationship with the individual design elements and in particular their interaction with the other biophilic strategies since, as has been mentioned, each design decision acts in cooperation with all the others in order to produce a coherent whole.

5) Animals

Throughout mankind's evolutionary history, interaction with animals has been a fundamental part of his life. The frequent and prolonged presence of a variety of animal species, especially those endemic to the area, in people's daily lives can, in combination with other factors, contribute to their well-being. Although it is possible to implement additional strategies (such as aquariums and cages) and other technological means at the indoor level, this is often not feasible due to economic factors and space constraints.

6) Weather

Being aware of the weather conditions in an artificial environment can reconnect people with the natural world and have a beneficial effect on their psychology. Because of his special dependence on the weather and his instinctive response to it throughout his evolutionary course, perception of and contact with the weather elements is legitimate. Direct or indirect exposure to outdoor conditions can be achieved through various design strategies that enhance the communication and interaction between open and closed spaces in an urban center and blur the boundaries between them.

7) Natural landscapes and ecosystems

An ecosystem can be defined as a pot, a garden, a forest or even the whole planet. In general, an ecosystem includes plant and animal organisms, inanimate elements such as water, soil, rocks and geological features. The greater the diversity, the more interactions occur between its components and the more self-managing mechanisms it develops to ensure its survival and development. This results in the creation of a

balanced system and a stimulus-rich landscape. The integration of ecosystems and natural landscapes into an object is considered beneficial to humans as it enables them to come into direct contact with the elements of the natural world and provides them with a holistic experience. As it has been mentioned, the type of vegetation and the sight of a landscape have a different influence on people and on each individual. It is worth noting that humans generally have a tendency towards landscapes that resemble the savannah type (scattered trees, high herbaceous and bushy vegetation, presence of water), as this is where most of their evolution took place.

8) Fire

The discovery of fire is a pivotal development in the history of man and marks a new era in the formation of his societies, as it is considered the first step towards the exploitation of energy forms and is linked to the possibility of transforming materials from one state to another. The presence of fire in the indoor environment provides a warm atmosphere, both literally and metaphorically. Not only does it provide a means of heating, but it adds a particular range of natural colors and forms to the environment. This creates a pleasant sensation, stimulates interest and encourages positive responses and emotions. This strategy can be achieved, particularly in the interior, by incorporating candles, fireplaces and other installations that imitate the production of fire. In addition, it is possible to convey sensation through the creative manipulation of light, shadow and colors (Kellert & Calabrese, 2015).

2.7 Indirect experience with nature

1) Images of nature

The representation of the natural environment and its various elements and organisms (landscapes, plant and animal organisms, geological formations, water elements) is an indirect strategy that can enhance the experience of nature in the man-made environment. It can be applied either in combination with other strategies or as an alternative in certain cases where it is not possible to integrate real natural elements into the site (unfavorable conditions, economically unviable solution, not beneficial due to the use of the site) or where it is not possible to view natural landscapes from

the indoor environment (adjacent buildings blocking the view, absence of natural environment in the field of vision). The means by which this strategy can be implemented include the use of paintings, sculptures, photographs, posters, electronic screens for displaying images and videos and other means. It is important to emphasize that isolated use, disconnected from the other design elements, has little return while instead repeated and strategically planned integration of these media should be encouraged (Kellert & Calabrese, 2015; Gillis & Gatersleben, 2015; Birrane, 2016).

2) Natural materials

An important area of biophilic design is the appropriate selection and treatment of materials in the design of an object. The nature-inspired harmonious composition of the palette of materials, colors and textures used in an object is a decisive factor that shapes and alters not only its construction and appearance but also the atmosphere of the spaces in which it is located. The materials used in the various elements and furniture used in a space have the potential to catalyze the feeling in it and provide unique sensory experiences through interaction with them. Materials derived from the natural environment and having undergone appropriate processing to add a physical dimension to the experience of the space and the object and enhance the multi-sensory perception of the human being. Timber, rocks, clay, cork, bamboo, hay, hemp fiber, rubber, cotton wool or leather fabrics, parts of trees and other plants, local materials which depend on the local flora, climate and the particular geomorphological conditions of a place are some examples. Indeed, when materials are of local origin, they encourage a sense of belonging to a specific environment with distinctive characteristics. In addition, it is legitimate to study and critically select and apply alternatives such as materials produced by recycling various materials (coffee grinds, wood waste, seaweed, coconut fibers). In this way it is possible to strengthen cooperation and mutual support with companies and craftsmen with common values and objectives. Finally, it is considered important to take into account the whole life cycle of materials (source of origin, processing method and means, methods of transport and distribution at the individual stages, consequences during use, recyclability or reusability) and to consider user compatibility and environmental

friendliness to ensure the sustainability of their use and choice (Kellert & Calabrese, 2015; Gillis & Gatersleben, 2015; Sayuti, 2019; DeGrace, 2019).

3) Natural colors

Color is considered a key element that contributes to the understanding and perception of a space or an object by humans and the shaping of their psychology and behavior when interacting with them. As vision has developed as man's dominant sense, it allows him to perceive and evaluate the environment around him and to orientate himself in it. Color is inextricably linked to the various processes necessary for survival, while also directly but subconsciously influencing the expression of emotions, cognitive function and the atmospheric perception and recollection of an object. Therefore, creating a color palette that promotes a harmonious and balanced whole is considered a crucial choice in biophilic design. It is considered preferable to choose earthy, soft and in some cases more vivid colors that can be observed in the elements and forms of nature (soil, rocks, water, plants, the colors of the sky at sunrise and sunset, the appearance of a rainbow). On the other hand, it is desirable to avoid, or use wisely, very strong, synthetic colors and to create strong color contrast (Kellert & Calabrese, 2015; Dolan & Smith, 2016; Sayuti, 2019).

4) Simulation of natural air and light

The artificial lighting and ventilation of artificial environments has evolved and improved significantly in recent years alongside advances in technological breakthroughs. However, for the most part, the methods used today do not simulate the sensation of natural lighting and ventilation but tend to create a static atmosphere inside spaces with negative consequences for people's physical and psychological health. In accordance with the principles of biophilic design, special care must be taken with artificial lighting so that, as far as possible and permissible, it imitates the qualities of natural light. Similarly, the design of the ventilation system in a space is beneficial to mimic through variations the characteristics of a natural ventilation to provide a more stimulating and natural atmosphere in the artificial environment (Kellert & Calabrese, 2015; Dolan & Smith, 2016).

5) Natural shapes and forms

Nature is an inexhaustible source of inspiration for the design of shapes and forms that can be widely used in the human environment to create attractive and exciting spaces and objects that simulate the dynamism and complexity of natural systems. Some sources of inspiration include plant organisms or parts of plant organisms such as leaves and tree trunks, the skin, fur, feathers, shells or shells of animal organisms, animal structures such as bird nests, bee hives and spider webs, waves and water flows. Organic forms share common characteristics such as a preference for curved lines, sinuous and tubular arrangements, the absence of straight and vertical angles and a sense of fluidity. The patterns and layouts resulting from the study and interpretation of natural elements and processes show a wide diversity and multiple possibilities for their use in design. The integration of organic forms gives balance, symmetry and beauty and fosters positive human response (Kellert & Calabrese, 2015, Wikipedia, An Introduction to Biophilic Design).

6) Nature's tenderness

This strategy involves the introduction into the design of forms and shapes that are not found in nature but are imaginary renderings of organic structures. As with the previous practice, they draw inspiration from the principles of nature and the characteristics of the natural world which they translate into spatial representations and design renderings. Examples of this approach are objects and products that resemble living organisms.

7) Wealth of information

The natural world is an extremely complex system that exhibits infinite diversity and perpetual variability. Despite the immeasurable wealth of information concentrated from the smallest to the largest scales and expressed in organic processes and organisms, natural systems are governed by a particular organization, structure and coherence. Man thrives in environments that are full of colors, textures, shapes and geometries found in nature or inspired by it. These spaces activate the human senses, arouse curiosity and interest, stimulate thought and imagination, and encourage participation and interaction. Finally, spatial conditions can create a sense of mystery

and encourage exploration of the space and new experiences (Kellert & Calabrese, 2015; Ulrich, 2002).

8) Natural geometries

The term natural geometries includes mathematical sequences that are found everywhere in the natural world (in living organisms and their parts, in soil and water formations, in weather phenomena). These structures exhibit certain characteristics such as increasing complexity, recurring patterns and hierarchical organization of information at all scales. One of the best known sequences is fractals, which describe highly complex geometric shapes consisting of infinite segments that are smaller copies of the whole image. Other mathematical geometries include the Fibonacci sequence and the golden ratio. These geometries impart both diversity and similarity to a physical structure resulting in a harmonious and balanced whole with a high degree of complexity running through all its scales. The application of natural geometries to biophilic design is not an unprecedented trend but the recognition and continuation of a practice that was carried out long before the invention of the term itself with numerous examples from the past (creation of the first settlements and buildings, Gothic and Islamic architecture, traditional architecture) express man's vital connection with natural forms and his primitive and fundamental need to reproduce them in his living environment. The spaces that result from the incorporation of a variety of fractal motifs (in surfaces, textures, colors, sounds, treatment of light) are rich in information and events. At the same time, they respond to human needs and natural tendencies and are perceived as aesthetically pleasing as they enrich the lived experience by activating the senses and stimulating interest Kellert & Calabrese, 2015; Sderlund & Newman 2015; Gillis & Gatersleben, 2015).

9) Change of time

Nature is in constant change and adaptation, which is reflected in the phenomenon of life. This fluidity is present in every aspect of the natural world and is expressed in the interrelated processes of creation, growth, decay and ageing. People are unconsciously attracted to patterns and materials in which the deterioration due to the passage of time becomes evident as they are instinctively linked to the processes of change. In design, this can be achieved by using materials that over time show

corrosion and therefore impart a sense of the flow of time and the evolution of history in the man-made environment (Kellert & Calabrese, 2015).

CHAPTER 3 Senses and design

3.1 Sensation

Sensation is a biological system used by an organism for sensation, the process of gathering information about the world and the organism's response to stimuli. For example, in the human body, the brain, which is part of the central nervous system, receives signals from the senses, which constantly receive information from the environment, then interprets these signals and elicits bodily responses. Although traditionally about five human senses were known (i.e. vision, smell, touch, taste and hearing), it is now recognized that there are many more (Bradford & Harvey, 2022). The senses used by various other organisms are even greater in variety and number. In the process of sensation, sensory organs collect various stimuli (such as sounds or smells) for transformation into a form that can be perceived by the brain. Sensation and perception are fundamental to every aspect of an organism's cognition, behavior and cognition.

In organisms, a sensory organ consists of a group of interconnected sensory cells that respond to a particular type of physical stimulus. Through cranial and spinal nerves (nerves of the Central and Peripheral Nervous System that transmit sensory information from the brain to the body and vice versa), different types of sensory receptors (photoreceptors, chemoreceptors, thermoreceptors) in the sensory organs transmit information from these organs to the central nervous system, eventually reaching the brain, where the sensory signals are processed and interpreted.

Sensory systems are divided into external and internal. The external senses in humans are based on the sensory organs of the eyes, ears, skin, nose and mouth. The internal senses detect stimuli from the internal organs and tissues. The internal senses available to humans include the vestibular system (sense of balance), as well as others such as spatial orientation, proprioception (relative body position) and pain. Other internal senses produce signals such as hunger, thirst, suffocation and nausea or various involuntary responses such as vomiting (Soderlund & Newman, 2015; Gillis & Gatersleben, 2015). Some animals are able to detect electric and magnetic fields, air humidity or light polarization, while other animals sense and perceive through

different systems, such as the echolocation system. Sensory modality or submodality is the method of encoding and transmitting sensory information. Sensory multimodality integrates different senses into a single perceptual experience. For example, information produced by one sense has the potential to influence the way information from another is perceived. Sensation and perception are studied by a variety of related disciplines, most notably psychophysics, neurobiology, cognitive psychology and cognitive science.

3.2 Vision

In the history of Western civilization, among the five senses, sight was considered the noblest of all. The dominance of vision and, by extension, of the image over the other senses has led to a one-sided experience, to a move away from the multisensory interpretation of a space or an object. We have been led to an uncontrolled influence of the image, which measures everything by its ability to show or self-project and turns the whole experience of life and objects into a visual process. Added to this, with the help of new technologies, is the digital image with its even greater potential for influence.

Since ancient Greek thinking, the emphasis has been on the image and vision. Heraclitus wrote that *"Eyes are more accurate than ears"*, while Plato considered vision to be the greatest gift of mankind. Aristotle, like the above, argued that vision is the noblest of the senses. Even in modern Western civilization, with the development of technology in terms of products, smart materials and interactive objects, we see the world as a stitching together of successive images. However, visual information projects a one-sided experience of the space or object. Besides, as Shin Azumi (2010) states, if an object has nothing to offer but its image, it misses an important opportunity.

3.2.1 Sight Benefits

But what is it that "helps" vision compared to the other senses? If we think of ourselves interacting with an object, the first impression that is created is the image of

that object. The image of materials, surfaces, shadow and light creates expectations for our other senses. From the image of an object and its materials, we can surmise how we will feel when we touch that object. Another reason why vision has so far been the dominant one among the senses is the immediacy and ease of the image. Through vision we can see the image of anything, from a distance. We can see a photograph of a room or an object, the surfaces and materials that make them up.

Despite the apparent advantages of vision, it is what distances us from the world around us while all other senses unite us with it (Pallasmaa, 2005). Also, the emphasis on the image may be the main reason why the products we experience are distinguished by neutrality. The image can be neutral because it keeps a distance between it and the viewer. But we could not think of a nihilistic sense of touch, for example, because of the unavoidable closeness, intimacy and sincerity of the materials it conveys. We leave much to chance and pass over even more if we experience the world by sight alone.

3.3 Touch

Touch is the second most familiar sense after sight. Many argue that all other senses are manifestations of touch, as specializations of the skin (Pallasmaa, 2005). Cartesian equated vision with touch. He believed that the sense of touch *"is more certain and less error-prone than sight"*. Haptic information is easy to handle and does not allow for errors and large deviations since roughness, weight, temperature are objective quantities that are perceived in a similar way by the user and leave little room for subjective interpretation by the user.

George Berkeley also associated vision with touch. He considered it impossible to understand materiality, distance and depth using vision alone. He says of touch, *"Vision needs the aid of touch, which provides a sense of stability, strength, and prominence. Vision divorced from touch could have no concept of distance, extroversion, or immersion, or, consequently, of space, object, or body"* (Lord & Templeton, 1986). The telling difference between vision and touch is found in the fact that *"visual space is presented to us in its entirety in an instant, whereas tactile space is revealed little by little"* (Hull, 1997). Also, in the case of touch, direct contact with

the object is required in order for the user to acquire the tactile information of materials and surfaces, unlike an image which does not require physical presence and proximity to be perceived.

According to Herssens and Heylighen (2011) *"as the terminology for touch is very extensive and has different connotations, we must first of all define the sense of touch associated with objects". Touch involves very different types of information (e.g. about pressure, temperature, shape) and uses both cutaneous perception (e.g. perception of skin) and kinesthetic receptors (e.g. perception of muscles, tendons, joints)[...]".*

3.3.1 Memory and Touch

The above information can be engraved in the memory of the user of an object, "mapping" it and imprinting it in his mind. Any reference through touch to a particular feature of that object will create the corresponding association through memory with it. Vision reveals what touch already knows. It could be argued that touch is the unconscious of vision (Pallasmaa, 2005) and acquires a symbolic meaning when we consider the associations that tactile information can create. For Pallasmaa *"a pebble that has been polished by the waves is pleasant to the hand, not only because of its shape, but because it expresses the slow process of chiseling, a perfect pebble in our palm materializes duration, it is time that has been transformed into shape"* and in his book he quotes a personal experience about the sense of touch saying: *"Standing barefoot on a soft, crystalline rock by the sea at sunset, feeling the warmth of the stone warmed by the sun through the soles of my feet is extremely therapeutic, making it a part of the eternal cycle of nature. One can feel the slow breath of the earth".*

It is our hands that touch most of the objects around us. In addition to the way we touch, the part of our body that is touched or touched is also important. Different parts of the body may differ in tactile response and are characterized by more or less sensitivity. For example, stimuli felt by the legs, back, arms and shoulders differ from those felt with the hand or face. We can therefore experience surfaces in many ways (sitting, lying down, rubbing them). We can feel the hardness or roughness of the

floor we walk on with our feet, and even feel the temperature or humidity of a room with our face, which may be related to the physical characteristics of the materials and surfaces of a room but are perceived through the broader sense of touch (sensors in the skin).

3.4 Hearing-Sound

According to Holl et al., (1994) *"the vivid reflections of the echo and its reverberations within a stone temple increases our sensitivity to the vastness, geometry and materiality of space. Imagine the same space carpeted and therefore acoustically 'soft' ... a spatial and experiential dimension of space is lost. We could redefine space or objects by shifting our attention from the image to how they are shaped through resonant sounds, vibrations of materials and textures."*

Sound is a very interesting material. Even though it is immaterial it can have a physical substance. Sound needs space and time to exist, two main factors that really highlight the potential of sound as a building material.

3.4.1 Sound and Vision

By thinking of an object created solely by sound and comparing it to an object where it is the image of surfaces that creates space, we can argue that while vision isolates, sound unites. Vision directs, while sound leaves more options. The sense of sight implies externality, while sound creates an experience of interiority. Looking at an object, sound approaches us, the eye approaches, but the ear receives (Pallasmaa, 2005). The importance of hearing may not be obvious but it provides a three-dimensional atmosphere.

But how do both elements work together? Consider that we interact with an object with closed eyes and hear sounds coming from the materials of that object. We could argue that if these materials are familiar to us and have a characteristic sound, such as metal or wood, we can figure out roughly what this object will look like and what materials it is made of. In a reverse process, where we interact with an object with our

ears closed and our eyes open, looking at the image of its materials, we can guess the sound that the materials will produce. Therefore, it is not only the image that can generate expectations for the other senses (Pallasmaa, 2005), but also sound, and perhaps smell, taste and touch, can generate expectations related to the other senses.

It follows from the above that sound is a misunderstood "material" that could become a key to understanding the world around us, if we treat it as a parameter that can create interesting spatial conditions. The aesthetic and scientific properties of sound, as well as its personal interpretation, play an important role in the multisensory experience of objects. If we want to talk more specifically about sound and materiality, we can say that its physical properties and personal interpretation create associations and relationships between materials and sounds. Thus, we have associated most of the materials with which we come into contact with a particular sound and also with a personal view of it. The same is true, to a greater or lesser extent, of the other senses.

3.4.2 Temporal Nature of Sound

Sound in relation to the image is characterized by its temporary nature which is largely determined by the movements and choices of the user of the object. Sound also offers an intense variety of sounds whether the user is moving or remaining stationary in space in relation to the change in the image achieved through the user's movement in space. If the user does not move, the image remains static.

3.5 Smell

The most timeless memory of any object is often its smell. “There are 10,000 different smells. Every dwelling has its own distinct smell' (Pallasmaa, 2005).

3.5.1 Smell and Memory

Smell is the sense that has the power to capture and retain the memory of any object. It is the sense that is inextricably linked to the element of memory and this can be

easily understood if we consider how a particular smell makes us without realizing it remember something that had been completely erased from our visual memory (Pallasmaa, 2005). Smell, therefore, is inextricably linked to memory. It is characteristic that the message of smell takes the longest time to reach the brain but also lasts longer than the messages of the other senses. So smell lasts longer.

Smells have the ability to recall states and images, so it becomes possible to recognize an object through the olfactory system. As Pallasmaa says, the smell of a candy store makes us think of the innocence and curiosity of childhood, the scent of a bakery conjures up images of health and physical strength. The seaside towns where the main occupation of the inhabitants is fishing give off an unforgettable smell because of the meeting of the smells of the town with the smells of the sea. The strong smell of seaweed brings out the sense of the depth and weight of the sea, and gives any ordinary city the image of lost Atlantis.

In today's world, with the prevalence of e-shops, the physical contact with the products on the market and therefore with their smell is lost. All the products that once "filled" the spaces with their smells have now been visualized on a computer screen. Rarely do we now encounter the smell of handmade leather shoes from the shoemaker's shop, which reminds us of horses and saddles and the enthusiasm for riding.

3.5.2 Fluidity of odor

Unlike the immediacy of image and measurable sound that can be recorded, odor is difficult to record and therefore difficult to interpret completely objectively. We see here the element of subjective-personal interpretation coming in. For the above reason, very often the smell is criticized for its transience, fluidity and its inability to substantiate anything objective. Smell (like taste, which can also be described as fluid), especially in relation to sight, hearing and touch, has the peculiarity that it does not need to be 'present'. This fact can easily become a problem if the smell does not appear when it is needed, e.g. when it is necessary to control it to establish a course or to use it for navigation. The fluidity of the smell makes it difficult to manage as it does not remain constant, like an image in a room. More specifically with regard to

the design of odors, we cannot accurately determine their intensity, duration and range. A new treatment of objects in relation to olfaction is therefore needed.

In an attempt at a new approach, we can say that the scent beyond its practical part, gives a lot of design options. If we evaluate the smell of an object, not as a "necessary evil" and a by-product of design, but appreciate it as a means that contributes to the daily activation of the senses and the experience of an object in a space, we will also understand its value, something that until now only people who have lost their sense of smell for a long time can confirm.

Referring to materiality, we can argue that the smell, mainly of natural materials such as wood, stone or clay, but also of artificial materials such as concrete, metal, plaster, paint, glass have a characteristic smell that is engraved in our memory and associated with it. By approaching smell in a different way than hitherto, as an integral part of the design and its outcome rather than as a by-product of it, the smell of objects could be a very well-designed condition that leaves nothing more than the other senses to chance. The smell of an object is also related to the condition in which it is found. Even the same object, with the same materials, has a different smell depending on the state it is in.

3.6 Taste

Taste is perceived through the taste buds. There are five basic tastes: bitter, salty, sweet, sour and "umami" (the 5th basic taste after sour, sweet, bitter and salty). Grease is a flavor that nowadays tends to be considered a basic flavor.

3.6.1 Symbolic Value of Taste

If we read the description by Junichiro Tanizaki, a great Japanese writer of modern Japanese literature, of the process of tasting a bowl of soup, we will notice how he describes this process as affecting the whole body. More specifically he states: *"With the vessel passed over with lacquerware there is a beauty in that moment between the removal of the lid and the lifting of the bowl to the mouth, when one looks towards the still, silent liquid in the dark depths of the bowl, its color differing little from the bowl*

itself. What lies in the darkness one cannot discern, but the palm detects the gentle movements of the liquid, steam rises from within creating droplets on the rim, and an aroma hovering over the steam, evoking a subtle anticipation ... A moment of mystery, it could almost be called, a moment of ecstasy".

In the above description, a typical, for Western culture, eating process is described as a ritual and acquires symbolic meaning. Taste is used as a starting point for the activation of the body and all other senses and acquires a symbolic dimension. The stimulation of the senses is achieved with a sensory trigger which, like a domino effect, activates the other senses. The stimulation of the senses could be similar in the design and experience of a space or object this time and not of food. If we want to relate taste to materiality, we can argue that each material has its own taste.

3.6.2 Taste and Memory

The taste of an object usually arises from memories as opposed to the smell which triggers the memory. Rarely do we encounter direct contact with the materials of an object in order to perceive its taste. Usually seeing a familiar material, we associatively know its taste. So we can perceive the taste of an object even if we do not taste the materials at that moment, as long as we have tasted them at some point. Taste is the sensation that, while always present, is the sensation we perceive most rarely in an object. How many times have we used an object and then remember its taste as vividly as we remember its image or smell?

3.7 Chemical Composition of Materials

In a more objective-scientific approach, in terms of chemical composition, the non-edible materials that are more prone to oxidation are also the ones that have the greatest impact on taste. The physical properties of some metals have been examined and some general-objective trends in taste have emerged. For example, metals such as copper and aluminum have a strong taste, while metals such as gold and silver are more tasteless (hence the high use of silver cutlery). The above conclusions are only a very small piece of research as there has been no previous systematic research on the

relationship between the physical-chemical properties of materials and perceived taste.

An original experiment from the Institute of the Making set out to investigate the taste of some of the widely known metals. Referring to the experience of testing materials, Dr. Laughlin created the same spoon with seven different materials, starting with zinc and ending with gold to investigate the relationship between the experience of eating and the materials of the surfaces that come into contact with the food and thus assess the properties of different metal spoons. The results showed how different materials can enhance or detract from the taste of food.

After testing, it was observed that the difference in taste is significant enough to affect the perception of taste and enjoyment of food depending on the material of which the cutlery is made. More specifically, spoons made of copper and zinc had a strong metallic taste and enhanced or added to the bitter taste of each of the creams tested, as expected. To the surprise of the scientists, they also enhanced the dominant taste of the food at the same time. In other words, the sweet custard tasted slightly sweeter when eaten with copper or zinc spoons than when eaten with gold or stainless steel spoons, while the savory custard seemed saltier respectively. Gold seems to be so neutral that it allows the taste of the food to "shine" without any alteration.

3.8 Common Code of Values

The prevalence of vision has led to the creation of a common code of values and interpretation, common at least insofar as the conclusions concern the interpretation of the physical characteristics of the objects we see. At a deeper level of reading, the social background and the group of people to whom we refer play an important role. We can accept that among people with common references, a common code of interpretation of objects through vision has developed.

As far as the other four senses are concerned, this common treatment and interpretation of items referred to touch, smell, hearing and taste is not so strongly present. The common code of values and interpretation referring to the other four

senses is absent and this leads to their deactivation in front of the "eyes" of the users of an object.

3.9 Absence of Senses

What can the absence of smells and tastes from an object mean? Can the absence of smell and taste be related to the absence of seasoning in cooking? Does the absence of seasonings necessarily create a boring and neutral effect? Or if food ingredients are characterized by a very strong smell and taste, is the absence of seasoning exactly what they need to bring out their flavor?

Today, there are many designers in the world who are trying to redefine the sensory approach to design through an enhanced sense and presence of materiality and its effect on the senses (Pallasmaa, 2005). As the senses are downplayed in design studies while it is necessary to interpret objects with all of them, it is urgent that we invest in a design education that does not exclusively promote visuality and rewards innovative proposals that appeal to all senses. We also need to develop physical and material ways of understanding objects, activating senses that are usually excluded (smell, taste).

3.10 Activation of the Senses

Having come into contact with the materials of an object, having recognized their physical properties, one would expect the existence and combination of these materials, their orchestration, to provoke stimuli for the activation of all the senses of the user of the object. Let us consider an orchestra consisting of many musical instruments that need someone to tune them. The existence and playing of music does not guarantee a sonorous or harmonious result. Proper coordination and orchestration of the orchestra by the conductor is essential to create a quality result. Similarly, it is the design orchestration of the materials that can activate the senses. All materials can be interpreted and have an effect on all the senses. The question is how they are arranged and composed so that they manage not to remain neutral by projecting a superficial image, but to trigger a deeper stage of reading by the user. This is a

challenge for the designer of an object. This bet is not easy considering that everything that is materialized is made of materials, but few products manage to activate the senses. In most cases we stick to a reading of the image of an object and stop there.

What is the language that activates the senses? According to Katsarou, (2010) *"By foregrounding the role of the senses as mediators of experience and seeing how different people manipulate their senses in relation to the urban environment, with its given cultural properties, designers are provided with ways of multi-sensory design and redesign"*. O'Neill states that it takes the combination of many senses, such as touch, sense of orientation, balance, sound, movement and memory of past experiences, which ultimately combine to create the overall experience (Herssens & Heylighen, 2011).

Our nature's deeper desire to perceive and experience objects through all of our senses dictates that the designer should restore this disturbed balance by paying attention to the quantity and quality of textures, sounds and smells in the objects and spaces they create. Our body is the tool to experience objects and through it we enter the world of sensory activation. Even with our eyes closed, our imagination unfolds full of shapes, colors, sizes and movements. Through the different senses, we gain knowledge about the world around us. An important element in understanding the world is the stimulation of the senses. If we agree that we experience the built environment with all our senses, few designers have in mind not only the form, but also the tactile, olfactory, gustatory and auditory identity of their object while designing (Herssens, 2012).

Materials with their physical characteristics are addressed to the senses and through them expect to be interpreted. The diminishing interest in the sensory properties of objects and the increasing importance of images imply a reduced activation of the senses or even their loss in some areas.

Modern product design must respond to the need for contact with the body and the senses. A design is needed with layers of complexity waiting to be experienced that is not content with a morphological - formalistic approach but that challenges the senses to awaken, the body to move, the mind to remember and the heart to feel.

3.11 Conclusions

- The fact that people's living conditions have changed so much in a short period of time has caused problems for the psyche of individuals due to the difficulty of adapting to these changes.

- People in urban centers are plagued with stress due to various conditions such as noise, air pollution, high population density and reduced availability of natural elements.

- Having elements of nature within an urban environment has been shown to be beneficial to the mental health of people of all ages.

- The need for contact with the natural environment may sometimes be conscious and sometimes unconscious, but it never ceases to exist, because this contact is the only thing that can restore them to their original equilibrium.

- It has been found that after exposure to nature, the positive effects generated are improved performance, well-being, relaxation and experience.

- People who spend most of their time in nature have better physical, emotional, psychological and social health. This exposure to nature has many positive effects on human health such as relaxation, stress reduction, improved sleep and enhanced immune function.

- Since people have moved to urban centers, opportunities for direct contact with nature have decreased. Their activities are now restricted around urban environments.

- The less green a person's environment is, the more the person is at risk of morbidity and mortality and exposure to nature brings positive health effects.

- As far as ecotherapy is concerned, we know that it provides many benefits, such as improved cognitive function, overall well-being as well as improved physical and mental health. In addition, there are several examples of ecotherapy activities. Such examples include meditation in nature, creating eco-arts, gardening therapy and animal therapy. The benefits of these activities have been shown to improve physical and mental health, reduce stress, improve cognitive function and increase overall well-being.

- For ecotherapy to work, not all of its activities necessarily need to take place in natural environments. That is, even in the city you can observe elements of nature such as trees, flowers, and birds. Anywhere a person can observe elements of nature and reconnect with it.

- Arts and crafts in nature help individuals in reducing their stress and anxiety.

- Exposure to nature is not only enjoyable, but can also be the most effective way to improve our focus and ability to concentrate.

- An environment must be at least somewhat familiar and cohesive to be restorative. In this context, familiarity with the environment does not necessarily mean that we have been in the exact environment in the past, but that it is similar enough to the places we have visited that we do not feel uncomfortable, confused or out of place, so that things happen in a relatively simple, smooth and predictable way.

- An image with moderately structured complexity, moderate depth of field, focal point and natural content such as vegetation and water quickly evoke interest and positive emotions, attract attention and, as a result, remove or reduce negative thoughts and allow the autonomic physiological arousal triggered by stress to subside.

- The composition of the content of nature is specific, and includes specific types of physical properties or characteristics that are supposed to facilitate stress reduction. These may include elements and features such as "calm or slow-moving waters, lush green vegetation, flowers, savannah-like or park-like qualities"

- In our species, environmental preference is related to the aesthetic quality of the natural environment. Biophilia implies a love of animals, plants and all other living organisms, as well as an innate preference for natural environments because of our evolutionary past.

- Direct experience with nature includes practices that promote real contact with natural elements within the artificial environment, such as: light, air, water, plants, animals, weather, natural landscapes and ecosystems, and fire. Indirect experience with nature involves the incorporation of elements that replicate the natural world, simulate the natural world or mimic natural processes. Practices included are: images of nature, natural materials, natural colors, simulation of natural air and light, natural shapes and forms, nature suggestion, information richness, change and patina of time,

natural geometries, and biomimicry. Finally, the experience of space and place considers the critical and effective integration in design of the spatial characteristics of the natural environment that have influenced the formation of the human profile and includes the following strategies: perspective and refuge, organized complexity, integration of parts into the whole, transitional spaces, mobility and wayfinding, connection to place.

- Biophilic strategies respond to the senses of the human body and its relation to a space. Sight, hearing, touch, taste and smell as well as posture and body movement are the means by which man perceives and recognizes the environment around him. Although vision is the dominant sense, the other senses play an important role in the perception and understanding of various stimuli and in the response to them.

- It is the design orchestration of materials that can activate the senses. All materials, if interpreted, can have an effect on all the senses.

- Our body is our tool to experience objects and through it we enter the world of activating the senses. Even with our eyes closed, our imagination unfolds full of shapes, colors, sizes and movements. Through the different senses, we gain knowledge about the world around us. An important element in understanding the world is the stimulation of the senses.

CHAPTER 4 Concretization of the design framework

In this chapter, we will get to know the people for whom the object is going to be meant for and define the problem space, as well as, the direction which the design process is going to follow.

4.1 User framework

Since the product that will be designed aims to target people that live stressful lives in big cities with little to no natural environment around, it is important to know these people and their day to day life in order to create a product that will be of use to them.

First we are going to examine the urban lifestyle. The urban lifestyle relates to the way of living that is adopted in densely populated areas and to the conditions and the quality of life in cities. Although different in spatial structure, resources availability, size, social, cultural, and economic characteristics, all cities merge naturally with built environments. However, in the present day and mostly in megacities, human intervention through time has faded out the natural presence to just a subtle shade. The built environment of cities is composed of buildings, communications, services, industry, commerce, and leisure infrastructures. Each city's own activities are supported by the built environment and by the complex network of synergies and dependencies with other regions, local and globally, that provide for all kinds of resources and goods that cities require, generating the city metabolism. All these interconnections and linkages within the city and to the outside induce urban citizens to adopt certain city lifestyles. Urban lifestyles may be abridged by the following characteristics: a general acceleration of life with long working times, rushing hours in traffic jams, and strictly well-defined weekday routines with lack of time for quietness and to contemplate, higher consumption levels of basic needs such as water, food, and energy than in rural areas and the longing to be, simultaneously, judgmental and socially recognized by peers (even if they are strangers) through possessions and socialization habits (Urban Lifestyles and Consumption Patterns; Living in a large city).

An important factor that has changed in the last few years is the amount of time people spend outside .After the global pandemic many businesses adapted the way their employees work and changed this with a work from home policy. This meant that instead of having to go to work every day the employees had the choice to work from home. Even though the pandemic has passed, many companies still operate with these systems due to the benefits it has. Although, the employees seem to not have an issue with that and with many of them preferring this new adjustment, one thing that is overlooked is that they interact with others less and little by little they cut themselves off their environment. So, in the end, they tend to adopt very solitary habits and do not have the drive to go outside and enjoy activities in open spaces, athletic activities and socializing.

Some characteristics of people living in urban cities (Greenwald, 2018):

- They consume a lot of fast food and often prefer food for on the go. This happens due to the busy program of most people living in big cities so, since urbanites have other places to be, they prefer to eat on the go.
- They understand the value of every centimeter on their space. Since usually, apartments and rooms are quite small in the big cities people living there have to try to cram their belongings in these very small places. However, these people are characterized by their willingness to make these small spaces work, since at the end of the day, they are unable to live anywhere else, as the spaces, even though they are small, the rents are often very high. So, these people have adapted in these conditions.
- They have to learn to sleep through anything. City people are accustomed to sleeping soundly despite blaring car horns and noisy neighbors.
- Even though these big cities are very densely populated, most people are very isolated and are used to just minding their own business no matter what happens in their surroundings.
- They rarely have time to waste. This refers to the fact that city people have a very busy schedule and every activity they have is planned ahead of time. This means that spontaneous activities are rare and they take comfort in a well-structured routine.

Since the most common areas used in a house are the living room and the bedroom, it would be wise to know the standard sizing of these places in an urban city, since we would want our object to be able to fit properly in those spaces without filling up the space too much. In the pictures below, we can observe the standard sizing of these areas, however, since we are creating an object for very populated areas where many people live with roommates and houses are mostly not that large in space, in order for more houses to be put in an area, it would be best, to consider and design the object having in mind the smaller standard dimensions for these rooms (Standard Sizes of Various Rooms.

STANDARD SIZES BEDROOM:

ROOM SIZE	DIMENSIONS (in Meters)
LARGE SIZE ROOM	4.26 X 4.87
MEDIUM SIZE ROOM	3.65 X 3.65
SMALL SIZE ROOM	3.04 X 3.04

STANDARD SIZES LIVING ROOM:

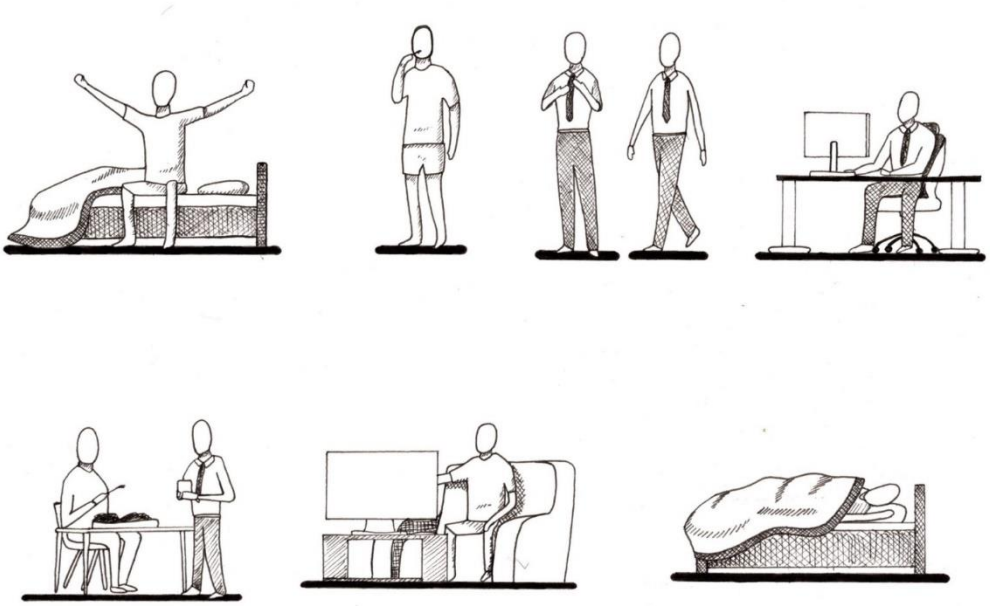
ROOM SIZE	DIMENSIONS (in Meters)
LARGE SIZE ROOM	6.71 X 8.53
MEDIUM SIZE ROOM	4.88 X 6.1
SMALL SIZE ROOM	3.66 X 5.49

Below we can see some other statistics that refer to urban cities and people living in them.

- More than 4 billion people live in urban areas globally.
- The UN estimates 2007 was the year when, for the first time, more people in the world lived in urban than in rural areas.
- Estimates on urban populations vary – mainly as a result of disagreements on the exact definition of an ‘urban area’ and what this includes.
- Just under 1-in-3 people in urban areas globally live in a slum household.

- For most of human history, populations lived in very low-density rural settings. Urbanization is a trend unique to the past few centuries.
- By 2050 it's projected that more than two-thirds of the world population will live in urban areas.
- It's projected that close to 7 billion people will live in urban areas in 2050.
- People tend to migrate from rural to urban areas as they become richer.
- Living standards tend to be higher in urban areas (Ritchie & Roser, 2018).

Finally a sketch was created to showcase a typical day of a working individual that resides in an urban city.



4.2 Product designs inspired by nature

Nature-inspired products are more attractive, unique, simple and well thought out, whether they are aesthetically or functionally inspired. The solutions, shapes and textures found in nature are endless. The following products are some strong examples of design that is inspired by nature.

Butterfly Stool by Sori Yanagi

Japanese designer Sori Yanagi's iconic butterfly stool is a classic piece of furniture that uniquely combines oriental forms with the plywood casting technique developed by Charles and Ray Eames. The gently curved silhouette of the double-shelled seats is reminiscent of butterfly wings - eternally prepared for flight (Mamaqi, 2017; Yanagi, 1954).

Coral Chair

Influenced by the shapes of microorganisms in marine life, the overall shape is a multiple replication of subunits that create the shape of a CORAL. This version was created by studio aisslinger and released in 2009. The construction of an addition of hexagonal funnels that are a hybrid of felt and polycarbonate hexagons create comfortable and elastic seats in various shapes (Retail design blog, 2011).

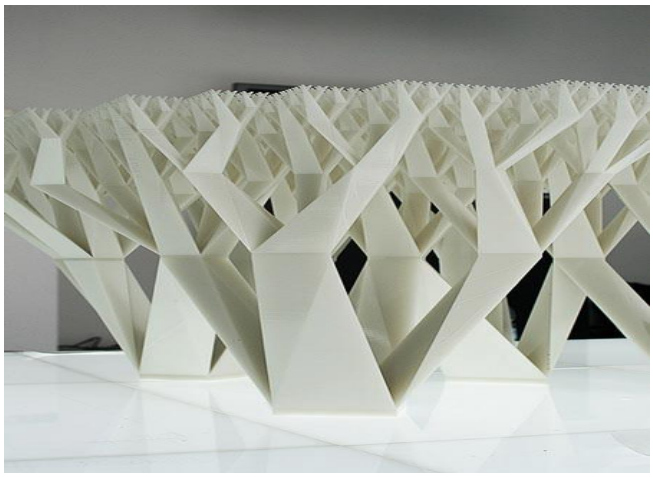
Algue by Ronan and Erwan Bouroullec

A modular system inspired by seaweed. This space divider forms its own thin branching ornament which, thanks to the thicker hole-like areas at the ends of the nineteen points of the unit, can also be connected at as many points as needed to form complex grids (Desing addict. Algue).

Bloom by Patrick Jouin

Lighting design and natural forms have a long and fruitful history. In this iconic luminaire designed in 2010, each petal of shade is articulated at the base, producing a varied spectrum of light, from direct to diffuse. It is manually activated and the user can customize it (Materialise, 2010).

Fractal Table by Platform Wertel Oberfell



The Fractal Table is a table piece derived from studies in fractal growth patterns. Tree-like stems grow into smaller branches until they become very dense towards the top. The Fractal Table, developed by Wertel Oberfell Platform together with Matthias Bär, is impossible to build without rapid prototyping (Fairs, 2008).

NATURE V2.01 Chair

Inspired by the global debates about GMO products and the ecological crisis on earth, "Nature v2.01" explores today's harsh human relationship with nature and our desire for authenticity. The pieces, which feature ash bark formed over timber and resin, are based on the idea that if trees had square trunks, less wood would be wasted. These pieces look like they were grown in someone's backyard rather than made in a design studio (Strum, & Chair, 1966; Beautiful Nature Inspired Product Designs).

Seasons Dishware by Nao Tamura

"Seasons" is an interpretation of functional kitchen and serving utensils, inspired by nature and technology, through the cultural lens of Japan. Like a real leaf, each serving dish is versatile and multi-purpose. It is wrapped for storage using the advantages of silicone to ensure its use in the oven or microwave, able to withstand repeated cleaning in the dishwasher (Van Wey, 2014).

Zen Perfume by Igor Mitin

The bottles consist of two main parts - a glass container for perfume and an imitation of a natural object, made of embossed plastic. The plastic mold is placed on top of the bottle and sealed with glue, so they both form a single object. The texture and density of the plastic form mimics the look and feel of a real natural material (Living Moss Bath Mat by Nguyen la Chanh).

Moss Bath Mat by Nguyen La Chanh

Nguyen La Chanh designed this moss bathroom mat as a project for her degree at ECAL Switzerland. She designed a product that brings that feeling of living green to the feet .The living moss bath mat: "Larosée" is an eco-friendly product made with sustainable production methods and recycled materials. The bath mat consists of a rigid frame made of latex plastazote foam in which various types of moss plugs are nested. Nguyen La Chanh used a mix of pillow, island and forest moss varieties to create this product (ZEN perfume design-concept).

Bloom Chair by Kenneth Cobonpuere

Inspired by a delicate flower, the Bloom chair is made up of hundreds of fine stitches radiating from the center of the seat. Handcrafted from microfiber stitched over a fiberglass-reinforced top, Bloom's petals unfold from a swiveling steel base (Teicu, 2011).

Warde by HQ ARCHITECTS

A set of giant urban flowers placed in an open market square in the centre of Jerusalem, blooming and reacting to pedestrians and traffic in the public space. If a pedestrian is looking for a moment of shade on hot summer days, the flower will swell and stay open until the person leaves. When the tram approaches the station - all four flowers will bloom at the same time and signal pedestrians to hurry if they want to catch the tram (Hq Architects).

Gruppo Strum – Pratone Chair

The Pratone chair was inspired by the word pratone meaning "big lawn" and is a chair shaped like long green stems. The grass blades are flexible, making the chair suitable for relaxing, hiding and playing. Its grass-like appearance provides an organic and natural element. The Pratone chair plays with proportions and material discrepancies, developed from polyurethane foam creating a seat and reclining surface that can be used in many different positions as it bends its shape to fit around the user. The unconventional concept was designed in 1966 by Gruppo Strum, a group of Italian architects (Derossi et al., 1972).

4.3 Sound

The chirping of the canary, the cry of the parrot, the rustling of the leaves, the crashing of the waves, the sound of the plane landing, the running water of the spring, the thunder, the barking of the dog, the voice of the man, the pulse of the tree, the synthetic sound of the computer, the sound of the acoustic guitar... Where does nature stop and man begins? Where does sound stop and noise begin? Where do the sounds of nature stop and 'artificial sounds' begin? All three of the above questions have no clear answers that would satisfy our need to arrange the difficult and colorful objects of our lives into square boxes.

In the field of environmental empathy in particular, one way towards the understanding, appreciation and ultimately protection of nature, is probably the questioning and revision of the bipolarity of the nature-human scheme, and the creation of a broader and more flexible scheme that will place man within the boundaries of nature (Georgopoulos & Tsaliki, 1993; Green, 1995). Thus, nature, will cease to be on the opposite shore punished for patiently accepting the unwanted parts of material and psychic everyday life and will become part of the wider identity of individuals. In such an attempt to connect people to nature, the sounds of nature

and those of humans can be used as bridges, or points of identification between the pre-existing boxes of "nature" and "human". But do the sounds of nature, in the broad sense, have a significant effect on humans, to the extent that they allow us to use them to redefine entrenched mental schemas and change negative attitudes? If so, where does the possibility of this effect come from, and finally, in what ways could these sounds be used as bridges between nature and man in the context of the environmental reintegration of people in urban centers?

4.3.1 Noise

Noise, caused by transport, industrial and recreational activities in the city, is one of the most serious environmental problems, with significant consequences for the health of residents. Although humans can adapt to a wide range of noise intensities, there are certain limits to this adaptive capacity.

Very intense, unexpected or persistent noise impairs the adaptive capacity of the individual. In the European Union, surveys have found that 17-22% of the population is continuously exposed throughout the day to dangerously high levels of external noise (>65db), while 40% is exposed to noise levels that cause severe annoyance (55-65db).

The adverse health effects of noise include sleep disturbance, distraction, auditory disturbance, psychological disturbance, cardiovascular disturbance and reduced well-being. High noise levels (>85db), which develop in entertainment centers and on certain means of transport, usually result in a loss of auditory acuity, which is irreversible due to the destruction of nerve cells. Exposure to noise also increases blood pressure and heart rate and disrupts hormonal function.

4.3.2 Degree of impact of nature sounds on people

The primary sounds of nature are capable of causing human beings emotions with a wide variety of quality and depth. This variety depends both on the objective characteristics of the auditory stimulus in question and on the objective and subjective factors of the listener.

The same sound of nature may have a different psychosomatic effect on two people, depending on their age, the psychological state of the moment, their previous relevant sound experiences, etc. A key element in assessing the negative or positive effect of a particular nature sound is the degree to which the listener perceives it as "threatening" or non-threatening. The fact that man himself has long considered nature sounds to be important to him is shown in particular by the role he assigned to them in his cosmogonical theories.

The healing effect of the primary sounds of nature throughout the centuries is evident both through historically documented practices and through relevant myths and tales of various cultures. In shamanic rituals, from ancient times to the present day, singing has been used as a healing tool. The use of singing for healing purposes is also mentioned in many instances in Greek history and mythology. For example, it is said that *"the musicians Terpandros and Arion healed the Ionians and the inhabitants of Lesbos with their songs"* (McClellan, 1991/1997).

The non-human primary sounds of nature were also thought to have healing properties. Consider that in ancient Greece, healing centers such as those found in the temples of Asclepius were located in beautiful locations with plenty of space in nature. At the healing center of the temple of Asclepius in Pergamum, on the western coast of Turkey, the sounds of birds and running water must have dominated the soundscape of the time. According to Kekek, *"In the northern parts of the library there was the sacred gallery to which they descended by 16 steps. It was 80 m long, with a cylindrical dome, sometimes lined with marble. When the patients walked through the sacred gallery, the sweet sound of the water running alongside made them quiet."* (Kekek, c.h., p. 87).

4.3.3 Importance of the sounds of nature for people

The role of the sounds of nature in the survival of primitive humans was very important, since these sounds warned them of the position and situation of their prey, which he was in danger of being devoured by some of them. In addition, the sounds of nature also gave people information about the weather, the time of day and the seasons of the year, about life or death and about illness or health. Today, the role of the sounds of nature in human survival is much less obvious, although it exists. The

danger of a live tiger on the hunt has been replaced by the stress of work. Today's workers may not be devoured by tigers but there is a risk of heart attacks. Most modern people in the western world no longer live close to nature, but their natural need for it has not disappeared. They once tried to bring nature and its sounds into the apartment, with the canary in the cage and the poor dog on the balcony, but nature, rather well, is not carried within four walls, neither by the pet nor by the CD with the waves of the sea. The experience of nature and its sounds requires a wide open space as a "theatre" and a listener with all his senses available. Thus frequent walks in the parks and holidays in the countryside ultimately help modern people to "survive" in the difficult and often "unnatural" cities he has built.

4.3.4 Sounds of nature and emotion

The proximity of human music to emotion is due, according to Langer (in Reese, 1977), to the fact that both are dynamic rather than static structures and thus music is able to represent the quality of emotion. This is true for human songs, but why is it not for the songs of birds and the running of water in a river? Since these expressions or phenomena are also dynamic structures, and to the extent that humans can perceive them as such, it is possible for them to affect them emotionally.

Based not only on theory, but also on everyday experience, it can be argued that the sounds of nature are capable of evoking strong emotional reactions in people, ranging from strong fear and anxiety, with the hearing of sounds such as thunder, earthquake or the hostile cry of a dangerous animal, to the supreme elation and peace with the hearing of a light wave, the twittering of birds, or the familiar timbre of a loved one's voice. Through multiple positive experiences with nature sounds, people are able to derive pleasure from the now familiar natural sounds.

4.3.5 The tranquility offered by the sounds of nature

There is now scientific evidence for the beneficial properties of nature sounds, as researchers have concluded that the rustling of leaves, the sound of rain and river water can induce changes in the brain and bring about calm. So the sounds of nature help us to relax, and brain scans of related research reveal that these natural sounds

can contribute to better performance in tasks that require a high level of concentration and attention. Why is this the case? Researchers from the medical schools at the Universities of Brighton and Sussex found that listening to 'natural sounds' affects the systems that control the stress response and other functions of the autonomic nervous system, with associated effects on brain calmness.

In collaboration with artist Mark Ware, van Praag's team there was an experiment conducted where participants listened to sounds recorded from natural and artificial environments, while their brain activity was measured on an MRI scanner and autonomic nervous system activity was monitored through changes in heart rate (Stefatou, 2017).

When we listen to nature sounds, there is an increase in nervous system activity associated with relaxation of the body. Interestingly, the amount of change in nervous system activity depends on the initial state of the participants: people who were more stressed before the start of the experiment also showed the greatest physical relaxation when listening to nature sounds, while those who were already relaxed showed less effect.

How can we blur the lines between the outside and inside? How do we restore the natural bond and curiosity between people and the natural environment? All people need, is a trigger to go and explore nature and its beauty.

It is said that you do not notice some things until you experience them. So, I would like to provide an object that works as a trigger to help reconnect people with the natural environment and make them understand how codependent we are to the natural elements. I would like to make people understand that your whole body is not only the physical body, but it extends to one's surroundings. In order to achieve that, I must try to make the user feel what is like to interact with nature and how by doing so, one can live a better life. Some of the techniques I deem important to use are:

- Use materials such as stone, wood, natural metals and other natural materials.
- Incorporate shapes with nature patterns or geometric patterns seen in nature which the users will naturally associate with nature.
- Incorporate colors from nature like greens, blues, browns and earth tones.

4.3.6 Sounds and frequencies

Having understood the profound effect that sound has on the human body and mind people have been pushing the boundaries of how the healing effects of sound and frequencies in general can be measured. Sound frequencies have been used as part of therapies through manipulating human brain waves to promote healing and it has been used to treat illnesses such as insomnia, anxiety, depression and disorders of the nervous system.

Here are some of the instruments frequently used in sound frequency therapy:

- Hammered dulcimer
- Singing bowls
- Gongs
- Windchimes
- Pan flutes
- Hang
- Didgeridoo
- Kalimba
- Djembe
- Rainstick
- Drums

Even though sound healing is just now starting to get scientific credibility, the concept of it has been around for generations (Tibetan Singing Bowls, Healing Frequencies of the Human Body: Full list and Benefits).

4.3.7 The art of Foley

How do we create a sound mood? No one is better at doing that than Foley artists that work for movies or documentaries. Foley is the art of sound and the term originated from Jack Foley who was working in the movie industry and thought to make sounds in post-production in sync with the picture to mimic sonically what is happening in the scene. Ever since, that reproduction of sound effects added to film in post-production is called the art of Foley. Some examples of this technique to mimic sounds for scenes would be hitting coconut cells on the ground to mimic horse hooves or using a feather duster to mimic the sound of birds flying. With that technique they are capable of replicating weather elements and sounds of nature as well.

Sometimes though, instead of just mimicking the sounds these artists have to create sounds for things that do not produce sound in a way that conveys to the viewer the correct feeling and mood of what he sees in the film. This is where we observe the importance of sound, as just with the visual aspect, the viewer always feels like something is missing. This technique is used a lot in nature documentaries. So, how would a spider walking on a web sound, or a flower blossoming? What sounds should we produce to make the viewer feel not only visually, but acoustically, what these things are through a screen? These are the questions that these artists are called to respond to and create something to make the experience of viewing complete. For example, the Northern lights do not make a sound, yet these artists are trying to create sounds, to produce the feeling of what the Northern lights would sound like, if they produced sounds. In the end, all sound is two elements hitting one another (Maio, 2022).

4.4 Objects for inspiration regarding the sense of sound

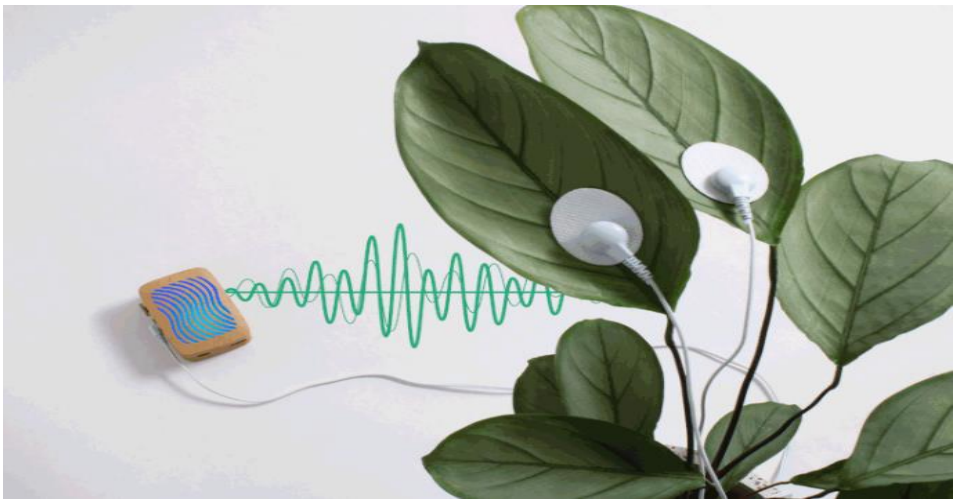
Zen water fountains

A Zen fountain is an object that complies with the Zen philosophy in an attempt to induce meditation and relaxation. It is a scientifically established fact that sounds of running water produce relaxing effects. It makes your mind relax and soothes your soul. The sound of flowing water affects us subconsciously, hence causing a soothing influence on the body, mind and spirits. Often, people will find themselves subjected to loud noises such as traffic, people talking, music, etc. from their surroundings. Unless, their house or office is sound proofed, chances are these unwarranted sounds – noise pollution really, can interfere with their work or sleep. Indoor fountains provide a great white sound to drown the noise and enable people to work efficiently and sleep well (WaterfallNow, 2016).

In addition, water is known to reduce your stress levels. The sound of water is known to reduce the stress causing hormones and relax the muscles and joints. If in one's bedroom, it can improve sleep quality and generally the mood of the individual. Hence, in the stressful life that most people live today, indoor fountain can be a perfect way to decompress and relax.

PlantWave

PlantWave is a device that detects slight electrical variations in a plant via two electrodes placed on the leaves, and then these variations are graphed as a wave, which is translated into pitch messages that play musical instruments (Experience Plant Wave. Tune into nature and listen to plant music).



Sound sculptures

While most sculptures are intended to be viewed, there are some that strive to stimulate our other senses as well. There are many sculptures that are installed at various locations around the world, and interact with natural forces like the wind and the rain to create soothing music, like the Singing Ringing Tree in Burnley, England. In this example, when the wind blows, the sculpture produces an eerie sound in several octaves (Patowary, 2016).

4.5 Requirements

The object must:

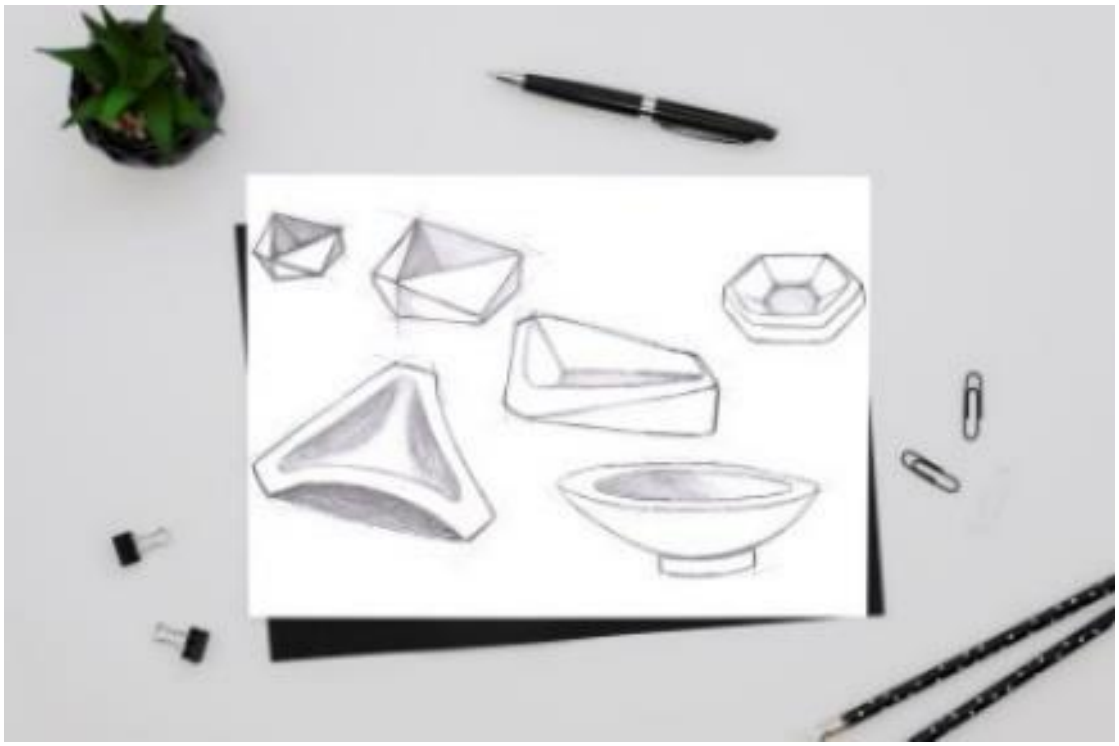
- Have a visual connection to nature, the elements of nature, ecosystems and natural processes
- Evoke mainly auditory and visual stimuli that trigger an intentional reference to nature
- Be designed with objects, materials, colors, shapes, sequences and patterns found in nature
- Create a desire for users to experience the natural environment
- Include sounds inspired by the natural landscape
- Be easy to use

CHAPTER 5 Design

The aim of the project is the construction of objects, according to the principles of ecopsychology, that will transfer elements of nature into the personal space, which will help the user to reintegrate into the natural environment. The user's contact with the object creates interaction with the natural environment within the noisy and stressful rhythms of urban centers and acts as a parody force for the user to experience the need to regain contact with vivifying nature in person, through activities.

5.1 DESIGN IDEATION

In the first part of the design process, in order to achieve the design of an object that meets the purpose that has been set, taking into account the research that preceded it and the users for whom the object is intended, some ideas for concepts were conceived. At this early stage, two ideas emerged as the best of the rest. Thus it was considered important to delve into the structures of these objects, as the morphology of these objects affects their very function. As can be seen in the following ideation, various manifestations of the objects were drawn as we proceeded with the conceptualization.



Through this ideation, we then focused on the most interesting and most functional sketches for the specific objects. An important step we had to follow in the design, so that the concepts would perform exactly the function we wanted, was to repeat the prototyping part several times. This was because it was the only way that we could evaluate whether the concepts were functional and then know exactly what needed to

be changed or improved in the concepts, in order for them to perform their purpose. In the designed objects, the very form of the objects themselves must be designed optimally, as how the objects are designed affects the sound they produce.

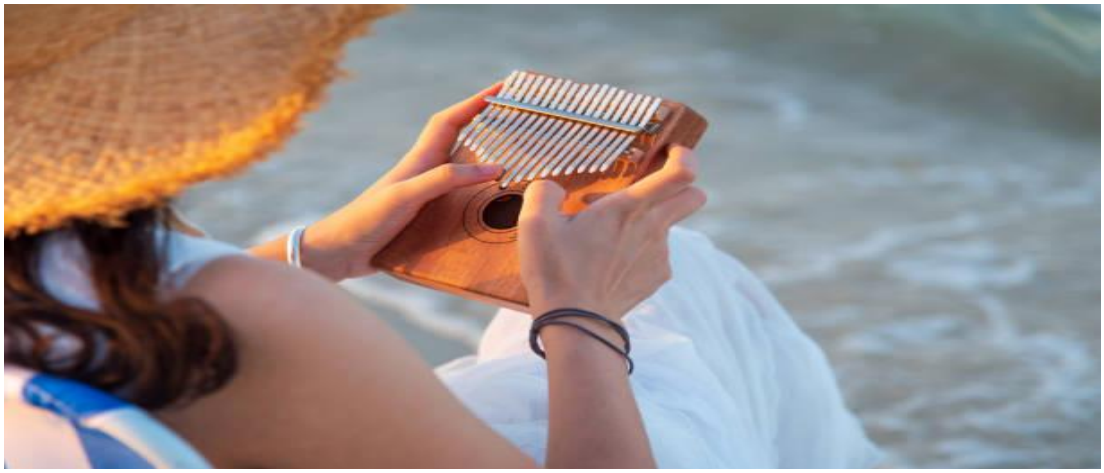
It was therefore chosen to proceed with two concepts. This was done as one object required an active action from the user, meaning that in order to produce the sound the user must interact with the object, while the other object required a passive stance from the user, meaning that the user without doing any action could hear the sound the object makes.

5.2 Concept 1

5.2.1 Original inspiration

For the first concept, inspiration was drawn from the preceding research on sounds and frequencies and the fact that some of these sounds are capable of leading to relaxation and clarity. According to this theory, various instruments and objects that produce sounds are used for this purpose. One of these that was considered interesting is the kalimba musical instrument, as the sounds it produces are "ethereal" and at the same time connect the listener to the natural environment. So the question was raised as to how can we create an object that produces these kinds of sounds without requiring any musical skill and knowledge from the user and at the same time pushing the user to interact with natural elements?

To begin with, what is the musical instrument kalimba and why do its sounds transport us to the natural environment?



The Kalimba is a popular African musical instrument. It belongs to the reed group. Its sound is created by reverberating plates of different lengths and a hollow body. Shorter plates produce higher sounds and vice versa. Tweezers are attached to the metal nut. The instrument received the name "caliba" from the Europeans. It was originally called Mbira and belonged to the lamelophone group. It also includes African instruments such as tsantsa, lekembe, luembu, lala and many others (Desing addict. Algue)

It consists of a sound box and a series of metal bars, placed next to each other and at the appropriate length to produce the specific notes. The Kalimba is described as an instrument that produces a haunting, fluid percussive sound that is considered tranquil and enchanting.

Because of the materials of which the kalimba is made, the sound produced reminds many people of the sounds of the natural environment as air passes through and moves elements of nature, thus producing a plethora of sounds that captivate us and demand our attention. It is no coincidence, moreover, that this musical instrument was often used during night ceremonies to help those in attendance fall into a trance. Other times, sounds from the kalimba are also used in the film industry when the visual content is a quiet natural environment, in order to evoke in the viewer the feeling of being in that landscape, demonstrating how the sound of this instrument connects us with nature.

The following object was therefore designed with this in mind.

5.2.2 Materials:

- Plastic (base)

- Metal (basic structure of the instrument)

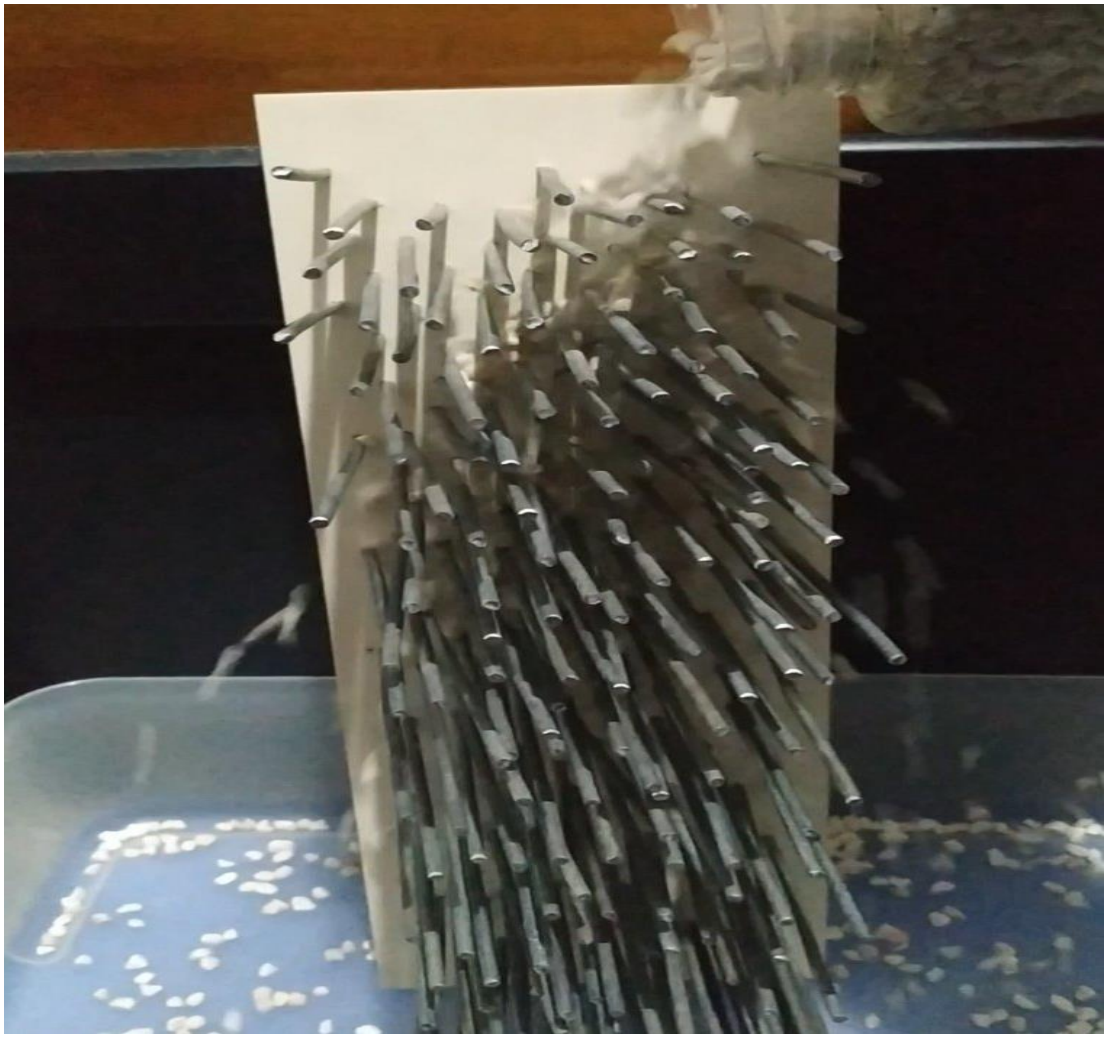
- Stones (hollow stones for the large ones and small pebbles for the throws)

According to the design of the basic skeleton of the metal piece of the object, a rough model was made to see if the function is correct and if something in the design should be changed in order to make the sound as desired.

5.2.3 Mode of use

The metal construction is made in order for the user to pick up stones located on the base and by dropping them into it from the top side, sound is produced. Due to the randomness of the throwing each time the sound produced will vary and through interaction the user will interact with physical materials. Also the metal part of the object is made so that the user, without knowing music, can produce audible sound. The user can have it placed in his personal space and whenever he wishes to use the object in order to experience the natural environment through the interaction of touch, hearing and sight.

5.2.4 Prototyping



5.2.5 Observations from the prototyping

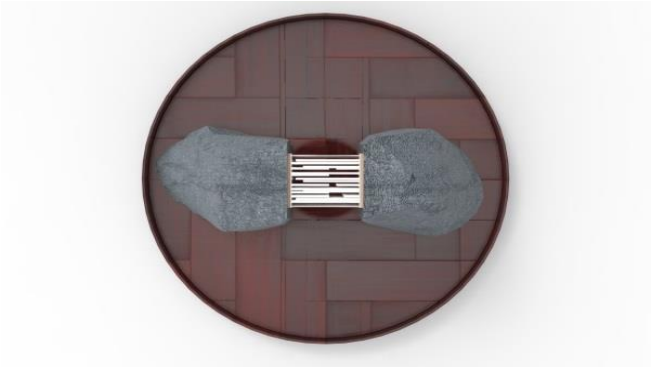
The main observation, after the construction of the rough model, is that there should be some kind of covers at the side points, as during the throwing of the stones many of them after the first or second impact with the metal rods would escape from the structure. This resulted in the duration of the sound being too short and the pebbles had the potential of being thrown off the base. In addition, it was deemed necessary at a later stage to change the material and shape of the base, as the plastic does not refer to natural materials and the shape does not offer anything special for the placement of the object in the space.

5.2.6 Object characteristics:

- Large stone made with an artificial hollow process so that the product will be comprised of natural materials and to keep the object from being too heavy.
- Recessed at the bottom of the stones to give more room for the user to put their hand to pick up stones to throw.
- Wooden base with a small wall in the periphery to keep the stones from falling out.
- Long metal construction with different sized metal rods to produce different notes when striking the stones.
- Metal rods spaced apart so that the pebbles do not get stuck inside the metal construction.

5.2.7 Concept 1 - Phase 2

In the second phase, the design of the object was improved according to the observations made during prototyping, in order for the object to perform its function better. The object will be explained in detail in a later part of this paper, as we will see that this was the concept that we ended up focusing on.



5.3 Concept 2

5.3.1 Original inspiration

For the second object, inspiration was drawn from the preceding research on water fountains and how the sound of running water transports us to a natural landscape. Especially in noisy urban centers, the presence of running water is able to suppress the noises of this environment. Yet another important element that helped in getting the idea for this concept was the so-called sound sculptures, as what was sought to be constructed was about how the shape of the object would make the water make a certain sound.

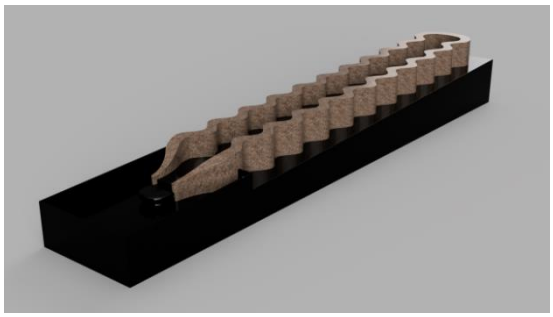
So, in this object, the element of water was emphasized, since it is a key element that connects us to the natural environment and reminds us of it, making us want to attend natural landscapes. It is no coincidence that many people, when they want to go to natural landscapes to feel at peace, choose walks by the sea and natural springs and rivers.

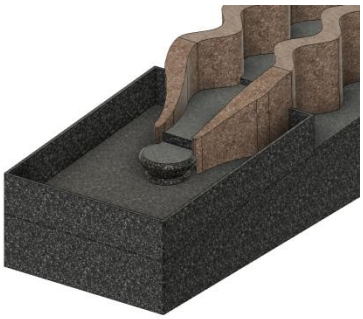
Apart from the above, the emergence of the idea of this object was helped by a basic observation. It was observed that very often people who go to the sea when sitting in silence after a while fall asleep. This is because of the soothing and rhythmic sound that the waves make when they crash on the sandy beach. So, apart from the fact that the element of water helps us to experience the natural environment, it was sought through the object that the user should return to their natural rhythms as it is observed that in urban centers due to the intense rhythms and information overload people tend to live permanently in a state of stress.

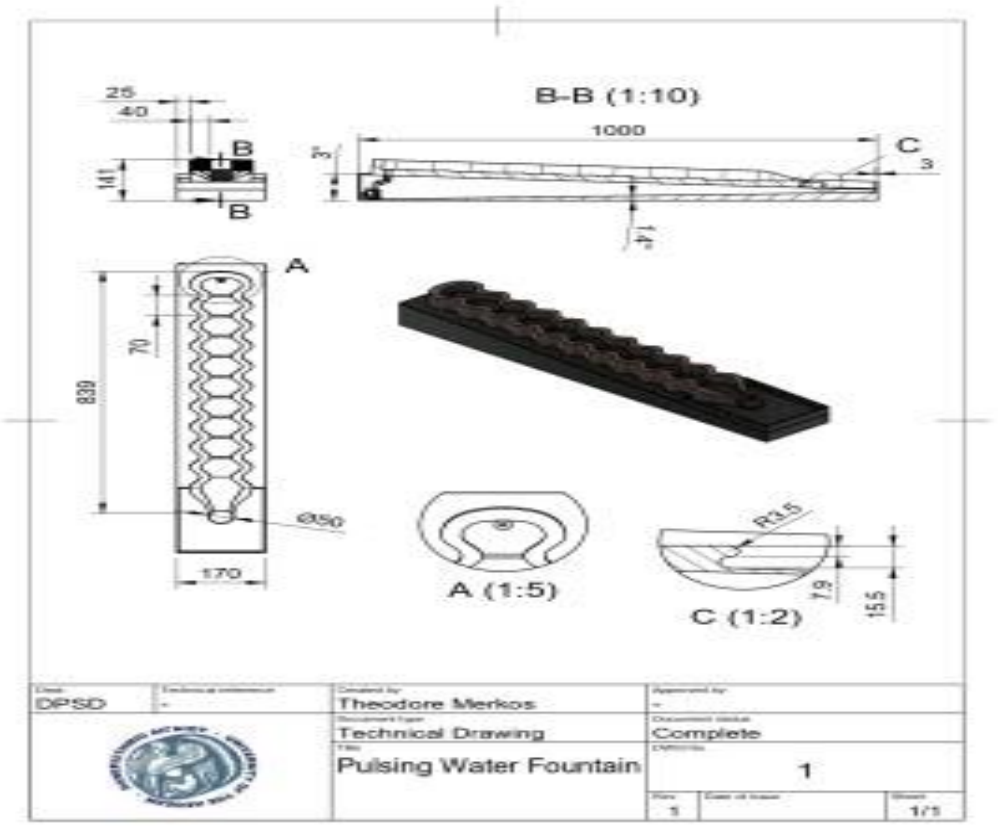
The basic question that this object answers is how through its structure the sound coming out of the water will be made with a controlled rhythmicity. Through the design of this object an attempt was made to achieve the water falling at a rate of 52 bpm per minute. This was done as this is the ideal rhythm of a human heartbeat at rest. An attempt was therefore made through the object to achieve a situation where the heart rate of the users, after listening to the object for some time, would synchronize with the rhythm of the water. This is possible to achieve, as the heart rhythm often tries to come into balance with other rhythms one hears. This is

demonstrated through music, where when a song has a fast beat the listener's heart rate rises.

In the first stage, the following object was designed to try to achieve this property.







However, prototyping was of paramount importance to see if the object actually performs the function and to understand the changes that need to be made to the design in order for it to perform its purpose accurately.

Through the experiments conducted with the above model, the following observations were made:

- The object was not working properly so the structure must be changed

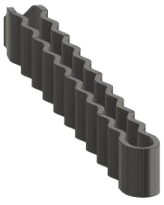
- Internal partitions were added and it worked better

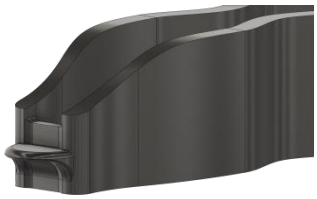
- The water had to be dropped from a greater distance at the end in order to be heard

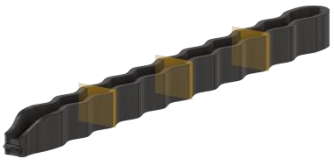
- The outer walls, once internal partitions were put in, had to be raised to prevent overflow

- The outer walls had to be narrowed and the spaces between the inner cavities had to be enlarged

So according to these changes a second indicative 3d was created to make a second mock-up, in order to repeat the experiments until the object's function was achieved. Essentially, the problem that emerged was how to solve the issue of rhythm without mechanical means, but through the form of the object.







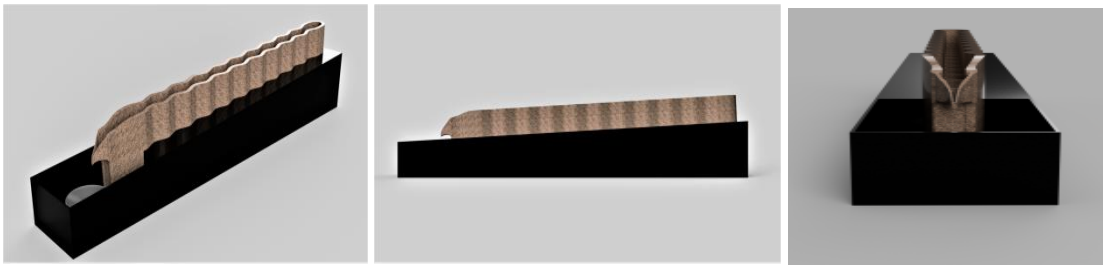
Through the experiments conducted with this second model, the following observations were made:

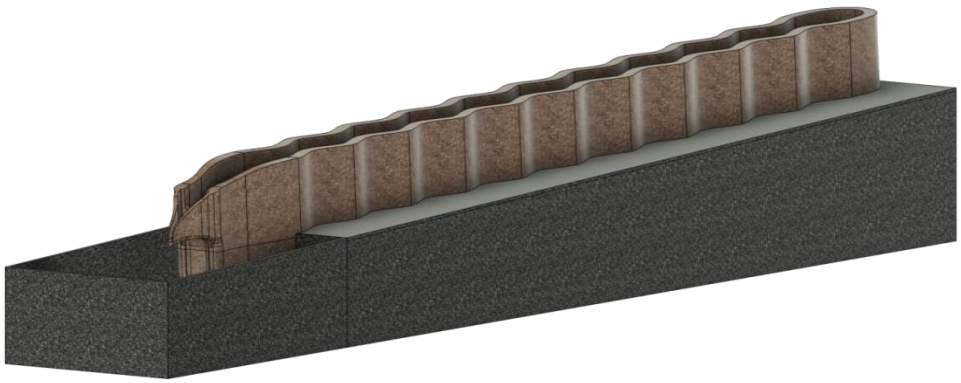
- The object worked much better but the last internal partition had to be raised to achieve the desired rhythm.

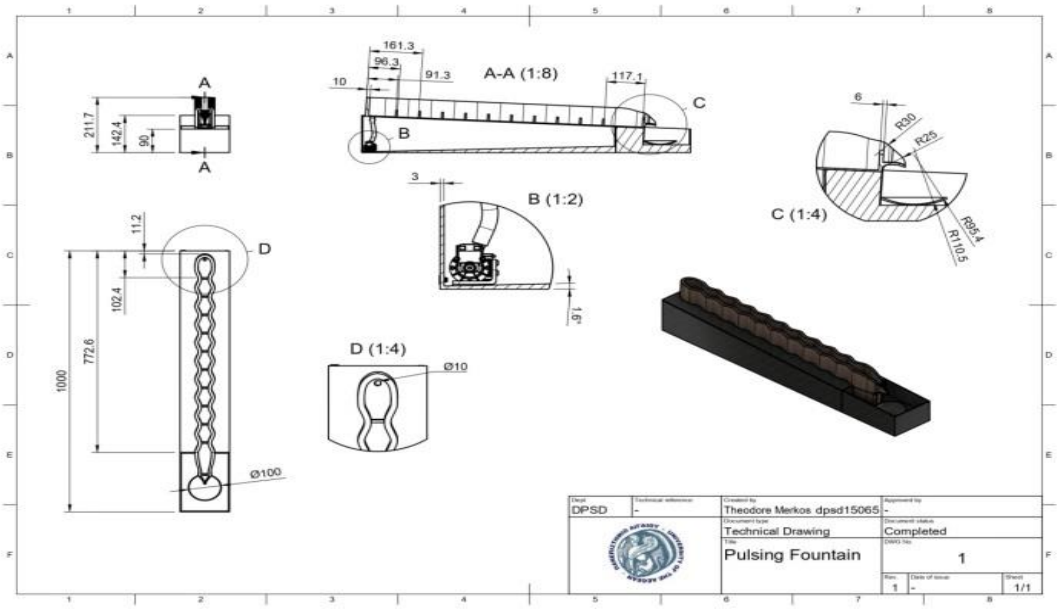
- The water exit point from the main structure had to be redesigned, as shown in the model by intervening in the spout. As the water falling is of small quantity, it is best to have it all fall at once from a specific point to make it sound better.

- Finally, a bowl had to be added at the point where the water falls, as shown in the photos, as this makes the water sound much better when pouring. Ideally the saucer should be glass because it produces a nicer sound when the water is being poured.

According to these new observations, the following object was designed.







5.3.2 Materials:

- Granite (base)
- Stone (walls)
- Glass ("plate")
- Basic mechanism used in indoor fountains, where it will be set at low pressure to get the water out very slowly and achieve the correct function.

5.3.3 Mode of use

This object is passive action, so it does not require the user to take any action to make the desired sound. To operate the object, the user places it in his or her space, fills the base with water and sets it in operation. The object's system starts to supply the system with water. After the water falls into the saucer it overflows and is then sucked into recesses that guide it into the base. Due to the slope of the base inside, the water goes backwards where it is picked up again by the machine and re-supplies the system with water.

5.3.4 Object characteristics

- The inclination of the base that the walls press against is 3 degrees to achieve exactly the desired function.
- Spout for the water to fall all together into the saucer.
- Small recesses to let the water enter the base to be discreet to the user.
- Side walls with a wavy shape as shown to create angulation and achieve the desired function.
- Internal base with reverse slope direction than the top to push the water backwards where the feedback mechanism is located.

5.3.5 Concepts evaluation and final concept selection

After extensive evaluation and use of the two objects, the following observations were made:

Concept 1

- Depending on the stones available for throwing, the sound of the object changes, so it is an element we can exploit in the design to make the object more interesting.

- The fact that the object requires an active action from the user leads to the fact that the object better achieves its purpose, which is to reintegrate the natural environment into the space of people in urban centers and to bring back to users the curiosity and desire to visit and interact with natural landscapes.

- Due to its structure as an object and the materials it is made of, it is also perceived as a work of art, since apart from being a simple product, each part of the object is handmade and due to the different stones that can be used, each object will be unique, giving the user a feeling of exclusivity. Furthermore, as it does not have specific dimensions, it can, while performing the same function, be made in different sizes.

- As an object it can be placed either on the floor or on a bedside table or even a desk and can be a permanent decorative element of the space.

- Due to the fact that the object also functions as a work of art, although it requires active use to produce the sound, it is still a constant reminder of the beauty of the natural environment.

- In addition to the sense of hearing the object engages quite a bit with the sense of touch. We know that the more senses involved in a situation, the richer and fuller the user experience.

Concept 2

- The object is aesthetically very satisfying and at the same time its aesthetics is the reason why it works as we want it to.

- Due to its elongated form it can be comfortably placed in the personal space of people in urban centers.

- Apart from the sound element it is quite interesting for the user to observe the ripples created within the walls.

- Although for the most part the sound emitted by the water is soothing the rate at which it falls may not be helpful to some users.

- Compared to concept 1 it does not evoke the same level of interest in the user to reconnect with nature.

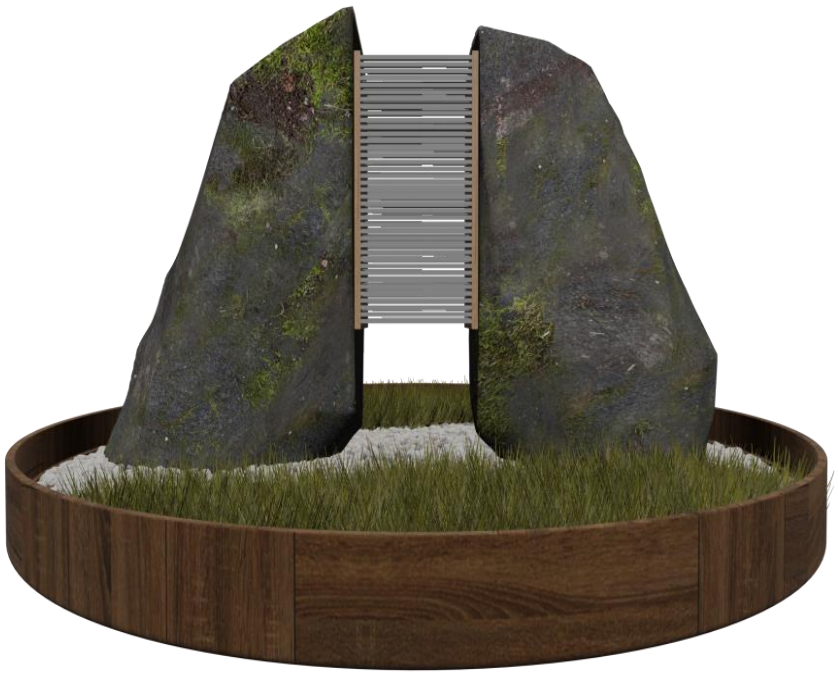
- Due to its very specific function after a while the user may start to become disinterested in the object and not use it as often.

- The object must be, as we can see, quite long as it takes several iterations to create the desired ripple. So, it is harder to store it on a surface and mostly it is convenient to place it on the floor near a socket so it can work.

Through the observations listed above it was deemed that concept 1 would be the best to take to the final design stage. We can see that its positive elements outweigh concept 2 and achieving the purpose we set out to help reintegrate people living in urban centers into the physical environment is much better accompliced with concept 1.

For these reasons the following final concept was therefore created.

5.4 The Cerridwen



The naming of this object is derived from the Celtic Goddess Cerridwen who was said to be the Goddess of moon, magic, agriculture, nature, poetry, music, art, science and astrology. She rules the realms of death, fertility, regeneration, inspiration, magic, enchantment and knowledge. Seeing as nature, music, art, regeneration and inspiration was important in the conception and function of this object the name Cerridwen was thought to be fitting for it.

5.4.1 Materials:

- Herringbone wood (base)
- Metal (basic structure and tides of the instrument)
- Stone (hollow stones for the large ones and small pebbles for the throws)
- Real grass and other natural elements that the user will take care after.

5.4.2 Mode of use

The basic manner of operation of the object does not change and remains the same as it was articulated in the design of this object. However, thanks to its new construction, the metal grid can be detached and replaced with another model that produces different sounds when throwing the stones. This gives the user the possibility to explore other soundscapes. Besides that, natural materials such as grass and flowers will be added to the base which will be natural, so the object will also function as a personal small garden. This also introduces the concept of caring for the object, which as stated in the research leads users to a greater emotional attachment to an object and a greater appreciation of the natural environment.

As each object is a kind of artwork, each one is different and the parts of the base covered by natural materials will be different from object to object. However, these points will be distinct to separate the area where the stones are placed from the other natural elements (grass, flowers) so that they are easy to care for by the user.

5.4.3 Features

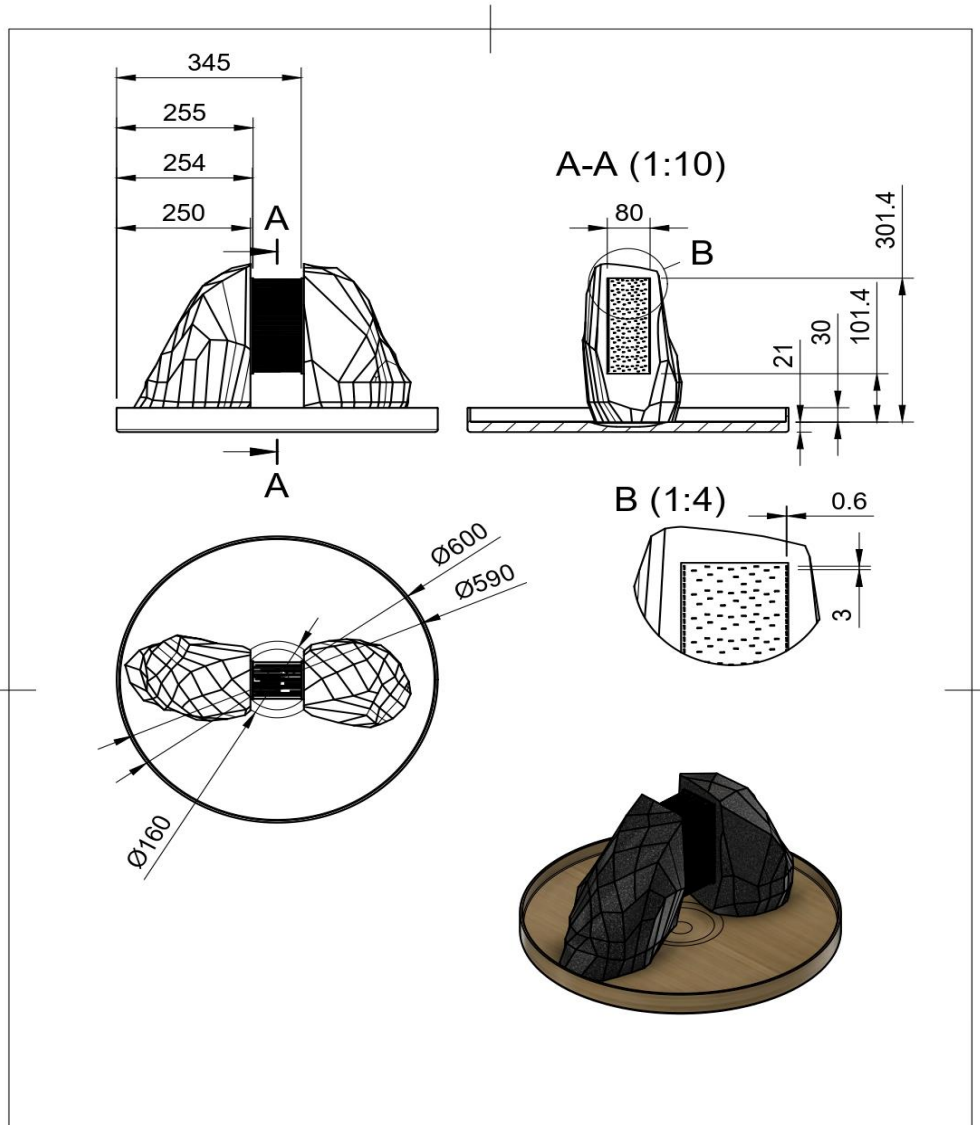
- Although the object does not have a specific technical design, as it is a handmade object and each one is unique, some measurements should be specific so that the user can change the metal mesh of the construction. The distance between the stone separations should always be 12 cm.

- Due to the hollow stone on the sides of the grid a nice resonance is achieved when listening to the sound of the object.

- The large stones are screwed to the base to remain stable.

- The stones that accompany the object to be placed on the base will be of a certain size because otherwise they will not be suitable for the function of the instrument because they may get stuck between the metal tides.

Below we can also observe the technical sketch of our concept. However, as it has been stated, since the object is mostly going to differ per unit, the measurements are indicative. The object constitutes as some kind of art piece/accent piece so, different sizes will be made, some larger, some smaller, so the people will be able to choose from a variety of objects. The only measurement that must be the same across all objects is the distance the large rock split parts have as seen in the technical sketch.



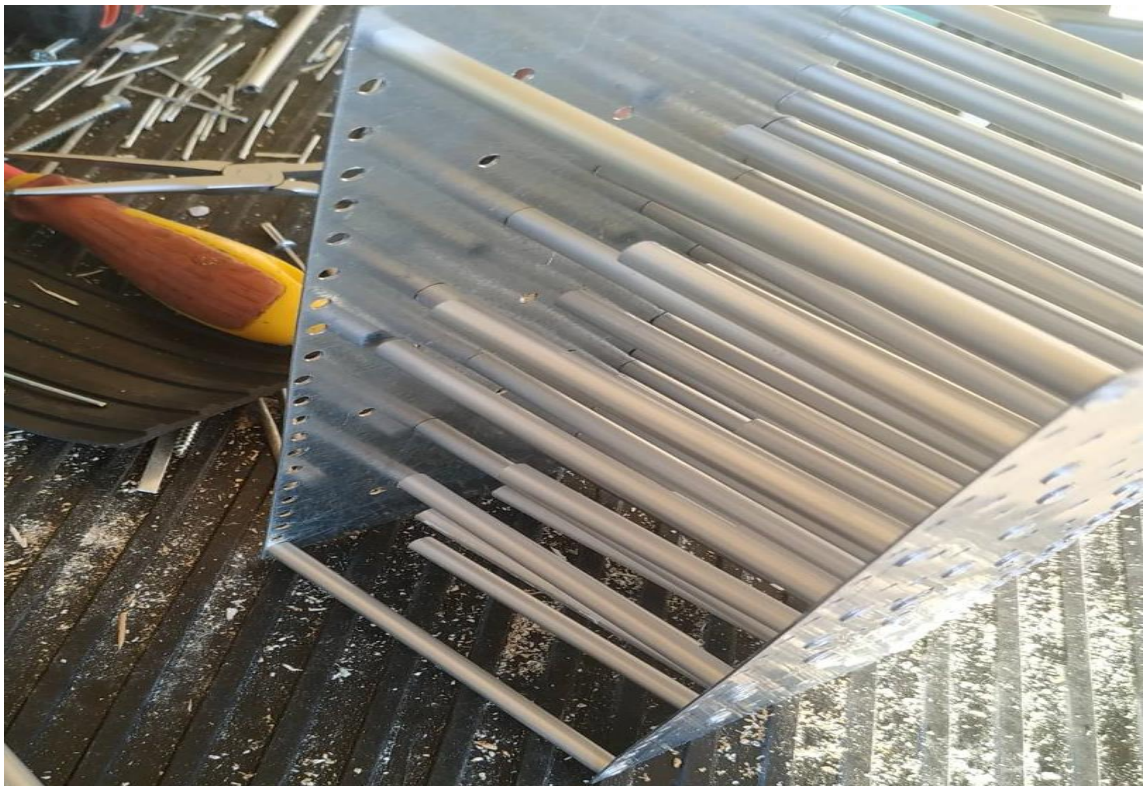
Dept.	Technical reference	Created by	Approved by
DPSD	-	Theodore Merkos dpsd15065	-
		Document type: Technical Drawing	Document status: Completed
		Title: Tranquility Soundscape	DWG No.: 1
			Rev.: 1 / Date of issue: - / Sheet: 1/1

So, according to all the above, the final functional model of the object was created as an indication in order to evaluate it in the environment of use and to better define the soundscape produced during its use and ultimately to see if it serves the objectives we set. Below we can see pictures of the process that was followed for the prototyping, how the object looks in the personal space of users and how it is used.

Cutting the wooden base

Creating a mold to fill in order to simulate the rocks

Installing the metal rods on the metal sheets for the instrument



Finished prototype

Prototype in use

5.4.4 Describing the soundscape

Since the object is about creating a soundscape, there is not a way of hearing the object in this document, nor are images of the object's form sufficient to be understood. Thus an attempt is made at this point to describe the sound produced each time the user throws stones into the system.

The sound produced could be likened as:

- A stream of water passing between rocks
- The sound of a wave bursting on a surface and creating bubbles
- Hail in the forest
- Water fountains

5.4.5 Evaluation

As we have already evaluated the object in terms of use, aesthetics and user interaction previously, this evaluation aims to see whether the object meets the specifications we have set and achieves the objectives we have set.

Firstly, in terms of the objective of reintegrating the user into the physical environment it can be argued that the object achieves this, as through the overall interaction with and care of the object an emotional bond with it is built. The user in his/her effort to experience such emotions again and again and to activate his/her senses will slowly have the desire to explore nature through walks and perhaps even bring back souvenirs of nature found during his/her interaction with the natural environment and integrate them into the object. This gives the object an even more personal character. Also, in order to properly care for the natural elements of the object, the user's interest in learning the optimal way to care for the object slowly develops, thus developing the connection he or she feels with the natural environment. Sounds are something we do not easily forget when we hear something special, so the user will want to relive the sound experience offered by the object, and such sounds are only found in natural environments.

Finally, in terms of design specifications, the object is easy for the user to understand its function, is designed with materials, colors and shapes found in nature, includes as

described sounds inspired by the natural landscape, evokes mainly auditory but also visual and tactile stimuli that evoke intentional references to nature, has a visual connection with nature and as examined and described above creates the desire for users to experience the natural environment.

5.4.6 Conclusions

The objects designed are nothing more than a stimulus for the user to seek to reconnect with nature. If there is no will on the part of the user and if the user has not realized the importance of the role of nature in his/her life, then any object designed will fail in its purpose. That is why it is important to have environmental education and people from an early age to acquire an integral connection with nature. Moreover, it must be understood that our alienation from the natural environment seriously harms us both psychologically and physically. Only in this way will the face of urban centers be changed to actively include the natural landscape rather than cutting it off. This is the backbone behind the biophilia and biophilic planning movement. However, biophilia requires change on a larger scale and is primarily about communities and societies.

So how can we change the whole community to actively integrate nature into it? This is of course quite difficult as it requires will at a national level to make such changes. Thus, while an attempt has been made through this project to create something that tackles these issues at the individual level, the basic problem still requires the vigilance and attention of all those who live and shape urban centers.

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