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OPTIONAL COURSE: BUILDING INDUSTRY

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“TO UNDERSTAND THE  
ARCHITECTURE, ONE NEEDS  
TO SIT AND MASTER ITS  
INTERCONNECTION WITH  
LIGHT”

# INDUSTRIAL ILLUMINATION IN ENDOGENOUS ARCHITECTURE

BY

NIKITA PIKALOV(AS)

“NO ONE WANTS THE INTERIOR OF A NIGHTCLUB TO BE LIT LIKE A HIGH STREET AT MIDDAY AND WHO WANTS TO WORK IN A HOSPITAL LIT LIKE A NIGHTCLUB?”

“LIGHT AND ARCHITECTURE IS 3D CREATION, THUS ONE NEED TO WORK WITH THE 360 DEGREE APPROACH.”

“WE NEED THE SHADOWS JUST AS MUCH AS WE NEED THE LIGHT IN ORDER TO CREATE GOOD VISUAL CONDITIONS. IN ORDER TO MAKE GOOD LIGHTING DESIGNS YOU HAVE TO CONSIDER BOTH THE LIGHT AND THE SHADOWS. IT CAN BE LEARNED FROM THE NATURE. THE LIGHTING LEVEL MAKES YOU SEE OBJECTS AND THE SHADOWS MAKE YOU UNDERSTAND THEIR NATURE AND SHAPE.”

“THE ARCHTIECT DOES NOT NEED TO KNOW THE MATHEMATICS OR EXACT METHODS, BUT A GENERAL UNDERSTANDING OF THE PRICIPLES INVOLVED IN MEASURING LIGHT IS A VALUEBLE AID IN DEVELOPING A SUCCESSFUS DESIGN.”

2010 NOVEMBER 23

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## PROLOGUE

### INDUSTRIAL ILLUMINATION IN ENDOGENOUS ARCHITECTURE

IN THIS REPORT AUTHOR WILL BE SEARCHING FOR ANSWER ON QUESTION: HOW DOES THE INDUSTRIAL ILLUMINATION OF ENDOGENOUS ARCHITECTURE AFFECTS HUMAN ACTION AND EMOTION; HOW TO MAKE EFFECT POSITIVE IN REGARD TO ERGONOMICS, AESTHETICS AND LIGHT SOURCES? SEARCH FOR ANSWER WILL BE PERFORMED THROUGH ANALYSIS AND SYNTHESIS OF OPTICS AND ARCHITECTURE, LIGHT UNITS AND SOURCES, LIGHT ERGONOMICS AND AESTHETICS.

THE REASON OF SUBJECT CHOICE IS AUTHOR WILL TO GAIN KNOWLEDGE ABOUT LIGHT IN ARCHITECTURE. LIGHT IS IMPORTANT NOT ONLY IN ARCHITECTONIC SPHERE, BUT, FIRST OF ALL, IN ONTOLOGICAL PART OF PHILOSOPHY. TO UNDERSTAND THE ARCHITECTURE, ONE NEEDS TO SIT AND MASTER ITS INTERCONNECTION WITH LIGHT. KNOWLEDGE OF LIGHT WILL ASSIST ONE TO ENHANCE AND IMPLEMENT HIS IDEAS.

AUTHOR IS MORE FOCUSED ON EFFECT OF INDUSTRIAL ILLUMINATION IN ENDOGENOUS ARCHITECTURE ON HUMAN ACTION AND EMOTION, FOR THE ARCHITECTONIC MEASURE AND ARTIFICIAL LIGHT IS ADJUSTED TO HUMAN BODY AND NEED. THUS, IT IS IMPORTANT TO HAVE A POSITIVE EFFECT OF LIGHT AND ARCHITECTURE ON HUMAN ENTITY.

TO ANSWER ON MAIN REPORT QUESTION ONE NEED TO UNDERSTAND AND ANALYZE, WHAT IS THE LIGHT AND ARCHITECTURE AND HOW THE INDUSTRIAL LIGHT SOURCES ARE CATEGORISED? THEREFORE, NEXT QUESTION CAN BE SUMMONED: WHAT IS THE ERGONOMICAL AND AESTHETICAL EFFECT ON HUMAN ENTITY? AFTER THAT KNOWLEDGE SYNTHESIS WILL BE PERFORMED AND INFERENCE WILL BE STATED.

FOR ANALYSIS PART BOOKS AND WORLD WIDE WEB WILL BE USED. FOR SYNTHESIS PART 3D PROGRAM UTILIZATION AND INTERVIEWS WILL BE PERFORMED. THE PROCESS OF REPORT CREATION IS NEITHER PERSONAL DEDUCTIONS, NOR GENERAL INDUCTIONS, AS MERGE OF BOTH IS IMPLEMENTED.

REPORT PROCESS CREATION IS DIVIDED INTO THREE PARTS: THEORY, ILLUSTRATIONS AND PRACTICE.

REPORT IS COMPOSED OF TWO SECTIONS, ANALYSIS AND SYNTHESIS, DIVIDED INTO FOUR PARTS:

PART-I	LIGHT AND ARCHITECTRE
PART-II	UNITS AND SOURCES
PART-III	ERGONOMICS AND AESTHETICS
PART-IV	FOUR LEVELS OF LIGHT

I HOPE YOU FIND THIS REPORT USEFUL, FOR A LOT OF EFFORT IS PUT INTO THIS WORK.

### ACKNOWLEDGMENT

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ALL PEOPLE, WHOSE INTERNET PAGES I HAVE VISITED.

ALL PEOPLE, WHOSE IMAGES I HAVE USED.

THANK YOU.

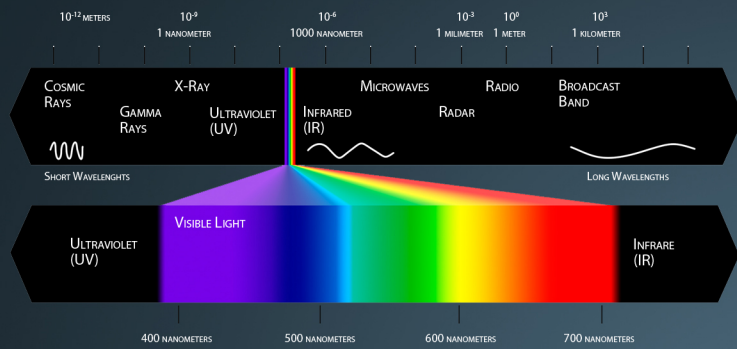


IMAGE 1. ELECTROMAGNETIC SPECTRUM. FIRST TOP BLACK LINE IS ELECTROMAGNETIC SPECTRUM, SECOND BOTTOM BLACK LINE IS VISIBLE SPECTRUM INTERVAL. HERE IT IS ALSO POSSIBLE TO SEE THE LIGHT WAVELENGTH IN NANOMETERS AND ITS EFFECT ON LIGHT COLORATION DIFFERENCE.

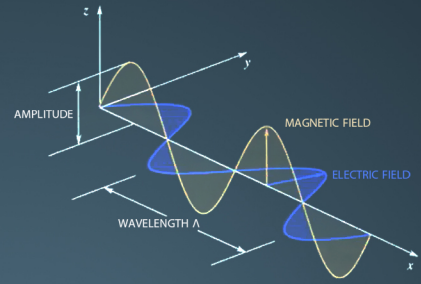


IMAGE 2. LIGHT WAVE. ELECTRIC FIELD IS REPRESENTED AS A BLUE WAVE IN XY PLAIN, WHILE MAGNETIC FIELD IS YELLOW - IN XZ PLAIN. AMPLITUDE AND WAVELENGTH IS ALSO MARKED ON THIS ILLUSTRATION.

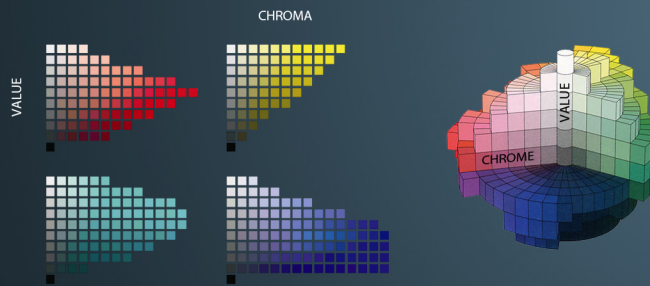


IMAGE 3. MUNSELL COLOR SYSTEM. ON LEFT THERE ARE FOUR 2D COLOR SYSTEMS FOR SEPARATED SINGLE HUE. ON RIGHT THERE IS A 3D SPHERE COLOR SYSTEM. HUE EXPRESSES THE BASIC QUALITY OF THE COLOR. THERE ARE FIVE BASIC HUES: RED, YELLOW, GREEN, BLUE AND PURPLE. VALUE IS THE MEASURE OF LIGHTNESS. THE WHITE IS PLACED AT THE TOP, WHILE BLACK IS PLACED AT THE BOTTOM. CHROMA IS THE MEASURE OF THE SATURATION OF COLOR. MOVING AWAY FROM THE CENTER IN HORIZONTAL DIRECTION COLOR SATURATION BECOMES GREATER.

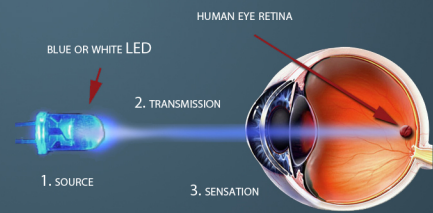


IMAGE 4. LIGHT TRANSMISSION. ILLUSTRATION DISPLAYS A SUPERFICIAL CONCEPT OF LIGHT ESSENCE: SOURCE, TRANSMISSION AND SENSATION. INTERESTING FACT TO KNOW - WHITE OR BLUE LEDs CAN PERMANENTLY DAMAGE PERSON EYES, EVEN WHEN ONE DO NOT FEEL PAIN.

# PART I-A | LIGHT AND ARCHITECTURE

BEFORE INTRODUCING THE INDUSTRIAL ILLUMINATION IN ENDOGENOUS ARCHITECTURE, IT IS NECESSARY TO GAIN GENERAL UNDERSTANDING OF ARCHITECTURE AND LIGHT.

## 01. OPTICS

TO BEGIN WITH, OPTICS IS PHYSICS BRANCH, WHICH IS FOCUSED ON LIGHT. IN PHYSICS TERMS, LIGHT IS ELECTROMAGNETIC RADIATION IN REGION OF VISIBLE SPECTRUM. THE VISIBLE SPECTRUM IS ONLY MINIMUM INTERVAL OF WHOLE WIDE ELECTROMAGNETIC SPECTRUM, WHEREAS THE ELECTROMAGNETIC SPECTRUM IS RANGE OF WHOLE POSSIBLE FREQUENCIES OF ELECTROMAGNETIC RADIATION, AND ELECTROMAGNETIC RADIATION IS TRAVELLING TRANSVERSE WAVE OF ELECTRIC AND MAGNETIC FIELDS. IN PLAIN WORDS - LIGHT IS ELECTROMAGNETIC RADIATION OF A WAVELENGTH THAT IS VISIBLE TO THE HUMAN EYE, WHICH MEANS THAT EYE RECOGNIZE ONLY INTERVAL FROM RED TO VIOLET (IMAGE 1).

FURTHERMORE, THERE ARE THREE MAIN MEASUREMENTS, WHICH DESCRIBES THE LIGHT WAVE: IT IS LENGTH, AMPLITUDE AND FREQUENCY. THE WAVE LENGTH IS INTERVAL OF SINGLE OSCILLATION, MEASURED IN METRES; AMPLITUDE IS THE MAXIMUM VALUE OF ANY PERIODICALLY VARYING QUANTITY, MEASURED IN VOLTS PER METER; AND FREQUENCY IS THE NUMBER OF OSCILLATIONS, WHICH WAVE PERFORMS PER SECOND (IMAGE 2).

MOREOVER, LIGHT IS MONOCHROMATIC, BUT, ESSENTIALLY, AT THE SAME TIME IT IS POLYCHROMATIC, FOR LIGHT IS MIXTURE OF SEVERAL RADIATIONS WITH DIFFERENT WAVELENGTHS. TO MAKE IT CLEAR, THE ELECTROMAGNETIC RADIATION WAVELENGTH INDICATES WAVE REGION IN ELECTROMAGNETIC SPECTRUM, HENCE THE VISIBLE SPECTRUM WAVELENGTH IDENTIFIES THE COLOR.

VISIBLE SPECTRUM (LIGHT) HAS WAVELENGTH BETWEEN 380-780 NM. FOR INSTANCE: WAVE WITH 700 NM WAVELENGTH IS IDENTIFIED AS RED COLOR AND WAVE WITH 400 NM IS IDENTIFIED AS VIOLET COLOR.

CONCERNING THE COLORATION, THERE ARE THREE MAIN ELEMENTS, WHICH DESCRIBES THE DYE OF LIGHT: IT IS HUE, LUMINOSITY AND SATURATION. HUE IS COLOR, WHICH DEPENDS FROM WAVELENGTH; LUMINOSITY (VALUE) IS AMOUNT OF DARK AND BRIGHT IN THE COLOR (THE HIGHER LUMINOSITY (AMPLITUDE), THE BRIGHTER THE COLOR); AND SATURATION (CHROMA) IS MEASUREMENT OF COLOR PURITY AND INTENSITY (IMAGE 3).

ONE CAN HAVE AN ABILITY TO SEE IF ONLY LIGHT STIMULATES THE ORGANS OF SIGHT, WHICH MEANS THAT VISION DEPENDS FROM LIGHT. IN GENERAL, TO BE MORE PRECISE, LIGHT, REFLECTED FROM OBJECTS AND SUBJECTS, ENTERS THE ORGANS OF SIGHT AND TRANSFORMS INTO THE ELECTRONIC IMPULSES THAT ARE SENT TO THE BRAIN.

FUNDAMENTALLY, LIGHT ESSENCE CAN BE DIVIDED INTO THREE PHASES: SOURCE, TRANSMISSION AND SENSATION (IMAGE 4). SO FAR GENERAL UNDERSTANDING OF TRANSMISSION (LIGHT) AND SENSATION (VISION) WAS DESCRIBED. WE ARE NOT GOING TO DIVE INTO THE OPTICS DEEPER EXPLANATION, BUT A VAST INFORMATION WILL BE ANALYSED CONCERNING THE LIGHT SOURCES.

## 02. INDUSTRIAL ILLUMINATION

ILLUMINATION, IN REGARD TO SOURCES, CAN BE CATEGORIZED INTO NATURAL LIGHT AND ARTIFICIAL LIGHT. NATURAL LIGHT CATEGORY COMPRISES OF CELESTIAL (E.G. SUNLIGHT, MOONLIGHT, LIGHTNING, ETC.) AND TERRESTRIAL (E.G. BIOLOGICAL, VOLCANIC, ETC.) ILLUMINATION. ARTIFICIAL LIGHT CATEGORY COMPRISES OF TERRESTRIAL (E.G. FIRE, CHEMISTRY, ETC.) AND INDUSTRIAL (E.G. ELECTRICITY) ILLUMINATION.

INDUSTRIAL ILLUMINATIONS IS THE ONE, WHICH WE WILL BE FOCUS ON.





IMAGE 5. SUPERFICIAL CHRONOLOGY OF LIGHT AND ARCHITECTURE. ILLUSTRATION DISPLAYS THE FOCUS OF THIS REPORT - LIGHT PART, WHICH WILL BE ANALYZED. IT IS COMBINATION OF LIGHT CATEGORIZATION AND ARCHITECTURE CATEGORIZATION. HIGHLIGHTED ICONS IS THE TRACK TO THE PART WE ARE INTERESTED IN. CORPOREAL ARCHITECTURE IS RELATED TO MATERIAL PART OF IT, WHEREAS INCORPOREAL ARCHITECTURE IS IMMATERIAL, SUCH AS LIGHT, SOUND OR HEAT. ARCHITECTONIC ILLUMINATION HAS ITS FOUR SECTIONS OF NATURAL AND ARTIFICIAL LIGHT IN ENDOGENOUS OR EXOGENOUS ARCHITECTURE. OUR AIM IS INDUSTRIAL ILLUMINATION.

## PART I-B | LIGHT AND ARCHITECTURE

### 03. ARCHITECTURE

ONE SHOULD KNOW, THAT ARCHITECTURE IS ART AND SCIENCE OF DESIGNING AND ERECTING THE PHYSICAL STRUCTURE (E.G. BUILDINGS, BRIDGES, ROADS, ETC.) AND TO BE MORE PRECISE - ARCHITECTURE IS INDUSTRIAL DESIGN.

TO MAKE IT CLEAR, CREATION CAN BE DIVIDED INTO TWO CATEGORIES - SENSORIAL ART AND INDUSTRIAL DESIGN. BOTH CATEGORIES HAVE SAME FEATURES, BUT IN THEIR DIFFERENT MEANINGS.

SENSORIAL ART CAN BE CREATED IN ORDER TO IMPLEMENT A COMFORT IN ONE'S PSYCHE, WHILE INDUSTRIAL DESIGN CAN BE REALIZED TO IMPLEMENT A COMFORT FOR ONE'S MACHINERY (BODY). BOTH CAN BE CREATED BY MEANS OF BEING INSPIRED AND BOTH CAN BE AN INSPIRATION SUBJECT FOR CREATION.

IN ADDITION, AESTHETIC HAS A MAIN ROLE IN ART AND DESIGN AND, ESSENTIALLY, IN CONTEMPORARY TIMES, NOT ONLY AESTHETIC, BUT ALSO KNOWLEDGE, EVEN BUSINESS, IS INVOLVED INTO THE CREATION.

### 04. ENDOGENOUS ARCHITECTURE

WE ARE NOT GOING TO CATEGORIZE AN INDUSTRIAL DESIGN INTO MORE DETAIL SECTIONS, FOR OUR INTERESTS GO IN OTHER DIRECTION. IT IS ENOUGH TO KNOW, THAT ARCHITECTURE IS PART OF INDUSTRIAL DESIGN.

FUNDAMENTALLY, ARCHITECTURE IS COMPOSED FROM TWO PARTS - EXOGENOUS (MACRO-LEVEL) AND ENDOGENOUS (MICRO-LEVEL) ARCHITECTURE.

EXOGENOUS ARCHITECTURE INCLUDES IN ITSELF AN URBAN AND LANDSCAPE CREATION (CITY AND NATURE). IT IS ARCHITECTURE IN LARGE SCALE, WHILE ENDOGENOUS - IN SMALL ONE. ENDOGENOUS ARCHITECTURE INCLUDES IN ITSELF A CONSTRUCTION AND DETAIL CREATION (E.G. BUILDING, BRIDGE, ETC.).

THIS IS THE PART IN WHICH AN INDUSTRIAL ILLUMINATION WILL BE DESCRIBED (IMAGE 5).

IN THIS STATE ONE IS FAMILIAR WITH GENERAL UNDERSTANDING OF LIGHT AND ARCHITECTURE. THUS ONE CAN COMPREHEND THE MEANING OF REPORT TITLE.

WITH THIS BEING SAID, WE CAN MOVE FURTHER TO THE SECOND PART. TO FIND OUT THE POSITIVE INDUSTRIAL LIGHT SOURCES EFFECT ON HUMAN ACTION AND EMOTION IT IS IMPORTANT TO CATEGORIZE THEM AND UNDERSTAND THEIR UNITS.

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EACH CATEGORY, SUB-CATEGORY (SUB-C) AND UPDATE HAS A LOT OF TYPES, WHICH ARE NOT SHOWN IN THIS TREE

IMAGE 6. SUPERFICIAL CHRONOLOGY OF INDUSTRIAL ILLUMINATION. THERE ARE TWO BRANCHES: FILAMENT AND DISCHARGE LAMPS. DISCHARGE LAMP IS ALSO COMPOSED OF LOW AND HIGH PRESSURE LAMPS. THREE FOLLOWING LAMP CATEGORIES WILL NOT BE IN COMPARISON LIST: LED, OLED AND NEON LAMP.



## PART II-A | UNITS AND SOURCES

BECAUSE OF INDUSTRIAL LIGHT APPEARANCE IT BECAME NECESSARY TO EVALUATE THE LEVEL OF LIGHT, WHICH SHOULD BE PROPER FOR VISION, AND DETERMINE THE UNITS OF MEASURE, WHICH WILL HELP TO CONTROL THE LIGHT.

### 05. LIGHT UNITS

THERE ARE TWO MEASURING SYSTEMS USED FOR ELECTROMAGNETIC RADIATION ENERGY, CALLED: RADIOMETRY AND PHOTOMETRY. RADIOMETRY SYSTEM MEASURE ENERGY THROUGH WHOLE ELECTROMAGNETIC SPECTRUM, WHEREAS PHOTOMETRY IS REFERRED TO THE VISIBLE SPECTRUM (LIGHT). ONE WILL NOT BE INFORMED ABOUT RADIOMETRY SYSTEM, FOR IT IS OUT OF OUR INTEREST, BUT, IN GENERAL, THEIR CONCEPTS ARE CLOSE TO EACH OTHER.

PHOTOMETRIC SYSTEM COMPOSED OF SIX QUANTITIES, BUT IT IS ENOUGH TO KNOW ONLY TWO OF THEM, WHICH IS: LUMINOUS FLUX AND ILLUMINANCE LUX.

LUMINOUS FLUX (LM) IDENTIFIES THE QUANTITY OF ENERGY EMITTED PER SECOND, OR, IN OTHER WORDS, POWER.

ILLUMINANCE LUX (LX) IS MEASURE OF INTENSITY, WHICH HITS OR PASSES THROUGH A SURFACE ( $1 \text{ LX} = 1 \text{ LM} / \text{M}^2$ ).

HERE ARE SOME CLASSICAL ILLUMINANCE VALUES, WHICH WILL LET ONE TO IMAGINE THE UNITS RATION:

SUNNY DAY IN THE SUMMER	100 000 LX
CLOUD DAYTIME SKY IN THE SUMMER	20 000 LX
SHOP WINDOWS	3 000 LX
OPERATING THEATRE	1 500 LX
DRAWING OFFICE	750 LX
OFFICE	500 LX
ENTRANCE HALLS	150 LX
STREETS AT NIGHT	30 LX
NIGHT WITH FULL MOON	0.25 LX
NIGHT WITH CLEAR SKY AND NO MOON	0.01 LX

FURTHERMORE, SOURCE WOULD EMIT ITS LUMINOUS FLUX IN ALL DIRECTIONS IF ONLY THERE WOULD BE NO OBJECTS IN SPACE. LIGHT DIRECTION AND FORM DEPENDS FROM LAMP SHAPE AND SURFACES, WHICH SURROUNDS THE SOURCE.

AT THIS STAGE, IT IS NECESSARY TO KNOW THE MAIN CATEGORIES OF INDUSTRIAL LIGHT SOURCES OFFERED ON THE MARKET. THIS WILL HELP TO FIND AN ANSWER ON MAIN REPORT QUESTION (IMAGE 6).

### 06. INDUSTRIAL LIGHT SOURCES

#### FILAMENT LAMP

IT IS OLDEST AND MOST SPREAD ELECTRICAL EQUIPMENT, WHICH PRODUCE THE ILLUMINATION.

AN ELECTRIC CURRENT PASSES THROUGH A THIN METAL FILAMENT, PLACED WITHIN A GLASS GLOBE WITH VACUUM IN IT. THE ELECTRIC CURRENT INCANDESCES THE FILAMENT REACHING HEAT OF 2500-2700 K. THIS GIVES A BIRTH TO BOTH HEAT AND LIGHT. FILAMENT LAMP EMITS A WARM WHITE LIGHT THAT IS FLICKER-FREE. IT CAN GIVE A VERY GOOD COLOR RENDERING, HIGH LIGHTING INTENSITY AND VERY GOOD FOCUSING CHARACTERISTICS (E.G. SPOTLIGHT). ON THE OTHER HAND, FILAMENT LAMP LIFE IS SHORT (1000-3000 HOURS).

THERE ARE TWO MAIN FILAMENT LAMP CATEGORIES: TRADITIONAL AND HALOGEN INCANDESCENT LAMP.

TRADITIONAL INCANDESCENT LIGHT BULB CAN BE BOUGHT IN A WIDE INTERVAL OF FORMATS AND POWER. SEVERAL MAIN BENEFITS OF THIS BULB ARE: LUMINOUS FLUX CAN BE CONTROLLED, FAST SPEED OF INCANDESCENCE AND GOOD CHROMATIC QUALITY. FROM OTHER POINT OF VIEW, THIS BULB EFFICIENCY IS PURE, FOR ONLY 10% OF ITS ENERGY IS TRANSFORMED INTO LIGHT, WHILE THE REST IS USED FOR HEAT.

HALOGEN INCANDESCENT LIGHT BULB IS SIMILAR TO ABOVE CATEGORY. DIFFERENCE IS THAT IT HAS LONGER LIFE SPAN (2000-3000 HOURS, WHILE TRADITIONAL HAS AROUND 1000 HOURS) AND WHITER LIGHT.

INCANDESCENT LIGHT BULBS CAN BE WITH INCORPORATED REFLECTOR. IT IS ELECTRICAL LIGHT EQUIPMENT, WHICH IS PROJECTED TO GIVE A BEAM OF LIGHT IN A CONCRETE DIRECTION. CAUSE OF THE REFLECTIVE SURFACE AND SHAPE OF THE BULB, THE QUANTITY OF LIGHT CAN BE INCREASED FROM 50-300%, COMPARING IT WITH AN AVERAGE LIGHT BULB.



LAMP CATEGORY

POSITIVE FEATURES

NEGATIVE FEATURES

ENVIRONMENT CATEGORY



TRADITIONAL INCANDESCENT LAMP

IMMEDIATE LIGHT UP  
WARM LIGHT COLOR (2700 K)  
CONTROLLABLE INTENSITY  
COMPACT SIZE  
GOOD CHROMATIC EFFICIENCY

POOR LUMINOUS EFFICIENCY (UP TO 25 LM/W)  
LOW DURABILITY (1000 HOURS)  
MEDIUM FUNCTION POSITION LIMIT  
MEDIUM COST

RESIDENTIAL ENVIRONMENT



HALOGEN INCANDESCENT LAMP

IMMEDIATE LIGHT UP  
WHITE LIGHT COLOR (2900 K)  
CONTROLLABLE INTENSITY  
COMPACT SIZE  
GOOD CHROMATIC EFFICIENCY

POOR LUMINOUS EFFICIENCY (UP TO 25 LM/W)  
MEDIUM DURABILITY (2000-3000 HOURS)  
MEDIUM FUNCTION POSITION LIMIT  
MEDIUM COST

RESIDENTIAL AND COMERCIAL / SERVICE ENVIRONMENT



HALOGEN INCANDESCENT LAMP WITH INCORPORATED REFLECTOR

IMMEDIATE LIGHT UP  
WHITE LIGHT COLOR (2900 K)  
CONTROLLABLE INTENSITY  
COMPACT SIZE  
GOOD CHROMATIC EFFICIENCY  
QUANTITY OF LIGHT INCREASE 50-300%

POOR LUMINOUS EFFICIENCY (UP TO 25 LM/W)  
MEDIUM DURABILITY (2000-3000 HOURS)  
MEDIUM FUNCTION POSITION LIMIT  
MEDIUM COST

RESIDENTIAL, COMERCIAL / SERVICE AND CULTURAL / EDUCATIONAL ENVIRONMENT



FLUORESCENT LAMP

WHITE / YELLOW LIGHT COLOR (2700-6500 K)  
CONTROLLABLE INTENSITY  
GOOD LUMINOUS EFFICIENCY (UP TO 100 LM/W)  
HIGH DURABILITY (UP TO 8000 HOURS)  
PERFECT CHROMATIC EFFICIENCY  
LOW COST

MEDIATE LIGHT UP  
NONCOMPACT SIZE  
MEDIUM FUNCTION POSITION LIMIT  
DIFFICULTY IN DISPOSAL

RESIDENTIAL, COMERCIAL / SERVICE, CULTURAL / EDUCATIONAL AND INDUSTRIAL ENVIRONMENT



COMPACT FLUORESCENT LAMP

WHITE / YELLOW LIGHT COLOR (2700-6000 K)  
CONTROLLABLE INTENSITY  
COMPACT SIZE  
GOOD LUMINOUS EFFICIENCY (UP TO 100 LM/W)  
HIGH DURABILITY (UP TO 10000 HOURS)  
UNLIMITED FUNCTION POSITION  
PERFECT CHROMATIC EFFICIENCY  
LOW COST

MEDIATE LIGHT UP  
DIFFICULTY IN DISPOSAL

RESIDENTIAL AND COMERCIAL / SERVICE ENVIRONMENT



SODIUM VAPOUR LAMP  
LOW-PRESSURE  
HIGH-PRESSURE

WARM YELLOW LIGHT COLOR (2000-2500 K)  
COMPACT SIZE  
HIGH LUMINOUS EFFICIENCY (UP TO 150 LM/W)  
VERY HIGH DURABILITY (UP TO 24000 HOURS)

DELAYED LIGHT UP  
UNCONTROLLABLE INTENSITY  
LIMITED FUNCTION POSITION  
POOR CHROMATIC EFFICIENCY  
HIGH COST

ROADWAY AND INDUSTRIAL ENVIRONMENT



MERCURY VAPOUR LAMP

COLD GREEN / BLUE LIGHT COLOR (4000 K)  
COMPACT SIZE  
GOOD LUMINOUS EFFICIENCY (UP TO 115 LM/W)  
VERY HIGH DURABILITY (UP TO 24000 HOURS)

DELAYED LIGHT UP  
UNCONTROLLABLE INTENSITY  
LIMITED FUNCTION POSITION  
POOR CHROMATIC EFFICIENCY  
DIFFICULTY IN DISPOSAL  
HIGH COST

INDUSTRIAL AND COMERCIAL / SERVICE ENVIRONMENT



HALOGEN METALLIC VAPOUR LAMP

BRIGHT WHITE COLOR (2300-5500 K)  
COMPACT SIZE  
GOOD LUMINOUS EFFICIENCY (UP TO 115 LM/W)  
VERY HIGH DURABILITY (UP TO 15000 HOURS)  
EXCELLENT CHROMATIC EFFICIENCY

DELAYED LIGHT UP  
UNCONTROLLABLE INTENSITY  
MEDIUM FUNCTION POSITION LIMIT  
DIFFICULTY IN DISPOSAL  
HIGH COST

INDUSTRIAL AND COMERCIAL / SERVICE ENVIRONMENT

IMAGE 7. SUPERFICIAL INDUSTRIAL LIGHT CATEGORIZATION. EACH LAMP CATEGORY FEATURES ARE COLLAPSED INTO POSITIVE AND NEGATIVE COLUMN. THIRD COLUMN IS SUGGESTED ENVIRONMENT FOR LIGHT UTILIZATION.

# PART II-B | UNITS AND SOURCES

## DISCHARGE LAMP

THIS IS THE BRANCH, IN WHICH GAS IS USED FOR ILLUMINATION PRODUCTION. IN A GLASS OR QUARTZ TUBE VACUUM IS PLACED AND AFTER THAT SMALL AMOUNT OF GAS OR METALLIC VAPOUR IS INSERTED. DISCHARGE LAMP HAS A HIGH LIGHTING EFFICIENCY AND LONG LIFE SPAN (2700-24000 HOURS). CHROMATIC LIGHT VALUE DEPENDS ON THE TYPE OF LAMP: WARM WHITE, NEUTRAL WHITE OR COOL WHITE. THE DISADVANTAGES OF THIS TYPE ARE THAT LIGHT OF THIS LAMP CAN BE DIMMED TO A RIGID LIMIT AND IT IS MORE COMPLEX TO MANUFACTURE THIS CATEGORY RATHER THAN OTHERS.

THERE ARE TWO MAIN DISCHARGE LAMP CATEGORIES: LOW-PRESSURE AND HIGH-PRESSURE LAMP.

LOW-PRESSURE LAMP (FLUORESCENT LIGHT TUBE) EMITS THE LIGHT NOT DIRECTLY THROUGH GAS, BUT BY AN INTERNAL SURFACE OF THE TUBE, WHICH IS COVERED WITH LUMINOUS MATERIAL (LOOKS LIKE A WHITE POWDER). A DIFFERENT COMPOSITION OF LUMINOUS MATERIAL EFFECTS THE COLOR OF LIGHT. BENEFITS OF FLUORESCENT LAMP ARE: IT QUICKLY LIGHT UP (BUT NOT AS FAST AS FILAMENT LAMP), LUMINOUS FLUX IS UNDER CONTROL, HIGH EFFICIENCY AND LONG LIFE SPAN (UP TO 8000 HOURS).

NOWADAYS COMPACT FLUORESCENT LAMP IS AVAILABLE. IT IS ABSOLUTELY SAME CONCEPT AS CLASSICAL FLUORESCENT LAMP, BUT IN SMALL COMPACT SIZES, WHICH CAN BE USED IN RESIDENTIAL BUILDINGS.

HIGH-PRESSURE LAMP CATEGORY IS DIVIDED INTO TWO MAIN TYPES: METALLIC VAPOUR AND HALOGEN METALLIC VAPOUR LAMP.

IN METALLIC VAPOUR LAMP MERCURY OR SODIUM IS MOSTLY USED. ONE SHOULD KNOW MORE ABOUT SODIUM VAPOUR LAMP, FOR IT HAS THE BEST FUNCTIONAL FEATURES. THERE ARE HIGH AND LOW PRESSURE VARIATION. LOW-PRESSURE SODIUM VAPOUR LAMP IS MOSTLY USED FOR ROAD-SIDE, INDUSTRY AND SECURITY INSTALLATIONS. THEY ARE EFFICIENT AND SUSTAINABLE (DO NOT CONTAIN MERCURY) - THIS IS THE REASON WHY THIS TYPE IS STILL USED, EVEN THOUGH IT HAS A LOW QUALITY OF MONOCHROMATIC LIGHT (YELLOW). IF ONE IS INTERESTED IN AESTHETICS FOR ARCHITECTURE DESIGN, THIS TYPE IS NOT SUITABLE, UNLESS THE ORIGINAL IDEA HAS OCCURRED.

HIGH-PRESSURE SODIUM VAPOUR LAMP ILLUME A REALISTIC COLOR OF LIGHT (FROM WHITE TO YELLOW). THIS LAMP TYPE HAS A LONG LIFE SPAN (UP TO 15000 HOURS), BUT LIGHTING UP INTERVAL IS LONG AND INTENSITY IS NOT UNDER CONTROL.

FROM FUNCTIONAL POINT OF VIEW, SODIUM VAPOUR LAMP IS MOST EFFICIENT, WHILE FROM AESTHETICAL SIDE IT IS VERY LIMITED.

HALOGEN METALLIC VAPOUR LAMP CAN ALLOW ONE TO REACH VERY DIFFERENT EFFECTS, FOR IT WIDELY VARIES IN SIZES, COLORS AND POWER, BUT ITS DURABILITY IS MEDIUM (ABOUT HALF OF MERCURY VAPOUR TYPES), IT TAKES A LONG TIME TO LIGHT UP AND IT HAS A HIGH PRICES.

THE NEXT SENTENCE IS WELL PUT TO DESCRIBE THE HIGH-PRESSURE LAMPS: HIGH-INTENSITY DISCHARGE LAMPS COMBINE THE FORM OF AN INCANDESCENT LAMP WITH THE EFFICACY OF A FLUORESCENT LAMP.

THE FOLLOWING IS A BRIEF OVERVIEW OF SUMMARIZED DATA IN REGARD TO DIFFERENT LIGHT CATEGORIES AND TYPES:

SOURCE CATEGORY:	EFFICIENCY (LM/W)	DURATION (H)	COLOUR TEMPERATURE (K)
INCANDESCENT LIGHT BULB	14	1000	2700
HALOGEN LAMP	20	3000	2900
FLUORESCENT LAMP	100	8000	2700-6000
HALOGEN METALLIC LAMP	80	8000	3200
HIGHT-PRESSURE SODIUM LAMP	130	9000	2000
LOW-PRESSURE SODIUM LAMP	190	10 000	1800

IN CONTEMPORARY TIMES LIGHT-EMITTING DIODE (LED) BECAME VERY POPULAR AS AN INDICATOR FOR DEVICES AND AS A LIGHTING SOURCE. LED BENEFITS ARE: IT IS LONG-LASTING, INEXPENSIVE, WITH HIGHT CHROMATIC EFFICIENCY AND COMPACT SIZE. MOREOVER, NEW INDUSTRIAL LIGHT SOURCE IS DISCOVER - ORGANIC LIGHT-EMITTING DIODE (OLED), WHICH CREATES A VAST POSSIBILITIES FOR ARCHITECTS, AND IN GENERAL, FOR INDUSTRIAL DESIGN.

AS ONE CAN SEE, EACH LAMP HAS ITS OWN BENEFITS AND DRAWBACKS, BUT BY MEANS OF COMPARISON BEST SOLUTIONS WILL COME (IMAGE 7).

WITH THIS KNOWLEDGE, WHICH IS NECESSARY FOR MAIN REPORT QUESTION, WE CAN MOVE TO THE NEXT IMPORTANT ANALYTICAL PART - LIGHT ERGONOMICS AND AESTHETICS.

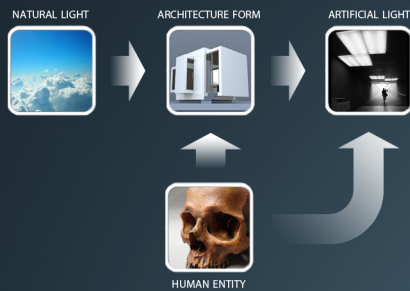


IMAGE 8. CHAIN OF ERGONOMICAL EFFECT. ILLUSTRATION DISPLAYS THE DEPENDENCE OF ARTIFICIAL LIGHT IN REGARD TO ERGONOMICS. THE ARROW IS DIRECTED FROM LEADER TO FOLLOWER.

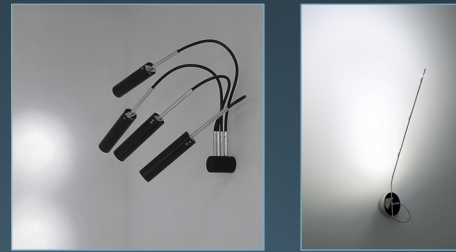


IMAGE 9. DIRECT AND INDIRECT LIGHTING. IMAGE ON THE LEFT SHOWS THE DIRECT LIGHTING, WHILE IMAGE ON THE RIGHT - INDIRECT.



IMAGE 10. DIRECT LIGHTING EXAMPLE. IMAGE REPRESENTS THE COMMERCIAL MEETING AREA, ILLUMINATED WITH DIRECT (AND SEMI-DIRECT) LIGHTING. DIRECT LIGHTING MOSTLY USED FOR TASK PERFORMANCE.

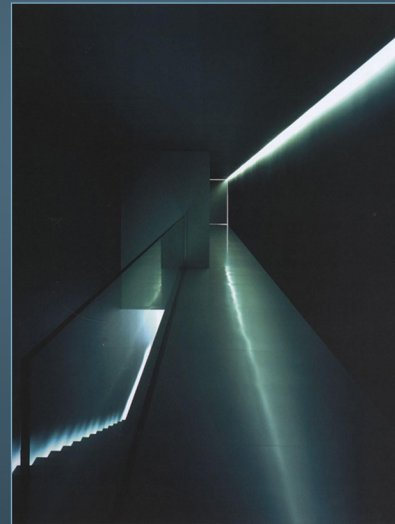


IMAGE 11. INDIRECT LIGHTING EXAMPLE. IMAGE REPRESENTS THE COMMERCIAL HALL AREA, ILLUMINATED WITH INDIRECT (SEMI-INDIRECT) LIGHTING. INDIRECT LIGHTING MOSTLY USED FOR GENERAL VISION.

## PART III-A | ERGONOMICS AND AESTHETICS

SOUND IS MUSIC, WHEREAS LIGHT IS ARCHITECTURE. ESSENTIALLY, THERE IS NO ARCHITECTURE WITHOUT LIGHT. THUS, ONE SHOULD KNOW THAT IT IS IMPORTANT TO UTILIZE LIGHT IN PROPER WAY, WHETHER IT IS NATURAL OR ARTIFICIAL ILLUMINATION, BECAUSE LIGHT, CONTROLLED BY ARCHITECT, ENHANCE AND IMPROVE SPACE, WHILE ARCHITECT, WITH NO KNOWLEDGE OF LIGHT, DEGRADES IT.

ARCHITECTONIC ILLUMINATION CAN BE DIVIDED INTO THREE FUNDAMENTAL SEGMENTS: IT IS ERGONOMICS, AESTHETICS AND ECONOMICS.

### 07. INDUSTRIAL LIGHT ERGONOMICS

TO BEGIN WITH, NATURAL (CELESTIAL) LIGHT MUST DICTATE FORM OF ARCHITECTURE, MAKING IT ERGONOMICAL FOR BOTH, NATURE AND HUMAN. IN CONDITION OF ARTIFICIAL (INDUSTRIAL) LIGHTING, DIRECTION IS OPPOSITE - ARCHITECTURE FORM DICTATES THE ARRANGEMENT OF LIGHT. HENCE, NATURAL ILLUMINATION IS LEADER, WHILE ARTIFICIAL IS FOLLOWER (IMAGE 8).

FURTHERMORE, ARTIFICIAL (INDUSTRIAL) LIGHT SOURCES MUST BE ADJUSTED TO HUMAN BODY, TO HUMAN DEEDS. THIS IS THE MAIN RULE, WHICH ONE SHOULD ACCEPT AS BASIS. SECOND IMPORTANT THING TO KNOW IS THAT OBJECTS, NOT INDIVIDUALS, NEED TO BE ILLUMINATED.

FINALLY, BEFORE DESIGNING LIGHTING IN ARCHITECTURE, ONE SHOULD THINK ABOUT WHAT ENVIRONMENT WILL BE ILLUMED AND WHAT KIND OF LIGHT SOURCES CAN BE USED. ONE SHOULD ANALYSE AND LOOK THROUGH INDIVIDUAL BODY MOVEMENTS, ACTIONS AND NEEDS.

AFTER ALL, LETS FINALLY COMBINE LIGHT WITH ARCHITECTURE.

IN GENERAL, LIGHTING CAN BE DIRECT OR INDIRECT. DIRECT LIGHTING IS STRAIGHT STREAM OF LIGHT FROM SOURCE TO OBJECT, WHILE INDIRECT LIGHTING IS BOUNCED LIGHT FROM SURFACE (E.G. WALLS, CEILING, ETC.) TO OBJECT (IMAGE 9).

DIRECT ILLUMINATION IS USED TO BE MOST PROPER FOR BOTH, COMMERCIAL AND RESIDENTIAL ENVIRONMENTS. IT IS EASY TO DESIGN, BUT IT HAS A SLIGHT PROBLEM WITH GLARE. IN WORK AREAS (E.G. WORK ROOM, MEETING ROOM, ROOM IN PUBLIC USE, ETC.) DIRECT SYMMETRICAL ILLUMINATION IS PREFERRED AND PERFECT SOLUTION WOULD BE TO LET LIGHT FALL ON A WORKING POSITION FROM THE SIDE (IMAGE 10).

TALKING ABOUT INDIRECT LIGHTING, IT CAN GIVE AN IMPRESSION OF A BRIGHT ROOM WITHOUT A GLARE APPEARANCE. BECAUSE OF THE HIGH ENERGY CONSUMPTION, THIS METHOD IS USUALLY COMBINED WITH DIRECT LIGHTING (E.G. 70% OF DIRECT AND 30% OF INDIRECT ILLUMINATION IN ROOM SPACE) (IMAGE 11).

INDUSTRIAL LIGHT SOURCE SHOULD PREFERABLY BE AROUND 2.5-3.0 M HIGH. IF LIGHT SOURCE IS INSTALLED LOWER THAN SUGGESTED HEIGHT, DISCOMFORT CAN BE CREATED FROM GLARE AND HEAT RADIATION.

TO ORIENTATE IN INTERNAL AREA IT IS ENOUGH TO SUPPLY SPACE WITH 20 LX OF ILLUMINATION VALUE (MOSTLY, THIS SMALL QUANTITY IS NOT USED FOR LIGHTING); IN WORK AREAS MINIMUM 200 LX OF ILLUMINATION VALUE CAN BE USED (A MEAN LEVEL OF 300 LX FOR INDIVIDUAL OFFICES AND OF 750 LX FOR LARGE ROOMS IS SUGGESTED); AND 2000 LX IS RECOMMENDED AS THE OPTIMUM LIGHTING FOR WORK AREAS.

CONCERNING THE CHOICE OF SOURCES FOR SPECIFIC BUILDING TYPES, MOSTLY HALOGEN FILAMENT LAMPS AND FLUORESCENT DISCHARGE LAMPS ARE USED FOR INTERIOR LIGHTING. SOMETIMES FLOOR AND CEILING SURFACES NEED TO BE ILLUMINATED. IN THIS KIND OF CASE IT IS ALSO A POSSIBILITY TO USE HIGH-PRESSURE DISCHARGE LAMPS.

ONE SHOULD ALSO KNOW THAT WALL FLOOD LIGHTS AND SPOT LIGHTS ARE VERY USEFUL IN MUSEUMS, GALLERIES, EXHIBITIONS AND SUCH. FURTHERMORE, FOR CINEMAS, THEATRES, PUBLICITY, FACTORIES, OFFICES AND ALIKE FLUORESCENT DISCHARGE LAMPS ARE COMMONLY UTILIZED. HIGH-PRESSURE MERCURY VAPOUR LAMPS ARE MOSTLY USED FOR FACTORIES AND WORKSHOPS (ALSO FOR EXTERIOR LIGHTING).

THIS IS THE GENERAL EXPLANATION OF LIGHT ERGONOMICS CONCEPT. WHEN FUNCTIONAL PART OF LIGHT IN ARCHITECTURE IS UNDERSTOOD, ONE CAN GET FAMILIAR WITH AN AESTHETICAL PART OF IT.

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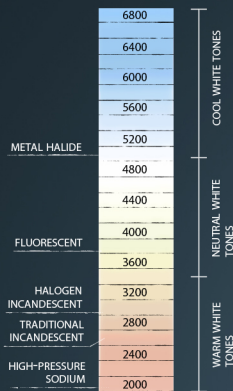


IMAGE 12. COLOR TEMPERATURE COLUMN. COLUMN IS DIVIDED INTO THREE SECTIONS: WARM, NEUTRAL AND COOL. NUMBERS SHOWS THE COLOR TEMPERATURE IN KELVIN UNITS. SOME INDUSTRIAL LIGHT SOURCES ARE IDENTIFIED IN REGARD TO THEIR COLOR TEMPERATURE. IT CAN BE INTERESTING TO COMPARE THEM WITH NATURAL LIGHTING: CLOUDLESS SUMMER DAY WOULD HAVE A 10000 K, A CLOUDY SKY WOULD BE AROUND 6000 K AND A DULL AFTERNOON IS ABOUT 4000 K.



IMAGE 14. RESTAURANT IMAGE. IMAGE DISPLAYS A RESTAURANT LIGHTING IN RELAXING AMBIENT (WARM, YELLOW-ORANGE COLOR).



IMAGE 13. COLOR TEMPERATURE EXAMPLE. THREE BULBS ARE USED IN TWO CATEGORIES (INCANDESCENT AND FLUORESCENT LAMP) AND DIFFERENT COLOR TEMPERATURE. LOW TEMPERATURE SOURCES TEND TO BE WEIGHTED TOWARDS THE RED END OF THE SPECTRUM, WHILE HIGH TEMPERATURE SOURCES ARE TOWARDS THE BLUE END OF THE SPECTRUM.



IMAGE 15. WORKING AREA IMAGE. IMAGE SHOWS A COMMERCIAL AREA WITH ILLUMINATION FOR CONCENTRATION MOOD (COOL, WHITE-GREEN COLOR).

## PART III-B | ERGONOMICS AND AESTHETICS

### 08. INDUSTRIAL LIGHT AESTHETICS

AS SOUNDS MAKE FILM EMOTIONAL, AS COLORS MAKE PICTURE ATTRACTIVE, SAME LIGHT MAKES ARCHITECTURE ALIVE.

IT IS ARCHITECT, WHO HAS TO CONTROL THE ILLUMINATION. ESSENTIALLY, WHEN DESIGNING THE LIGHT, ONE SHOULD THINK ABOUT HOW TO MAKE PLACE ATTRACTIVE, HOW TO RAISE A WILL IN INDIVIDUAL TO RETURN TO THE SAME PLACE, HOW TO MAKE SPACE COMFORTABLE AND PLEASANT, AND WHAT KIND OF EMOTIONS LIGHTING SHOULD PROVOKE.

CREATIVITY PLAYS AN IMPORTANT PART IN LIGHT DESIGNING, BUT SINGLE THING SHOULD NOT BE FORGOTTEN - IT IS AESTHETICS, WHICH FOLLOWS THE FUNCTION (ERGONOMICS).

TO TELL THE TRUTH, NOT ONLY LIGHT ERGONOMICS, BUT ALSO SURFACE MATERIAL DICTATES THE WAY TO THE LIGHT AESTHETICS. IN RELATION TO SURFACE MATERIAL, THERE ARE TWO FEATURES, WHICH SHOULD BE IN ATTENTION; IT IS REFLECTION AND COLOR.

ABSOLUTE WHITE SURFACE REFLECTS OF 1.00 AND A PERFECT BLACK SURFACE WOULD HAVE A 0.00. TO HAVE AN IMAGE OF SURFACES REFLECTION FEW EXAMPLES ARE GIVEN BELOW:

WHITE EMULSION PAINT ON PLAIN PLASTER SURFACE	0.80
CONCRETE	0.40
TIMBER	0.20

IT IS VERY IMPORTANT WHERE ONE WILL PLACE HIS COLOR, AS COLOR HAS DIRECT EFFECT ON HOW BRIGHT OR DARK THE ENVIRONMENT WILL BE. IF SURFACE, FOR INSTANCE, PAINTED IN RED, IS CLOSE TO THE ILLUMINATION SOURCE, THE LIGHT WILL BOUNCE FROM THE SURFACE AND TRANSFER ITS COLOR FURTHER, ILLUMINATING THE SPACE WITH A RED HUE. IF WHOLE ROOM IS PAINTED WITH WHITE, SMALL QUANTITY OF LIGHT SOURCES AND LOW INTENSITY CAN BE ENOUGH TO MAKE THIS SPACE SUITABLE FOR PROPER VISION.

ANOTHER THING ONE SHOULD KNOW IS THAT COLOR OF LIGHT DEPENDS FROM CHOICE OF LAMP. TO BE MORE PRECISE, COLOR TEMPERATURE SHOWS THE LIGHT COLOR, MEASURED IN KELVINS. THERE ARE THREE DISTINCTION TYPES CAN BE IDENTIFIED: WARM WHITE (COLOR TEMPERATURE UNDER 3300 K), NEUTRAL WHITE (3300-5000 K) AND COOL WHITE (OVER 3300 K) (IMAGE 12-13).

FURTHERMORE, GOOD THING TO KNOW IS THAT WARMER LIGHT IS OFTEN SUITABLE FOR PUBLIC AREAS TO CREATE RELAXATION ENVIRONMENT, WHILE A COOLER LIGHT CAN BE USED IN COMMERCIAL AREAS TO MAKE A CONCENTRATION MOOD, AS LIGHT AFFECTS HUMAN EMOTION AND HUMAN EMOTION AFFECTS HUMAN ACTION (IMAGE 14-15).

IN THIS STAGE ONE CAN UNDERSTAND, THAT WELL DESIGNED ILLUMINATION HAS A LARGE INFLUENCE ON HUMAN ACTION AND EMOTION. WE ARE NOT GOING TO TOUCH THE ECONOMICAL PART OF LIGHT IN THIS REPORT, FOR IT IS OUT OF OUR INTERESTS.

NOW ALL INFORMATION CAN BE SYNTHESIZED AND REPORT PROBLEM CAN BE SOLVED.



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## PART IV | FOUR LEVELS OF LIGHT

AFTER ALL ANALYSIS, PERFORMED IN THIS REPORT, ANSWER CAN BE FINALLY IMPLEMENTED.

LOOKING AT PROBLEM FROM ABSTRACT VIEW, LIGHT SOURCES AFFECT HUMAN ACTION IN REGARD TO MIND, LOGIC AND THINKING, WHILE HUMAN EMOTION IS AFFECTED IN RELATION TO SOUL, PSYCHE AND FEELING. IT MEANS, THAT LIGHT ERGONOMICS CAN BE FORMED INTO GENERAL RULES, REGULATIONS, WHICH CAN BE FOLLOWED BY ARCHITECTS OR LIGHT DESIGNERS, WHEREAS LIGHT AESTHETICS DEPENDS FROM EACH INDIVIDUAL, MOSTLY FROM CLIENT, AND CAN BE REALIZED BY MEANS OF DESIGNER AND CLIENT MUTUAL UNDERSTANDING.

TO MAKE A POSITIVE AFFECT OF INDUSTRIAL ILLUMINATION IN ENDOGENOUS ARCHITECTURE ON HUMAN ACTION AND EMOTION, FOUR LEVELS MUST BE FOLLOWED (HIERARCHY IS IMPORTANT).

### FIRST LEVEL - SAFETY.

AS WE ALREADY KNOW, HUMAN IS THE MAIN MEASURE FOR ARTIFICIAL LIGHTING, WHICH MEANS, THAT THE MOST IMPORTANT IS LIFE AND HEALTH. TO REACH THAT STATE, ONE MUST CREATE SAFE ENVIRONMENT FOR HUMAN ACTION. DESIGNER MUST MAKE SURE, THAT LIGHTING PROVIDES THE SUITABLE VISUAL CONDITIONS FOR PERSON TO ORIENTATE IN ENVIRONMENT, FIND HIS WAY AND PERFORM SAFETY MOVEMENTS WITHOUT LOSING LIFE OR GETTING HURT.

### SECOND LEVEL - FUNCTION.

AFTER LIFE AND HEALTH, HUMAN NEEDS AND ACTIONS ARE IMPORTANT. THUS, BEING IN SAFE AMBIENT FOR ADEQUATE ORIENTATION, LIGHTING MUST BE ADJUSTED IN SUCH A WAY, THAT PERSON WOULD BE ABLE TO PERFORM HIS TASK. TO REALIZE THIS STAGE, ONE CAN USE NORMS AND GUIDELINES, WHICH PLAY AN ASSISTANT ROLE FOR ARCHITECT OR LIGHT DESIGNER.

### THIRD LEVEL - COMFORT.

EVEN THOUGH IT IS SAFE AND TASK CAN BE PERFORMED, HUMAN NEED TO HAVE A SUITABLE FEELINGS IN RELATION TO ENVIRONMENT.

DESIGNER MUST MAKE SURE, THAT LIGHTING MAKE PERSON FEEL COMFORTABLE FOR HIS TASK IMPLEMENTATION. THAT WAY INDIVIDUAL ACTION WILL BE REALIZED IN EFFICIENT AND (PERHAPS) PLEASANT FORM.

### FOURTH LEVEL - CREATIVITY.

BEAUTIFUL OBJECT, SUBJECT OR DEED ATTRACTS PERSON ATTENTION. TO MAKE TASK MORE EFFICIENT AND PLEASANT, IT IS IMPORTANT TO CREATE AN ATTRACTION TO ENVIRONMENT BY MEANS OF LIGHT AESTHETICS.

ONE CAN SEE, THAT TWO FIRST LEVELS ARE RELATED TO ERGONOMICS AND ACTIONS, WHILE TWO FINAL LEVELS - TO AESTHETICS AND EMOTIONS.

IT IS IMPORTANT TO NOTICE, THAT EVERYTHING GOES AROUND SAFETY, EFFICIENCY AND PLEASURE. WHICH STATES, THAT: TO MAKE A POSITIVE LIGHTING AFFECT ON HUMAN ACTION AND EMOTION, IT IS IMPORTANT TO MAKE ENVIRONMENT SAFE, EFFECTIVE AND PLEASANT.

THE PROBLEM IS SOLVED, BUT ONE THING IS LEFT - WHAT LIGHT SOURCES CAN BE SELECTED TO MAKE A POSITIVE EFFECT?

TO TELL THE TRUTH, THERE IS NO SUCH A LIGHT SOURCE, WHICH COULD AFFECT HUMAN ACTION AND EMOTION IN POSITIVE WAY, AS EACH ENVIRONMENT, EACH PERSON ACTIONS AND EACH PERSON EMOTIONS DICTATES THE WAY FOR INDUSTRIAL ILLUMINATION. FROM INDUSTRIAL ILLUMINATION CHRONOLOGY AND CATEGORIZATION (IMAGE 6-7), ONE CAN SEE THE BENEFITS AND DRAWBACKS TO COMPARE. BY MEANS OF COMPARISON, ARCHITECT OR LIGHT DESIGNER CAN DECIDE WHAT TO UTILIZE, WHAT IS MORE IMPORTANT FOR HIM. IF ENVIRONMENT AND HUMAN TASK IS MORE INTERESTED IN FUNCTION, RATHER THAN AESTHETICS, HIGH, OR EVEN LOW PRESSURE SODIUM LAMPS CAN BE USED IN INTERIOR DESIGN. IF INTEREST IS MORE FOCUSED ON ENVIRONMENT ATTRACTION AND AESTHETICS, LEDs OR SOME OTHER LIGHT SOURCES CAN BE UTILIZED (MATTER OF TASTE).

ONE CAN CHOOSE WHAT SUITS HIM MOST, BUT, IN ANY CASE, AFOREMENTIONED FOUR LEVELS MUST BE FOLLOWED.



## SOURCES LIST AND THEIR REFERENCES

### LITERATURE:

FRANCESCO LEGRENZI - "VRAY: THE COMPLETE GUIDE" (FIRST EDITION 2008)  
ERNST AND PETER NEUFERT - "ARCHITECTS' DATA" (THIRD EDITION 2000)  
CHARLOTTE BADEN-POWELL - "ARCHITECT'S POCKET BOOK" (SECOND EDITION 2001)  
DAVID ADLER - "PLANNING AND DESIGN DATA" (SECOND EDITION 1999)  
HENRIK CLAUSEN - "LIGHT AND COMMUNICATION" (FIRST EDITION 2009)  
JANET TURNER - "DESIGNING WITH LIGHT" (FIRST EDITION 1998)  
PBC INTERNATIONAL - "LIGHTING THE WORKPLACE" (FIRST EDITION 1988)  
MAX KELLER - "LIGHT FANTASTIC" (FIRST EDITION 1999)

### ENTERTAINMENT:

BLIZZARD ENTERTAINMENT - "STAR CRAFT 2" (2010) (TRY TO PLAY AND CHECK THE TECHNICAL TREE)

### WORLD WIDE WEB:

FOCUS LIGHTING - [HTTP://FOCUSLIGHTING.COM/](http://focuslighting.com/)  
SPEIRS + MAJOR - [HTTP://WWW.SPEIRSandMAJOR.COM/](http://www.speirsandmajor.com/)  
LIGHTING PLANNERS ASSOCIATES - [HTTP://WWW.LIGHTING.CO.JP/ENGLISH/INDEX.HTML](http://www.lighting.co.jp/english/index.html)  
MARTIN - [HTTP://WWW.MARTIN.COM/FRONTPAGE/FRONTPAGE.ASP?EMPTY=0](http://www.martin.com/frontpage/frontpage.asp?empty=0)

## EPILOGUE

### SAFETY, FUNCTION, COMFORT AND CREATIVITY

THE PROBLEM WAS SOLVED AND QUESTION WAS ANSWERED.

**QUESTION:** HOW DOES THE INDUSTRIAL ILLUMINATION OF ENDOGENOUS ARCHITECTURE AFFECTS HUMAN ACTION AND EMOTION; HOW TO MAKE EFFECT POSITIVE IN REGARD TO ERGONOMICS, AESTHETICS AND LIGHT SOURCES?

**ANSWER:** TO MAKE A POSITIVE AFFECT OF INDUSTRIAL ILLUMINATION IN ENDOGENOUS ARCHITECTURE ON HUMAN ACTION AND EMOTION IN REGARD TO ERGONOMICS, AESTHETICS AND LIGHT SOURCES, FOUR LIGHT LEVELS MUST BE FOLLOWED: SAFETY, FUNCTION, COMFORT AND CREATIVITY (OR MAKE THE ENVIRONMENT SAFE, EFFECTIVE AND PLEASANT).

VAST EXPERIENCE WAS ABSORBED, STARTING FROM PHYSICS AND ENDING WITH AESTHETICS. FROM THIS REPORT ONE UNDERSTENDS THE LIGHT IMPORTANCE IN ARCHITECTURE. INDUSTRIAL LIGHTING NOT ONLY MAKE ENVIRONMENT SUITABLE FOR ORIENTATION, BUT ALSO AFFECT HUMAN MIND AND SOUL, CAN CREATE RELAXING OR PRODUCTIVE AMBIENT AND SUCH. MOREOVER, ONE CAN UNDESTAND, THAT THE MOST COMPLICATED AND, PERHAPS, MOST INTERESTING THING TO SPECIFY IS LIGHT SOURCE.

EVEN THOUGH A LOT OF ANALYSIS WAS PERFORMED AND KNOWLEDGE SYNTHESIZED, THIS REPORT CAN HAVE SOME SLIGHT ERRORS, FOR A LOT OF SOURCES AND A LOT OF OPINIONS CAN BE MET, WHEREAS TIME IS RUNNING AND TECHNOLOGICAL DEVELOPMENT IS GROWING IN GEOMETRICAL PROGRESSION. AUTHOR RECOMENTS TO CHECK ALL SOURCES, WHICH WAS USED FOR THIS REPORT AND, PERHAPS, EVEN MORE THAN THAT. AUTHOR ALSO SUGGEST TO TAKE AN INTEREST IN LED AND OLED SOURCES, WHICH IS TOPICAL NOWADAYS.

NEXT STEPS WOULD BE NATURAL LIGH IN ARCHITECTURE AND ARCHITECTONIC SOUND.

WITH THIS BEING SAID, AUTHOR APOLOGIZE IF SOME INFORMATION WAS ON SUPERFICIAL LEVEL, AS THERE WAS A LIMITED TYME FOR REPORT IMPLEMENTATION.

IF READER HAS FOUND SOME ERRORS, PLEASE, LET AUTHOR KNOW ABOUT IT (BY MAIL [SACOMPLEX@YMAIL.COM](mailto:SACOMPLEX@YMAIL.COM)).

### NOTES

#### ILLUSTRATIONS:

FRONT AND BACK PAGE "SIT AND MASTER" - NIKITA PIKALOV  
DO NOT REMEMBER SOURCES REFERENCES AND AUTHORS, AS A LOT OF IMAGES WAS VIEWED AND UTILIZED. ESSENTIALLY DEVIANT-ART AND GOOGLE WAS USED.



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