Product Design Project – III

Innovative indoor lighting products

By

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Project Guide

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APPROVAL SHEET

The Product Design Project III titled **"Innovative Indoor Lighting Products"** by **Nagsen P. Nandurgekar**

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Date : _____

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Abstract

Light plays very important role in our life. When sun rises it gives light to the whole world, but as it sets darkness begins. Humans discovered electricity to produce light. We are using light not only at night but also day time. Designers differentiated light for various purposes and designed light accordingly.

Thus Decorative lighting came into picture. As use of electricity increased, we are having shortage of electricity.

This project aims at designing a innovative decorative light system (Track/rail lighting) with good ambience, for particular task which will have low power consumption. Various aspects such as light, colour, colour and emotions are studied and tried to incorporate in the final product. Also an new concept of mood light lighting is incorporated in the final product.

The final product i.e. the **track light** for the **living room** can be fixed on the track on wall or ceiling, for flexible movement and proper positioning suitable goose pipe is used. Use of RGB controlled LED's gives us the choice of selecting our colour tone and thus single light provides multiple colours. Led in acrylic gives good ambience and also we can control the intensity of light.

Design Objective

To design innovative Indoor lighting products for better ambience and power saving…

To provide better lighting considering the requirement as per need.

Scope of Design:

Light is one of the important requirement in our day today life, shortage of electricity lead us to a condition of power saving. There are various types of decorative lights available in the market but they consume large power.

New techniques and colourful lights are still emerging in the market. So there is a scope for design in designing some products for low power consumption still giving desired results.

Introduction:

In this project I collected data from various fields related to light, and studied different areas. It includes different Types of lightings, different types of lights, power consumption, decorative lights, Colour and the relation between colour and emotion. Emerging market of LED attracted my mind and made me to get detailed exposure about LED market, LED products, Applications etc. As LED consumes low power, after doing ideation and lot many explorations in acrylic I got good results and I reached to my goal of Designing a Innovating Lighting Product.

DATA COLLECTION:

Types of Lighting

You'll find that you have several options to consider when selecting what type of lighting you should use in your home.

When selecting energy-efficient lighting, it's a good idea to understand basic lighting terms and principles. Also, it helps to explore your lighting options for indoors and/or outdoors if you haven't already. This will help narrow your selection.

Types of lighting include:

- Fluorescent lighting
- High-intensity discharge lighting
- Incandescent lighting
- Low-pressure sodium lighting
- Outdoor solar lighting

We can use the chart below to compare the different types of lighting.

Lighting Comparison Chart					
Lighting Type	**Efficacy (lumens/watt)**	**Lifetime (hours)**	**Colour Rendition Index (CRI)**	**Colour Temperature (K)**	**Indoors/Outdoors**
Incandescent					
Standard "A" bulb	10–17	750–2500	98–100 (excellent)	2700–2800 (warm)	Indoors/outdoors
Tungsten halogen	12–22	2000–4000	98–100 (excellent)	2900–3200 (warm to neutral)	Indoors/outdoors
Reflector	12–19	2000–3000	98–100 (excellent)	2800 (warm)	Indoors/outdoors
Fluorescent					
Straight tube	30–110	7000–24,000	50–90 (fair to good)	2700–6500 (warm to cold)	Indoors/outdoors
Compact fluorescent lamp (CFL)	50–70	10,000	65–88 (good)	2700–6500 (warm to cold)	Indoors/outdoors
Circline	40–50	12,000			Indoors
High-Intensity Discharge					
Mercury vapor	25–60	16,000–24,000	50 (poor to fair)	3200–7000 (warm to cold)	Outdoors

Metal halide	70–115	5000–20,000	70 (fair)	3700 (cold)	Indoors/outdoors
High-pressure sodium	50–140	16,000–24,000	25 (poor)	2100 (warm)	Outdoors
Low-Pressure Sodium	60–150	12,000–18,000	-44 (very poor)		Outdoors

Fluorescent Lighting

Fluorescent lamps use 25%–35% of the energy used by incandescent lamps to provide the same amount of illumination (efficacy of 30–110 lumens per watt). They also last about 10 times longer (7,000–24,000 hours).

The light produced by a fluorescent tube is caused by an electric current conducted through mercury and inert gases. Fluorescent lamps require a ballast to regulate operating current and provide a high start-up voltage. Electronic ballasts outperform standard and improved electromagnetic ballasts by operating at a very high frequency that eliminates flicker and noise. Electronic ballasts also are more energy-efficient. Special ballasts are needed to allow dimming of fluorescent lamps.

Improvements in technology have resulted in fluorescent lamps with colour temperature and colour rendition that are comparable to incandescent lamps.

Types of Fluorescent Lamps

Two general types of fluorescent lamps include these:

- Compact fluorescent lamps (CFLs)
- Fluorescent tube and circline lamps

We can use the chart below to compare these types of lamps. If we don't already, it helps to understand basic lighting principles and terms before making comparisons.

Fluorescent Lighting Type	Efficacy (lumens/watt)	Lifetime (hours)	Colour Rendition Index (CRI)	Colour Temperature (K)	Indoors/Outdoors
Straight tube	30–110	7000–24,000	50–90 (fair to good)	2700–6500 (warm to cold)	Indoors/outdoors
Compact fluorescent lamp (CFL)	50–70	10,000	65–88 (good)	2700–6500 (warm to cold)	Indoors/outdoors
Circline	40–50	12,000			Indoors

Compact Fluorescent Lamps

Compact fluorescent lamps (CFLs) combine the energy efficiency of fluorescent lighting with the convenience and popularity of incandescent fixtures.

CFLs can replace incandescents that are roughly 3–4 times their wattage, saving up to 75% of the initial lighting energy. Although CFLs cost 3–10 times more than comparable incandescent bulbs, they last 6–15 times as long (6,000–15,000 hours). See How CFLs Compare with Incandescents for more information.

How They Work

CFLs work much like standard fluorescent lamps. They consist of two parts: a gas-filled tube, and a magnetic or electronic ballast. The gas in the tube glows with ultraviolet light when electricity from the ballast flows through it. This in turn excites a white phosphor coating on the inside of the tube, which emits visible light throughout the surface of the tube.

CFLs with magnetic ballasts flicker slightly when they start. They are also heavier than those with electronic ballasts. This may make them too heavy for some light fixtures. Electronic ballasts are more expensive, but light immediately (especially at low temperatures). They are also more efficient than magnetic ballasts. The tubes will last about 10,000 hours and the ballast about 50,000 hours. Most currently available CFLs have electronic ballasts.

CFLs are designed to operate within a specific temperature range. Temperatures below the range cause reduced output. Most are for indoor use, but there are models available for outdoor use. You can find a CFL's temperature range on most lamp packages. You should install outdoor CFLs in enclosed fixtures to minimize the adverse effects of colder temperatures.

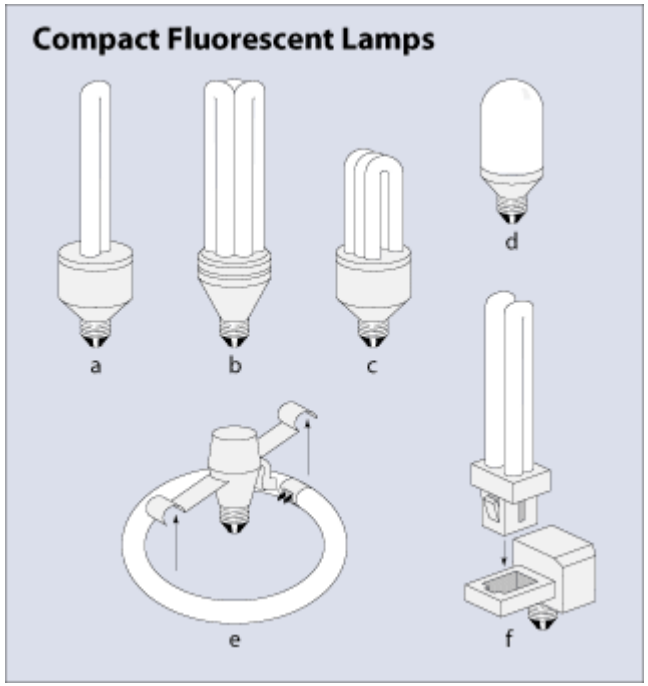
CFLs are most cost effective and efficient in areas where lights are on for long periods of time. You'll experience a slower payback in areas where lights are turned on for short periods of time, such as in closets and pantries. Because CFLs do not need to be changed often, they are ideal for hard-to-reach areas.

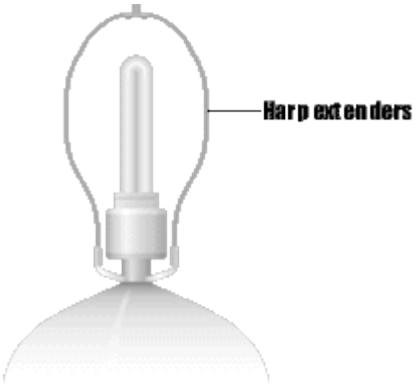
Types of Compact Fluorescent Lamps

CFLs are available in a variety of styles or shapes. Some have two, four, or six tubes. Others have circular or spiral-shaped tubes. The size or total surface area of the tube(s) determines how much light it produces.

Some CFLs have the tubes and ballast permanently connected. Other CFLs have separate tubes and ballasts. This allows you to change the tubes without changing the ballast. There are also types enclosed in a glass globe. These look somewhat similar to conventional incandescent light bulbs, except they're larger.

Sub-CFLs fit most fixtures designed for incandescent lamps. Although most CFLs fit into existing 3-way light sockets, only a few special CFL models can be dimmed.





Compact fluorescent lamps (CFLs) come in a variety of sizes and shapes including (a) twin-tube integral, (b and c) triple-tube integral, (d) integral model with casing that reduces glare, (e) modular circline and ballast, and (f) modular quad-tube and ballast. CFLs can be installed in regular incandescent fixtures, and they consume less than one-third as much electricity as incandescent lamps do.

Cheaper To Run, More Expensive To Install -They are cheap to operate as they emit about four times as much light per unit of electricity as incandescent lights do

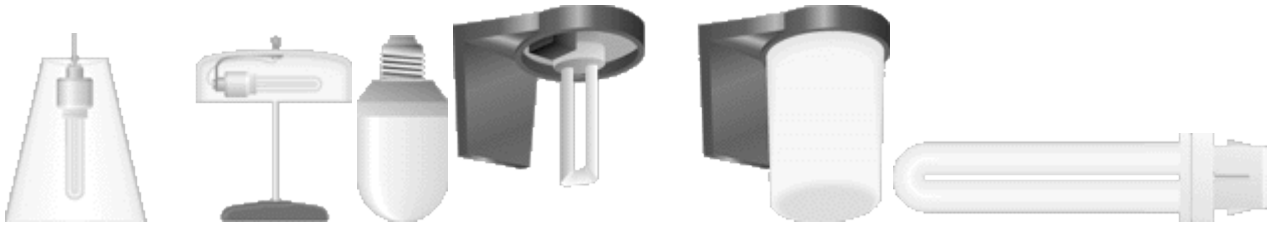
How They Work -Fluorescent lights work by placing an anode and a cathode at opposite ends of a glass tube

Industrial Tubes -These tubes include the ubiquitous "cool white" and "warm white" usually used in home and industrial lighting applications

Industrial Tubes -These tubes are tuned to produce the brightest possible illumination for the least amount of electricity

Full Spectrum -Full spectrum tubes imitate, as closely as possible, natural sunlight by emitting light in every spectral range

Bare Products		Covered Products			Reflector Products
Mini-Spiral or Twist	Tube or Universal	Incandescent/ A-line	Globe G25, G30, G40	Candelabra, Post or Bullet Shape	Indoor and Outdoor R20, R30, R40, PAR38
					



Spiral Lamps: The spiral lamp is the most popular model of compact fluorescent bulbs. Spiral bulbs are particularly suitable to table floor lamps, ceiling fixtures, wall sconces, and outdoor covered lamps.

Tube Lamps: This type of lamp is particularly fit for table floor and task lights, pendant fixtures, ceiling fixtures and outdoor covered fixtures.

The incandescent A-line fluorescent is particularly suitable for table/floor lamps, pendant fixtures, ceiling fans and outdoor covered fixtures.

Globe fluorescents are suitable for pendant fixtures and ceiling fans.

Candelabra, Post or Bullet shape fluorescents are suitable for wall sconces and outdoor covered lamps.

Indoor reflector fluorescents are suitable for recessed cans and track lighting.

Outdoor reflector fluorescents are particularly suitable for outdoor exposed fixtures. Be careful with fluorescent for outdoors: some do not operate well at cooler temperatures (below 40ºF), though there are “weatherproof” models and Energy Star models qualified to low outdoor temperatures.

Integral and Modular Types

Fluorescent Lights (CFLs) can be of two types:

1) "integral" bulb/ballast or
2) "modular".

Modular CFL’s involve a pin-based bulb that is separable from the ballast, which can be reused when the bulb burns out (usually the ballast supports five bulb replacements).

Integral type CFL’s is a sealed set, comprising an integrated bulb-ballast.

Though modular CFL's have some advantages (the bulb without the ballast is cheaper…), the integral CFL's are much more common, and the only models presently qualified by organisms as Energy Star.

In the case of modular CFL's, when buying a bulb to replace another one, make sure that the rating of the bulb's lumen output and the design of its base is the right one…

- Fluorescent wattage

Manufacturers are offering three very popular wattages:

- the13-watt (60-watt incandescent equivalent)
- the 18-watt (75-watt incandescent equivalent) and
- the 26-watt (100-watt incandescent equivalent).

- Fluorescent colours

Today's fluorescents haven't the disadvantages of old ones: newer compact fluorescent lighting may also involve warm tones that make them indistinguishable from incandescent.

- Switch On and Off

Use the CFL's in rooms and areas of the house where the lights aren't switched on and off too frequently. Otherwise, the CFL's life will shorten. Minimum periods of fifteen minutes are desirable.

- Fluorescent lights and Mercury

Fluorescent lights contain small amounts of mercury in their tubing. Old lights should be put in recycling centers. If your state permit people to put used and broken fluorescent bulbs in the garbage, seal the bulb in a plastic bag and put it into the outside trash or any other protected outside trash location.

- Cares with broken fluorescent lights

If a bulb breaks in your house, open a window and leave the room for 15 minutes or more. Then, with gloves, carefully scoop up the fragments and powder (do not use a vacuum or broom: use stiff paper or cardboard) and place them in a sealed plastic bag. Also place all the cleanup materials in another sealed plastic bag…

- Fluorescent lights and incandescent fixtures

Most compact fluorescent lights work in common incandescent fixtures, but some may have trouble operating in older ones.

- Dedicated fluorescent fixtures

Though Compact Fluorescent Lamps (CFLs) can now be used in almost all incandescent fixtures, it's usually preferable to use dedicated fluorescent fixtures – they allow higher energy savings, and a better light, reliability and longevity.

Kitchen & Lighting Design

The lighting design of a kitchen is highly dependent of its size and configuration. Small kitchens might only demand a central fluorescent fixture and some task lighting under cabinets, but a larger kitchen will demand a more complex lighting.

- Kitchen lighting techniques

Kitchen lighting design is based on three main types of lighting:

- Ambient or general lighting;
- Task lighting: to illuminate particular areas of the kitchen;
- Accent decorative lighting: for details, depth and décor (examples: recessed low-voltage fixtures to highlight art; fixtures strategically placed to illuminate collections).

It's a good lighting practice to begin with task lighting - for countertops, breakfast area and other possible areas of the kitchen. General background light is often studied later.

- Lighting Kitchen & Task Areas

Fluorescents are excellent as task lights. They are a common option under cabinets, where they perform a direct illumination of the counters. There are specific cabinet flat fixtures that can use fluorescents. More focused lighting – a light over the sink, for instance – can also be performed by a compact fluorescent lamp (CFL).

Recessed lights placed above counters as task lighting may also be fluorescents (CFLs).

- Eating Area and Pendant light fixtures

Pendant light fixtures are excellent to individualize areas in the kitchen. Lighting the eating area is a good example of such application. Pendants allow a localized task light, and are excellent as a decorative element and to «separate» that area.

Pendant fixtures can also be used in rooms attached to kitchen (breakfast rooms, for instance).

- General Lighting

In some cases, namely in very small kitchens, task lighting may turn general lighting rather dispensable. Well placed lights over the counters may provide all the needed lighting. But in most cases, general lighting is indispensable.

General lighting creates a warmer room and softens shadows. General lighting is often placed on the ceiling or on the space between the cabinets and the ceiling (if the cabinets do not reach that space).

- Ceiling fans

Ceiling fans are an excellent option on kitchen lighting, namely as a general lighting option. They are very useful during warmer weather (allowing cooling savings) and since they can be equipped with decorative lighting fixtures they can also be decorative. Energy Star has many qualified ceiling fans for kitchens.

- Direct and indirect lighting

The use of both direct and indirect lighting allows an excellent lighting output for kitchens. Indirect lighting is obtained by hidden lights - on top or under cabinets or in hidden ceiling areas - when the light reflects itself on a ceiling or a wall.

Direct lighting is obtained by using recessed and surface lights, or light fixtures on pendant and chains.

- High ceiling and colours of the kitchen

Higher kitchen ceilings demand brighter light bulbs. Darker colours of kitchen counters – dark marbles… - or other surfaces might imply additional lighting.

- Fluorescent lights

Selection of high-efficiency lamps and fixtures is essential in kitchen lighting. Whenever possible, prefer fluorescent lighting for your kitchen. They are more expensive, but they last much longer than incandescent, and consume much less. Classical fluorescent lamps (tubes) and Compact Fluorescent Lamps (CFLs) are a major element of energy savings.

Today's CFLs can be used with ordinary fixtures, and since they are small and adapted to ordinary fixtures they can perform the design and lighting functions usually reserved to incandescents.

- Controls and switches

Bet on separated switches for each lighting area. Different lights should have separate controls - the counter, the breakfast table area, the sink or the pantry can each have a separate switch… – in order to obtain energy savings.

Light dimmers can reduce the wattage and output of lamps - and lighting controls are also commonly used to smooth transition between the kitchen and adjacent rooms or complementary spaces.

Bathroom lighting elements

The bathroom lighting design is highly dependent of the bathroom size and configuration. Small bathrooms might only demand a central ceiling fluorescent fixture (or a ceiling fan with a light kit) and a pair of vanity fixtures, but a larger bathroom demands more lighting elements.

- Bathroom Vanity lighting

Do not put fixtures over the mirror if you want to avoid casting shadows on your face. Lighting fixtures should be mounted on either side of the vanity mirror, 35 - 40 inches (0.9-1 m) apart. Fixtures can be placed on the mirror's surface, if the mirror is too large. To get even illumination and avoid shadows, you should also center each fixture approximately at head level.

- Bathroom general lighting and moisture

Bathroom moisture can be avoided and linked to lighting. For that, you should install a properly sized ventilation/exhaust fan with a build-in light, preferably Energy Star or other qualified fan. The fan will provide both good ventilation and lighting (and energy savings).

- Ceiling fans basics

If you are remodeling your bathroom, you should considerer also insulation. The walls (mainly those behind tubs and showers) should be well air-sealed and insulated. Just seal possible air leaks and install the right insulation,

- Bathroom exhaust fan & Lighting

Many exhaust fans models include a light kit – which can be an energy efficient fluorescent light bulb. Choose a qualified model (Energy Star…) with a fluorescent light, to get higher energy savings.

Exhaust fans with light, use separate switches: one for the fan and one for the light source (and eventually a third one for a night light).

Some exhaust fans also include heaters (for winter months, to warm up the bathroom), which demands an additional switch.

- Other bathroom lighting

Large bathrooms may demand some more lighting besides the vanity lighting and the general lighting provided by ceiling lights.

The shower is an area where lighting can also have some advantages –eventually a recessed light with a glass lens.

Small recessed spotlight directed to some decorative elements are other type of lighting you may want to consider. This kind of lighting is called accent decorative lighting and its goal is mainly decorative and involving small areas and details of the bathroom.

- Bulbs, fixtures and switches

Choose CFLs (Compacts Fluorescent Lights) and other fluorescents. Fluorescents will provide bright, warm light and they use much less energy than standard lighting.

Light dimmers – and other lighting controls - can reduce the wattage and output of lamps. They are also an advantageous option to get electricity saving.

Living room lighting areas

Lighting should take into account the activities performed in the living/dining room, and the areas of lighting that can and should be considered:

- reading and other task areas
- fireplace area
- bar, buffet, sideboard areas
- game tables area
- TV, video, games and computer areas
- dining room table area
- accent-decoration areas

Television, video, games, computers areas

It's highly advantageous to watch TV without a harsh contrast of light and shadow in your field of vision. The same is valid to activities as playing with video games and even when playing or working with computers.

To avoid that contrast, place a lamp that casts a soft light on the wall behind the set.

- Reading area:

Reading, sewing and other tasks demand task lights that should be adjustable to the optimum height and angle. To avoid glare, the bottom of the shade should coincide with the eye level).

Task lighting can be accomplished by placing a floor lamp at either side of the correspondent chair or sofa...

- Dining room table area:

Dining room lighting is usually centered in a chandelier suspended over the table.

You may use a dimmer to control the atmosphere, and downlights to get task lighting, when necessary. You

may also consider a ring of four recessed or track lighting in the ceiling, around the table, to get general and decorative lighting.

- Fireplace area:

Wall fixtures on each side of the fireplace emphasizes the fireplace and provides general lighting.

- Bars, buffets, sideboard areas:

Living room bars can be lighted from above with small miniaturized low-voltage pendants, or with recessed lights. A buffet or sideboard can be illuminated with wall sconces on both sides. Objects around can be highlighted with recessed down-lights, located in the ceiling above.

- Game tables area

Shaded pendants with energy-efficient compact fluorescent tubes are a good solution to light game tables.

- Accent / decoration elements

You may use fixtures strategically placed to illuminate collections; or lights placed on the wall behind a plant, to cast and accent its silhouette; or recessed low-voltage lights to highlight family portraits, paintings and other arts, or to highlight shelves and glassware, China cabinets, hutches, wall niches (low-voltage lights will spread a beam of white light).

- Making the family-room seem larger

To make the living room seem larger you may light an entire wall, using recessed lights mounted on the ceiling. The lights should be placed at an equal distance from each other and the wall.

- Fluorescent lighting

Bet on fluorescent. Modern fluorescents are excellent as task lights or for ambient lighting, and allow immense energy-savings relatively to incandescents.

New CFCs (Compact fluorescents Lamps) are available in styles and types that can accommodate to most common fixtures.

Also bet on efficient reflector bulbs - for task and reading lighting or for accent-decorative lighting. An example: a 50W reflector ("R") bulb can illuminate as much as a non-reflector (“A”) 100W bulb.

- Dimmers and different switches for energy savings

Use dimmers to control and vary the lighting. Dimming controls are ideal for the living room and the dining room because they allow to control the lighting to suit each activity and set the mood, and also because they allow energy savings.

Different switches controlling the different lighting areas in the dining and family room are also essential to reduce the lighting bills.

Controls as timers and sensors, to turn outdoor lighting on and off automatically, are also elements you should consider.

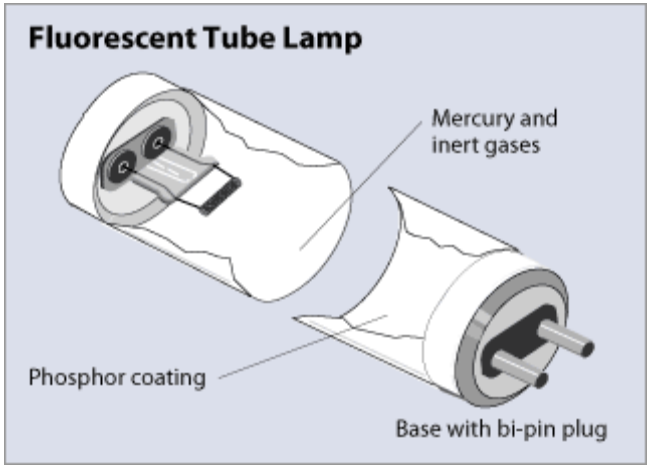
Fluorescent Tube and Circline Lamps

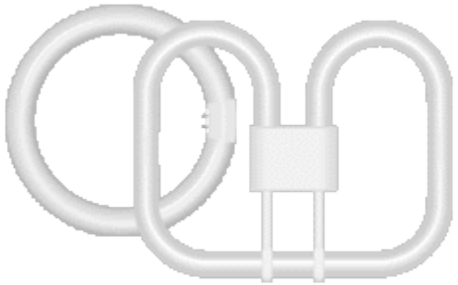
Fluorescent tube lamps—the second most popular type of lamps—are more energy efficient than the more popular A-type standard incandescent lamps.

The traditional tube-type fluorescent lamps are usually identified as T12 or T8 (12/8 or 8/8 of an inch tube diameter, respectively). They are installed in a dedicated fixture with a built-in ballast. The two most common types are 40-watt, 4-foot (1.2-meter) lamps, and 75-watt, 8-foot (2.4-meter) lamps.

Tubular fluorescent fixtures and lamps are preferred for ambient lighting in large indoor areas. In these areas, their low brightness creates less direct glare than incandescent bulbs.

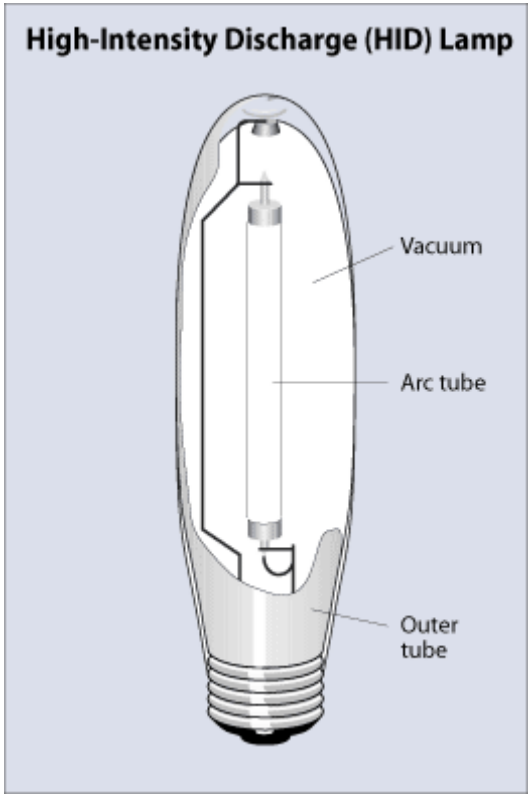
Circular, tube-type fluorescent lamps are called *circline* lamps. They are commonly used for portable task lighting.





In fluorescent tubes, a very small amount of mercury mixes with inert gases to conduct the electrical current. This allows the phosphor coating on the glass tube to emit light.

High-Intensity Discharge Lighting



In a high-intensity discharge lamp, electricity arcs between two electrodes, creating an intensely bright light. Mercury, sodium, or metal halide gases act as the conductor.

High-intensity discharge (HID) lamps provide the highest efficacy and longest service life of any lighting type. They can save 75%–90% of lighting energy when they replace incandescent lamps.

HID lamps use an electric arc to produce intense light. Like fluorescent lamps, they require ballasts. They also take up to ten minutes to produce light when first turned on, because the ballast needs time to establish the electric arc.

Because of the intense light they produce at a high efficacy, HID lamps are commonly used for outdoor lighting and in large indoor arenas. Since the lamps take awhile to establish, they are most suitable for applications where they stay on for hours at a time. They are not suitable for use with motion detectors.

Types of High-Intensity Discharge Lamps

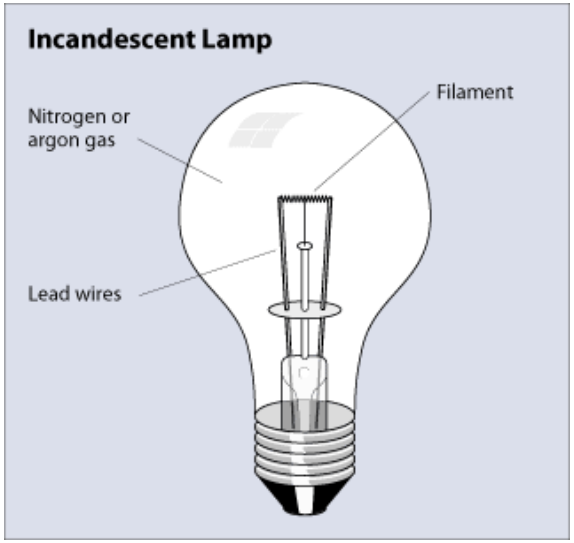
These are the three most common types of HID lamps:

- Mercury vapor lamps
- Metal halide lamps
- High-pressure sodium lamps.

We can use the chart below to compare these types of lamps

High-Intensity Discharge Lighting Type	Efficacy (lumens/watt)	Lifetime (hours)	Colour Rendition Index (CRI)	Colour Temperature (K)	Indoors/Outdoors
Mercury vapor	25–60	16,000–24,000	50 (poor to fair)	3200–7000 (warm to cold)	Outdoors
Metal halide	70–115	5000–20,000	70 (fair)	3700 (cold)	Indoors/outdoors
High-pressure sodium	50–140	16,000–24,000	25 (poor)	2100 (warm)	Outdoors

Incandescent Lighting



Incandescent lighting is the most common type of lighting used in homes. It has traditionally delivered about 85% of household illumination.

Incandescent lamps operate without a ballast. They light up instantly, providing a warm light and excellent colour rendition. You can also dim them. However, incandescent lamps have a low efficacy compared to other lighting options (10–17 lumens per watt) and a short average operating life (750–2500 hours).

Incandescent lamps are the least expensive to buy, but because of their relative inefficiency and short life spans, they usually are more expensive to operate.

The incandescent lamp is the oldest and most common type of lamp. Light is emitted when electricity flows through—and heats—a tungsten filament.

Types of Incandescent Lamps

These are the three most common types of incandescent lamps:

- Standard incandescent lamps
- Tungsten halogen lamps
- Reflector lamps

You can use the chart below to compare these types of lamps. If you don't already, it helps to understand basic lighting principles and terms before making comparisons.

Incandescent Lighting Type	Efficacy (lumens/watt)	Lifetime (hours)	Colour Rendition Index (CRI)	Colour Temperature (K)	Indoors/Outdoors
Standard "A" bulb	10–17	750–2500	98–100 (excellent)	2700–2800 (warm)	Indoors/outdoors
Tungsten halogen	12–22	2000–4000	98–100 (excellent)	2900–3200 (warm to neutral)	Indoors/outdoors
Reflector	12–19	2000–3000	98–100 (excellent)	2800 (warm)	Indoors/outdoors

Standard Incandescent Lamps

Known as the screw-in "A"-type light bulb, standard incandescent lamps are the most common—but the most inefficient—light source available.

These standard incandescent lamps produce light from a tiny coil of tungsten wire that glows when it is heated by an electrical current.

Larger wattage incandescent bulbs have a higher efficacy than smaller wattage bulbs. However, a larger wattage lamp or bulb may not be the most energy- or cost-effective option, depending on how much light is needed.

"Long-life" bulbs, with thicker filaments, are a variation of these A-type bulbs. Although these bulbs last longer than their counterparts, they are less energy efficient.

Tungsten Halogen Lamps

Tungsten halogen lamps—a type of incandescent lighting—achieve better energy efficiency than standard, incandescent A-type light bulbs.

Tungsten halogen lamps have a gas filling and an inner coating that reflect heat. Together, the filling and coating recycle heat to keep the filament hot with less electricity.

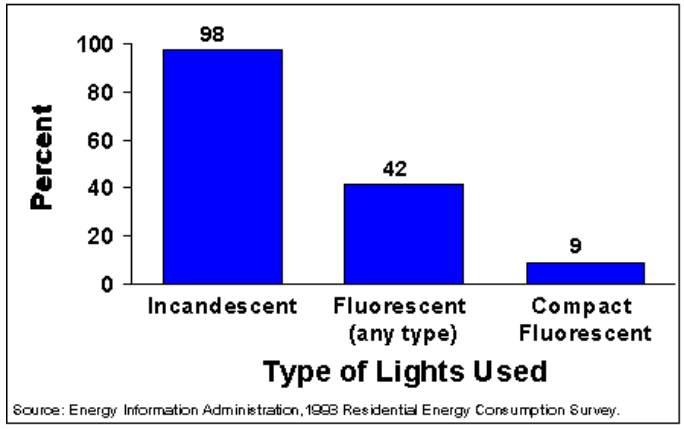
These lamps provide excellent colour rendition. They also are considerably more expensive to buy than standard incandescent lamps, but are less expensive to operate because of their higher efficacy.

Reflector Lamps

Reflector lamps (Type R)—a type of incandescent lighting—spread and direct light over specific areas. They are used mainly for floodlighting, spotlighting, and downlighting.

There are two types of reflector lamps: parabolic aluminized and ellipsoidal. Parabolic aluminized reflector lamps (Type PAR) are used for outdoor floodlighting. Ellipsoidal reflector lamps (Type ER) focus light beams about 2 inches (5 centimeters) in front of its enclosure, projecting light down from recessed fixtures. Ellipsoidal reflectors are twice as energy efficient as parabolic reflectors for recessed fixtures.

Figure 1. Percent of Households Using Incandescent, Fluorescent, and Compact Fluorescent Lights, 1993



Source: Energy Information Administration, 1993 Residential Energy Consumption Survey.

Residential Energy Consumption Survey (RECS) . . .

Nearly all (98 percent) households use incandescent lights, 42 percent use fluorescent lights of any type, and 9 percent use compact fluorescent lights (Figure 1). However, when the actual use of types of lights is considered, only 13 percent of the lights used for 1 or more hours per day are fluorescent, and less than 1 percent of lights used for 15 minutes or more per day are compact fluorescent.

Commercial Buildings Energy Consumption Survey (CBECS) . . .

Approximately two-thirds of all commercial buildings use incandescent lights, but only 14 percent of lit floorspace is lit by incandescent lights, while approximately 77 percent is lit by fluorescent lights and approximately 3 percent is lit by compact fluorescent lights (Figure 2). CBECS also collects information on two other types of lighting equipment--halogen and high-intensity discharge (HID). Of lit commercial floorspace, 2 percent is lit by halogen lights and 8 percent is lit by HID lights (Table 3).

Figure 2. Percent of Lit Commercial Floorspace Lit by Incandescent, Fluorescent and Compact Fluorescent Lights, 1995

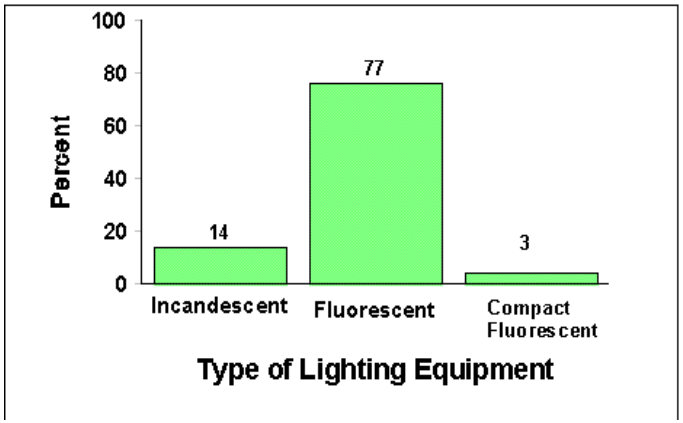
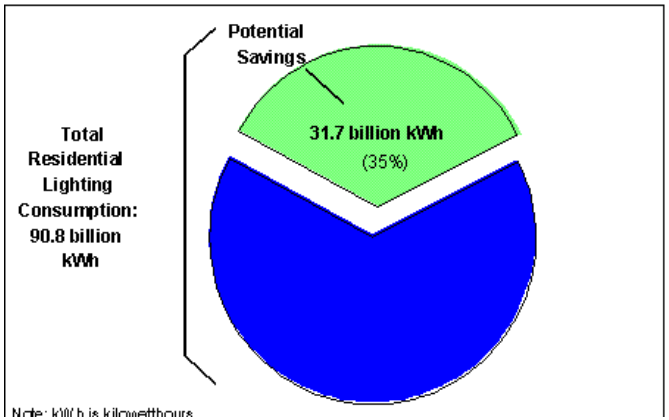


Figure 3. Potential Energy Savings from Replacement of Incandescent Lights with Compact Fluorescent Lights, 1993



In the Residential Sector . . .

The greatest potential for energy savings in the residential sector occurs for lights that are used for longer periods of time. Therefore, potential savings are calculated for only those lights used for 4 or more hours per day. This analysis also assumes that compact fluorescent lights need about one-third the wattage of incandescent lights. Although an 18-watt compact fluorescent light produces the same number of lumens as a 75-watt incandescent, issues of light placement and colour quality make a higher wattage compact fluorescent light more suitable.

In the Commercial Sector . . .

In 1995, U.S. commercial buildings used a total of 352 billion kWh of electricity for lighting. Although some energy savings would occur by simply replacing incandescent lights with fluorescent lights, CBECS data suggest greater energy savings will occur by replacing existing fluorescent lights with more energy-efficient equipment such as electronic ballasts, which increase fluorescent efficiency by up to 25 percent. For example, a study of a 440,000-square-foot office building in Washington, DC, which rewired T-12 fluorescent lamps and magnetic ballasts with smaller-diameter T-8 lamps and electronic ballasts, revealed a potential for annual savings of about 290,000 kWh, worth $27,000 per year to the building owner. Power per fixture was reduced by 20 percent, from 110 watts to 88 watts. The 1995 CBECS reported that 48 percent of total commercial floorspace (56 percent of lit floorspace) was served by fluorescent lights with energy-efficient ballasts. There remains a significant fraction of commercial building floorspace that can be upgraded with more energy-efficient lighting equipment.

Low-Pressure Sodium Lighting

Low-pressure sodium lamps provide the most energy-efficient outdoor lighting compared to high-intensity discharge lighting, but they have very poor colour rendition. Typical applications include highway and security lighting, where colour isn't important.

Low-pressure sodium lamps work somewhat like fluorescent lamps. Like high-intensity discharge lighting, low-pressure sodium lamps require up to ten minutes to start and have to cool before they can restart. Therefore, they are most suitable for applications where they stay on for hours at a time. They are not suitable for use with motion detectors.

You can use the chart below to compare low-pressure sodium lamps with high-intensity discharge lamps. If you don't already, it helps to understand basic lighting principles and terms before making comparisons.

Outdoor Solar Lighting

Outdoor solar lights are easy to install and virtually maintenance free. Best of all, they provide free electricity.

Outdoor solar lighting systems use solar cells, which convert sunlight into electricity. The electricity is stored in batteries for use at night. Manufacturers most commonly use nickel cadmium, sealed lead acid, and lead acid batteries.

Outdoor solar lighting systems will work in most areas of the United States. However, it is important to consider geographic and site specific variables when choosing a product. A solar lighting system will work well only as long as the solar cells receive the manufacturer's recommended hours of sunlight.

The "nightly run time" listings on most "off-the-shelf" products are based on specific sunlight conditions. Outdoor solar lights located in places that receive less sunlight than the solar cells need will operate for fewer hours per night than expected. Nightly run times may also vary depending on how clear the sky is on any given day. Operating times in the winter months may vary as much as 30%–50%. Unless the solar lighting system has been sized specifically for winter operation, it will not operate for the specified number of hours per night in a given

location. Shading of the solar cells by landscape features (vegetation, buildings, etc) will also impact battery charging and performance. Watch for bird droppings, too. Insufficient battery charging will not only affect performance, it also may reduce the life of the battery.

Some solar lighting systems are self-contained units. You only need to place the lights in a sunny location. Others have the lights separate from a solar cell panel. Only the panel needs to be placed in a sunny location. Units vary in size from small eight-inch, red-glowing pathway markers to pole-mounted patio and high-beam security lights.

Before you buy an outdoor solar lighting system, check with the manufacturer to see if replacement bulbs or batteries are available. Some units do not provide replacement options.

Home outdoor solar lighting systems are often available in hardware, lighting, and discount stores as well as through environmentally oriented mail order companies.

LIGHTING SERVICES

Interior

Good interior design is the application of the best or most appropriate equipment in an economical but effective manner. Commercial & Industrial lighting schemes carried out for the following applications:-

- Offices
- Office Atria
- Retail Outlets
- Schools
- Hospitals
- Sports Halls
- Swimming Pools
- Manufacturing Plants
- Warehouses
- Multi-Storey Car Parks

Exterior

The key objectives to consider when looking at an exterior design are safety, performance and appearance. Building & area lighting schemes carried out for various applications including:-

- Architectural
- Security
- Amenity
- Car Parks
- Sports Facilities
- Street Lighting

Emergency

An emergency lighting system is designed to enable the building to meet fire safety legislation in a way that is visually acceptable and meets the end user's needs for operation and maintenance.

All exit route, open area, and directional signage designs carried out to the latest BS standards. Planning for self-diagnostic monitoring systems is also available (easicheck / self test etc).

INDOOR LIGHTINGS:

Nothing affects our lifestyle quite the way indoor lighting does. When you're entertaining, make your guests feel more welcome by choosing the right Indoor light.

DESIGN ELEMENTS:

Following are the design elements for interior lightings...

Chandeliers

Chandeliers enhance the beauty of a dining area and when the light is dimmed, a soft, glowing atmosphere similar to candlelight is created. Don't forget your choice of Chandelier Shades and Chandelier glass to personalize your selection.

Chandeliers add sparkle and style to your dining room while giving you the general lighting you need for dining and entertaining. Chandeliers are also used in bedrooms, foyers, or over a living room grouping or a grand piano. Some Chandeliers are designed with downlights to for homework or table games, or as accent for table settings. Chandeliers are available in both incandescent and ENERGY STAR® fluorescent light sources. The addition of a dimmer control, chandelier shades and chandeier glass lets you alter the intensity of light to suit the mood and activity.

Chandelier Lighting

Chandelier Lighting helps create a mood or an effect, it aids in a task, and also helps express your personal style. Whether casual, contemporary, eclectic, modern, transitional, or simply traditional, Chandeliers are the perfect way to achieve your desired fashion or functional needs. Don't forget to order your chandelier accessories, chandelier shades, and chandelier glass to personalize your choice of fixture.

Traditional Chandeliers

As one of the most recognized names in Traditional Chandeliers, Sea Gull Lighting is proud to feature hundreds of styles making us the selection of Home Builders, Architects, and Interior Designers today. Single Tier Chandeliers, Multi Tier Chandelier Fixtures, Bound Glass Chandeliers & Energy Efficient Chandelier Lighting will enhance the beauty of any room. Choose from our large selection of plated and hand painted finishes such as polished brass

chandeliers, antique silver chandeliers, weathered iron chandeliers, white chandeliers, aged brass and many more traditional chandelier finishes to meet your decorating needs.

Wall Sconces

With a decorative wall sconces or torchiers, lightingcan transform a functional room or hallway into a cozy retreat or dramatic passageway.

Wall Sconces

Bathroom Lighting offers shadow-free lighting for shaving, grooming, and applying makeup in your, powder room, spa, or dressing area. In small bathrooms, mirrored lights will illuminate the entire room; but in larger areas, an additional ceiling fixture is often needed for general bathroom lighting.

Wall Lighting

Bathroom Lights, whether casual, contemporary, eclectic, modern, transitional, or simply traditional, the bathroom and powder room wall lighting fixtures by Sea Gull Lighting are the perfect way to achieve your desired fashion or functional needs. We offer styles and finishes that compliment the most popular faucet styles, making the selection even easier in incandescent or energy saving fluorescent bathroom lights.

Sconces

As one of the most recognized names in Bathroom lights, Sea Gull Lighting is proud to feature hundreds of wall and bathroom lighting styles making us the selection of Home Builders, Architects, and Interior Designers today.

Torchiers

Vanity Fixtures by Sea Gull Lighting have a large selection of plated and hand painted finishes such as polished brass wall and bath lights, antique silver wall and bath lights, variety of other finishes.

Wall Lighting Fixtures

Sea Gull Lighting also features many bathroom lighting fixtures and wall sconces that “ADA Compliant”. This standard, sometimes local building code, meets the requirements set by the Americans with Disabilities Act for wall mounted fixtures. Specifically, these products will not extend more than 4” off of the wall’s surface.

Mini Pendants

Mini Pendants - as graceful as a teardrop. Our mini-pendant lighting provide interest And warmth to any setting in a less formal style.

Mini Pendants

Mini Pendant Lighting can provide both task and general lighting. Equipped with shades or globes to avoid glare, they are suspended from the ceiling over dinette tables, game tables, kitchen counters, or other work areas. When used over end or night tables, they free up the space occupied by table lamps. Mini Pendant Lighting by Sea Gull Lighting are available in incandescent, halogen, and energy saving compact fluorescent light sources. The use of a dimmer control gives you the flexibility to vary the light to suit the occasion.

Mini Pendant Lighting

Mini Pendants whether casual, contemporary, eclectic, modern, transitional, or simply traditional, Sea Gull Lighting pendants are the perfect way to achieve your desired fashion or functional needs. Our designers pride themselves for using unique glass designs and shade materials that make these products some of the most attractive and desired styles available today in mini pendant lights.

Ambiance Mini Pendants

As one of the most recognized names in mini pendant lighting, Sea Gull Lighting is proud to feature hundreds of styles making us the selection of Home Builders, Architects, and Interior Designers today. Sea Gull Lighting's traditional pendant lighting is available in many sizes for indoor use.

Low Voltage Mini Pendants

Contemporary mini Pendant lighting needs can be achieved through Ambiance Lighting Systems brand, by Sea Gull Lighting, also features an extensive selection low voltage mini pendants and line voltage mini pendant lighting that afford endless configuration and design options. Sea Gull Lighting's track and track light fixtures are available in many sizes for indoor areas with incandescent, halogen, Xenon, and energy saving fluorescent light sources.

Line Voltage Mini Pendants

Modern mini pendant Lighting by Sea Gull Lighting. Select plated and hand painted finishes such as polished brass pendants, antique silver pendants and a variety of other finishes.

Under Cabinet Lights

Under cabinet lighting brings an unobstructed light to work surfaces as opposed to light coming from behind, creating shadows. Under cabinet lighting is a great way to add distinction and style to any kitchen or work area.

Under Cabinet Lighting

Cabinet Lighting, whether casual, contemporary, eclectic, modern, transitional, or simply traditional, the Kitchen and under counter fixtures by Sea Gull Lighting are the perfect way to achieve your desired fashion or functional needs. We offer styles and finishes that compliment the most popular faucet styles, making the selection even easier in incandescent or energy saving Cabinet lights.

Under Cabinet Lights

As one of the most recognized names in under cabinet lights, Sea Gull Lighting is proud to feature lighting styles making us the selection of Home Builders, Architects, and Interior Designers today.

Task Lights

Task Lighting by Sea Gull Lighting have a large selection of plated as polished brass wall and bath lights, antique silver wall and bath lights, variety of other finishes.

Track Lights

Track Lighting was never so easy with the patented Ambiance® Track Lighting system. Offering flexible and easy to install products for the most effective use of track lighting in any room.

Track Lights

Choose from a pre-assembled track lighting kits, or build your own track light package, or choose new track heads or track lights to add to or reconfigure an existing system. Easy for the do-it-yourselfer to install, track lighting pendant kits can connect to existing electrical outlets or just plug into a handy wall outlet.

Custom Track Lighting

We feature quality, state-of-the-art systems from the Ambiance® Lighting Systems rail lighting and track lighting product lines in the newest finishes like the eurotech finish. This is a sleek looking European styled product line. today.

Track Lighting Kits

As one of the most recognized names in lighting, Sea Gull Lighting is proud to feature hundreds of track lighting styles making us the selection of Home Builders, Architects, Retail Merchandising Professionals, and Interior Designers today. Sea Gull Lighting's track and track light fixtures are available in many sizes for indoor areas with incandescent, halogen, Xenon, and energy saving fluorescent light sources.

Track Lighting Components

Sea Gull Lighting has a large variety of track light finishes such as white, black, polished brass, chrome, eurotech, and more.




Fluorescent Lights

The look of fluorescent lighting and energy efficient lighting has evolved into decorative fixtures, sconces and outdoor fluorescent lighting that reduce operating costs.

Fluorescent Lighting

Fluorecent Lighting, particularly ENERGY STAR® qualified versions, work to reduce your energy bills and significantly and help to protect our environment.

Fluorescent Lights

Energy saving fluorescent products are available in chandeliers, pendants, wall sconces, vanity bath lights, ceiling mounted fixtures, recessed cans, outdoor lanterns, and more using compact fluorescent light bulbs and circle line lamps.

Custom Fluorescent Lighting

ENERGY STAR® qualified light bulbs and lighting fixtures generally use pin-based light bulbs, which do not screw into the socket, are brighter and have the added benefit of longer lamp life.

Fluorescent Lighting Kits

Each of us has a responsibility to protect our environment. We have the power, too. Just by purchasing something as simple as an ENERGY STAR® qualified light fixture by Sea Gull Lighting, businesses, organizations and consumers can play an important role in reducing greenhouse gas emissions and protecting our environment for future generations. Many local utility companies throughout the United States have programs that offer incentives and rebates to consumers for switching to these more efficient products.

Bathroom Lighting

Vanity and lathroom lighting dress up a bathroom, illuminate a wall mirror, and provide endless possibilities for vanities and dressing rooms. Our bathroom vanity lighting warms an otherwise cold room, enhances the beauty of vanity hardware.

Bathroom Lighting

Bathroom Lighting offers shadow-free lighting for shaving, grooming, and applying makeup in your, powder room, spa, or dressing area. In small bathrooms, mirrored lights will illuminate the entire room; but in larger areas, an additional ceiling fixture is often needed for general bathroom lighting.

Bathroom Lights

Bathroom Lights, weather casual, contemporary, eclectic, modern, transitional, or simply traditional, the bathroom and powder room wall lighting fixtures by Sea Gull Lighting are the perfect way to achieve your desired fashion or functional needs. We offer styles and finishes that compliment the most popular faucet styles, making the selection even easier in incandescent or energy saving fluorescent bathroom lights.



Bath Lights

As one of the most recognized names in Bathroom lights, Sea Gull Lighting is proud to feature hundreds of wall and bathroom lighting styles making us the selection of Home Builders, Architects, and Interior Designers today. Sea Gull Lighting's vanity fixtures, bent glass, bar lights, Hollywood strip lights, wall sconces, wall torchiers, and swing arm lamps will enhance the beauty of any bathe area.

Vanity Fixtures

Vanity Fixtures by Sea Gull Lighting have a large selection of plated and hand painted finishes such as polished brass wall and bath lights, antique silver wall and bath lights, variety of other finishes.

ADA Bathroom Fixtures

Sea Gull Lighting also features many bathroom lighting fixtures and wall sconces that "ADA Compliant". This standard, sometimes local building code, meets the requirements set by the Americans with Disabilities Act for wall mounted fixtures. Specifically, these products will not extend more than 4" off of the wall's surface.

Pendants

As graceful as a teardrop, our pendant lighting provides interest and warmth to any setting in a less formal style.

Pendant Lighting

Pendant Lighting can provide both task and general lighting. Equipped with shades or globes to avoid glare, they are suspended from the ceiling over dinette tables, game tables, kitchen counters, or other work areas. When used over end or night tables, they free up the space occupied by table lamps. *Pendant Lighting* by Sea Gull Lighting are available in incandescent, halogen, and energy saving compact fluorescent light sources. The use of a dimmer control gives you the flexibility to vary the light to suit the occasion.

Pendant Lights

Pendant Lights whether casual, contemporary, eclectic, modern, transitional, or simply traditional, Sea Gull Lighting pendants are the perfect way to achieve your desired fashion or functional needs. Our designers pride themselves for using unique glass designs and shade materials that make these products some of the most attractive and desired styles available today in pendant lights.

Traditional Pendants

As one of the most recognized names in Traditional Pendant lighting, Sea Gull Lighting is proud to feature hundreds of styles making us the selection of Home Builders, Architects, and Interior Designers today. Sea Gull Lighting's *traditional pendant lighting* is available in many sizes for indoor use.

Contemporary Pendants

Contemporary Pendant lighting needs can be achieved through Ambiance Lighting Systems brand, by Sea Gull Lighting, also features an extensive selection low voltage pendants and line voltage pendant lighting that afford endless configuration and design options.

Modern Pendants

Modern pendant Lighting by Sea Gull Lighting. Select plated and hand painted finishes such as polished brass pendants, antique silver pendants and a variety of other finishes.

Ceiling Lights

Close to ceiling fixtures add the finishing touch toa well-decorated environment providing a decorative, functional illumination to any location.

Ceiling Lighting

Ceiling mount lighting fixtures are ideal for use in foyers, hallways, bedrooms, utility work areas, stairways and many other locations. They work well in entry foyers to welcome guests to your house. Flush mount are preferred on lower ceilings. While semi-flush lights are ideal on medium to high ceilings. These fixtures are also great in hallways as a substitute for recessed lighting. In hallways, light fixtures should be used every 8 to 10 feet to ensure adequate even illumination.

Ceiling Lights

Flush mounts and ceiling fixtures by Sea Gull Lighting are available in incandescent and energy saving compact fluorescent light sources that are ENERGY STAR® qualified. Many Seagull lights also feature an exclusive, patented “Twist Lock” design that makes installation and relamping easy.

Custom Ceiling Lighting

Whether casual, contemporary, eclectic, modern, transitional, or simply traditional, Sea Gull Lighting ceiling mounted lights are the perfect way to achieve your desired fashion or functional needs. Our designers pride themselves for using unique glass designs and shade materials that make these products some of the most attractive and desired styles available today.

Ceiling Lighting Kits

As one of the most recognized names in lighting, Sea Gull Lighting is proud to feature hundreds of pendant lighting styles making us the selection of Home Builders, Architects, and Interior Designers today. Sea Gull Lighting’s pendant fixtures are available in many sizes for indoor and outdoor areas.

Ceiling Lighting Fixtures

Sea Gull Lighting has a large selection plated and hand painted finishes such as polished brass ceiling lights, antique silver ceiling lights, weathered iron ceiling lights, textured rust patina ceiling lights, white ceiling lights,

aged brass ceiling lights, antique crème ceiling lights, oxidized brass ceiling lights, hammered copper ceiling lights, \antique pewter ceiling lights, silver patina ceiling lights, antique bronze ceiling lights, olde iron ceiling lights, gold patina ceiling lights, brushed stainless ceiling lights, ashton brass ceiling lights, brushed nickel ceiling lights, golden aubergine ceiling lights, honeywood crackle ceiling lights, century bronze ceiling lights, eurotech, and a variety of other finishes.

Foyer Lights

Elegant foyer lights, from grand two-story foyers to a quaint country entryway, Sea Gull Lighting provides the foyer lighting fixture to illuminate and warm the welcome.

Foyer Lighting

Foyer lighting fixtures can create a congenial atmosphere, while providing you with the general lighting you need to greet guests and assure safe passage into other areas of your home. Some Sea Gull Lighting hall lighting and foyer lighting are designed with extra chain and wire to accommodate two-story entries or for use in stairways where ceiling heights are greatest.

Hall Lighting

Hall lighting whether casual, contemporary, eclectic, modern, transitional, or simply traditional, the hall lighting fixtures by Sea Gull Lighting are the perfect way to achieve your desired fashion or functional needs.

Foyer Lights

As one of the most recognized names in Foyer lights, Sea Gull Lighting is proud to feature hundreds of hall and foyer styles making us the selection of Home Builders, Architects, and Interior Designers today. Sea Gull Lighting's flush mounted lighting and semi-flush mounted ceiling lights, multi-tied chandeliers, hanging pendants, and energy saving lighting options will enhance the beauty of any homes' entrance or public area.

Hallway Lighitng

Sea Gull Lighting has a large selection Hallway Lighitng in both plated and hand painted finishes such as polished brass hallway Lighting, antique silver hall and foyer lights, weathered iron hall and foyer lights, and a variety of other finishes.

Ceiling Lights

Close to ceiling lights and hanging hall lighting and foyer lighting by Sea Gull Lighting are available in both incandescent and ENERGY STAR® fluorescent light sources. The addition of a dimmer control lets you alter the intensity of light to suit the mood and activity.

Transitions Lighting

For over a decade Ambiance® Lighting Systems by Sea Gull Lighting has delivered exciting, quality, low-voltage lighting solutions for residential, commercial, and architecual application. Now Ambiance Transitions joins the highly specified Ambiance Lighting Systems family of products. Ambiance Transitions, the line voltage lighting system that offers splashes of colour, style, and light on 120v rail and decorative pendant choices.

Ambiance Transitions line voltage rail systems offer general, task and accent lighting with design and instillation flexibility for any lighting challenge.

How to Configure Transitions Lighting Systems

Modern Lighting

You recognize how bad you look in the aircraft bathroom under the cruel fluorescent lights? You're every imperfection, seam, or stray hair highlighted.

That is how bad your home looks with no modern lighting.

Now that you have invested in some elegant furnishings and thoughtfully planned your living space, you will need contemporary lighting to add to it all. Lacking it, your living space is like a film star at the Oscars who forgot to put on there borrowed jewelry.

No more repugnant fluorescents, lava lamps, or messy desk lamps leftover from the dorm. Peruse Design Publics selection and showcase your pad like it's a movie star, not an unkempt jet-lagged traveler.

Traditional Lighting

With an eye towards aspect and approach, these traditionally fashioned hanging light fittings from LAMPS PLUS are a magnificent way to light your preferred living space. From brass candlestick to traditional shaded chandeliers, these furnishings will bring a new stage of detail and complexity to your residence.

Featured Traditional Lighting Options:

Featured in "Florida Design" magazine, its La Vida Buena styling from Kathy Ireland Home Gallery's Coleccion Illuminacion del Amor. This chandelier purely bursts with enthusiasm and style. Core column is accented by an oak leaf motif with crystal droplets. A lone tier of six lights with ivory bell shades finishes the look. View

Tiffany hanging lamps add a cozy appearance to your home decor. This pendant chandelier has an inverted design that offers warm, overall lighting, subtly dyed by the honey coloured glass panels. With hints of green, light blue and amber accents. View

Designer Lighting

There are three types of lighting, such as environment, assignment, and ornamental. Each one serves a specific and necessary purpose. Background illumination is made-up to compensate for natural light in daytime. At night, this light needs to be detached evenly in a room. Task lighting throws influential and focused light on an area. Decorative lighting is fashionable and a bright light is thrown on an object for highlighting it.

It can be used to lay emphasis on a painting, or an architectural element, an item of furniture, or a statuette. Pendant lighting is the latest form of kitchen embellishment used today. This is done by taking a simple set of three pendants. A new visual practice may be created by suspending these three pendants at diverse heights.

Some aspects of imaginative lighting include focusing a dim light across fences and walls, highlighting water features with a precise group of lights or enlightening trees when lights are placed below and behind them. Cautiously choose coloured lights such as mellow shades of yellow or red if you want to add warmth to the area. Leaves can be made to become visibly greener by placing a green light beneath the foliage. A Nordic impression can be fashioned with white or blue light. It is suggested not to use a blend of too many colours, as it can give a gaudy look.

Low Voltage Lighting

Low Voltage Lighting produces the same quantity of light but uses less electrical energy. They can offer two and a half times as much light as produced by the normal line voltage radiant lamps. In simple words, a 50 watt low voltage lamp could possibly be more than enough to produce as much light as offered by a 125 watt line voltage lamp. So there defiantly worth considering if you're looking for new lights.

Cornice lighting – a long light source a long a wall near the ceiling; light is directed down

Cove lighting – a long light source along a wall near the ceiling; light is directed up

LIGHT

TYPES OF LIGHTS

o Introduction

There are a number of different approaches used for illuminating aquaria. To make an informed decision as to what type of lighting should be employed, the fundamentals of light, colour and lighting systems should be understood. In this article we will examine the how light is qualitatively appraised with respect to colour and intensity. Different lighting systems will be examined, and most available types of lights will be discussed. Examples of some "real world" lighting systems will be given and analyzed with respect to effectiveness, initial cost, operating expense and longevity.

What Is Colour?

In 1666, English scientist Sir Isaac Newton discovered that when pure white light is passed through a prism, it separates into all of the visible colours. Newton also found that each colour is comprised of a single wavelength and cannot be separated any further into other colours.

Further experiments demonstrated that light could be combined to form other colours. For example, red light mixed with yellow light creates an orange colour. A colour resulting from a mix of two other colours is known as a **metamer**. Some colours, such as yellow and purple, cancel each other out when mixed and result in a white light. These competing colours are known as **complements**.

Colour Psychology - The Psychological Effects of Colour

While perceptions of colour are somewhat subjective, there are some colour effects that have universal meaning. Colours in the red area of the colour spectrum are known as **warm colours** and include red, orange, and yellow. These warm colours evoke emotions ranging from feelings of warmth and comfort to feelings of anger and hostility.

Colours on the blue side of the spectrum are known as **cool colours** and include blue, purple, and green. These colours are often described as calm, but can also call to mind feelings of sadness or indifference.

Colour Psychology as Therapy

Several ancient cultures, including the Egyptians and Chinese, practiced **chromotherapy**, or using colours to heal. Chromotherapy is sometimes referred to as light therapy or colourology and is still used today as a holistic or alternative treatment.

In this treatment:

- **Red** was used to stimulate the body and mind and to increase circulation.
- **Yellow** was thought to stimulate the nerves and purify the body.
- **Orange** was used to heal the lungs and to increase energy levels.
- **Blue** was believed to soothe illnesses and treat pain.
- **Indigo** shades were thought to alleviate skin problems.

Most psychologists view colour therapy with skepticism and point out that the supposed effects of colour have been exaggerated. Colours also have have different meanings in different cultures. Research has demonstrated in many cases that the mood-altering effects of colour may only be temporary. A blue room may initially cause feelings of calm, but the effect will be dissipate after a short period of time.

LIGHT AND COLOUR

o What is light

Visible light is that part of the electro-magnetic spectrum that lies between the wavelengths of ultraviolet and infrared. That's probably more that you need to know for the purposes of home aquaria.

o White light is all colours

When we see a rainbow, we are seeing white light split up into it's component colours, hence the expression "all the colours of the rainbow".

o Sunlight is different in different places in the world

Sunlight contains, more or less, equal portions of all colours of sunlight. Northern sunlight, that is, sunlight in areas north of the fortieth parallel, has more blue than equatorial sunlight because of absorption of all other colours, or wavelengths of light, by the atmosphere.

o Blue pictures underwater

This is the same effect that causes underwater photos taken below three feet to be so blue. Just as the atmosphere absorbs non-blue light so does water, except water absorbs non-blue light at a much greater rate. Almost all non-blue light below three feet of water is absorbed.

o How is light measured?

Light quality is expressed and measured in many ways. Light colour can be measured in degrees Kelvin (K) and the colour rendering index of a light source can be measured and expressed as CRI.

o Colour temperature - degrees K

White light can have different "warmths". A bit more red/yellow and white light appears "warmer". A bit more blue and light appears "cool". This can be quantitatively assessed by the assigning of a colour temperature, given in degrees Kelvin. Think of colour temperature as the colour of a block or iron as it is heated to various high temperatures. A warm, reddish light is around 3500 degrees Kelvin, and above 6000 degrees Kelvin the light takes on a blueish tone. Sunlight is somewhere around 5000 degrees Kelvin. The first part of the paragraph is misleading. Although people may think of blue as a "cooler" colour than red, it is actually hotter. For the physicists out there, iron is acting as a black body here.

o Colour rendering index (CRI)

The colour rendering index identifies the degree of colour shift objects undergo when illuminated by a particular light source. In simpler terms, the CRI expresses the degree to which a light source renders the true colour impression. The CRI is an index and ranges from 0 to 100. A light source having a CRI of 100 means objects illuminated by it look like they're supposed to; that is their natural colour is not distorted. A light source having a very low CRI would tend to make objects appear to be a different shade or even colour that they really are. An example of light with a high CRI is, obviously, sunlight. Some fluorescent tubes such as Daylight, Chroma 65 or Vita-Lite have a very high CRI. Some light sources such as Gro-Lux or sodium vapour lamps have very low CRI's.

Science of Colours:

We all know that all colours are made up of three primary colours - red, blue and green - in various combinations. Secondary colours are made up of mixing of these primary colours such as cyan; yellow and purple while tertiary colours are made up of mixing the secondary colours to the primary colours such as reddish orange and yellowish green. Absence of all the three colours make up an absolute black, which is almost non-existent, and the black we normally talk about is actually a tint or shade of the actual colour. Similarly all these three colours mixed in equal parts would produce pure white light such as sunlight. Colours that we are talking about are actually the light particles reflected by a substance when the source absorbs the rest of it. It is actually the tints, tones,values and shades of the basic key hues that make our world so colourful to look at.

Let us see, the actual meaning of the words used above:

- Hue means Colour such as red colour or red hue,
- Tint means the pure colour mixed with white such as tints of red means red mixed with white colour to produce different kind of reds and pinks,
- Tone of a colour means that the pure colour is mixed with grey,
- Value of a colour means the lightness and darkness of a shade achieved by the sheer or deeper application of the colour,
- Key colours are the dominant colours that we have chosen for room or home décor, while
  Shade of a colour means that the pure colour is mixed with black.

Choosing colour schemes:

Colour scheme helps us to determine the harmony between colours in home décor. A colour wheel can be quite useful while deciding a colour scheme for your home as it helps you to compare complimentary colours. Interactive colour wheel tools and software are available online for your reference. The use of colour wheel makes choosing the combination of colours for painting your walls, accents, furnishings, furniture and accessories much easier. Here are a few tips that you can use while deciding upon the colour scheme for your home:

Monochromatic colour scheme uses only one colour throughout. Variety is introduced by using various tints, tones, values and shades of that key colour and different textures.

Complimentary colour scheme uses two colours placed opposite to each other on the colour wheel, their tints, tones, shades and values such as yellow and violet. This scheme is quite bold and lend a dramatic touch to the home décor.
Analogous colour schemes use three hues placed adjacent to each other on the colour wheel but use either combination of warm colours only or combination of cool colours only.

Triadic colour schemes use three hues placed consecutively or at equal distances from each other such as red, yellow and blue, their tints, tones, shades and values

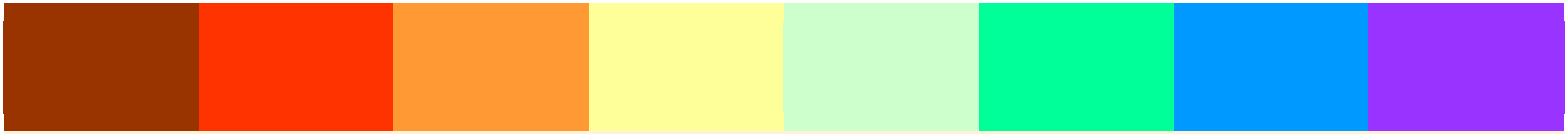
A novice can easily decide upon the colour scheme using the following steps:

Use your favorite pattern as the guiding line for your colour palette. The lightest colour in the pattern can be used for the background such as wall paint colour, medium colour for large furniture pieces, windows, doors, closets and cabinets while the darkest colour can be used for accessories.

Colour can make quite a lot of difference to the size and proportion of the room. So, remember that white and pale colours reflect light more to making the room appear larger while dark colours make room appear cozier and smaller.

When it comes to furniture and accessories, white and pale coloured objects or objects in similar colour as the wall recede into background while brighter and darker objects attract our attention more and seem to occupy more space, so if the room is really small, you can try buying furniture and furnishings in same colour as your walls or pale shades and accessorize with bright bold colours to create focal points.

- **Colours are good means to convey emotions. Although there is a psychology of colour and some of them have universal emotional effects, in most cases their meanings are culture dependent.**
- **The emotions associated to some colours have a strong cultural component**.
- **Colours are typically divided into warm (yellows, reds, oranges) and cool ones (blues, greens and violets)** due to primitive and probably universal associations to the sun and fire for the former ones and to water and vegetation the latter ones.



Warm and cool colours. In this example the colours of the left half are considered warm ones and those of the left half are considered to be cool.

The emotions associated to some colours have a strong cultural component. For example in China death is associated to green while in the West it's associated to the colour black. In other contexts green is linked to envy. Red means good luck in China while Westerners associate it with the sporting spirit. (See for example the page of Pantons about colour or the ErgoGero's page).

Nevertheless **it's worth distinguishing between emotions and meanings.** While emotions are unconscious, meanings have a stronger cultural and conventional component. The most emotionally primary colours appear to be red and blue. The act of seeing the colour red is capable of increasing the blood pressure and heart beat, while seeing the blue colour has the opposite effect.

Nevertheless it's not easy to take advantage of the psychology of colour in visualisation for the very reason that **their deep mechanisms are not yet well understood scientifically.**

Market researchers have devoted considerable effort to know **which colours are preferred by consumers** and how the fashion works in this matter. The meanings and associations vary noticeably between societies but are somewhat uniform in the western world, probably due to the strong cultural homogenisation. See for example the page at Cornell University

From Cailin Boyle's book Colour Harmony for the Web" we extract some of the **meanings associated to colour in western culture.**

The application of the psychology of colour understood as conveying emotional information has its maximum exponents in design, architecture, marketing and advertising, more that in Information Visualisation itself.

There are authentic mountains of information on the colour in the web and about its (supposed) optimal use in this or that application. Nevertheless, **the search for scientific articles about objective and verifiable features of colour psychology hasn't given me good results regarding how to apply it to designing information.** Any reference on the topic will be welcome.

Again, as in many other topics, many opinions are present but few truths show their colours.

- **Red**: danger, excitement, fire, passion, blood, fight or flight, some sexual connotation.
- **Purple**: Wealth, royalty, sophistication, intelligence.
- **Blue**: Quietness, serenity, truth, dignity, constancy, reliability, power.
- **Black**: Sophistication, elegance, power, rebellion.
- **White**: Purity, cleanness, luminosity, vacuum.
- **Yellow**: Warmth, the sun for many cultures, brightness, joy if little saturated.
- **Green**: Nature, fresh, vegetation, health, green/blues are the favorites of consumers

Colour has considerable impacts on human emotions. One may delight in the beautiful red and golden-yellow leaves of autumn, and in the magnificent colours of a sunset. One may be charmed by the coloured arch of a rainbow, and by gorgeous colours of flowering plants.

Just look at the tone-changing picture on the right: Does the achromatic tone show as "warm feelings" as does the fully saturated tone? Surely not!

The relationships between colour and emotion have long been of interest to both artists and scientists. Such relationships are called *colour emotion*.

Definition of Colour Emotion

Colour emotion can be defined, in a simple fashion, as the relationships between colour and the viewer's psychological response.

A more complex definition is perhaps the relationship between colour stimuli and *psychological responses in terms of both semantic associations and emotion words*, considering the configurations and the context in a visual experience.

For example, when seeing a red colour, we may have impressions like: "that's a very warm colour", "how exciting the colour feels", "the colour feels heavy" or "the colour makes me feel tense".

The adjectives in these phrases, such as "warm", "exciting", "heavy" and "nervous", are some of the keywords for colour emotion, although these are *not real emotion terms* (for discussions see here). To understand what this really means, why not take some colour tests as demonstrated in the following.

Colour Emotion vs. Colour Semantics

The term "colour emotion" has been incorrectly used during the past few years for studies into the relationships between colours and semantic words such as "warm" and "active". This mis-use led to great confusions, as "warm" and "active" are words for describing characteristics of colours, rather than human emotions. We may say "that is a warm colour", but we don't really feel warm because of seeing that colour.

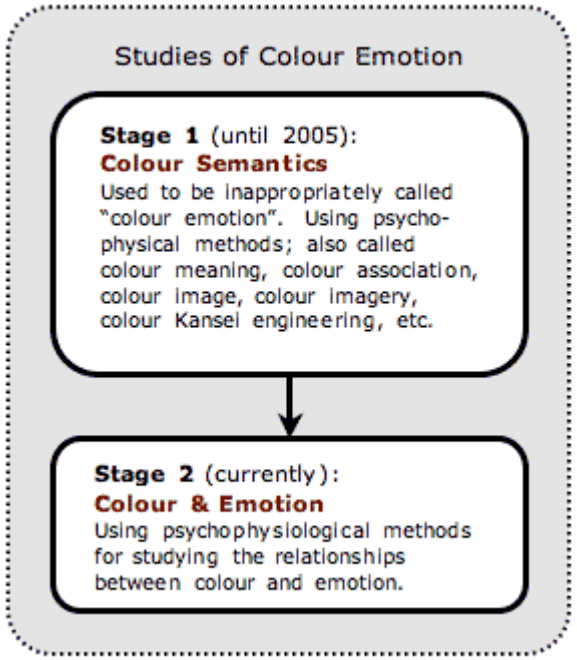
For further clarifications:

Colour emotion concerns human emotions evoked when seeing specific colours. "Emotion terms" are those describing human emotions such as *excitement*, *happiness* and *anxiety*.

Colour semantics concerns meanings or semantic associations of colours. Studies of colour semantics normally use word pairs to describe specific characteristics related to colours, such as *warm-cool*, *heavy-light* and *active-passive*.

Colour semantics research has started since early 20th century, with various names like "colour meaning", "colour association", "colour image", "colour imagery" and even "colour emotion". Perhaps the most widely recognised study of colour semantics, Kobayashi's "*colour image scales*" (1981), claims that there are 3 main dimensions of colour semantics: "warm-cool", "soft-hard" and "clear-greyish".

In 1997, when the Congress of the Association Internationale de la Coleur (AIC) was held in Kyoto, the term "colour emotion" started to emerge from the area of colour science, and has since become a term covering studies of both colour emotion and colour semantics. Unfortunately, most of the work labelled "colour emotion" between 1997 and 2005 should have been seen as colour semantics, including those by Sato *et al.* (2000) and by Ou *et al.* (2004a-b), as illustrated in the diagram on the right.



Major findings of colour semantics are summarised in here: single-colour semantics, colour-pair semantics and cross-cultural issues.

Some photographs showing various colour and light arrangements

Design Awards - Chaplo shows your interiors in their best light:

©2008 Paul Chaplo, MFA. Design Award Photography Texas

Franchise Restaurant Interior Photography: Restaurant: Pizza Inn Prototype Interior, Plano, Texas. 2008 Paul Chaplo, MFA.

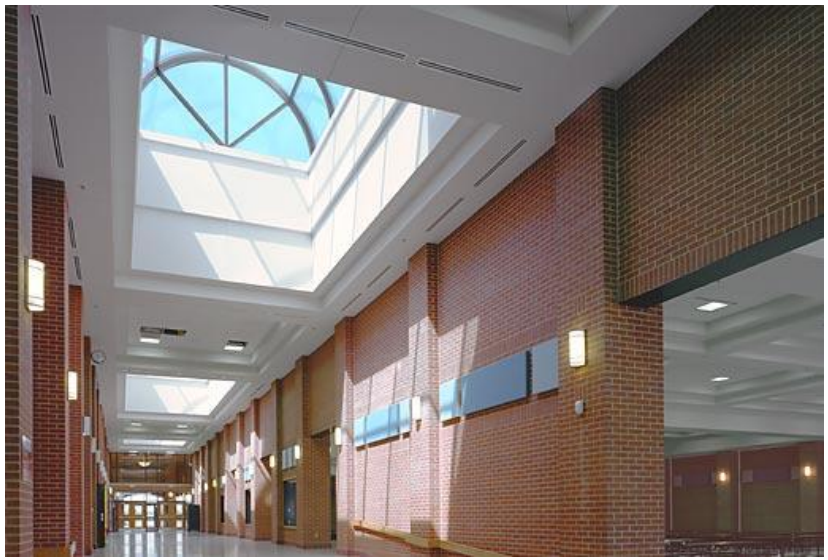
Residential Dallas/Fort Worth Interior Photographer: Paul Chaplo.

Second Take: Residential Dallas/Fort Worth Interior

RESIDENTIAL INTERIOR POOL ENCLOSURE: This pool enclosure was photographed in Las Vegas, Nevada for a national advertising campaign.

EDUCATIONAL - COMMUNITY FINE - PERFORMING ARTS CENTER AUDITORIUM This image was shot for a trade/show convention in Austin, TX.

AUDITORIUM SOUND LIGHTING TECHNICAL PHOTOGRAPHY: stage lighting and audio control center with well-balanced photographic lighting.

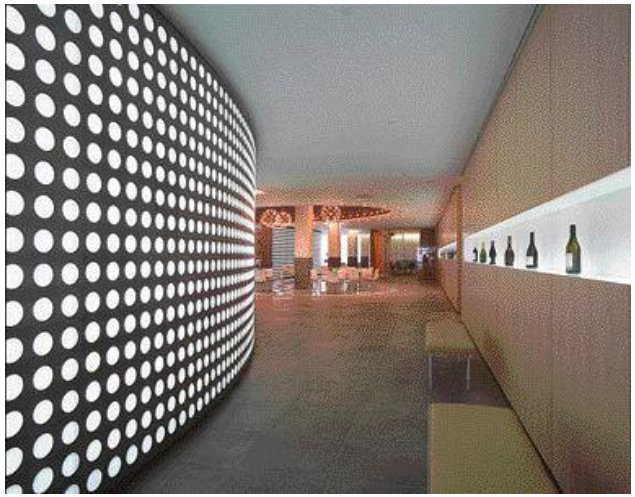


Masonry Educational Project: Monumental hallway / commons area. Published: McGraw-Hill Construction Magazine. ©2008 Paul Chaplo Digital Photographer Dallas, TX

Los Angeles, CA

Trendy spots lining the avenues of Bucktown and Wicker Park.

To Ensure An Error-Free Installation, the 250-Foot-Long Wall Was Constructed Using a Template Affixed to the Rough Concrete Floor



The Completed Office Space Uses a Variety of Interior Lighting Strategies to Define Its Various Programmatic Requirements.

Ambience

Ambiance Lighting

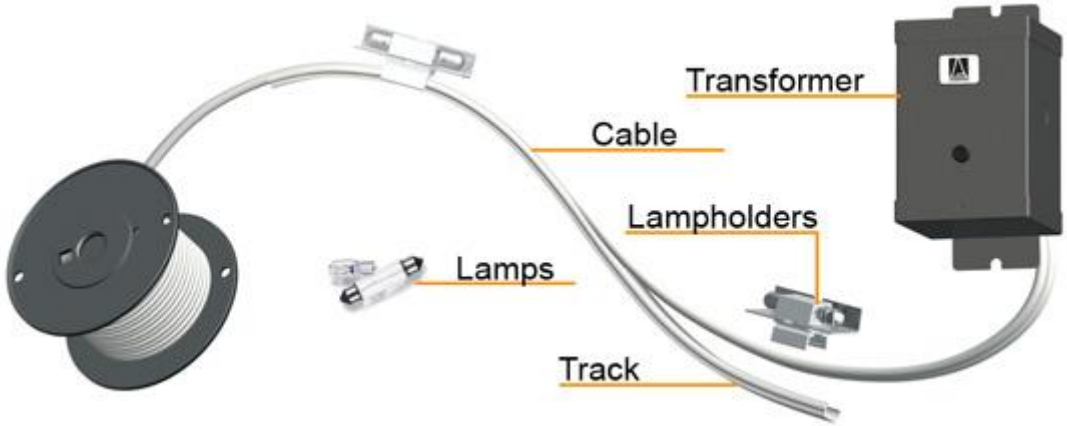
Ambiance low voltage lighting is easy to install, place light anywhere you need or want to create a dramatic effect with linear, surface mount, And recessed options.

Ambiance Low Voltage Lighting Systems are a high quality, exceptionally broad range of products specified in virtually any architectural, commercial and lighting application. This patented system is categorized into three categories.

About Linear Lighting

Ambiance low voltage lighting is easy to install, place light anywhere you need or want to create a dramatic effect with linear, surface mount, And recessed options.

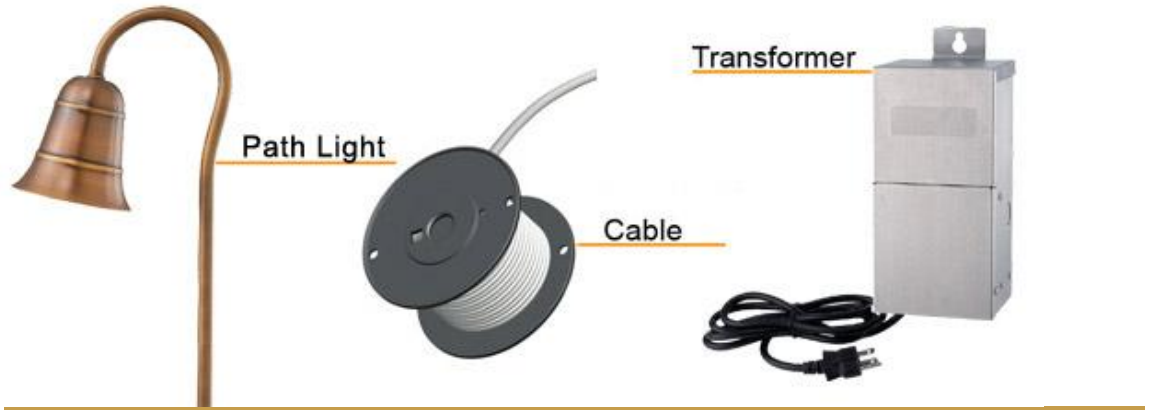
Configuration of Ambiance Low Voltage Linear Lighting Systems



Landscape Lighting

Ambiance low voltage lighting is easy to install, place light anywhere you need or want to create a dramatic effect with linear, surface mount, And recessed options.

Configuration of Ambiance Landscape Lighting Systems



About Transitions Lighting

For over a decade Ambiance® Lighting Systems by Sea Gull Lighting has delivered exciting, quality, low-voltage lighting solutions for residential, commercial, and architecual application. Now Ambiance Transitions joins the highly specified Ambiance Lighting Systems family of products. Ambiance Transitions, the line voltage lighting system that offers splashes of colour, style, and light on 120v rail and decorative pendant choices.

Ambiance Transitions line voltage rail systems offer general, task and accent lighting with design and instillation flexibility for any lighting challenge.

Configuration of Transitions Lighting Systems

Rail Lighting

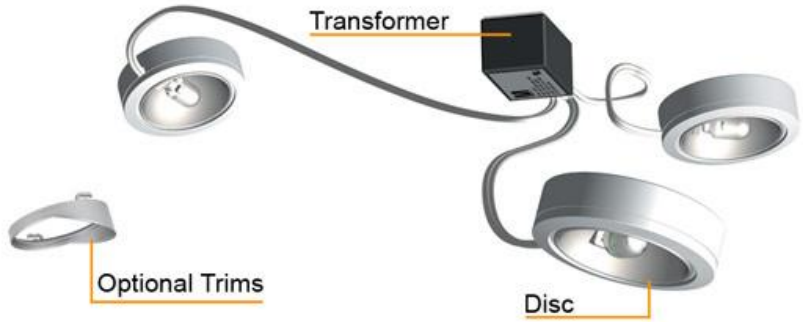
Ambiance low voltage lighting is easy to install, place light anywhere you need or want to create a dramatic effect with linear, surface mount, And recessed options.

Configuration of Ambiance Low Voltage Rail Lighting Systems

Disk Lighting

Ambiance low voltage lighting is easy to install, place light anywhere you need or want to create a dramatic effect with linear, surface mount, And recessed options.

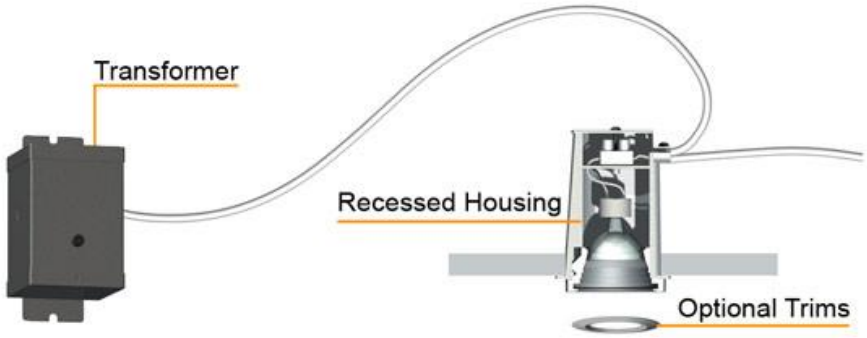
Configuration of Ambiance Disc Lighting Systems



Low Voltage Recessed

Ambiance low voltage lighting is easy to install, place light anywhere you need or want to create a dramatic effect with linear, surface mount, And recessed options.

Configuration of Ambiance Recessed Lighting Systems



Some pictures showing ambience lighting...

Above, first picture is without light and the other one was with light. Its clear to see the difference, the visual quality of picture gets improved with proper intensity and positioning of lights.


www.fietter.com

Lighting as per need

Architectural lighting

- Architectural lighting enables the designer/client to put their unique style into the form of the luminaire, as opposed to just having function of the lighting.This encompasses such diversity as colour as well as overall aesthetically pleasing design.










IMAGINE

Different types of lights used in Architectural lighting:

Diva

The cumulation of all of our manufacturing disciplines in one luminaire. 'DIVA' combines our injection, extruding, sheet steel, and special finishes with our design expertise together with the practicalities of multi lamp switching, dimming and infinite possible colour combinations to give this luminaire its own style and personality.

Bubble

A Suspended sphere of light, the bubble is a neat enterpretation of the ancient medieval candelabra. This luminaire is also available as a wall mounted version to portray the dynamics of an interior.
Designed to be installed in Architectural projects, this luminaire is characterised by its attractive styling and is available in three sizes that utilize the latest in energy efficient lamps with the option for variable colour lighting.
The BUBBLE integrates unobrrusively in diverse applications such as wide public areas, Hotel halls and reception desks, exhibition areas, conference rooms and show rooms.

Seven

A flexible design concept to be stylish and practical allowing the designer to exercise individual flair in lighting effects. This luminaire has up to three optics with the flexibility of ceiling or wall mounting and an adjustable micro-mirror arch for a customised lighting effect. This allows for the lighting of the wall, ceiling and work space simultaneously within the area.

Dea

Our 'DEA' range of luminaries were our first family of luminaries to deviate from the traditional louvered fitting, so allowing more design flexibility within the interior whilst utilizing the light available from the given lamps to diffuse and bounce the light all over the interior to creating a brighter and lighter workplace. These are available in a myriad of designs utilizing a range of lamps and can be recessed, surface, wall and suspended mountings.

MIG51

The Dynamic Character of this range is its ability to change shape in the space and render the space according to different angles of the luminaire components.
This range is available as suspended or wall mounted. The flexible optics are able to meet the demands of open spaces and office/VDT areas. With its upward and downward lighting ability this is a stylish solution for the modern work place.

Tail

Designed for minimalism , multifuctionality and colour, these are the essentials of modern architecture that are reflected in the TAIL range of products.
These fittings can be Suspended, Surface, Wall mounted or Free standing,and are also available as a continuous system. With a variety of optics and screens, this range is very versatile. There is also the option to incorporate coloured LED on each side of the luminaire for added visual effect.

QSD

A bold departure from the traditional circular downlighters available. The 'QSD' range of luminairs create their own unique style within the interior, whilst complimenting the square ceiling tiles traditionally fitted in modern buildings. These downlighters are available in a variety of lamp configurations and colours plus any number of feature glass designs.

Tek

This stylish wall mounted system was conceived mainly to combine lighting and beauty with technical excellence within corridors. 'TEK' can be continually mounted with all wiring concealed, or stand alone. We have the possibility to project light upwards and downwards, plus the usual variety of lamp sources and integral emergency options. With the growing trend to 'colour code' corridors for easy recognition (in hospitals for instance) this lighting system provides the perfect application, with the added benefit of having illuminated signage available.

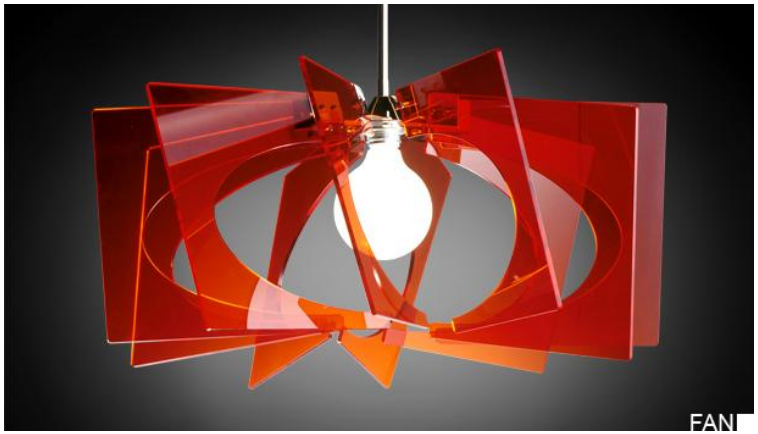
Ypsilon

Timeless design and sophisticated technology are the secrets of ypsilon's success. This system can be installed in single or continuous rows. Surface, suspended or wall mounted with a wide variety of fluorescent options and optics including up and downlight, louvred and diffused, whilst also incorporating wire-ways on either side, and can be fitted with integral emergencies and stand alone lighting controls all within its uniquely 'interior designer' lines.

Light

Light is a suspended luminaire available in two sizes with a variety of colour options to the bodies and accessories. This luminaire was devised primarily for the retail trade, where, by suspending the light source closer to the merchandise, the lighting designer could use far fewer luminaries, and create an 'all round' globe of light, rather than a blanket of light. Lamp sources vary from the 32w TC-D upto the powerful 250w Metal Halide.

DESIGNERS LIGHT:



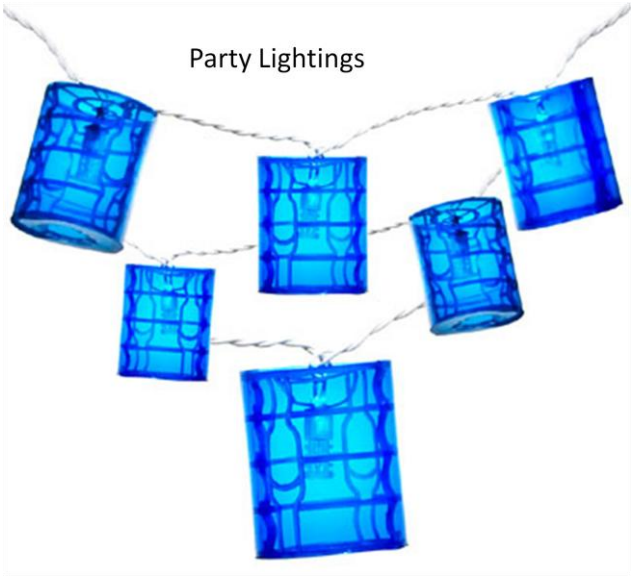
Roger borg neon lamps







townlite.en.alibaba.com



Interior Lighting

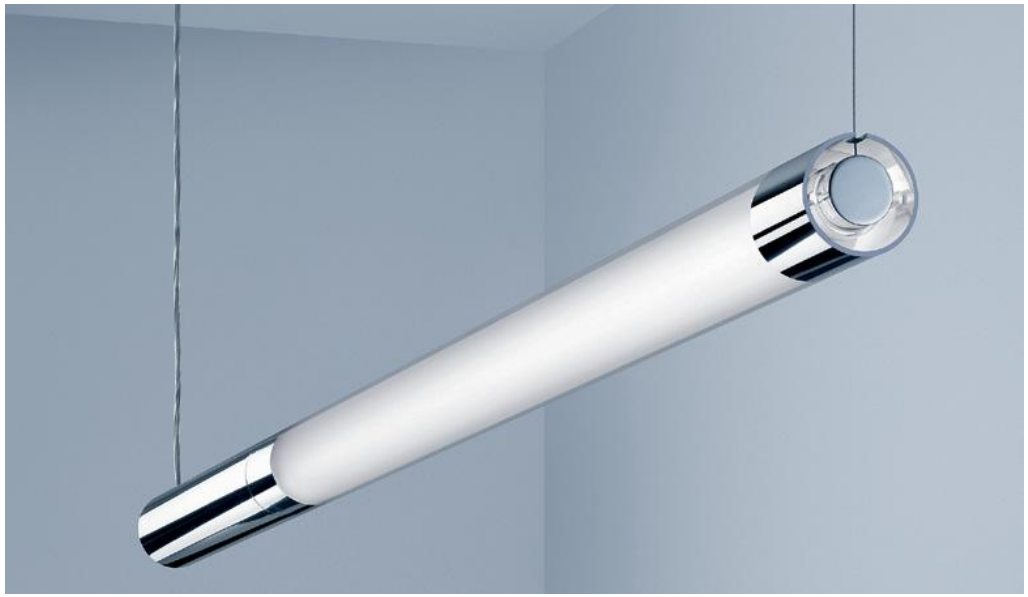
Automation House

Light for the future
AERO II Hybrid – The best of two worlds

In unveiling its new AERO II Hybrid pendant luminaire, Zumtobel presents office lighting of the future. This luminaire combines two efficient light sources which power a system that sets new standards.

Light expanding spatial limits
SCONFINE luminaire range by Matteo Thun

With the new SCONFINE luminaire range, developed in collaboration with the famous designer Matteo Thun, Zumtobel is presenting a series of wall-mounted, ceiling-mounted and pendant luminaires.

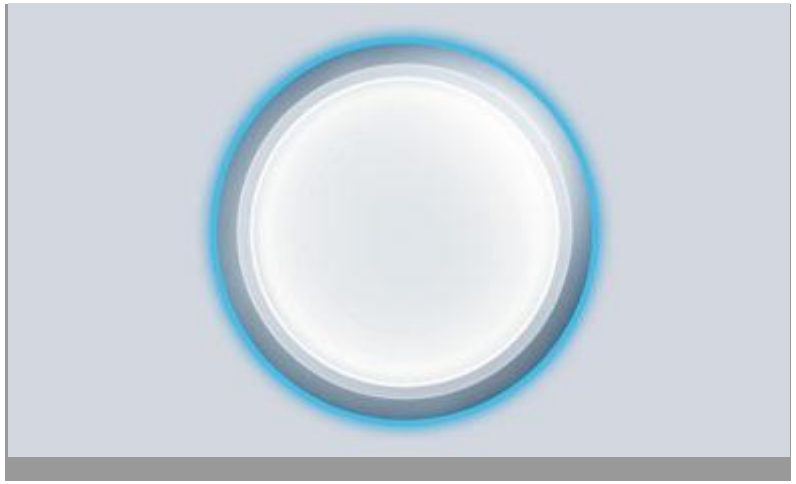


Multifunctional SUPERSYSTEM luminaire range
Minimum use of materials - maximum lighting comfort

Using Zumtobel's multifunctional SUPERSYSTEM lighting system, complex lighting solutions can be implemented in a design that is reduced to pure functionality.

HELISSA – always catching people's eyes
Round and square models now also available with IP 65

The HELISSA wall and ceiling-mounted luminaire is now also available with protection type IP 65, ensuring a consistent design in both indoor and uncovered outdoor areas.



The ARCOS spotlight range
Functional design – maximum lighting convenience

Zumtobel's new ARCOS spotlight and wallwasher system provides architects and designers with a complete range of spotlights fitted with various optics to light museums, art galleries and shops perfectly.

CIELOS modular luminous ceiling
Modular lighting system

The CIELOS extra-low profile, individually combinable lighting modules make designing and maintaining luminous ceilings amazingly straightforward. They are especially suitable for smaller and prestigious applications.

Downlight system 2LIGHT
Simply sensuous

Nothing less than revolutionary in aesthetics, and innovative in lighting technology and ergonomics – 2LIGHT, the new square downlight system, takes the stage.

Special Products 07/08
A wide range of special features

Conceived by architects, designers and lighting designers, realised by Zumtobel. These project luminaires are something special – in terms of design, lighting technology or application.

SCUBA moisture-proof luminaire system
Specialist luminaire for harsh conditions

SCUBA always provides perfect lighting conditions even under the most demanding environmental conditions and also boasts reliable protection against external influences and chemicals.

TUBILUX IP67
One luminaire for any situation

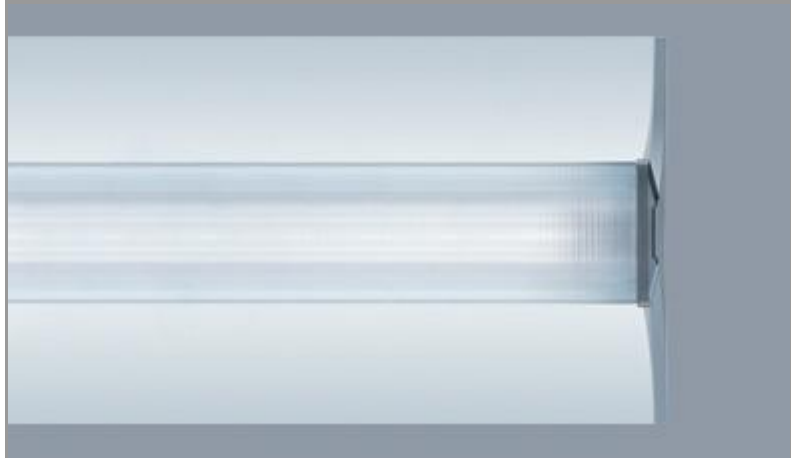
Light out of a tube: TUBILUX, the slim, robust tubular luminaire for difficult areas of application, defies even the harshest weather and environmental conditions thanks to top-quality materials.

VIVO Spotlight system
Precision through three hundred and sixty degrees

VIVO features intuitive, ergonomic luminaire design. Its special feature is a clip built into the housing that makes moving VIVO in any direction and locking it child's play.

MELLOW LIGHT IV
Surface-mounted and recessed luminaire

The sophisticated direct/indirect light ratio with sufficient shadow detail and contrast rendition – which is characteristic of the fourth generation of MELLOW LIGHT.



CLARIS II
Reduced minimalism with innovative cell louvre technology

CLARIS II is a classic which sets new trends: with its minimalist design, this modular lighting system blends unobtrusively into any architecture.

VIVO-S and VIVO-SL recessed spotlights
Flexible ceiling modules

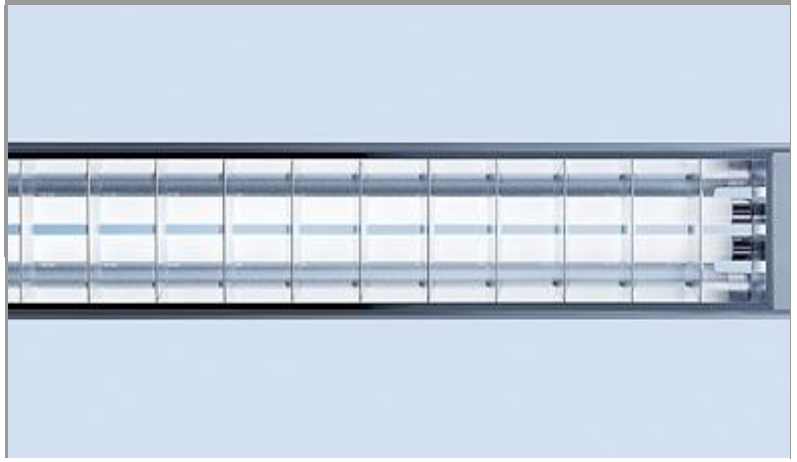
From downlighting to accent lighting with 360° precision – the new Zumtobel's swivelled-in spotlight modules provide maximum possible scope to meet every requirement.

PANOS Q downlight
The logical consequence of straight-line thinking

The square PANOS Q downlight by Zumtobel is the latest member of the PANOS family of high-quality, high-tech downlights and represents a genuine design alternative to its circular relatives.

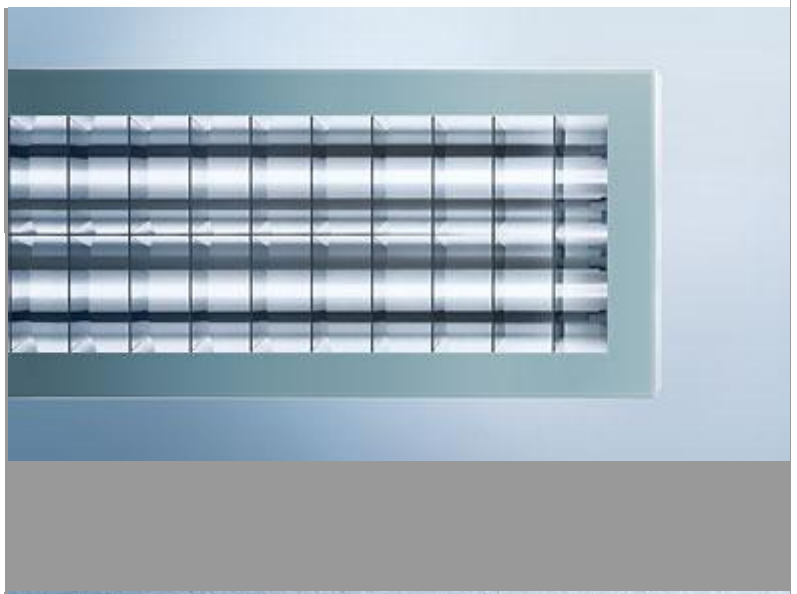
Dimming On Demand
A giant step into design freedom

Either ... or? The answer of the future is: On Demand. Dimmability and other luminaire functions are enabled as and when required, freeing users from the constraint of having to fix specifications in advance.



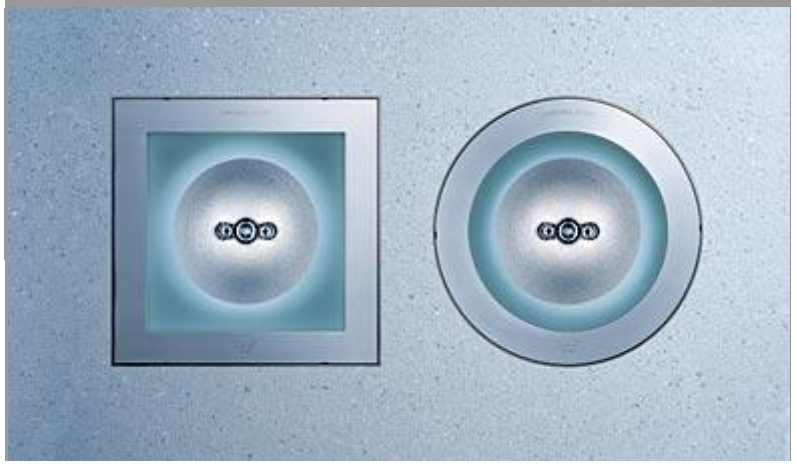
CLEAN clean-room luminaire
Three-level luminaire concept for clean-rooms

Excellent lighting for medical and industrial progress: For the CLEAN product range, the experience of clean-room designers was used and combined with state-of-the-art lighting technology.



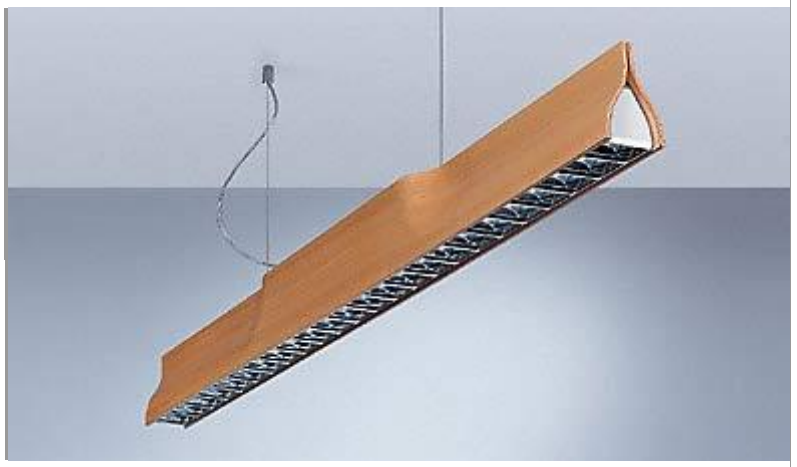
PASO II recessed floor luminaire
Lighting competence at every step and turn

PASO II knows how to hit the right buttons when it comes to setting dramatic contemporary lighting scenes whilst nevertheless remaining unobtrusive itself. Modern technology does not interfere with classic architecture.



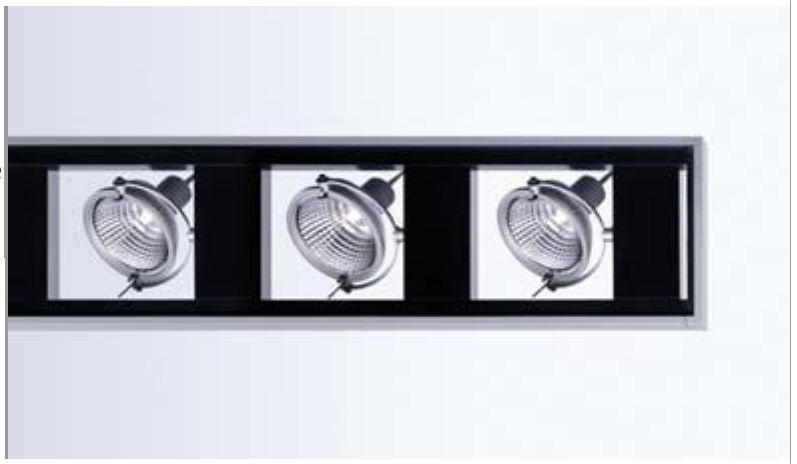
EVIO pendant luminaire
Manifestly different

The persuasive appeal of its look is due to materials which we have grown accustomed to in architecture and to its smoothly flowing forms. EVIO pendant luminaire sets standard in sophisticated offices and reception areas



CARDAN-SPIRIT luminaire range
Flexibility for lighting and creating accents

Their distinctive and angular appearance seems to be the most conspicuous feature of the new CARDAN-SPIRIT luminaire range. The fact that they are closely related to the SPIRIT spotlight range opens up numerous options.



SOLAR II spotlight system
Streamlined elegance

With the SOLAR II system, a new spotlight generation is born. Its unconventional organic design (created by Massimo Iosa Ghini) makes it a striking, self-assured lighting tool.

LIGHT FIELDS modular micro-pyramidal lighting
Pure innovation for the office

The LIGHT FIELDS lighting system designed by Sottsass Associati, a complete range fitted with micro-pyramidal optic, has been extended by the new MINI LIGHT FIELDS compact version.

TECTON continuous row lighting system
Fit for the IT age

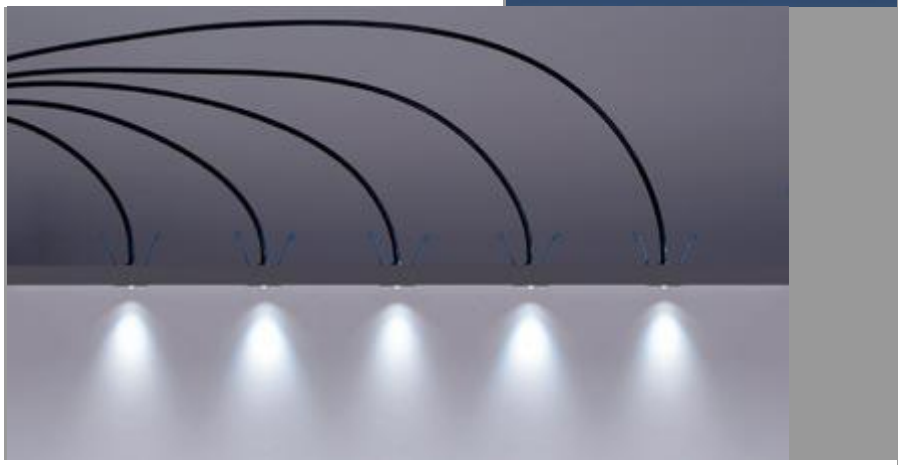
The TECTON continuous-row lighting system designed by Nicholas Grimshaw & Partners is a product of aesthetic merits, great versatility and fit for modern lighting management technologies.

RTX II design-oriented continuous row system
Avant-garde in terms of both material and shape

RTX II (designed by Charles Keller) is avant-gardist in terms of both material and shape, featuring advanced lighting technology for glare-free light, and extremely efficient thanks to its purely direct distribution characteristics.

STARFLEX modular fibre optic system
The new generation of optical string technology

Optical string and fibre optic technology is one of the most fascinating options of precise technical lighting. STARFLEX represents the new generation of optical string technology.



Optical string and fibre optic technology is one of the most fascinating options of precise technical lighting. The wide range of applications comprises the illumination of shops, museums and galleries as well as lighting in hotels, restaurants or wellness areas. Separating light from electricity as well as from UV and IR components opens up innumerable options, e.g. if priceless valuables are to be perfectly, yet gently lit.

Zumtobel's STARFLEX fibre optic system represents the **new generation of optical string technology**. An extensive portfolio of light engines ranging from 35W up to 250W allows its application in interior as well as in damp or outdoor areas. At the same time, utmost **safety** is provided by an internal system protection with electronic ventilation control and temperature sensor. New bonding

techniques for assembly of the PMMA fibres are a prerequisite for high-intensity engines with extreme lighting intensity.

LIGHTTOOLS modular lighting system
More than just a lighting channel

"What is most important is the light, and not the luminaire" – this is what French architect and designer Jean-Michel Wilmotte believes in. The LIGHTTOOLS lighting system is consistently based on this philosophy.

XENO spotlight system
One design, many accents

XENO (designed by Jean-Michel Wilmotte) stands for a design-oriented generation of spotlights for professional applications - the perfect solution for presentation and accentuation.

PANOS M, MWW and S downlights
Complete range of aesthetic merits and exquisite design

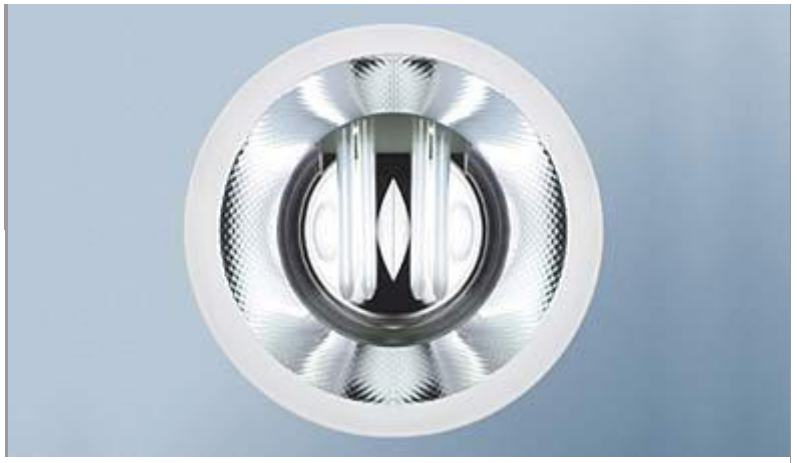
Tried and tested lighting technology, a novel concept and innovative materials – this is the secret of success of the products recently added to the PANOS range: PANOS M, PANOS MWW and PANOS S downlights.

MIRAL T16 surface-mounted louvre luminaire
Saving time thanks to innovative mounting bracket

MIRAL T16 has been designed especially for use in offices, schools and retail areas. It is characterised by an innovative installation concept and its flat contemporary design.

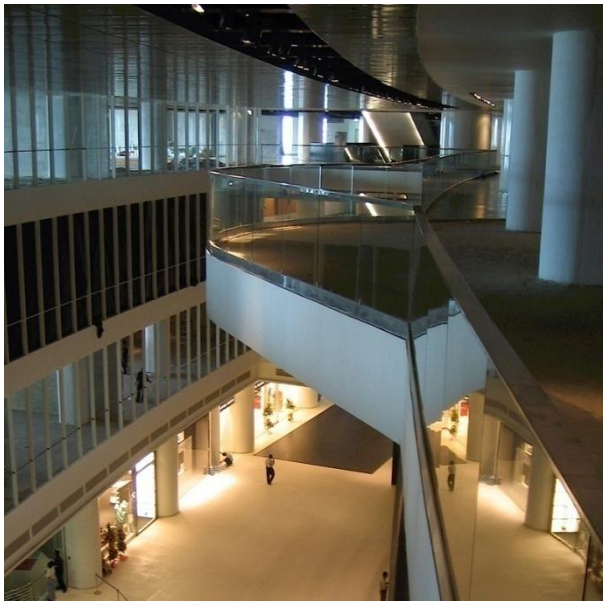
PANOS downlights
Sophisticated variety – uniform image

The PANOS complete downlight program is characterised by a sophisticated modular concept and the unmistakable design language developed by Sottsass Associati.



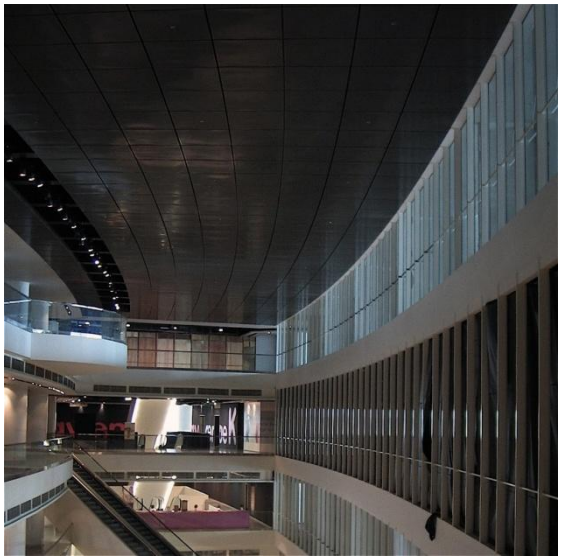
RAIN moisture-proof batten luminaire
For difficult conditions

Wherever unpleasant conditions prevail, with dirt and water being a challenge to the lighting solution, the RAIN moisture-proof batten luminaire feels at home.



- This is avenue K Mall, the atrium void is simply an awesome space rising some twenty metres, with an escalator connecting directly between the ground floor and level three.

lighting concept is minimalist, preserving a prestine and luxurious ambience to this museum like interior.



These ingenious **Electrical Stick Lights** create a magical, starry effect indoors or out. A detachable stake allows you to put them in the ground or even in plant pots. Perfect for illuminating paths or adding an enchanting glow to specific areas. Mains operated by one transformer plug. (Pack of ten on a wire).

Materials	Acrylic
Dimensions	Each light stick 68cm high
Care Guide	Mains operated by one transformer plug.

Candela Cloud 4 Lamp Set. These award winning portable lights provide a warm ambient glow that won't blow out in the wind, or set the house alight if left unattended. Equally useful on the dinner table or bedside, Candela rechargable lights replace hundreds of pounds worth of wax candles and they're cleaner, safer, and easier to use.

Materials	Made of fully-recyclable plastics
Dimensions	Size: 6.35cm wide x 15.5cm high
Care Guide	Energy-efficient LED light source. Portable and rechargeable. Child-friendly.Great indoors or outdoors. Water-resistant. Each set includes two lamps (White) and one charger giving 5 to 8 hours of light.

LED:

- Light Emitting Diodes (LEDs) are rapidly replacing Incandescent lighting for many applications.
- Most traffic lights have been replaced with LED's and many of todays new cars are equipped with LED tail lights.

  This is just the beginning!
- Over the next decade LED's are expected to become the light source of choice for most lighting applications.
- LED's are energy efficient. Produce less heat and last up to 100,000 hours. LED applications are unlimited.

  According to the Department of Energy "No other lighting technology offers the Department and our nation so much potential to save energy and enhance the quality of our building environments."

  What is solid state lighting?
- Solid state lighting (SSL) uses semi-conducting materials to convert electricity into light. It is the first truly new lighting technology to emerge for many years. SSL is an umbrella term encompassing different types of technologies including light-emitting diodes (LEDs) and organic light-emitting diodes (OLEDs). While both technologies are evolving rapidly, LEDs are the more mature technology, particularly for white-light general illumination applications.

  L.E.D.'s - What Are They & What Do They Do?
- The term L.E.D. stands for **Light Emitting Diode**. Modern electronics relies heavily upon L.E.D. light bulbs. For instance, L.E.D.s transmit information from remote controls, are used in traffic lights, digital L.E.D. clocks, flashlights, and to form images on jumbo television screens.
- L.E.D. light bulbs are miniature bulbs that do not use filaments to produce light. Therefore, the life of an L.E.D. is much longer than that of a regular incandescent bulb, because there is no filament to burn out. Incandescent bulbs also tend to be much larger in size due to the filament, which must be housed in a vacuum inside the bulb.

L.E.D. light bulbs lasts as long as a standard transisitor used in modern electronics, and are lit purely by the movement of electrons.

- The simplicity and long life of the L.E.D. makes its use very desirable for various technological applications. L.E.D. light bulbs are housed in a durable plastic rather than glass and perhaps most importantly, are efficient. In tradition incandescent bulbs heat is generated when activating the filament to produce light. This causes energy to be wasted on the production of heat rather than the production of light. In order to produce the same amount of light as an L.E.D., an incandescent bulb would have to work even harder. L.E.D. light bulbs save electricity and lower electric bills.

- Despite this positive scenario, incandescent bulbs are tailored to home lighting and will continue to be used until affordable, household L.E.D. light bulbs are available. At present, L.E.D. bulbs are expensive and recommended for low-light applications.

- A **LED lamp** (also called LED bar or Illuminator) is a type of solid state lighting (SSL) that uses light-emitting diodes (LEDs) as the source of light. They usually comprise clusters of LEDs in a suitable housing. They come in different shapes, including the standard light bulb shape with a large E27 Edison screw and MR16 shape with a bi-pin base. Other models might have a small Edison E14 fitting, GU5.3 (Bipin cap) or GU10 (bayonet socket). This includes low voltage (typically 12 V halogen-like) varieties and replacements for regular AC mains (e.g. 120 or 240 VAC) lighting. Currently the latter are less widely available but this is changing rapidly.

It is possible to create the entire colour spectrum (64 billion colours) to include white light with these three coloured bulbs.

How can three coloured bulbs make 64 billion colours? Colour mixing is achieved by varying the voltage to each of the red, green and blue bulbs. The controller for the colour mixing may be either an external unit or may be combined on the lighting unit itself.

Technology overview

To produce the white light necessary for SSL, light spanning the visible spectrum (red, green, and blue) must be generated in approximately correct proportions. This can be done using either white LEDs or by **colour mixing**.

There are a number of different techniques for generating white light with LEDs, each with different levels of efficiency and colour rendition (CRI). The alternative, colour mixing, involves using multiple colours of LEDs in a lamp to produce white light. Such lamps contain a minimum of two LEDs (blue and yellow), but can also have three (red, blue, and green) or four (red, blue, green, and yellow). As no phosphors are used, there is no energy lost in the conversion process, thereby exhibiting the potential for higher efficiency.

To be considered SSL, a number of LEDs must be placed close together in a lamp to add their illuminating effects. This is because an individual LED produces only a small amount of light, thereby limiting its effectiveness as a replacement light source. In the case where white LEDs are utilized in SSL, this is a relatively simple task, as all LEDs are of the same colour and can be arranged in any fashion. When using the colour-mixing method, however, it is more difficult to generate equivalent brightness when compared to using white LEDs in a similar lamp size. Furthermore, degradation of different LEDs at various times in a colour-mixed lamp can lead to an uneven colour output. Because of the inherent benefits and greater number of applications for white LED based SSL, most designs focus on utilizing them exclusively.

In 2008, SSL technology advanced to the point that Sentry Equipment Corporation in Oconomowoc, Wis. was able to light its new factory almost entirely with LEDs, both interior and exterior. Although the initial cost was three times more than a traditional mixture of incandescent and fluorescent bulbs, the extra cost will be repaid within two years from electricity savings, and the bulbs should not need replacement for 20 years.[1]

Driving LEDs on mains

LEDs are low-voltage devices, and have very low dynamic resistance, with the same voltage drop for widely varying currents. Consequently they cannot connect direct to most household sources without causing self destruction. A CR dropper (capacitor & resistor) followed by full wave rectification is the usual ballast with mains driven series-parallel LED clusters.

A single series string would minimise dropper losses, but one LED failure would extinguish the whole string. Paralleled strings increase reliability. In practice usually 3 strings or more are used.

Operation on square wave and modified sine wave (MSW) sources, such as many inverter, causes heavily increased resistor dissipation in CR droppers, and LED ballasts designed for sine wave use tend to burn on non-sine waveforms. The non-sine waveform also causes high peak LED currents, heavily shortening LED life. An inductor & rectifier makes a more suitable ballast for such use, and other options are also possible.

Comparison to other lighting technologies

See luminous efficacy for an efficiency chart comparing various technologies.

- Incandescent lamps (light bulbs) create light by running electricity through a resistive filament, thereby heating the filament to a very high temperature so that it glows and produces visible light. A broad range of visible frequencies are naturally produced, yielding a pleasing warm yellow or white colour quality. Incandescent light however, is highly inefficient, as over 98% of the energy input is emitted as heat. A 100 watt 120 VAC light bulb produces about 1700 lumens, about 17 lumens per watt. Incandescent lamps are relatively inexpensive to produce. The typical lifespan of a mains incandescent lamp is around 1,000 hours. They work well with dimmers. Most existing light fixtures are designed for the size and shape of these traditional bulbs.

- Fluorescent lamps (light bulbs) work by passing electricity through mercury vapor, which in turn produces ultraviolet light. The ultraviolet light is then absorbed by a phosphor coating inside the lamp, causing it to glow, or fluoresce. While the heat generated by fluorescent lamps is much less than its incandescent counterpart, energy is still lost in generating the ultraviolet light and converting this light into visible light. If the lamp breaks exposure to mercury can occur. Linear fluorescent lamps are typically five to six times the cost of incandescent lamp, but have life spans around 10,000 and 20,000 hours. Lifetime varies from 1,200 hours to 20,000 hours for compact fluorescent lamps.

Fluorescent tubes with modern electronic ballasts commonly average 50 to 67 lm/W overall. Most compact fluorescents rated at 13 watts or more with integral electronic ballasts achieve about 60 lumens/watt. Those with "iron" ballasts flicker at 100 or 120 Hz, and are less efficient. Most fluorescent luminaires are not compatible with dimmers. The quality of the light tends to be a harsh white because of the lack of a broad band of frequencies. To prevent mercury release, fluorescent tubes should be recycled by specialist routes rather than included in general refuse.

- **SSL/LEDs** LEDs come in multiple colours, which are produced without the need for filters. A white SSL can comprise a single high-power LED, multiple white LEDs, or LEDs of different colours mixed to produce white light. Advantages include:
  - **High efficiency** - LEDs are now available that reliably offer over 100 lumens from a one-watt device, or much higher outputs at higher drive currents
  - **Small size** - provides design flexibility, arranged in rows, rings, clusters, or individual points
  - **High durability** - no filament or tube to break
  - **Life span** - in properly engineered lamps, LEDs can last 50,000 - 60,000 hours
  - **Full dimmability –** unlike fluorescent lamps, LEDs can be dimmed using pulse-width modulation (PWM - turning the light on and off very quickly at varying intervals). This also allows full colour mixing in lamps with LEDs of different colours.
  - **Mercury-free** - unlike fluorescent and most HID technologies, LEDs contain no hazardous mercury or halogen gases

However, some current models are not compatible with standard dimmers. It is not currently practical to produce high levels of room lighting. As a result, current LED screw-in light bulbs offer either low levels of light at a moderate cost, or moderate levels of light at a high cost. In contrast to other lighting technologies, LED light tends to be directional. This is a disadvantage for most general lighting applications, but can be an advantage for spot or flood lighting.

Because individual LEDs are low-voltage DC devices, implementing SSL to operate from mains AC requires well designed circuitry and a thermal case to dissipate the heat.

Research and development

US Department of Energy

In May 2008 the U.S. Department of Energy (DOE) announced details of the Bright Tomorrow Lighting Prize competition. The L Prize is the first government-sponsored technology competition designed to spur lighting manufacturers to develop high quality, high efficiency solid-state lighting products to replace the common light bulb. The competition will award cash prizes, and may also lead to opportunities for federal purchasing agreements, utility programs, and other incentives for winning products.

The Energy Independence and Security Act (EISA) of 2007 authorizes DOE to establish the Bright Tomorrow Lighting Prize competition. The legislation challenges industry to develop replacement technologies for the most commonly used and inefficient products, 60W incandescent lamps and PAR 38 halogen lamps. The L Prize specifies technical requirements for these two competition categories. Lighting products meeting the competition requirements would consume just 17% of the energy used by most incandescent lamps in use today. A future L Prize program announcement will call for development of a new "21st Century Lamp," as authorized in the legislation.

The EISA legislation establishes basic requirements and prize amounts for each category. The legislation authorizes up to $20 million in cash prizes.

National Institute of Standards and Technology

In June 2008 scientists at the National Institute of Standards and Technology (NIST) announced the first two standards for solid-state lighting in the United States. These standards detail the colour specifications of LED lamps and LED light fixtures, and the test methods that manufacturers should use when testing these solid-state lighting products for total light output, energy consumption and chromaticity, or colour quality.

The Illuminating Engineering Society of North America (IESNA) published a documentary **standard LM-79**, which describes the methods for testing solid-state lighting products for their light output (lumens), energy efficiency (lumens per watt) and chromaticity.

The solid-state lights being studied are intended for general illumination, but white lights used today vary greatly in chromaticity, or specific shade of white. The American National Standards Institute (ANSI) published the **standard C78.377-2008**, which specifies the recommended colour ranges for solid-state lighting products using cool to warm white LEDs with various correlated colour temperatures. The standard may be downloaded from ANSI's Web site.

DOE is launching the Energy Star program for solid-state lighting products later in 2008. NIST scientists assisted DOE by providing research, technical details and comments for the Energy Star specifications. The Energy Star certification assures consumers that products save energy and are high quality and also serves as an incentive for manufacturers to provide energy-saving products for consumers.

The solid-state lighting community is continuing to develop LED lighting standards for rating LED lamp lifetime and for measuring the performance of the individual high-power LED chips and arrays. NIST scientists are taking active roles in these continuing efforts.

NIST is working with the U.S. Department of Energy (DOE) to support its goal of developing and introducing solid-state lighting to reduce energy consumption for lighting by 50 percent by the year 2025. The department predicts that phasing in solid-state lighting over the next 20 years could save more than $280 billion in 2007 dollars.

Other venues

Philips Lighting has ceased research on compact fluorescents, and is devoting the bulk of its R.& D. budget, 5 percent of the company's global lighting revenue, to SSL.

In January 2009, it was reported that researchers at Cambridge University had developed an LED bulb that costs £2 (about $3 U.S.), is 12 times as energy efficient as a tungsten bulb, and lasts for 100,000 hours. [3]

Remaining problems

The current manufacturing process of white LEDs has not matured enough for them to be produced at low enough cost for widespread use. There are multiple manufacturing hurdles that must be overcome. The process used to deposit the active semiconductor layers of the LED must be improved to increase yields and manufacturing throughput. Problems with phosphors, which are needed for their ability to emit a broader wavelength spectrum of light, have also been an issue. In particular, the inability to tune the absorption and emission, and inflexibility of form have been issues in taking advantage of the phosphors spectral capabilities.

More apparent to the end user, however, is the low Colour Rendering Index (CRI) of current LEDs. The current generation of LEDs, which employs mostly blue LED chip + yellow phosphor, has a CRI around 70, which is much too low for widespread use in indoor lighting. (CRI is used to measure how accurately a lighting source renders the colour of objects. Sunlight and some incandescent lamps have a perfect CRI of 100, while white fluorescent lamps have CRI varying from the 50s to 98.) Better CRI LEDs are more expensive, and more research and development is needed to reduce costs.

Variations of CCT (colour correlated temperature) at different viewing angles present another obstacle against widespread use of white LED. It has been shown, that CCT variations can exceed 500 K, which is clearly noticeable

by human observer, who is normally capable of distinguishing CCT differences of 50 to 100 K in range from 2000 K to 6000 K, which is the range of CCT variations of daylight.

LEDs also have limited temperature tolerance and falling efficiency as temperature rises. This limits the total LED power that can practically be fitted into lamps that physically replace existing filament & compact fluorescent types. R&D is needed to improve thermal characteristics.

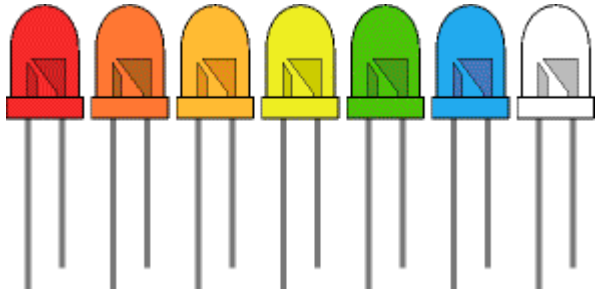
The long life of SSL products, expected to be about 50 times the most common incandescent bulbs, poses a problem for bulb makers, whose current customers buy frequent replacements. [1]

Applications

This garden light can use stored solar energy because of the low power consumption of its LED

- Traffic lights
- Automotive lighting
- Stage lighting
- Bicycle lighting
- Flashlight (Electric torches)
- Domestic lighting
- Public Transit Vehicle Destination signs
- Billboard displays
- Floodlighting of buildings
- Display lighting in art galleries to achieve a low heating effect on pictures etc.
- Train lights and Train Signals (Now common on nearly all modern and most older MU's and Loco's in the UK)

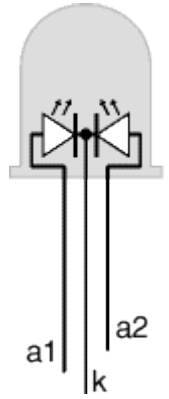
Colours of LEDs



LEDs are available in red, orange, amber, yellow, green, blue and white. Blue and white LEDs are much more expensive than the other colours.

The colour of an LED is determined by the semiconductor material, not by the colouring of the 'package' (the plastic body). LEDs of all colours are available in uncoloured packages which may be diffused (milky) or clear (often described as 'water clear'). The coloured packages are also available as diffused (the standard type) or transparent.

Tri-colour LEDs



The most popular type of tri-colour LED has a red and a green LED combined in one package with three leads. They are called tri-colour because mixed red and green light appears to be yellow and this is produced when both the red and green LEDs are on.

The diagram shows the construction of a tri-colour LED. Note the different lengths of the three leads. The centre lead (k) is the common cathode for both LEDs, the outer leads (a1 and a2) are the anodes to the LEDs allowing each one to be lit separately, or both together to give the third colour.

Bi-colour LEDs

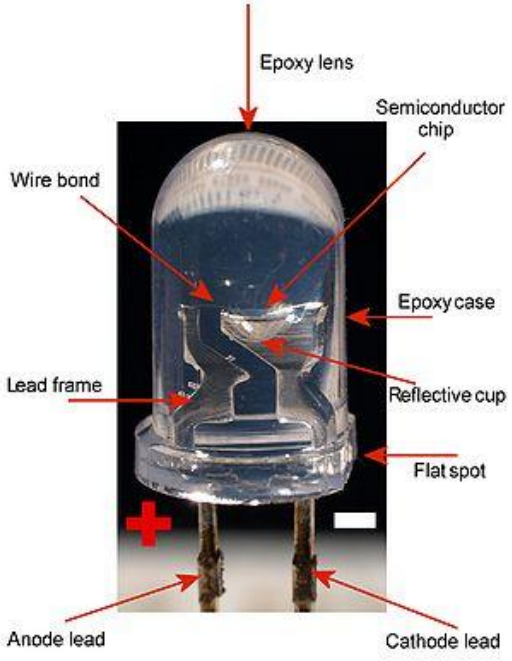
A bi-colour LED has two LEDs wired in 'inverse parallel' (one forwards, one backwards) combined in one package with two leads. Only one of the LEDs can be lit at one time and they are less useful than the tri-colour LEDs described above.

Sizes, Shapes and Viewing angles of LEDs

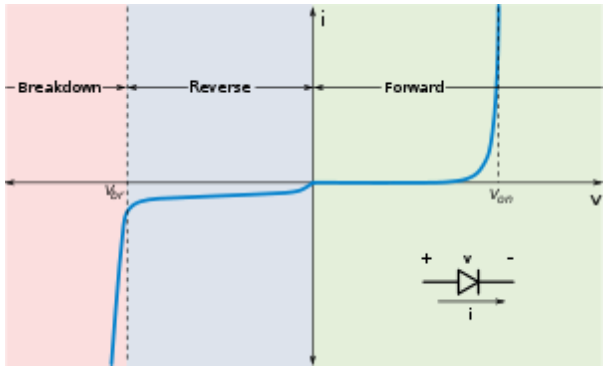
LEDs are available in a wide variety of sizes and shapes. The 'standard' LED has a round cross-section of 5mm diameter and this is probably the best type for general use, but 3mm round LEDs are also popular.

LED Clip

Round cross-section LEDs are frequently used and they are very easy to install on boxes by drilling a hole of the LED diameter, adding a spot of glue will help to hold the LED if necessary. LED clips are also available to secure LEDs in holes. Other cross-section shapes include square, rectangular and triangular.



The inner workings of an LED



I-V diagram for a diode an LED will begin to emit light when the on-voltage is exceeded. Typical on voltages are 2-3 Volt

Physics

Like a normal diode, the LED consists of a chip of semiconducting material impregnated, or *doped*, with impurities to create a *p-n junction*. As in other diodes, current flows easily from the p-side, or anode, to the n-side, or cathode, but not in the reverse direction. Charge-carriers—electrons and holes—flow into the junction from electrodes with different voltages. When an electron meets a hole, it falls into a lower energy level, and releases energy in the form of a photon.

The wavelength of the light emitted, and therefore its colour, depends on the band gap energy of the materials forming the *p-n junction*. In silicon or germanium diodes, the electrons and holes recombine by a *non-radiative transition* which produces no optical emission, because these are indirect band gap materials. The materials used for the LED have a direct band gap with energies corresponding to near-infrared, visible or near-ultraviolet light.

LED development began with infrared and red devices made with gallium arsenide. Advances in materials science have made possible the production of devices with ever-shorter wavelengths, producing light in a variety of colours.

LEDs are usually built on an n-type substrate, with an electrode attached to the p-type layer deposited on its surface. P-type substrates, while less common, occur as well. Many commercial LEDs, especially GaN/InGaN, also use sapphire substrate.

Most materials used for LED production have very high refractive indices. This means that much light will be reflected back in to the material at the material/air surface interface. Therefore *Light extraction in LEDs* is an important aspect of LED production, subject to much research and development.

Efficiency and operational parameters

Typical indicator LEDs are designed to operate with no more than 30–60 milliwatts [mW] of electrical power. Around 1999, Philips Lumileds introduced power LEDs capable of continuous use at one watt [W]. These LEDs used much larger semiconductor die sizes to handle the large power inputs. Also, the semiconductor dies were mounted onto metal slugs to allow for heat removal from the LED die.

One of the key advantages of LED-based lighting is its high efficiency, as measured by its light output per unit power input. White LEDs quickly matched and overtook the efficiency of standard incandescent lighting systems. In 2002, Lumileds made five-watt LEDs available with a luminous efficiency of 18–22 lumens per watt [lm/W]. For

comparison, a conventional 60–100 W incandescent lightbulb produces around 15 lm/W, and standard fluorescent lights produce up to 100 lm/W. (The luminous efficiency article discusses these comparisons in more detail.)

In September 2003, a new type of blue LED was demonstrated by the company Cree, Inc. to provide 24 mW at 20 milliamperes [mA]. This produced a commercially packaged white light giving 65 lm/W at 20 mA, becoming the brightest white LED commercially available at the time, and more than four times as efficient as standard incandescents. In 2006 they demonstrated a prototype with a record white LED luminous efficiency of 131 lm/W at 20 mA. Also, Seoul Semiconductor has plans for 135 lm/W by 2007 and 145 lm/W by 2008, which would be approaching an order of magnitude improvement over standard incandescents and better even than standard fluorescents.[19] Nichia Corporation has developed a white light LED with luminous efficiency of 150 lm/W at a forward current of 20 mA.

It should be noted that high-power (≥ 1 W) LEDs are necessary for practical general lighting applications. Typical operating currents for these devices begin at 350 mA. The highest efficiency high-power white LED is claimed by Philips Lumileds Lighting Co. with a luminous efficiency of 115 lm/W (350 mA).

Cree issued a press release on November 19, 2008 about a laboratory prototype LED achieving 161 lumens/watt at room temperature. The total output was 173 lumens, and the correlated colour temperature was reported to be 4689 K

Colour	Wavelength [nm]	Voltage [V]	Semiconductor Material
Infrared	$\lambda > 760$	$\Delta V < 1.9$	Gallium arsenide (GaAs) Aluminium gallium arsenide (AlGaAs)
Red	$610 < \lambda < 760$	$1.63 < \Delta V < 2.03$	Aluminium gallium arsenide (AlGaAs) Gallium arsenide phosphide (GaAsP) Aluminium gallium indium phosphide (AlGaInP) Gallium(III) phosphide (GaP)
Orange	$590 < \lambda < 610$	$2.03 < \Delta V < 2.10$	Gallium arsenide phosphide (GaAsP) Aluminium gallium indium phosphide (AlGaInP) Gallium(III) phosphide (GaP)
Yellow	$570 < \lambda < 590$	$2.10 < \Delta V < 2.18$	Gallium arsenide phosphide (GaAsP) Aluminium gallium indium phosphide (AlGaInP) Gallium(III) phosphide (GaP)
Green	$500 < \lambda < 570$	$2.18 < \Delta V < 4.0$	Indium gallium nitride (InGaN) / Gallium(III) nitride (GaN) Gallium(III) phosphide (GaP) Aluminium gallium indium phosphide (AlGaInP) Aluminium gallium phosphide (AlGaP)

Blue	450 < λ < 500	2.48 < ΔV < 3.7	Zinc selenide (ZnSe) Indium gallium nitride (InGaN) Silicon carbide (SiC) as substrate Silicon (Si) as substrate — (under development)
Violet	400 < λ < 450	2.76 < ΔV < 4.0	Indium gallium nitride (InGaN)
Purple	multiple types	2.48 < ΔV < 3.7	Dual blue/red LEDs, blue with red phosphor, or white with purple plastic
Ultraviolet	λ < 400	3.1 < ΔV < 4.4	diamond (C) Aluminium nitride (AlN) Aluminium gallium nitride (AlGaN) Aluminium gallium indium nitride (AlGaInN) — (down to 210 nm[25])
White	Broad spectrum	ΔV = 3.5	Blue/UV diode with yellow phosphor

Advantages of LED:

- **Efficiency:** LEDs produce more light per watt than incandescent bulbs.
- **Colour:** LEDs can emit light of an intended colour without the use of colour filters that traditional lighting methods require. This is more efficient and can lower initial costs.
- **Size:** LEDs can be very small (smaller than 2 mm^2) and are easily populated onto printed circuit boards.
- **On/Off time:** LEDs light up very quickly. A typical red indicator LED will achieve full brightness in microseconds. LEDs used in communications devices can have even faster response times.
- **Cycling:** LEDs are ideal for use in applications that are subject to frequent on-off cycling, unlike fluorescent lamps that burn out more quickly when cycled frequently, or HID lamps that require a long time before restarting.
- **Dimming:** LEDs can very easily be dimmed either by Pulse-width modulation or lowering the forward current.
- **Cool light:** In contrast to most light sources, LEDs radiate very little heat in the form of IR that can cause damage to sensitive objects or fabrics. Wasted energy is dispersed as heat through the base of the LED.
- **Slow failure:** LEDs mostly fail by dimming over time, rather than the abrupt burn-out of incandescent bulbs.
- **Lifetime:** LEDs can have a relatively long useful life. One report estimates 35,000 to 50,000 hours of useful life, though time to complete failure may be longer. Fluorescent tubes typically are rated at about 10,000 to 15,000 hours, depending partly on the conditions of use, and incandescent light bulbs at 1,000–2,000 hours.
- **Shock resistance:** LEDs, being solid state components, are difficult to damage with external shock, unlike fluorescent and incandescent bulbs which are fragile.
- **Focus:** The solid package of the LED can be designed to focus its light. Incandescent and fluorescent sources often require an external reflector to collect light and direct it in a usable manner.
- **Toxicity:** LEDs do not contain mercury, unlike fluorescent lamps.

Disadvantages

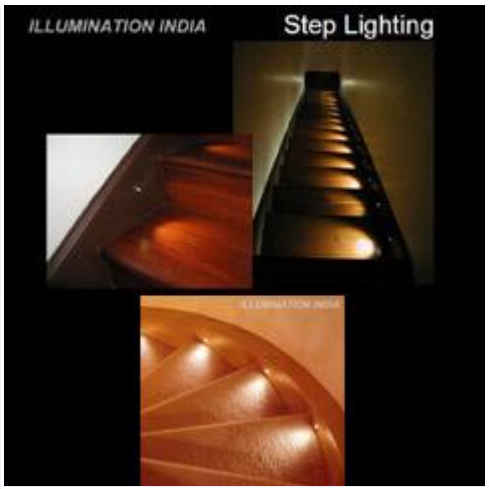
- **High price:** LEDs are currently more expensive, price per lumen, on an initial capital cost basis, than most conventional lighting technologies. The additional expense partially stems from the relatively low lumen output and the drive circuitry and power supplies needed. However, when considering the total cost of ownership (including energy and maintenance costs), LEDs far surpass incandescent or halogen sources and begin to threaten compact fluorescent lamps.
- **Temperature dependence:** LED performance largely depends on the ambient temperature of the operating environment. Over-driving the LED in high ambient temperatures may result in overheating of the LED package, eventually leading to device failure. Adequate heat-sinking is required to maintain long life. This is especially important when considering automotive, medical, and military applications where the device must operate over a large range of temperatures, and is required to have a low failure rate.
- **Voltage sensitivity:** LEDs must be supplied with the voltage above the threshold and a current below the rating. This can involve series resistors or current-regulated power supplies.
- **Light quality:** Most cool-white LEDs have spectra that differ significantly from a black body radiator like the sun or an incandescent light. The spike at 460 nm and dip at 500 nm can cause the colour of objects to be perceived differently under cool-white LED illumination than sunlight or incandescent sources, due to metamerism, red surfaces being rendered particularly badly by typical phosphor based cool-white LEDs. However, the colour rendering properties of common fluorescent lamps are often inferior to what is now available in state-of-art white LEDs.
- **Area light source:** LEDs do not approximate a "point source" of light, but rather a lambertian distribution. So LEDs are difficult to use in applications requiring a spherical light field. LEDs are not capable of providing divergence below a few degrees. This is contrasted with lasers, which can produce beams with divergences of 0.2 degrees or less.
- **Blue Hazard:** There is increasing concern that blue LEDs and cool-white LEDs are now capable of exceeding safe limits of the so-called blue-light hazard as defined in eye safety specifications such as ANSI/IESNA RP-27.1-05: Recommended Practice for Photobiological Safety for Lamp and Lamp Systems.
- **Blue pollution:** Because cool-white LEDs (i.e., LEDs with high colour temperature) emit much more blue light than conventional outdoor light sources such as high-pressure sodium lamps, the strong wavelength dependence of Rayleigh scattering means that cool-white LEDs can cause more light pollution than other light sources. It is therefore very important that cool-white LEDs are fully shielded when used outdoors.

LED PRODUCTS:

- **SOLINA surface-mounted and pendant luminaire**
  Elegant link between light and architecture
- Fitted with LEDs in RGB colours, the new SOLINA high-bay reflector luminaire provides exciting options for creating colour accents and colour sequences on the ceiling.

Led Spot Light

We ofer led spot light. These led spot lights are 1-Watt power used to highlight the step with different viewing angle that creates a very focussed and mild ambience around the area.

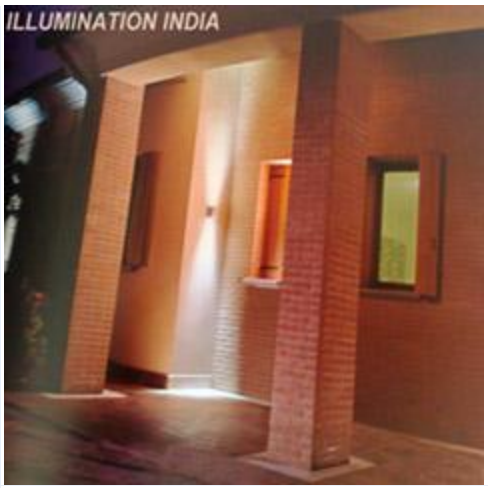


Led Light Tube

We offer led light tube. These led light tubes are 1 Watt power used in either side of the frosted acrylic tube in single or multi colours i.e warm white, amber and blue colour. Any colour combination can be made.

Led Up Down Light

We offer led up down light. These power led up down lights application that can be used both indoor as well as outdoor application as shown in the picture that creates a very pleasant ambience around the area.



Led Strip Light

Capitalizing on industrial experience, we offer a wide assortment of Led Strip Light. Most commonly used Led strip either SMD or piranha based used in glass steps to illuminate uniformly and in the same way it is used to illuminate the coves uniformly as shown in the picture.

Led Step Light

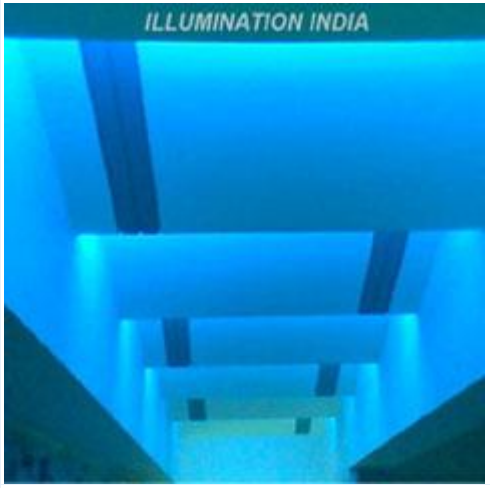
Our range of Led step lighting gives the effect of neon lighting and is available in 5 different diameters varying from 6 to 17 mm. It creates a beautiful straight light line up to 30 meters with double sided light source or 15 meters with single sided light source. It is also available on a reel with 30 or 60 meters.

Following are its unique features:

- Highly durable and reliable
- High shock/vibration resistance
- Water resistance
- Available in various specifications
- Ensures excellent performance

Led Strip Cove

We offer an exclusive range of led strip cove which ensures perfect transmission of light with minimal loss. Led strip in coves is available in 10 different diameters varying from 2, 5 to 17, and 3 mm on reels with 30 or 60 meters. Applications can be divided in the following 3 categories:



- **Places where heat and UV radiation are in acceptable such as art objects in a museum.**
- **Places where there is too little space for traditional lighting.**
- **Places where for safety reasons conventional lighting not can be used such as swimming pools, fountains etc.**

Multiple Up-DownLight

We offer superior quality range of Multiple Up-Down light for passage is made with an advanced optical grade epoxy, offering superior high temperature and ultra-violet resistance performance. Its Power led up-down light application that can be used both indoor as well as outdoor application as shown in the picture that creates a very pleasant ambiance around the area.

Acrylic Chandelier

We offer acrylic chandelier with led strip lights. Most commonly used led strip either SMD or Piranha based used in glass steps to illuminate uniformly and in the same way acrylic chandelier is used to illuminate the coves uniformly as shown in the picture.

Power Led Light

Our range of multiple power led light in showcase is specially designed so as to emit the maximum light. Its power led up-down light application that can be used both indoor as well as outdoor application as shown in the picture that creates a very pleasant ambience around the area. Available in various colours our range is highly durable and spectacular in its finish and therefore is in high demand across the globe.

RGB Light

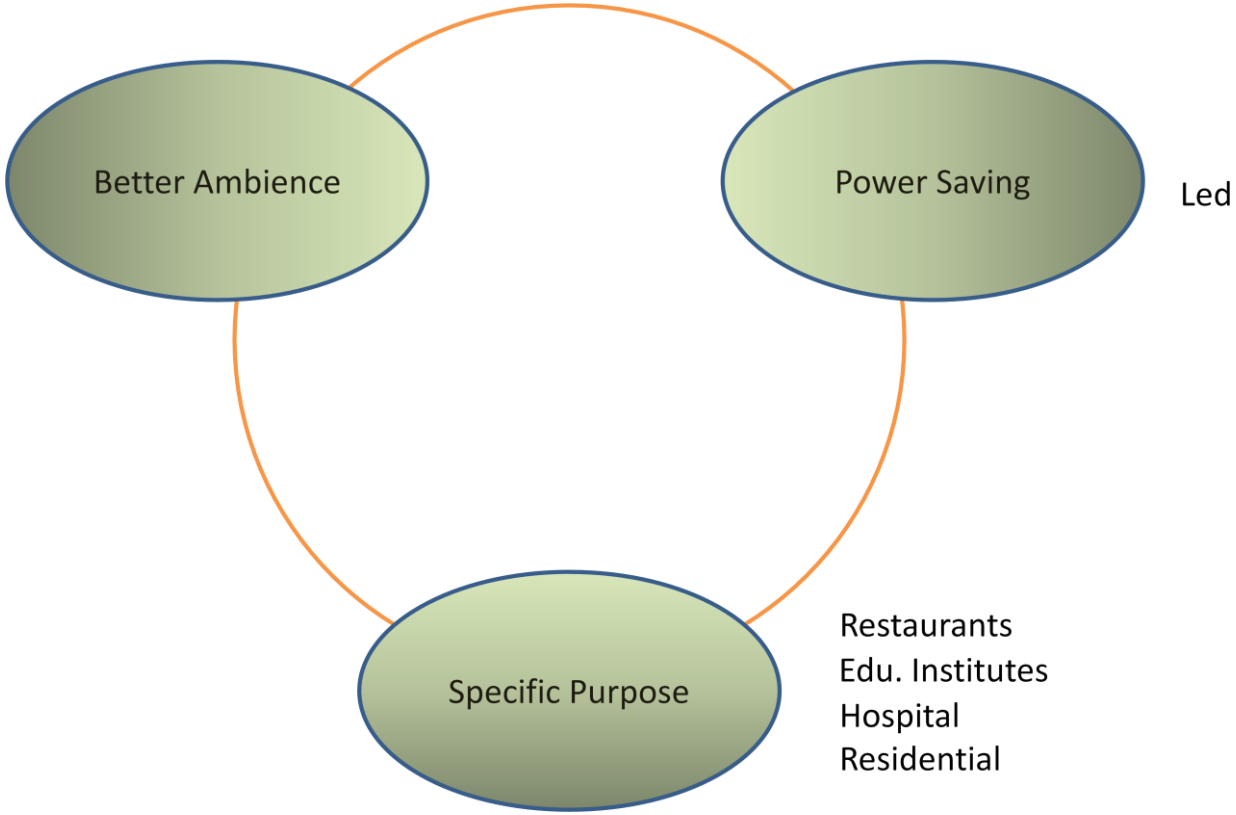
We offer RGB light in frosted glass. It's a very safe application to highlight the glass floor with waterproof Led application. It can be single or multicolour as desired.

Power Led in Onax Marble

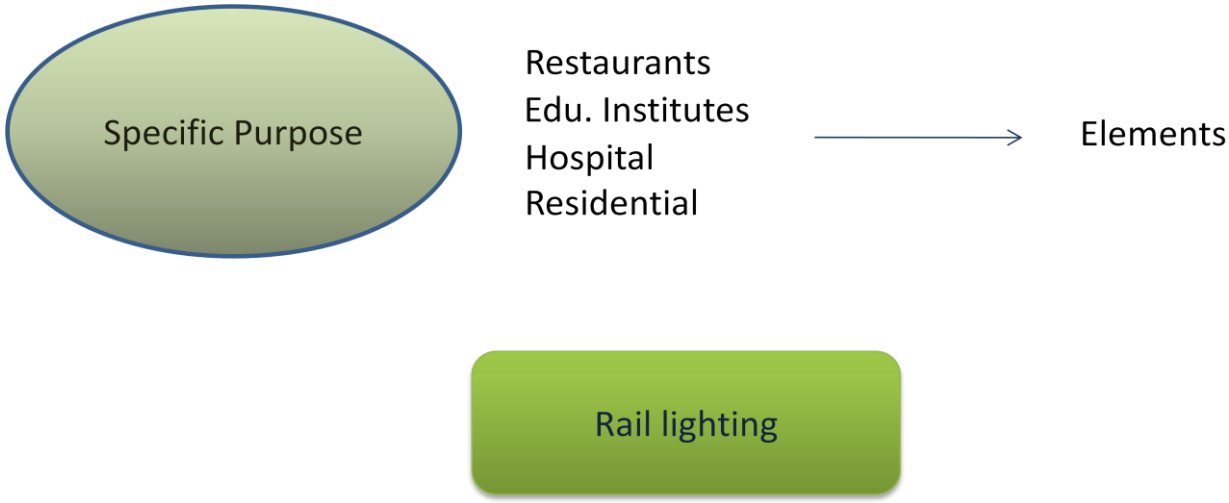
The power led application behind the onax marble is done with a very little gap within the wall. Mostly this application covers bathroom & passage area.

DESIGN POSSIBILITIES:

Designing a specific innovative interior lighting for better ambience with power saving i.e. with the use of led.



Gone through my data collection and finally narrowed down to rail/track lighting with the use of L.E.D.s.



Details of Rail/Track Lighting:

Track lighting is a method of lighting where light fixtures are attached anywhere on a continuous track device which contains electrical conductors. This is as opposed to the routing of electrical wiring to individual light positions. Tracks can be mounted to ceilings or walls, lengthwise down beams, or crosswise across rafters or joists. They can also be hung with rods from especially high places like vaulted ceilings.

Typical systems have line voltage (100 volts in Japan, 120 in North America, 240 elsewhere) running through a recessed track. The track may have a second "hot" conductor, so that two circuits may control lighting on the same track. This is selected by placing the tab of the connector on the fixture to one side or the other when attaching it to the track. There are three standard types of tracks used in North America, as well as elsewhere in the world. They are often termed "H", "J", and "L" track, after the names of the manufacturers that established the standards, Halo, Juno, and Lightolier. To identify a track fixture, you may use the following two rules: 1. if it has three contacts, it is probably "H" type 2. If the contact-tips are 1 inch apart, it is probably "J" type, if they are 7/8 inch apart, it is probably "L" type.

More modern systems are available with low voltage (10, 12, or 24 volts respectively) running through track, which is in itself decorative. In this case, the fixture may clamp onto a track made of two metal strips separated

with an insulating strip. Two-circuit configurations are rare in such systems. The track is powered by a transformer which converts the high voltage into low voltage. There are magnetic and electronic transformers.

A variation on this is **cable lighting**, whereby the fixtures are simply hung or suspended from uninsulated cables which likewise carry low voltage. These fixtures range from the very simple, such as two hinged rods from which a halogen lamp hangs, to the very artful, such as a human silhouette whose feet touch the wires and hands hold the bulb or its socket. Two sets of cables (such as in the corner of a room where two walls meet) can be connected together with short wires that have clips (such as alligator clips or screw clamps) at either end. Another variation is called flex track or monorail track lighting in which the fixtures are hung from a single line monorail track attached to the ceiling using stems. There are several different types of track. Some are very flexible and can be curved in any shape or form and some are more rigid and can be curved very slightly. Some patterns that can be made are "S curves" or "spirals".

It is also common to see line-voltage tracks with low-voltage fixtures. For these, each fixture requires a small transformer to operate it. For all low-voltage fixtures or systems a special dimmer (if used) is required, as standard dimmers are cheaply made and will cause flickering because of the interaction with the inductive electrical load.

Various adapters are available for combining features of track and other lighting. If the track is properly anchored, a hanging fixture may be suspended from it. The track itself can also be suspended. Rather than being hard-wired to a junction box (which requires a feeder device to be snapped into the track, either in the middle or at one end), it can also be end-fed from a standard wall outlet. Outlets can also be snapped into line-voltage track. There are "L" and "T" adapters for rigid track, as well as flexible ones for unusual angles, or to change the vertical angle where a ceiling changes slope. Adapter plates allow single fixtures to be attached directly to a junction box, by providing an extremely small section of track embedded into the plate. There are also arms which have the same feature, allowing fixtures to be mounted onto the same wall they shine onto, and having an attached electrical cord and wall plug.

Track Lighting

Track lighting offers lighting design flexiblity. You can set the right mood for a room with ambient lighting or provide the right accent or task light to live, work and play by. Customize your space with track lighting to create the perfect light.

Low Voltage Track Lights

Line Voltage Track Lights

Track + Components

W.A.C. Linear System Components + Accessories

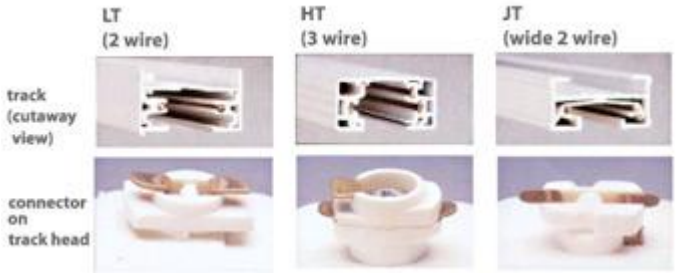
Two Circuit Track + Accessories

Track may seem like a challenge to pick out and install, but it really isn't. If this is your first time working with track lights, there is a lot of helpful information on our track lighting primer. Also be sure to visit our track lighting frequently asked questions (FAQs) page.

Track Style

YLighting offers the three standards in complete systems of track lighting: the 2-Wire "L", the 3-Wire "H", and the Wide 2-Wire "J" systems. All of our low and line voltage track heads are available in versions compatible with each standard, including Halo, Juno and Lightolier, which gives us the flexibility to meet different customer demands (LBL track and heads are only available in a 3-Wire "H" system). Each standard differs in its connection between the fixture (the head) and the track, so while the fixtures themselves look exactly the same, it is important to choose the right fixture to match the standard of the track you have installed or plan to install. If

you are starting from scratch, we recommend the three-wire "H" standard at is the most popular. Take a look at the track lighting FAQ for more information on track styles and compatibility with products from other manufacturers.



Transformers

All low voltage track lighting fixture styles are equipped with a self-contained electronic transformer that brings the line voltage of approximately 120 volts down to 12 volts, to make the voltage suitable for low voltage lamps (lightbulbs). This transformer is a rectagular block about 4" long that serves as both the base of the fixture and the connection to the track. These transformers will generally will work with standard (incandescent) dimmers. In rare instances, however, customers have reported that their fixtures produce a humming sound when used with a dimmer; in such cases we recommend that a better quality standard dimmer or an electronic dimmer be used, and, should the problem presist, we recommend a noise filter that is generally available from a store like Radio Shack. It is important to note that magnetic dimmers are not suitable for our low voltage track products.

Line Voltage Track Heads

Line voltage track heads are offered in a variety of styles. When compared with our low voltage track lighting products, the main difference is that the line voltage fixtures do not require a transformer, making the "base" which connects to the track a lot smaller. Because they do not use a transformer, line voltage track heads use a different set of lamps (lightbulbs) than the comparable low voltage fixtures.

>Wattage

Line voltage fixtures can accept lamps (lightbulbs) up to the stated wattage rating of the fixture (see the specifications on each fixture page). Low voltage fixtures are generally limited to 50W lamps (except for those fixtures that are limited to 35W MR11 lamps). However, for installations which require stronger illumination, the

bulk of the low voltage track fixtures we carry are also available in 75W versions (see the specifications listed on the page of the fixture in question).

Extensions

All low voltage track lighting heads (except for those from LBL Lighting) may be ordered with an optional 18", 24", 36" or 48" extension, which serves to increase the distance between the track and the head of the fixture with a rigid tube. As a special order, this extension may be ordered with a sloped ceiling connector at the transformer end for use with tracks installed on sloped ceilings. For the low voltage track styles, extensions form an integral part of the fixture (the fixture is assembled with the extension at the factory) and therefore extensions cannot be sold separately from the fixture itself. Furthermore, track lighting fixtures ordered with extensions may take a longer time to ship, depending on availability from our manufacturer, and **are not returnable under any circumstances**. For line voltage track fixtures, drops can be made using an extension rod. Line voltage extension rods are easily installable, but it is important to note that they are available for "H" style fixtures only.

My Approach:

- Clustering
- Testing some ideas to check their potential
- Detailed study of existing system
- Various possibilities for track light arrangements
- Concepts
- Exploration in different materials

IDEATION:

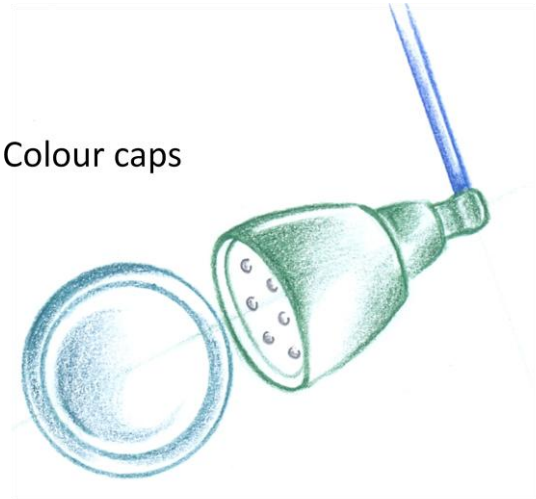
Did ideation considering various possibilities and further clustered them according to similar ideas.

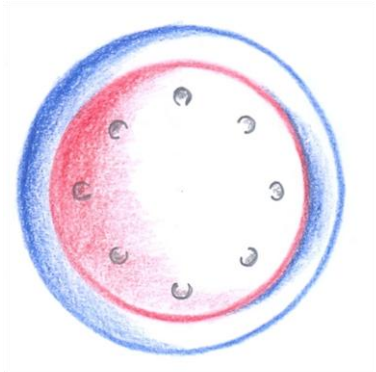
Cluster 1:

I named this cluster as “STATIC”

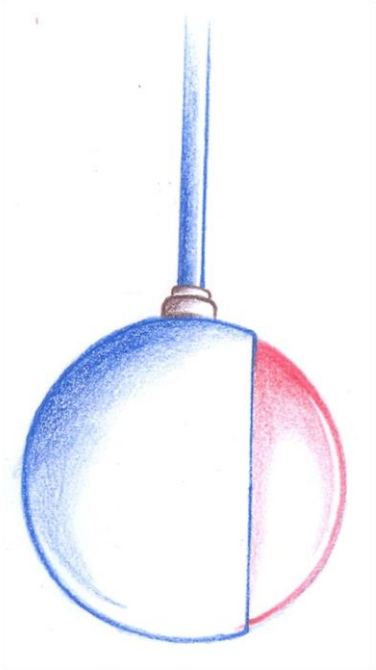
In this the collection of ideas were having almost no provision for movement, they were stationary and no dynamics.

Colour caps

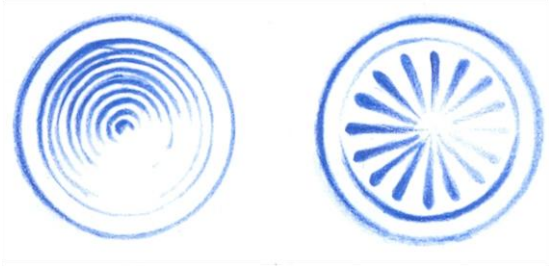


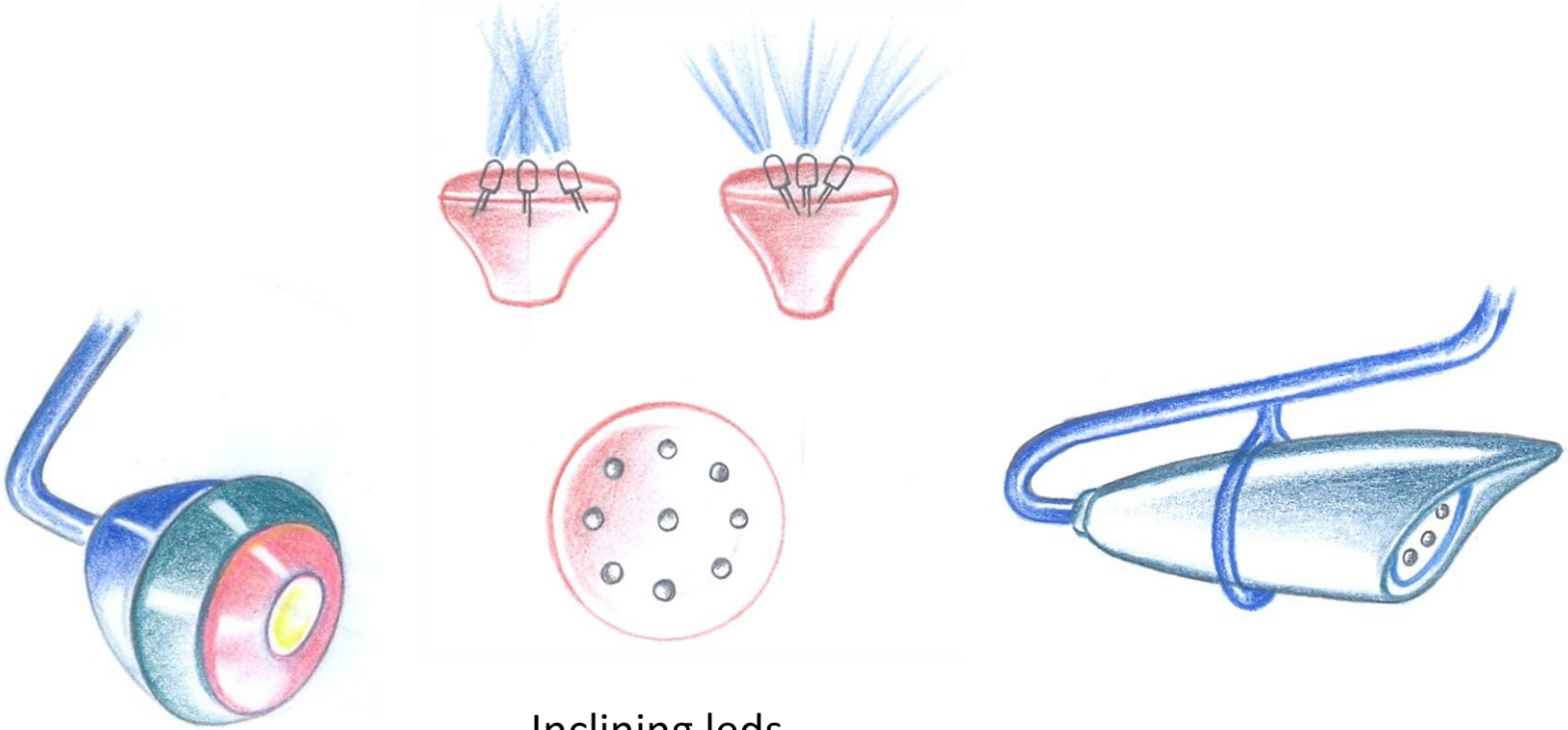


light ball

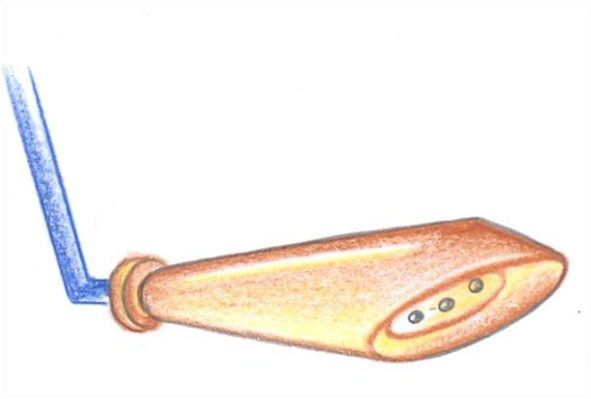


Various design patterns

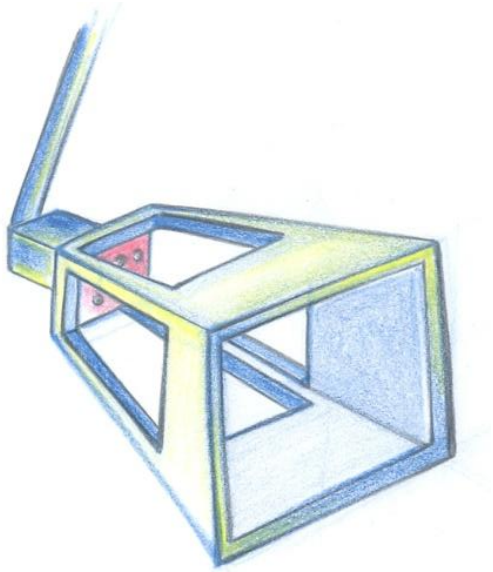


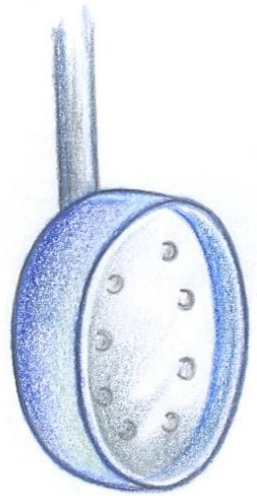


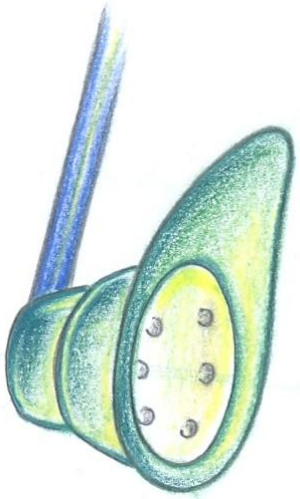
Inclining leds

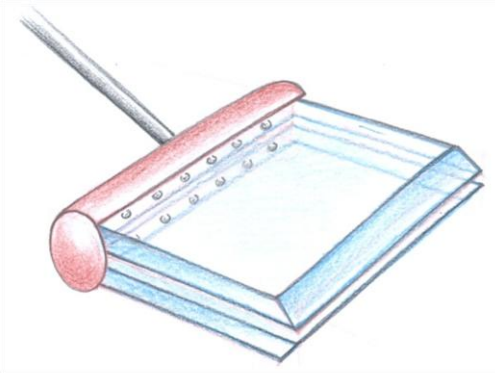


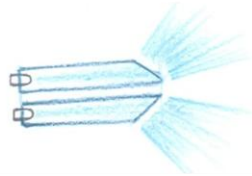
Movable light



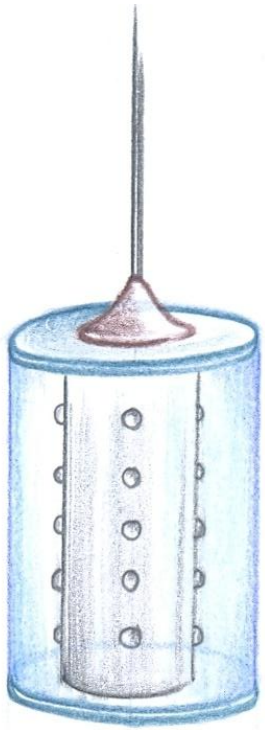




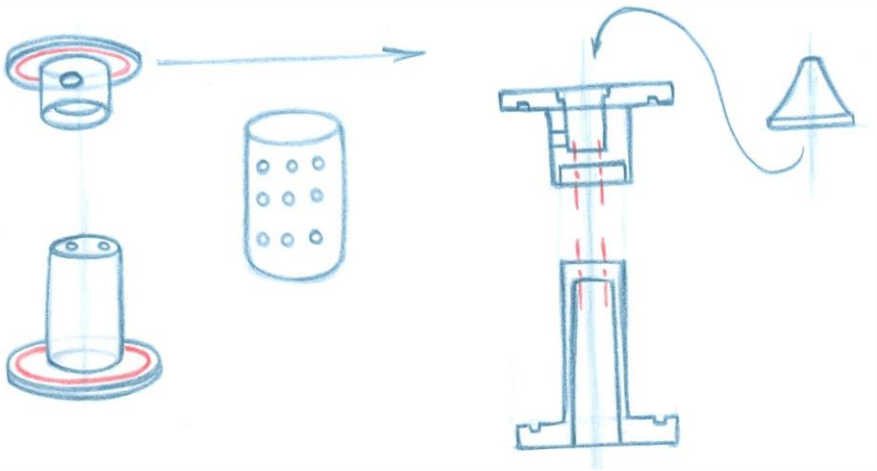


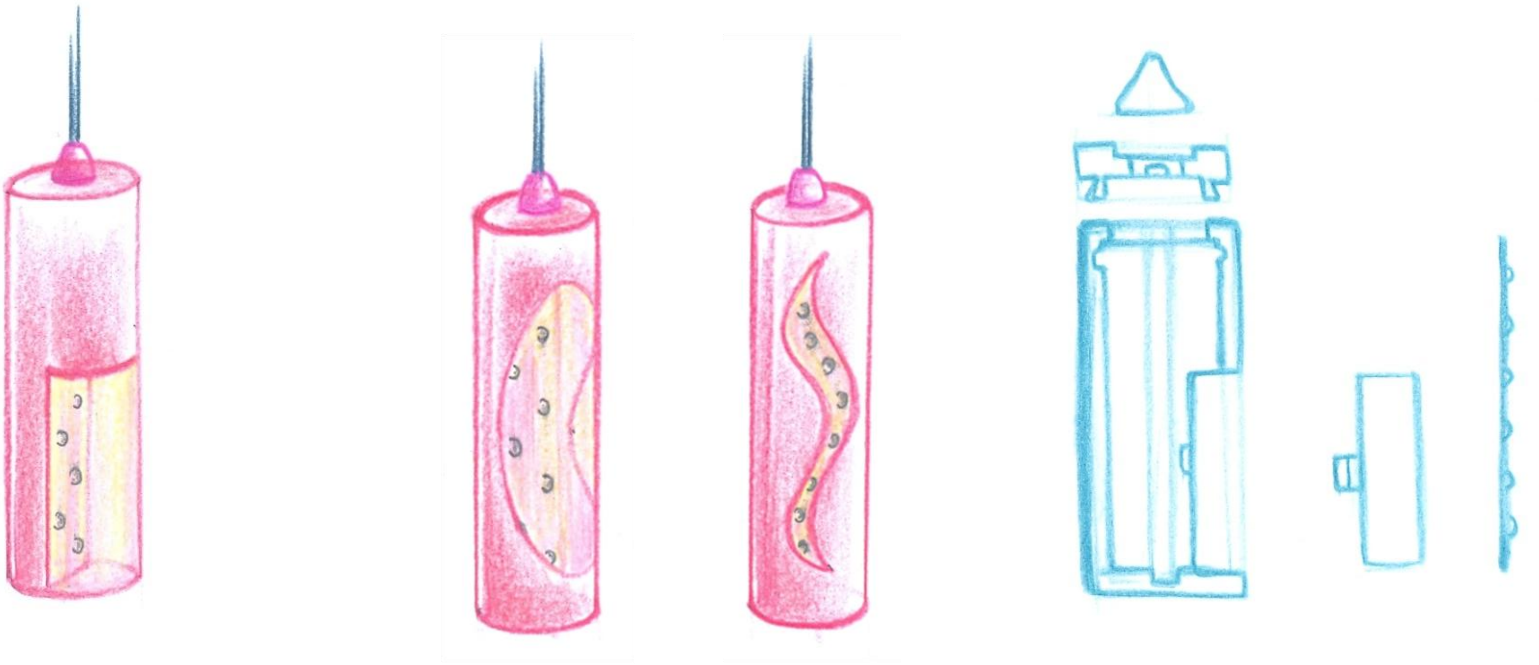


Chamfered acrylic plates



Possibility of various patterns

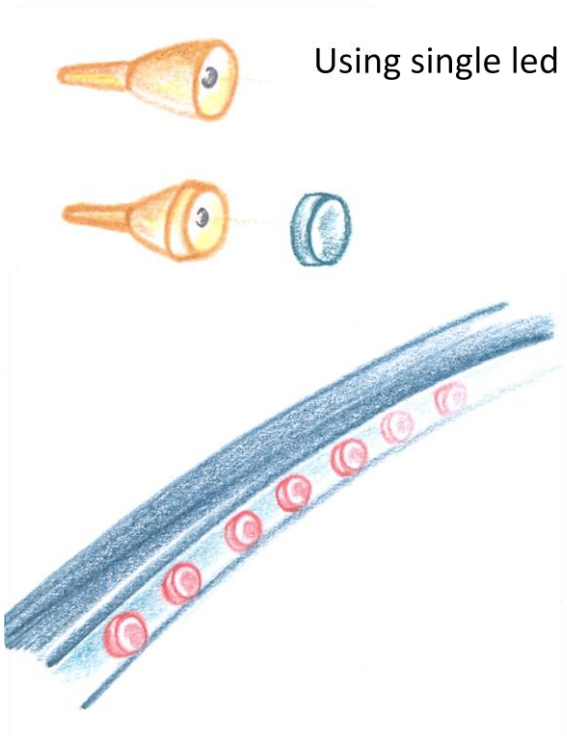




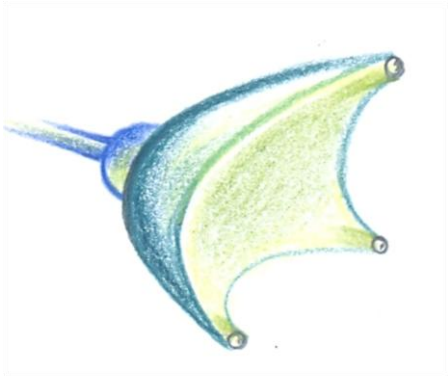
Various design pattern possib

Cluster 2:

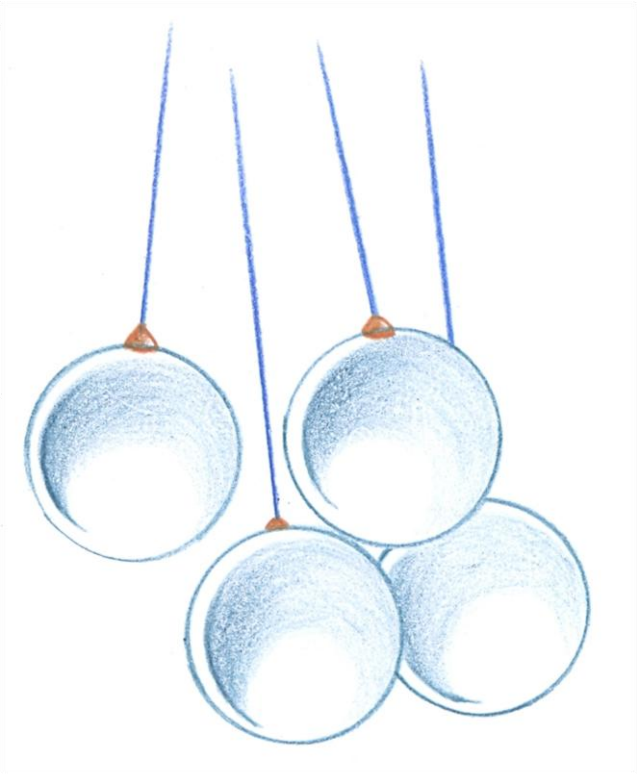
In this the Ideas were having use of single or few L.E.D.'s



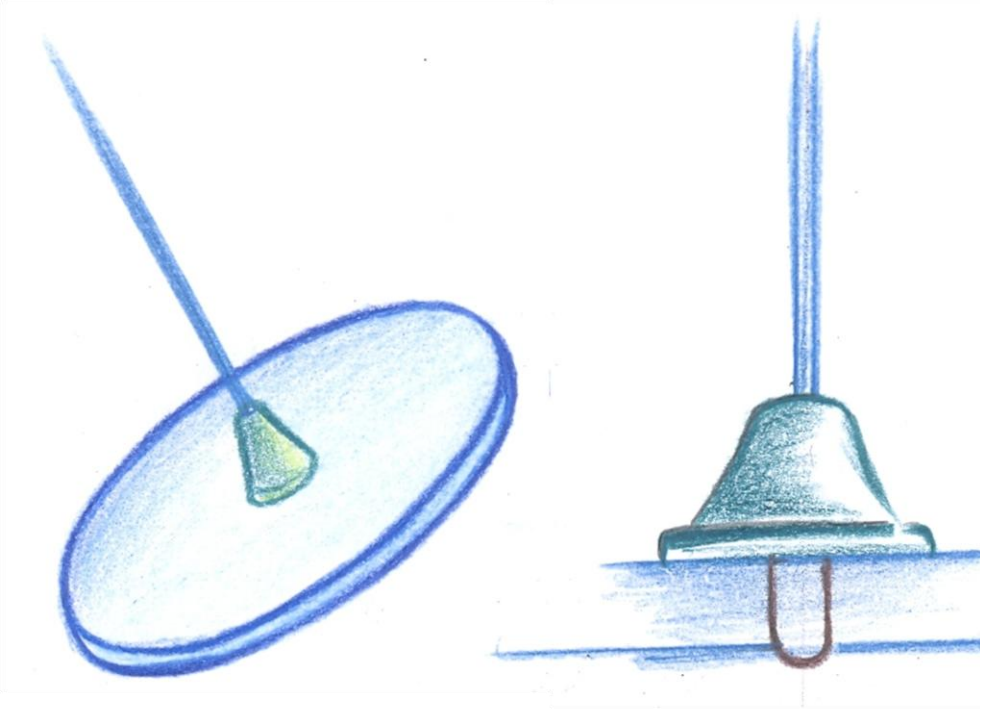
Using single led



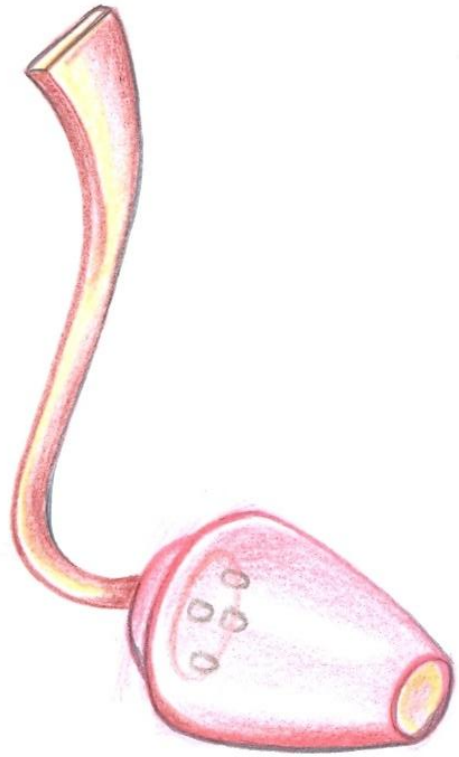
Led on edges



Using single or multiple led

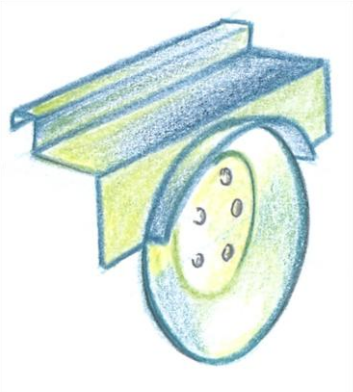


Acrylic plate with led at center

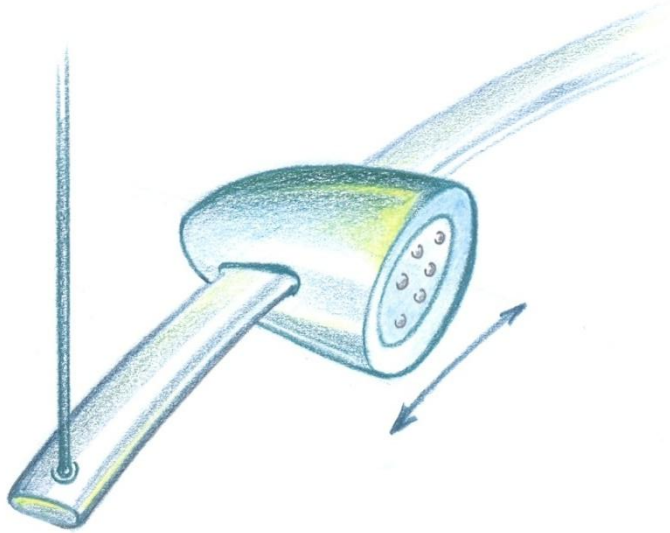


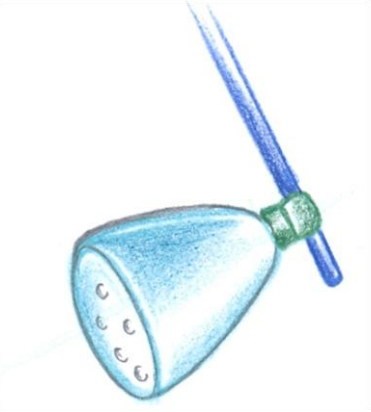
Cluster 3:

In this ideas having provision for sliding is considered

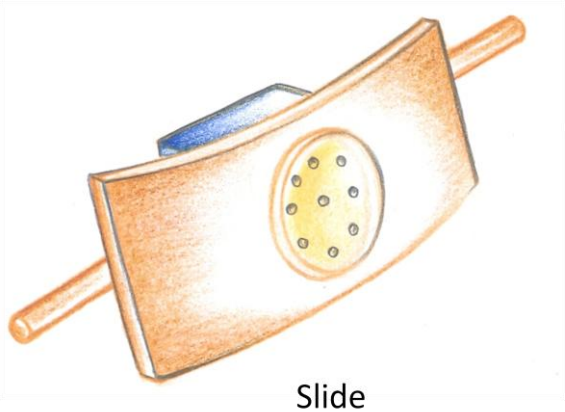


Groove for sliding

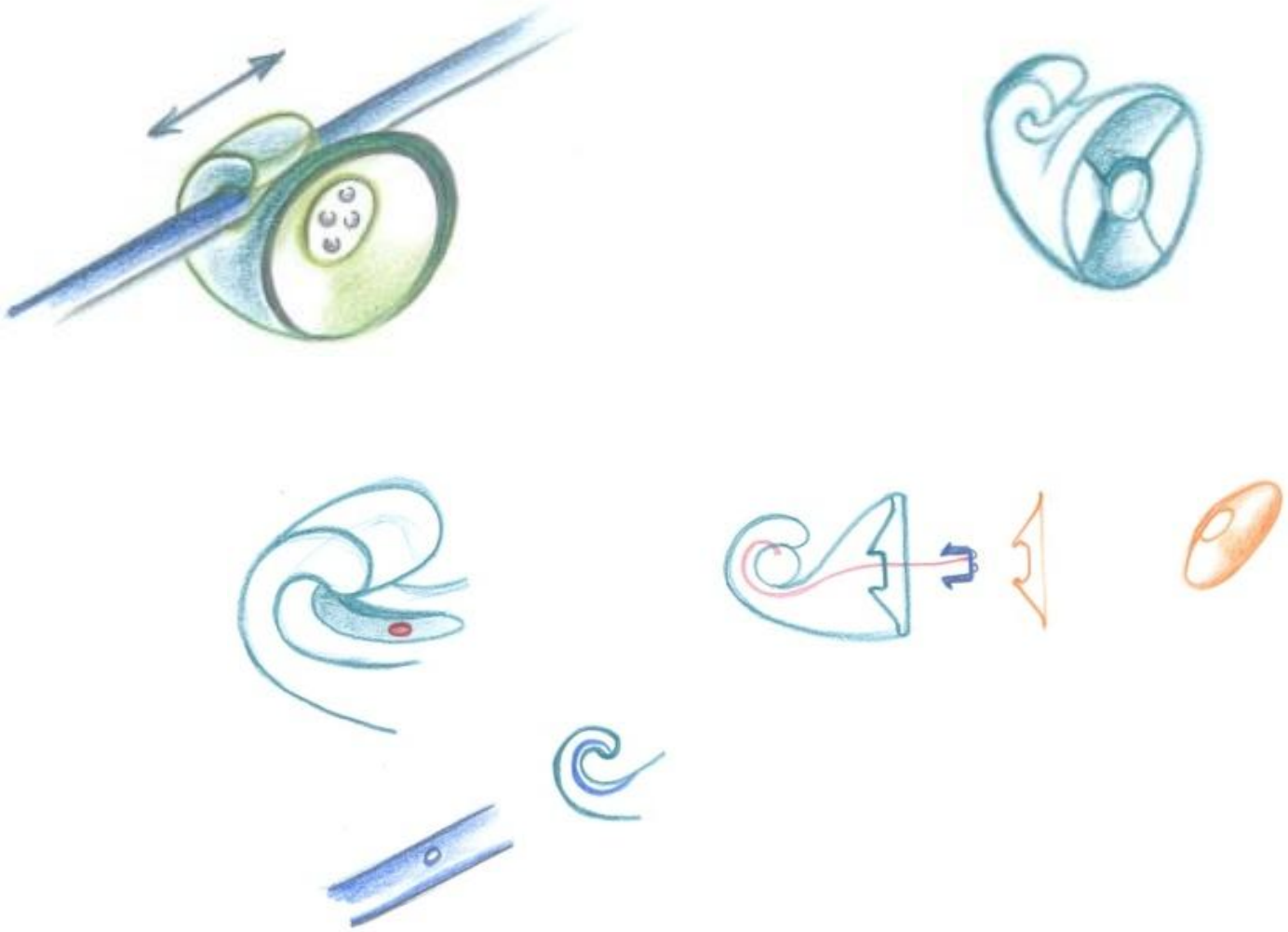




Slide Height adjustable

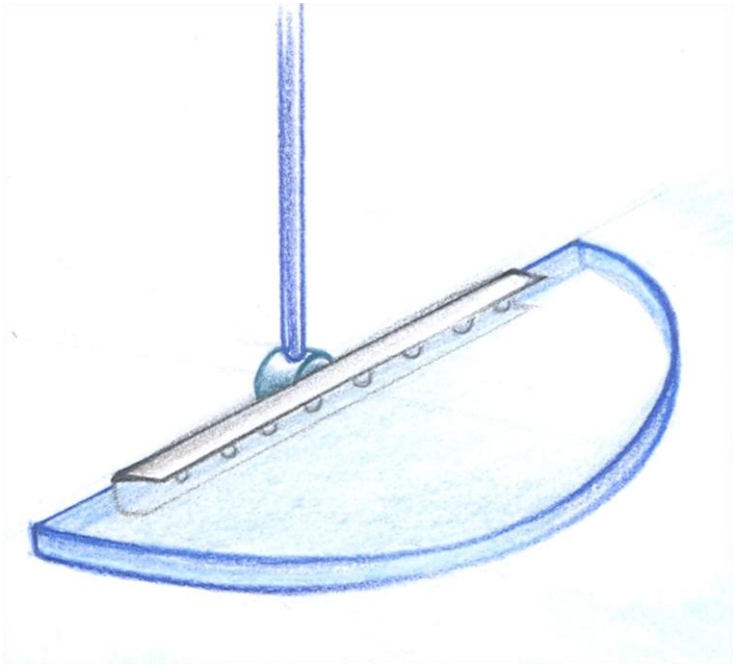


Slide

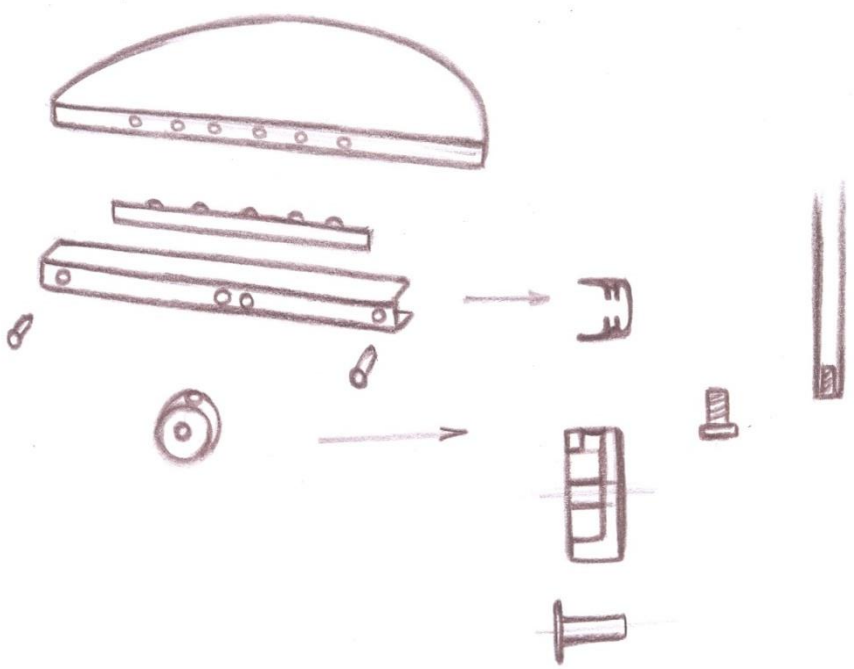


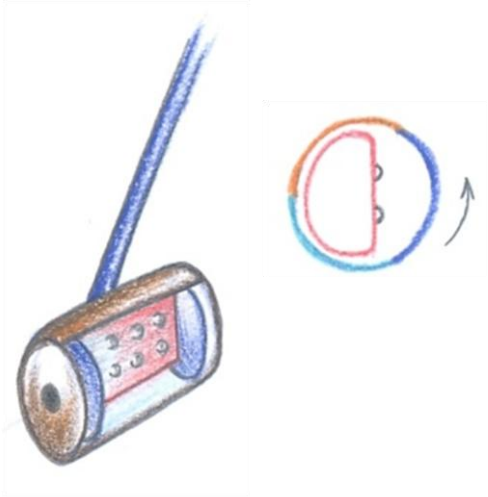
Cluster 4: Free move

In this Cluster the Ideas were having potential of moving in various directions.

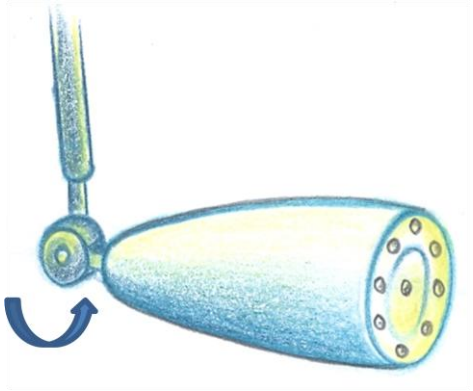


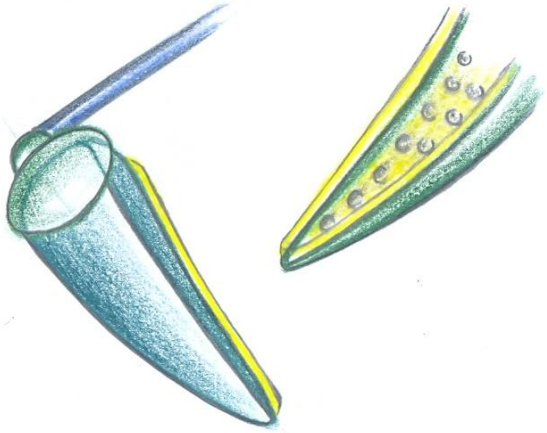
Acrylic plate & led's on edge

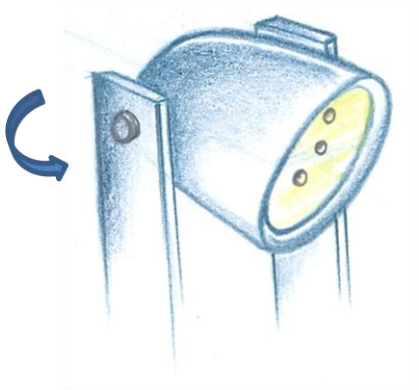


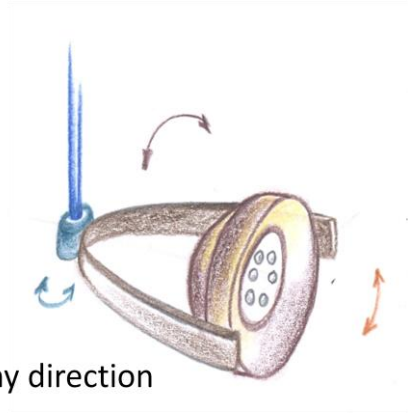


Three different shades

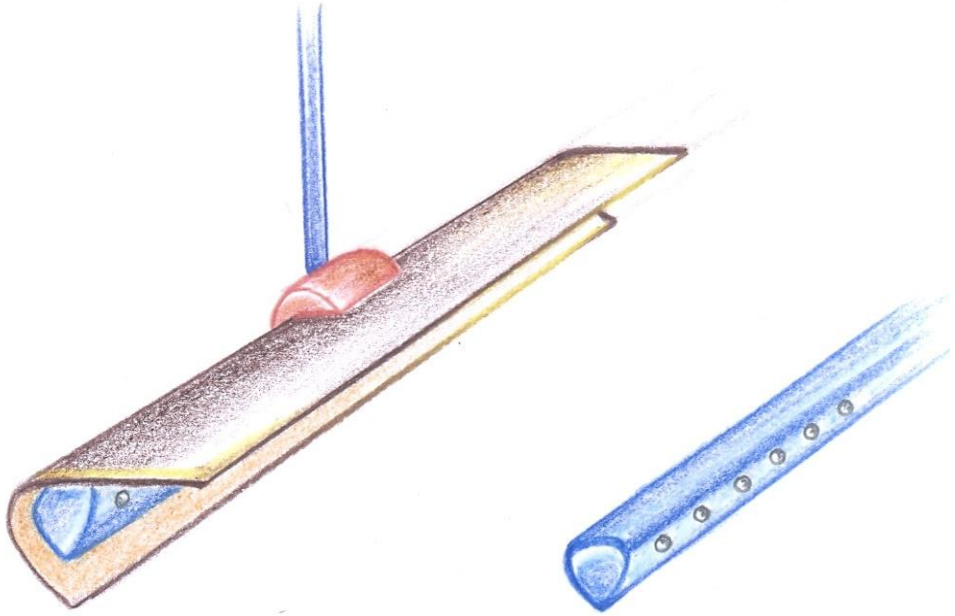


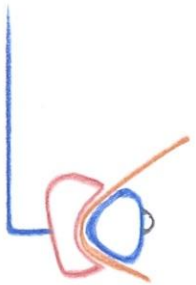


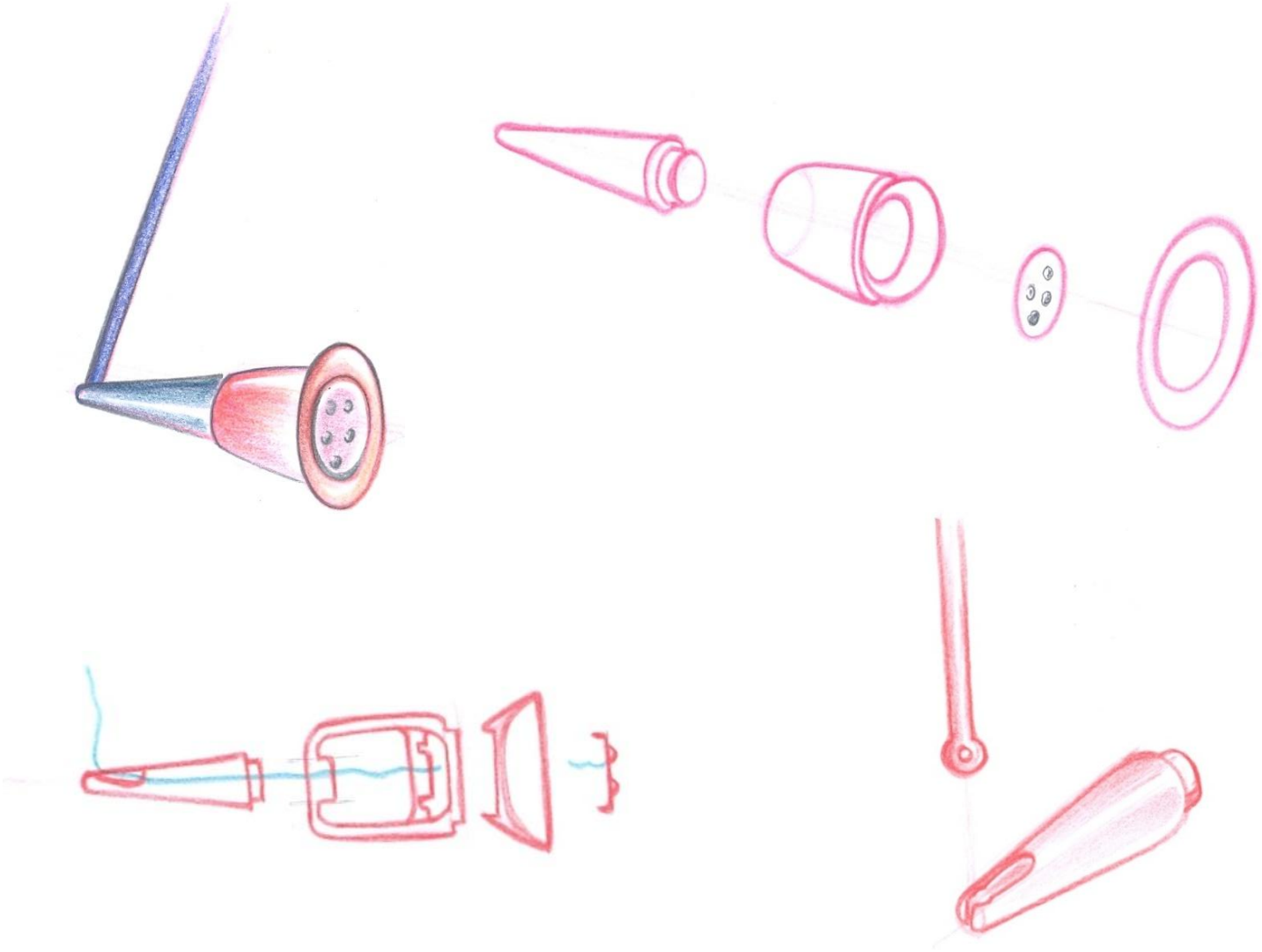


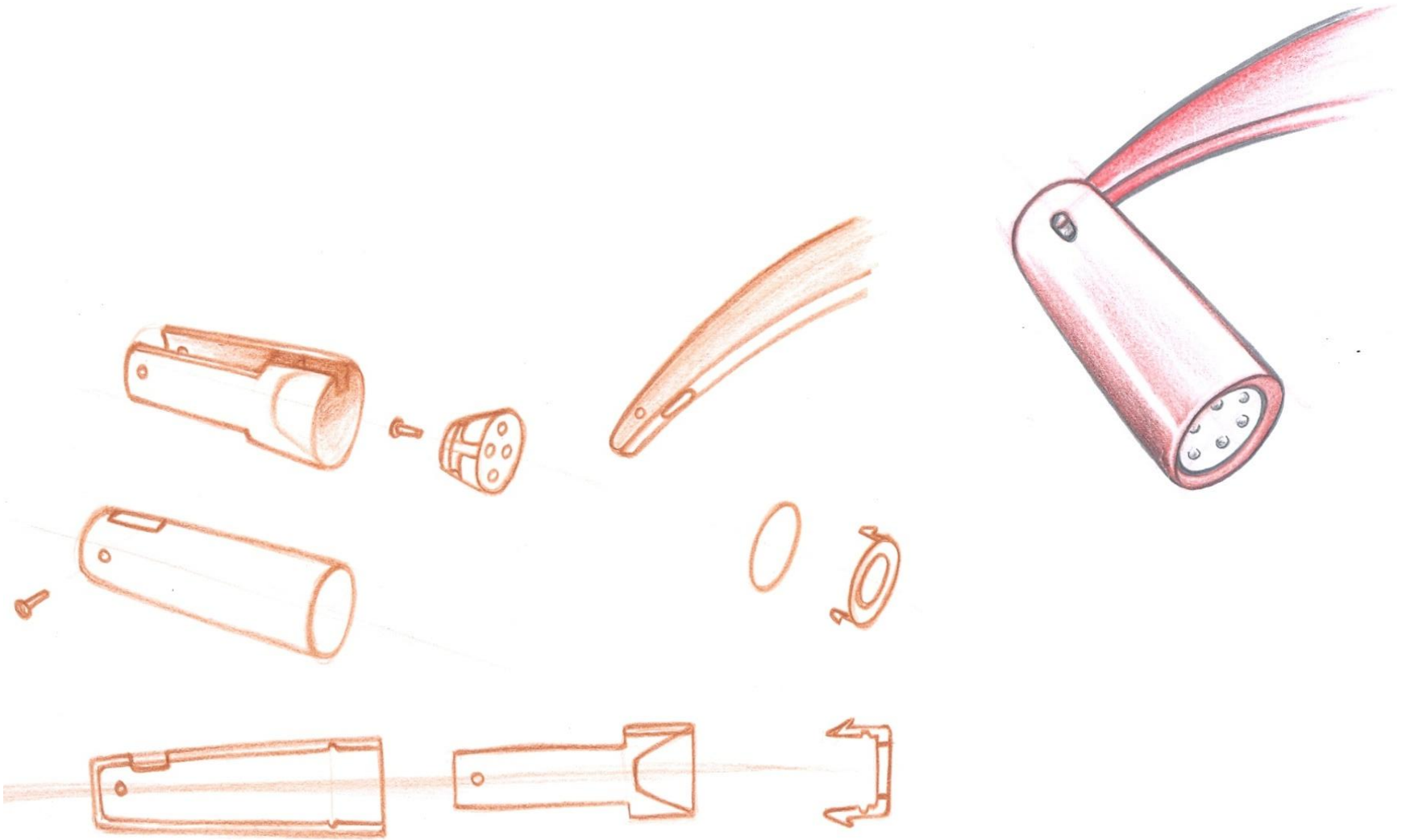


Movable in any direction

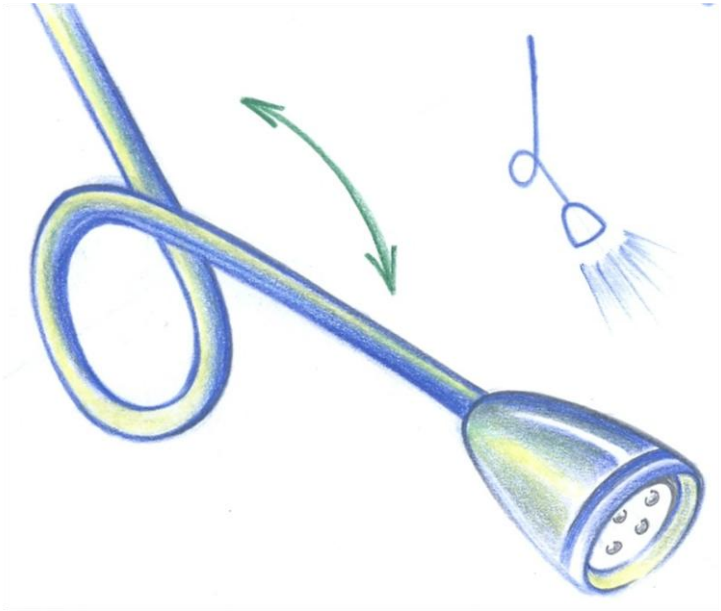


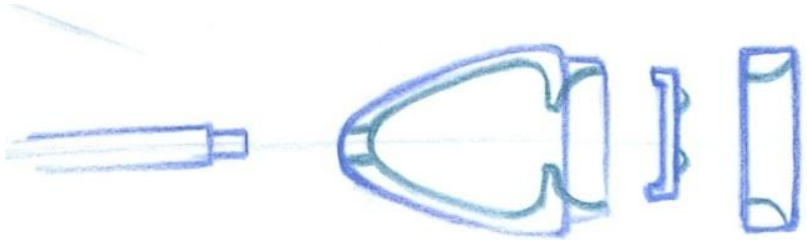


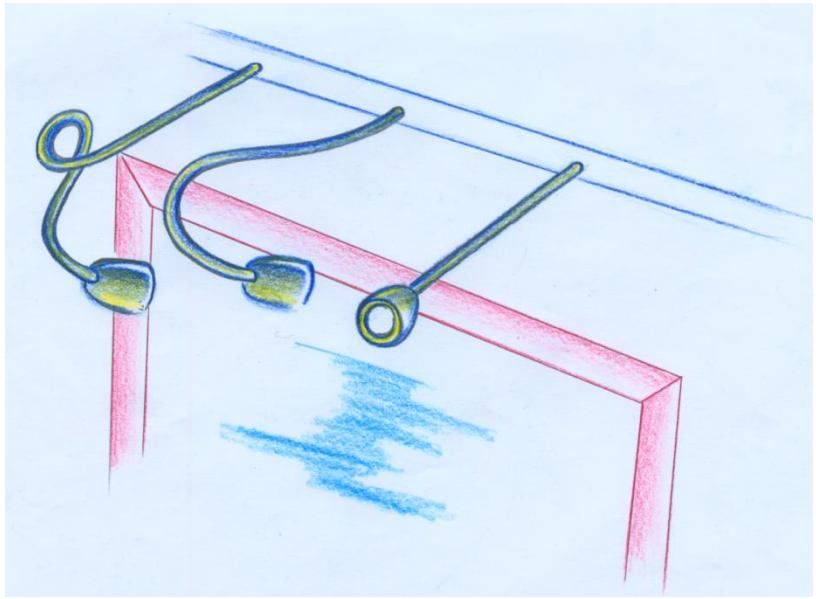




Goose pipe for easy adjustment



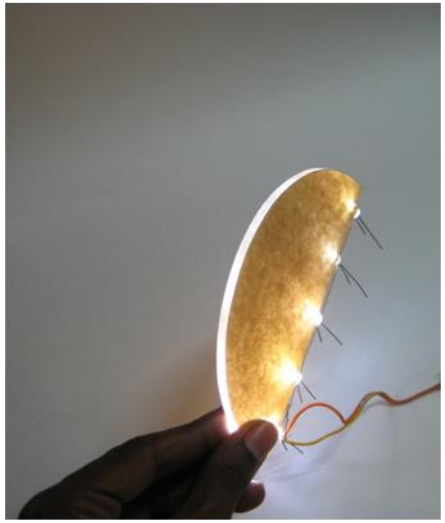


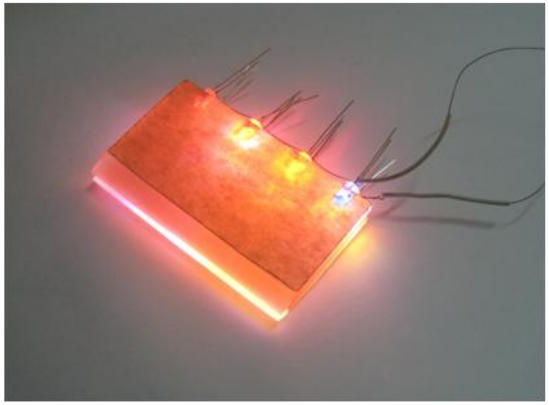


Initial Exploration:

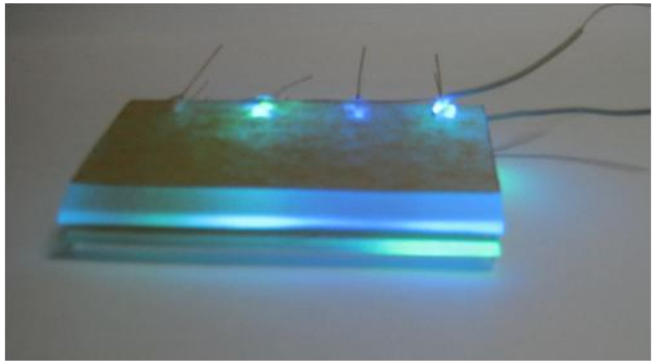
- Some ideas were tested to check their potential
- Different arrangements for position of track lights were tried out
- Different assembly possibilities, detailed drawings

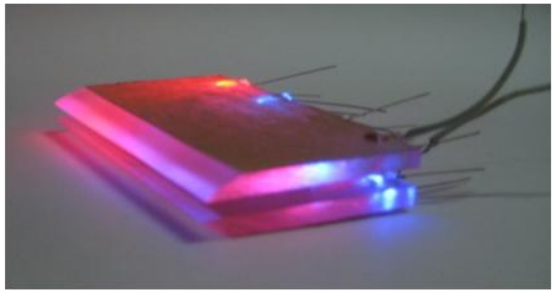
L.E.D.s in Acrylic:







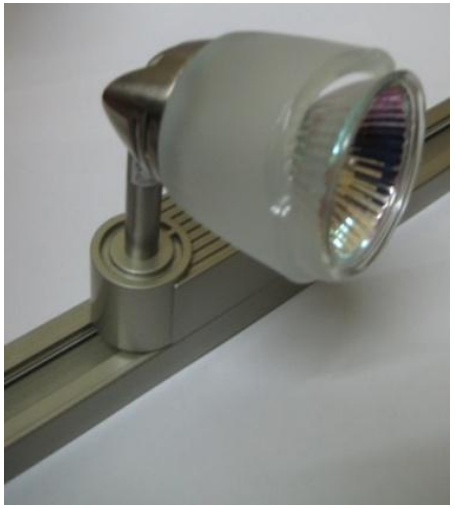




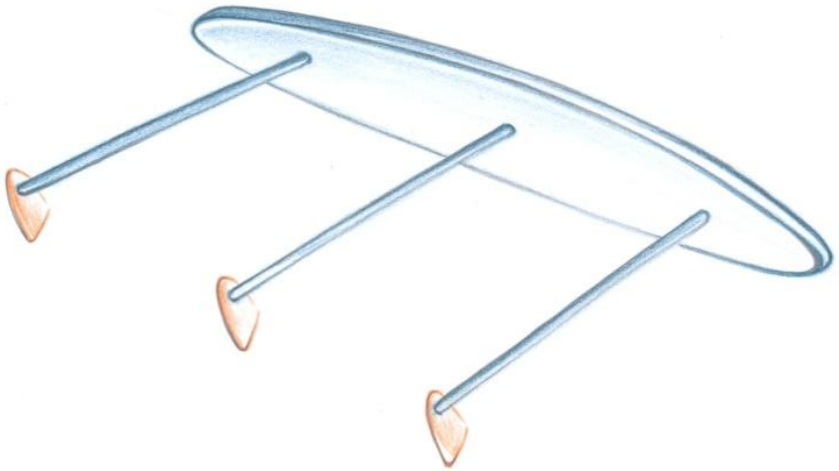
Study of existing products:

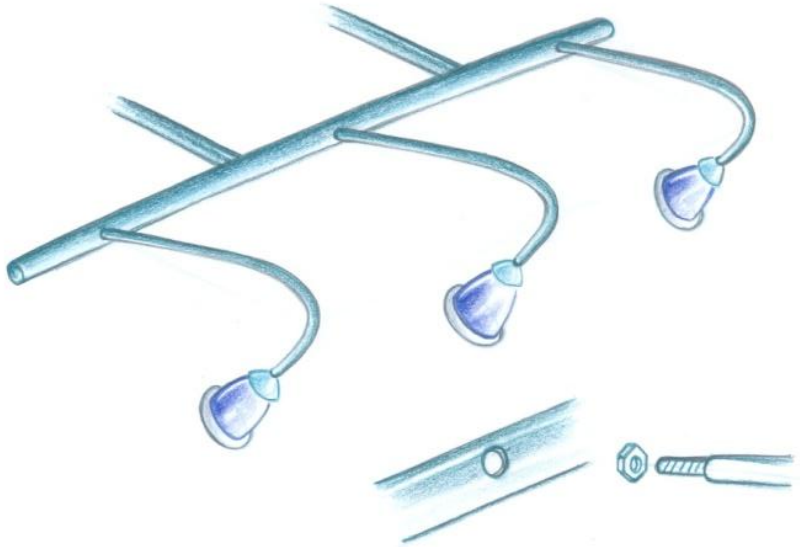


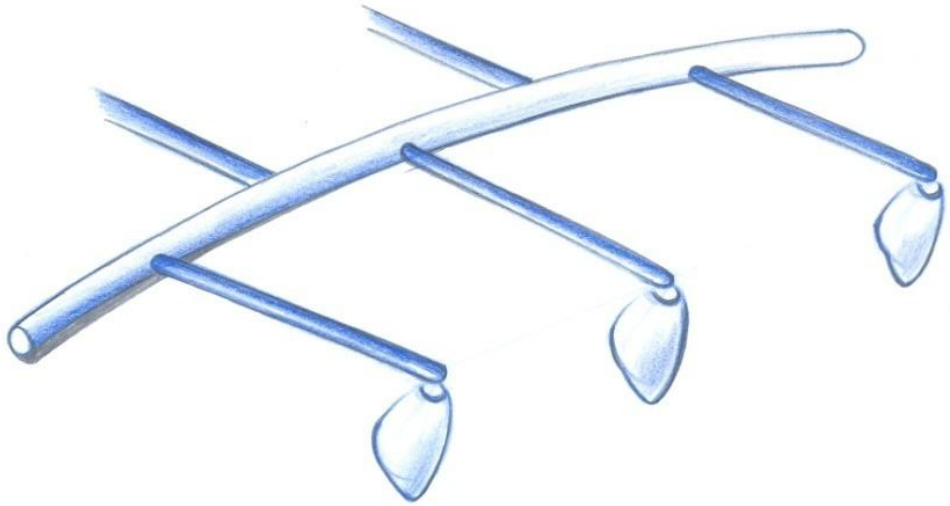


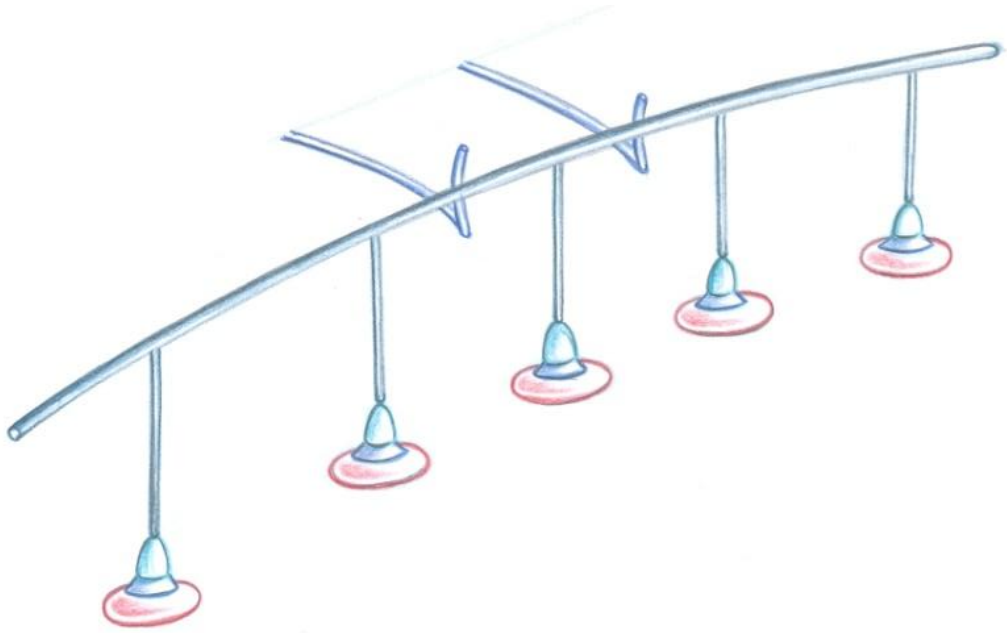



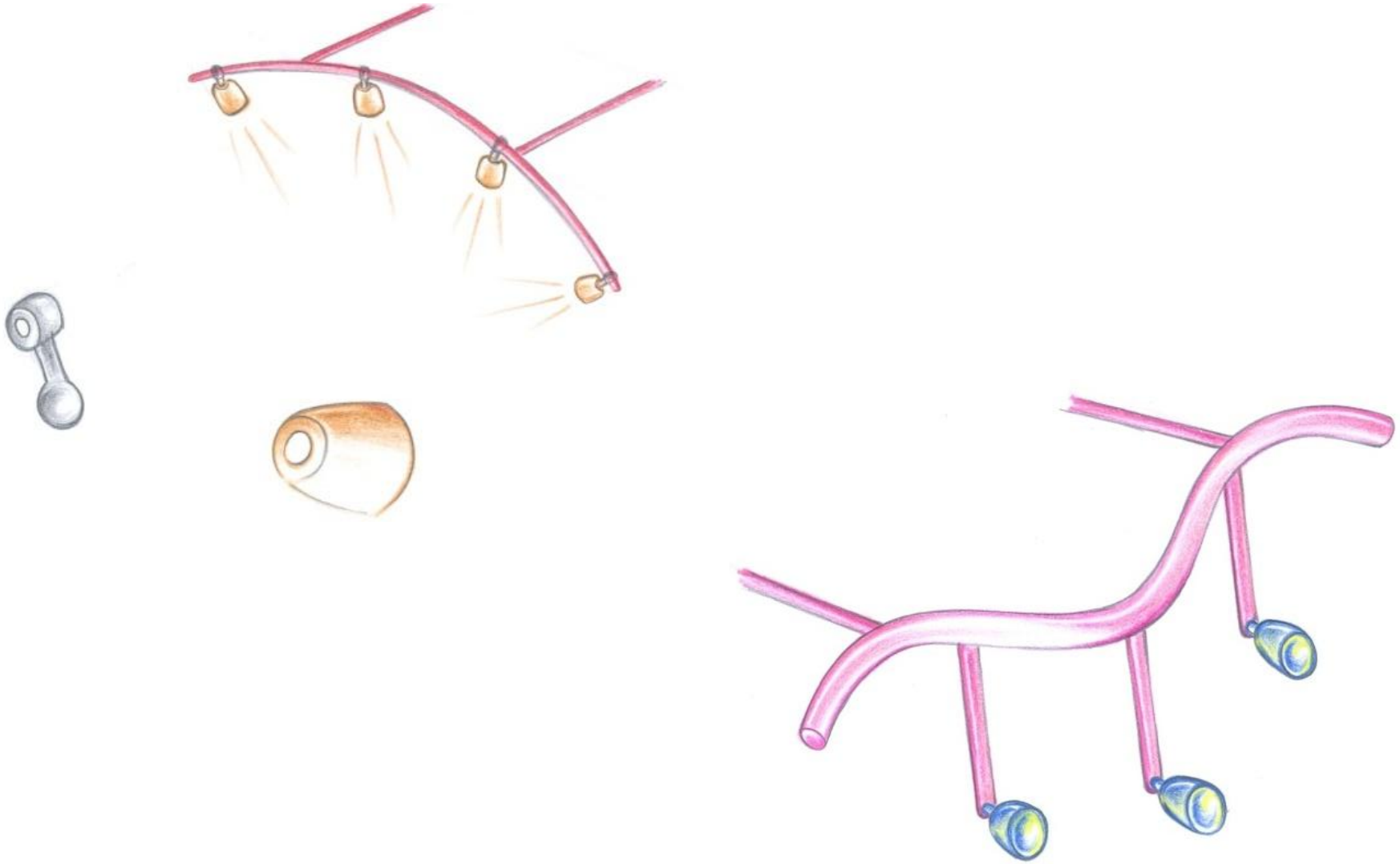
Positioning of lights:



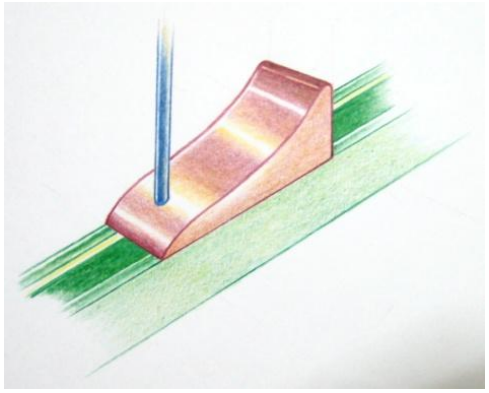
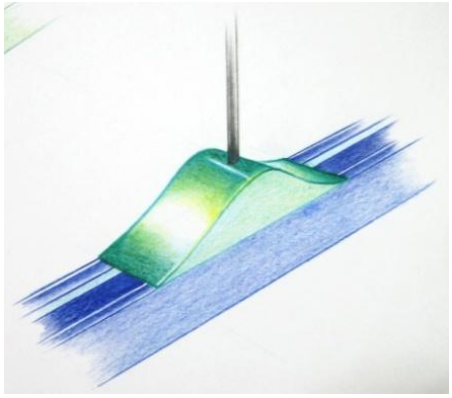
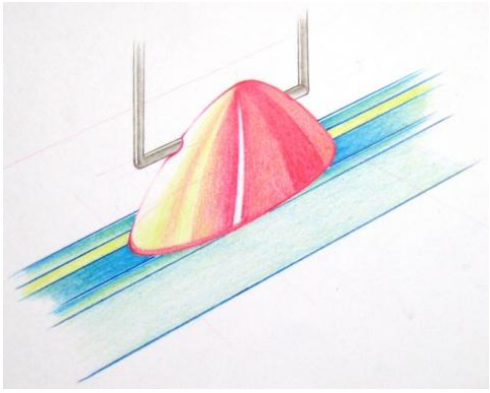
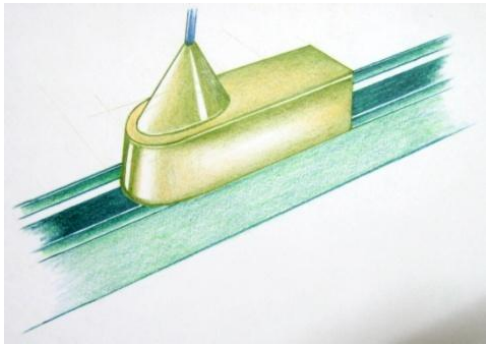
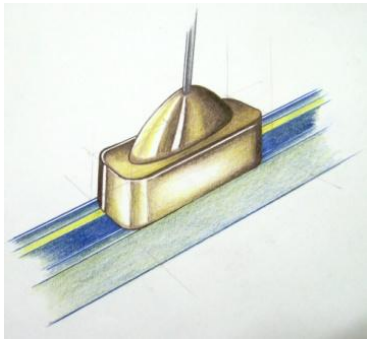
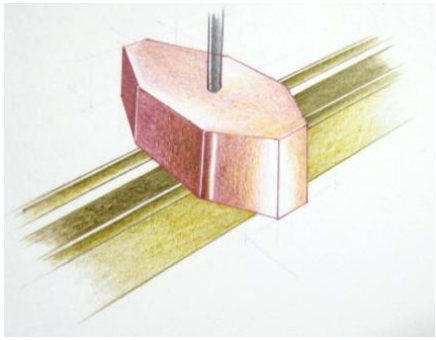
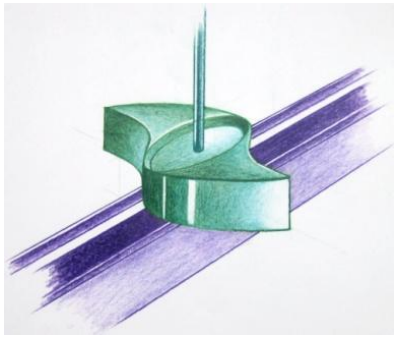






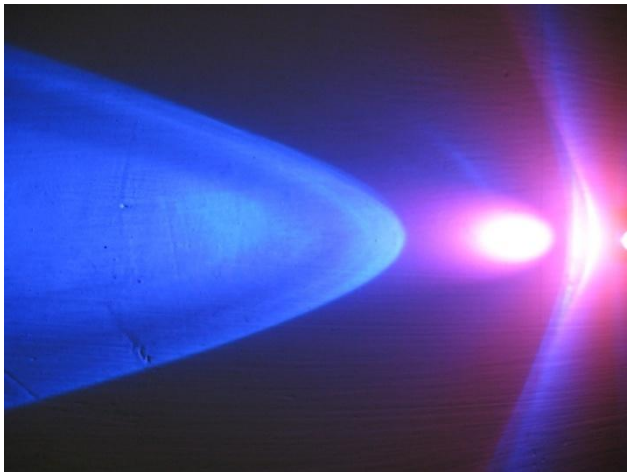


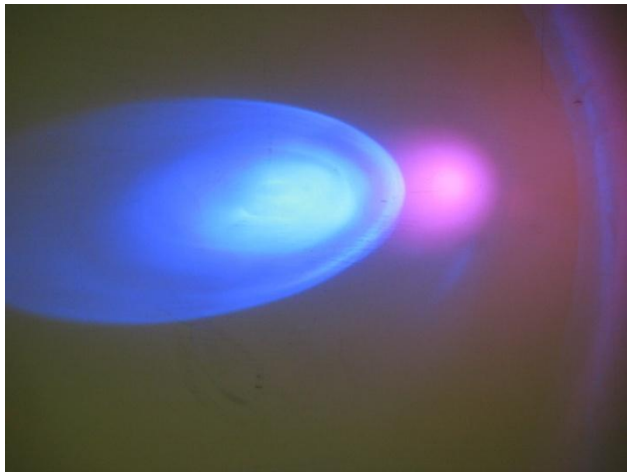
Various form possibilities for base of a track light can be seen below:

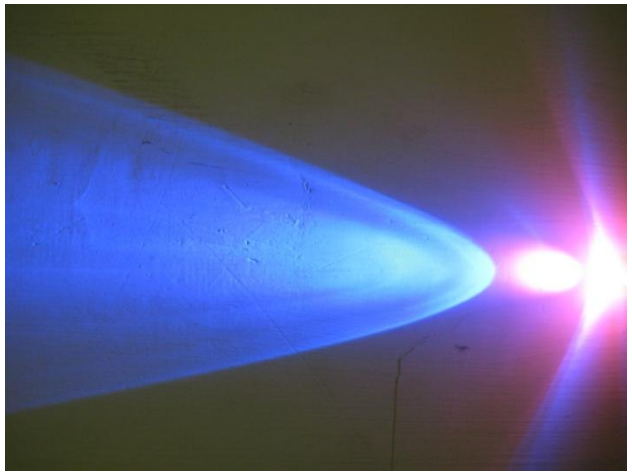








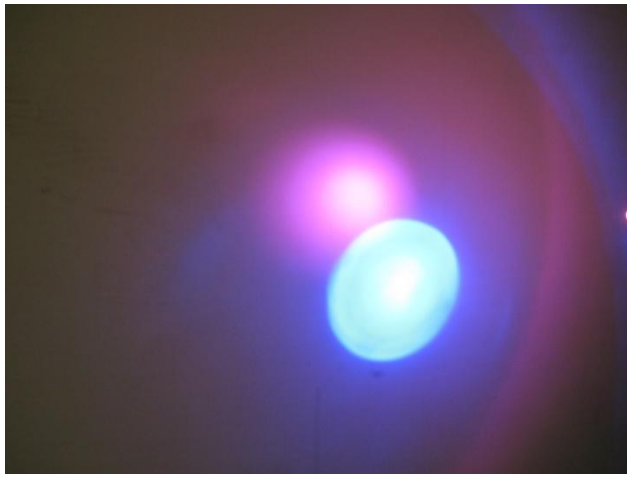
Explorations with light and materials:

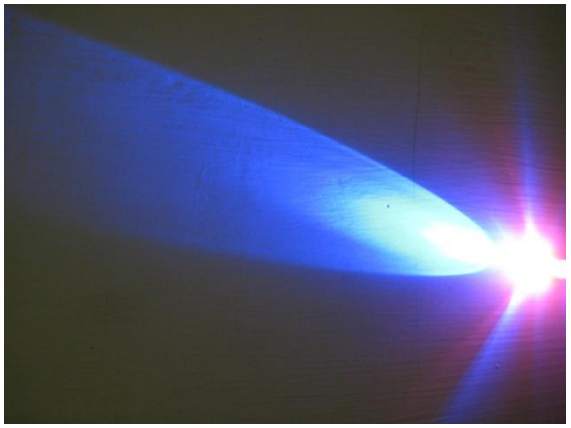
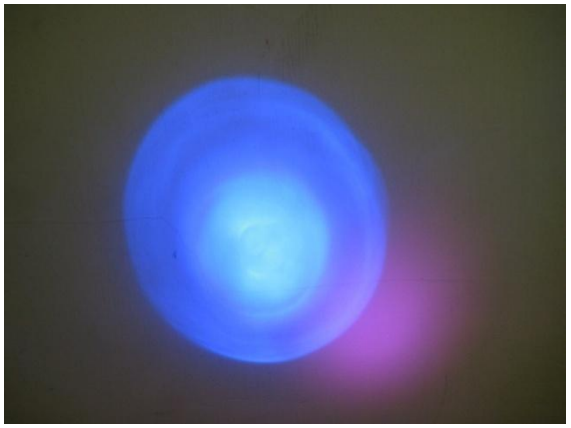
Light effects using two different colour led's are as follows:

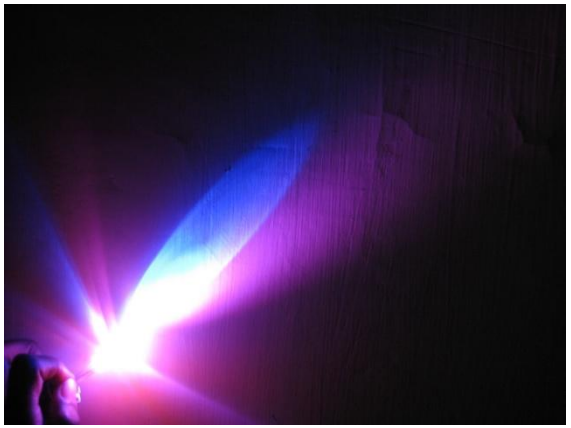




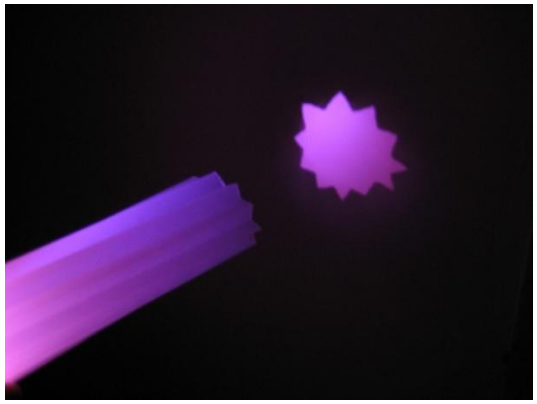


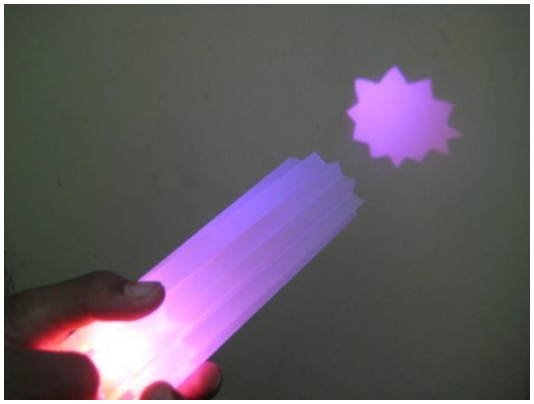


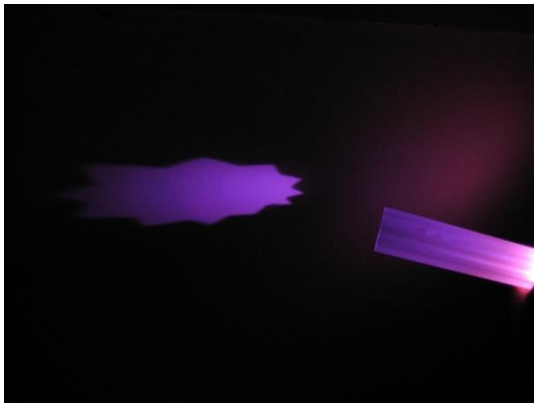



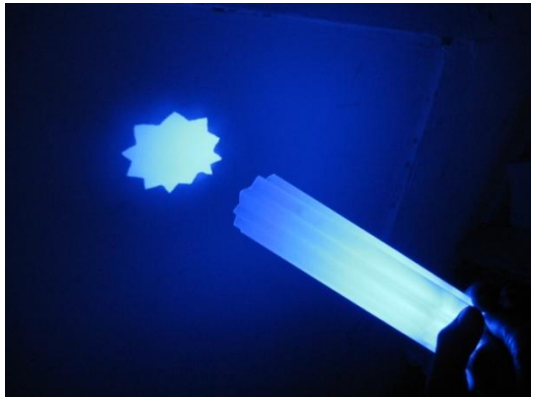


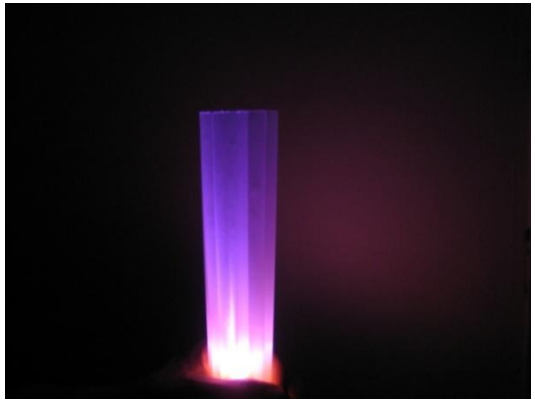

Various light shades using Led in translucent paper:

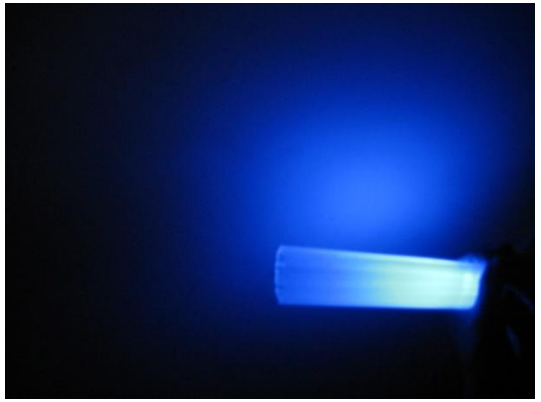




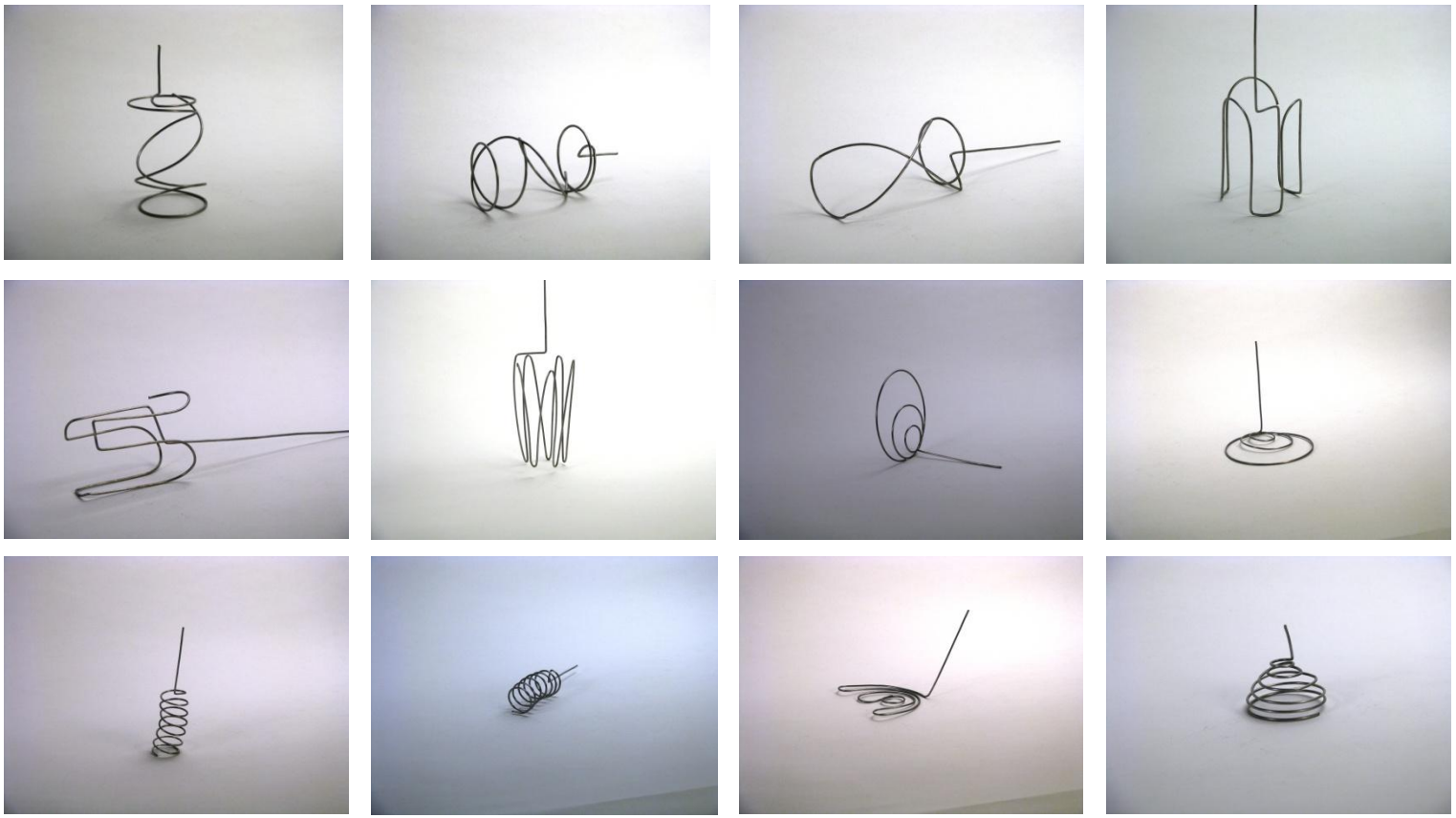


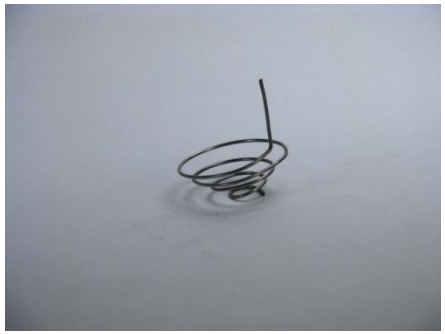
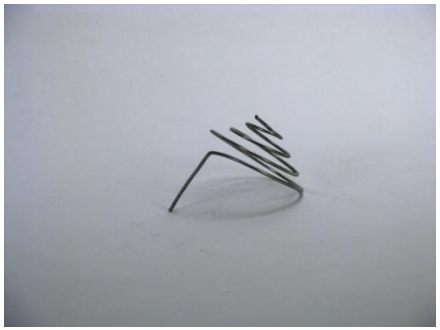
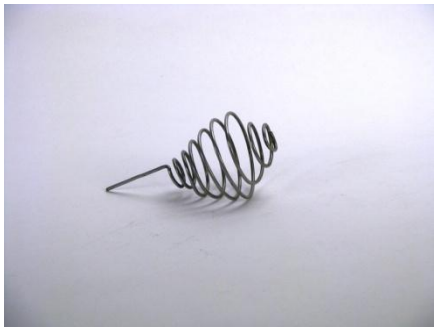
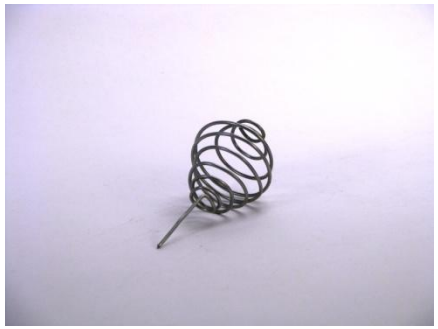






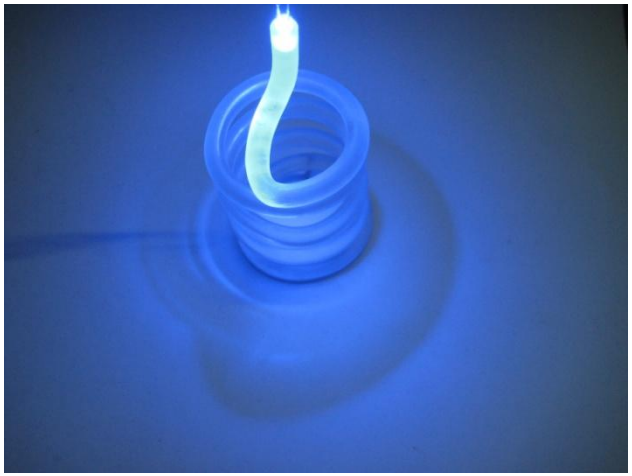
Various possibilities for acrylic rods are explored in wire, some of the pictures are as follows:

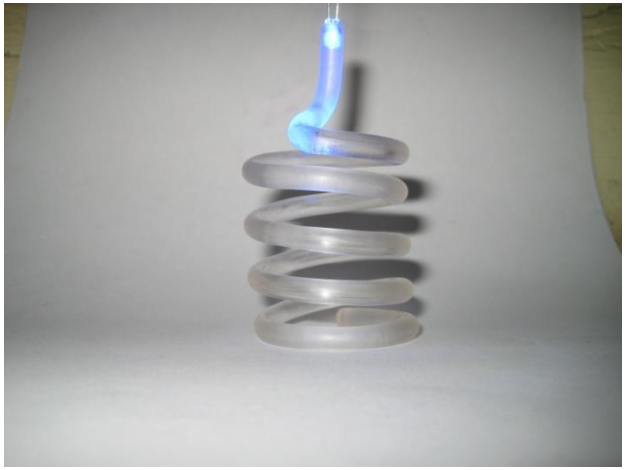


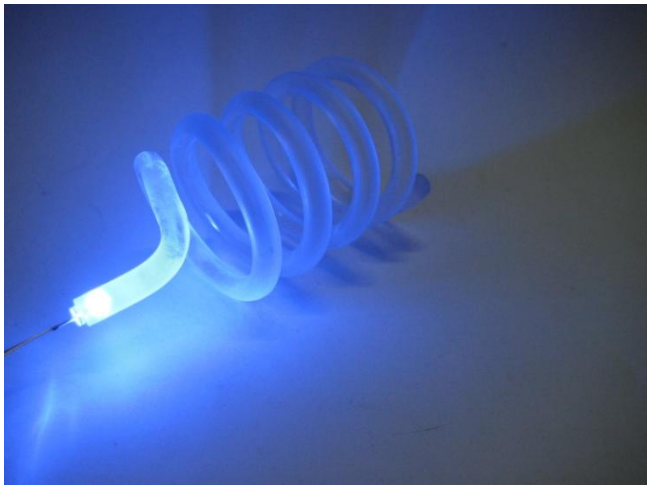
Led and acrylic rods:

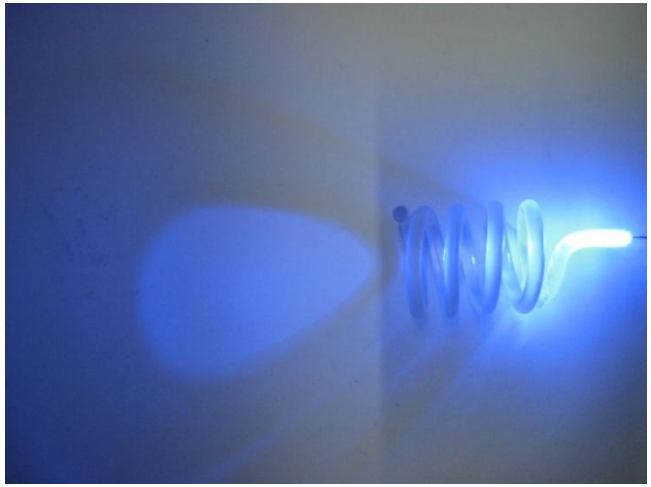
Acrylic transfers good light through it, spirals are made using acrylic rods.

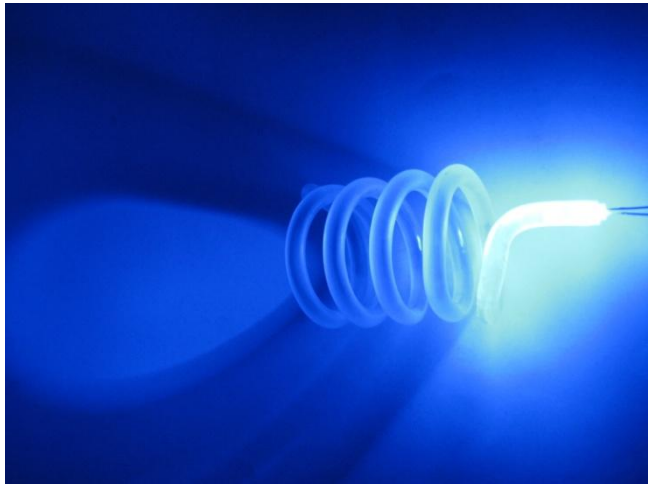




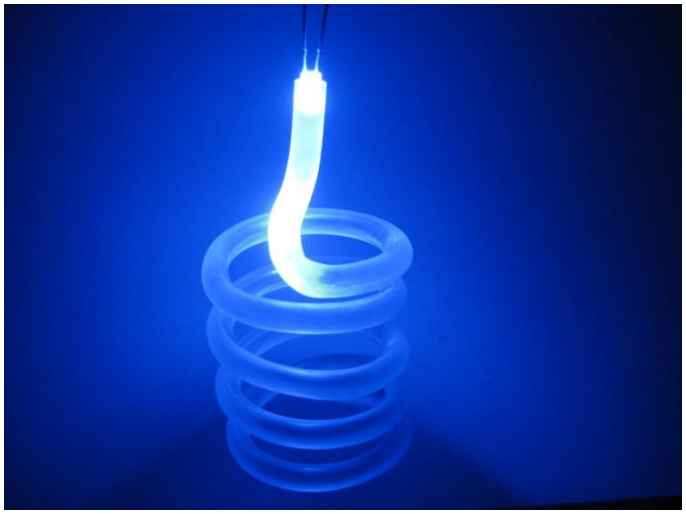
Effect of acrylic spiral light on the wall are as follows:



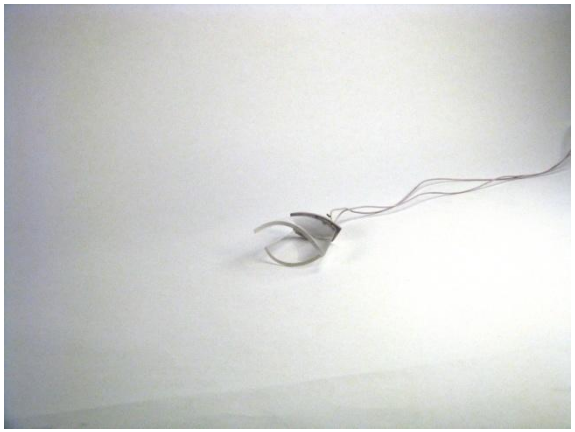


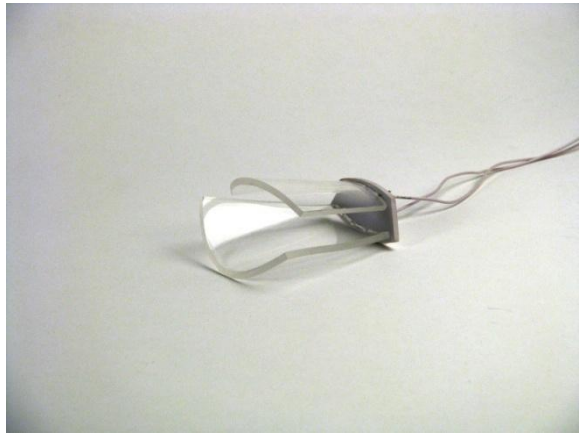


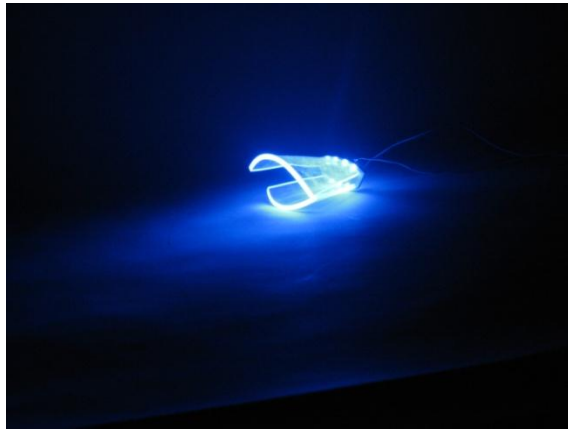
Some close ups of Acrylic spiral light, giving good ambience:

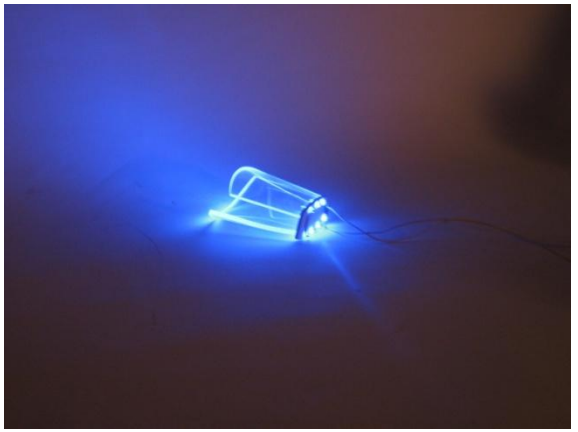


Led's inserted in formed acrylic sheet:

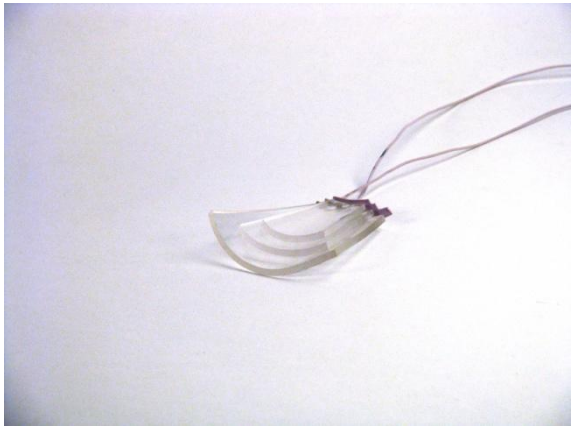
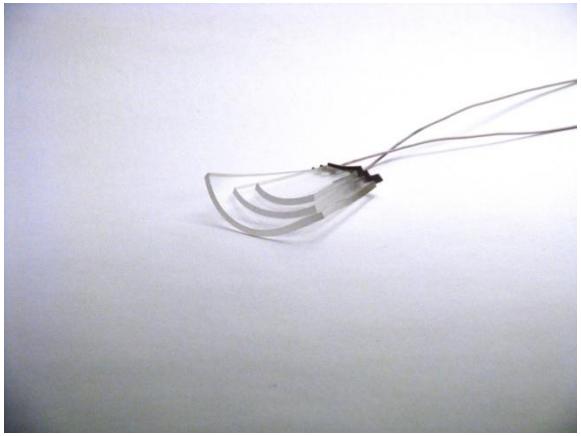
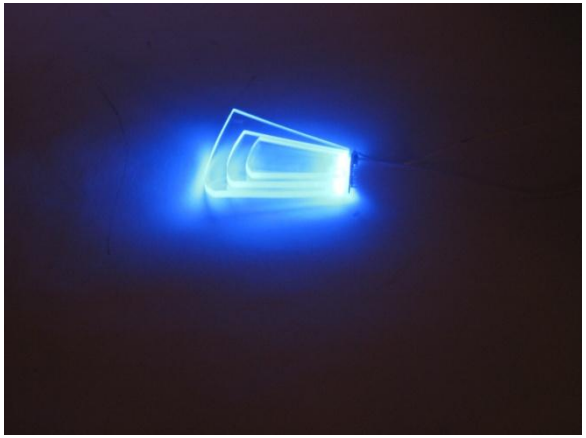
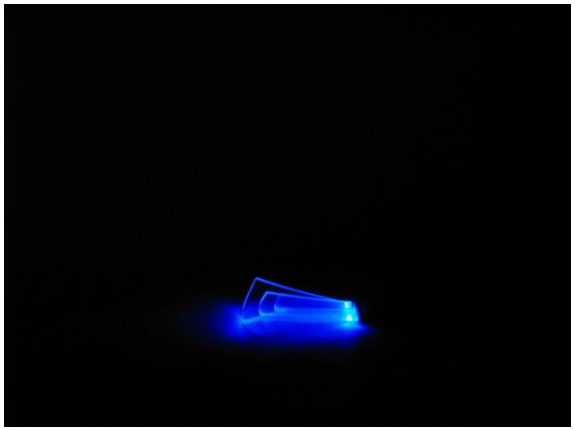
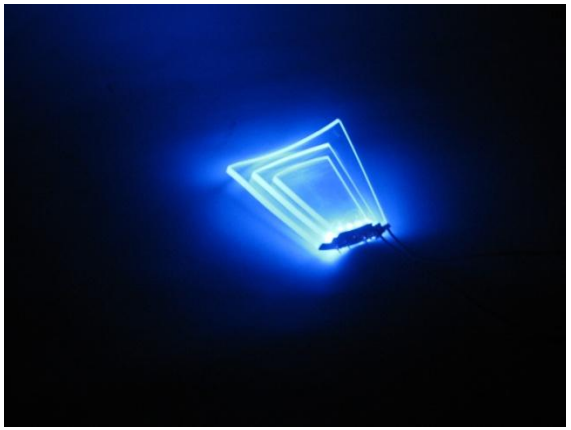




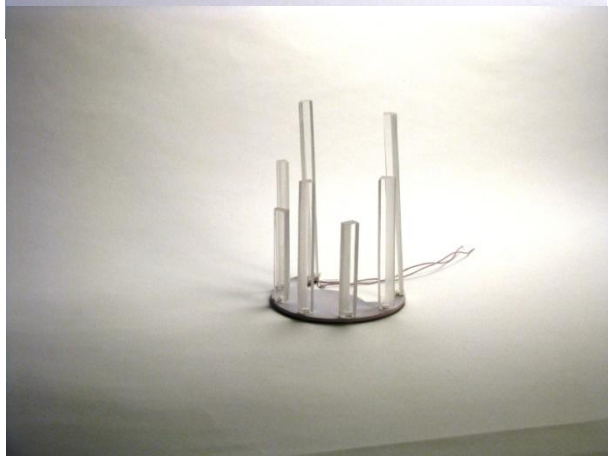


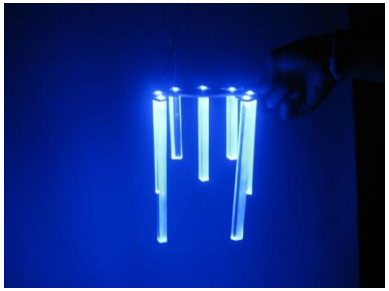


Curved Acrylic sheets placing one above the other:

Acrylic bars fixed to circular base with led inserted in it:

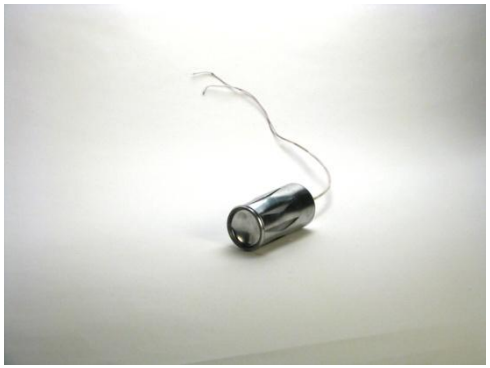


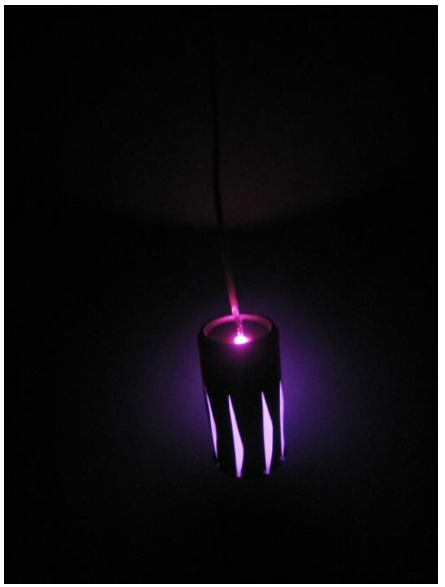


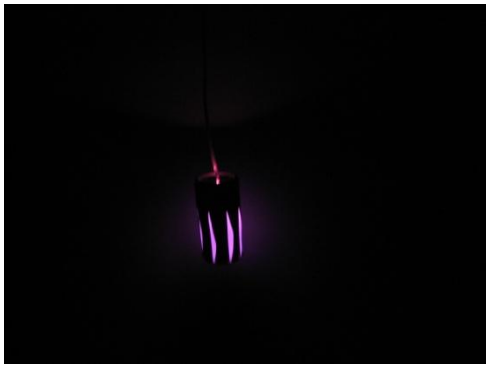


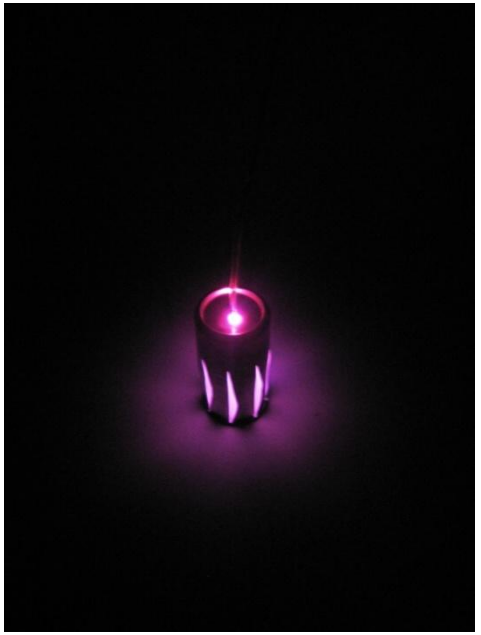



Can with a profile cut, effect of translucent paper and led:

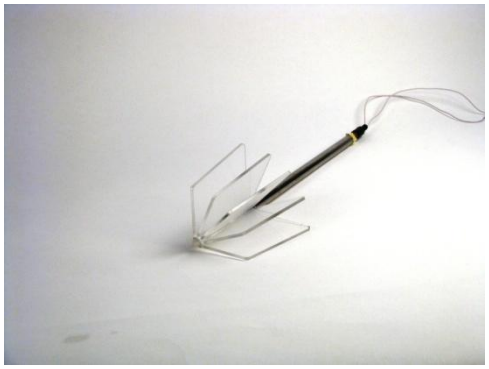
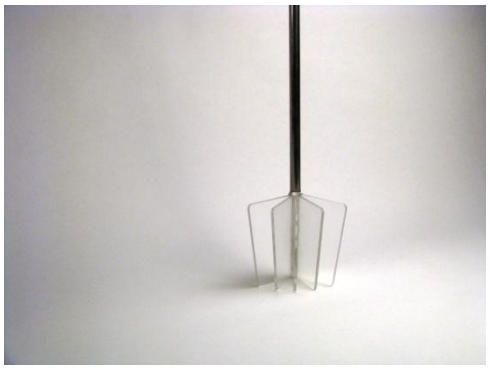




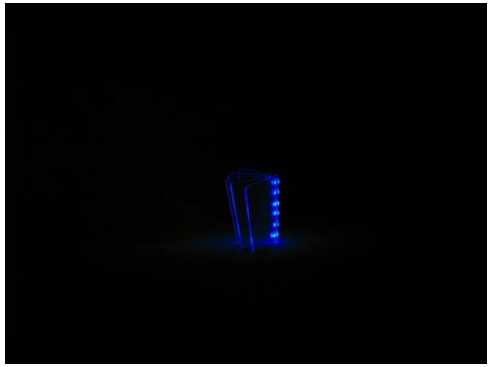




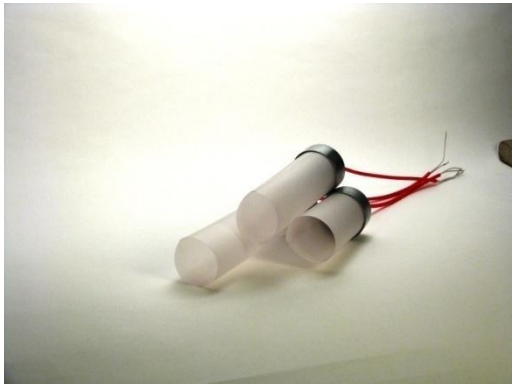
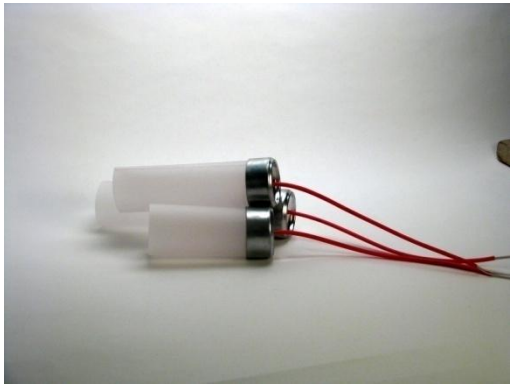
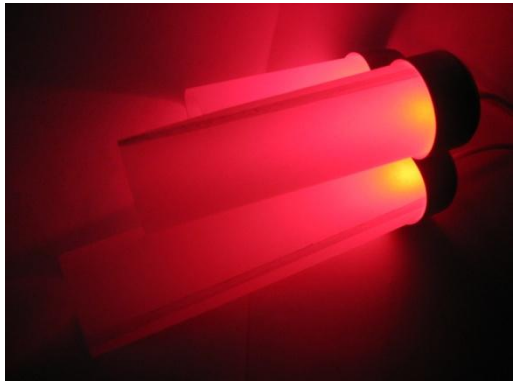
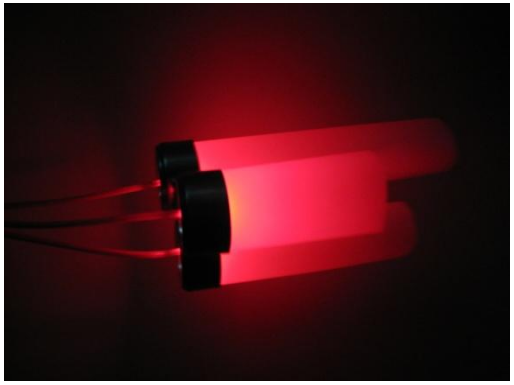
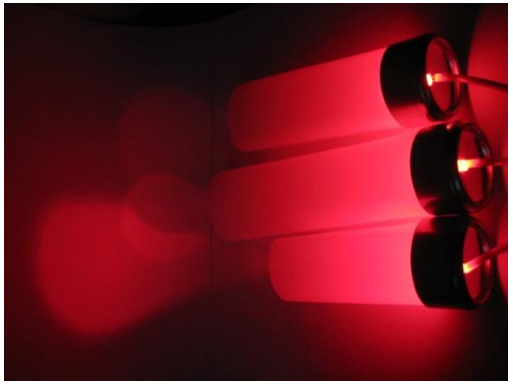
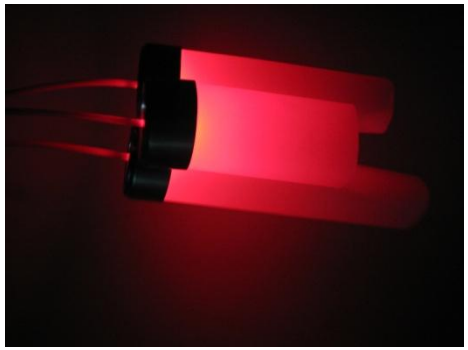
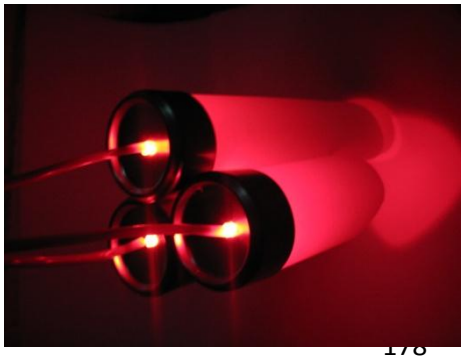
Light hanging from wall, using acrylic plates and led's:

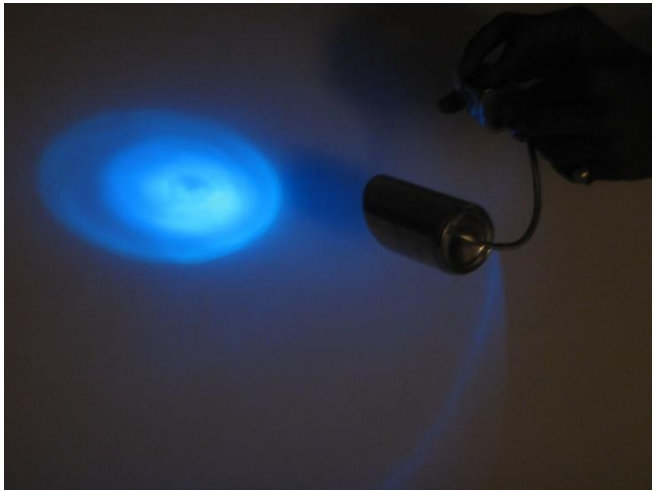



Translucent paper and led, hanging lights:

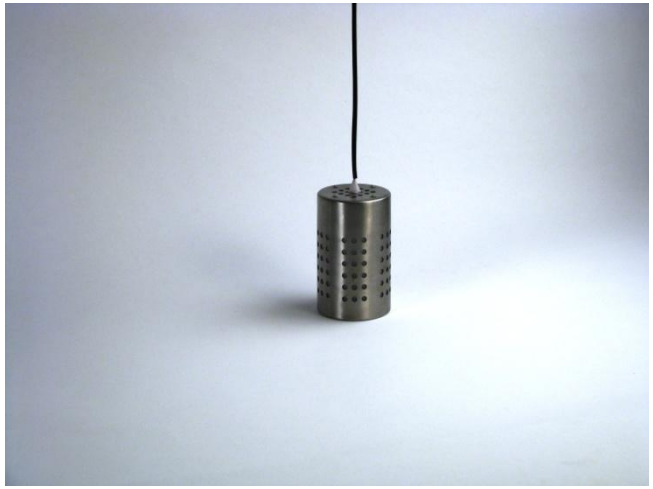









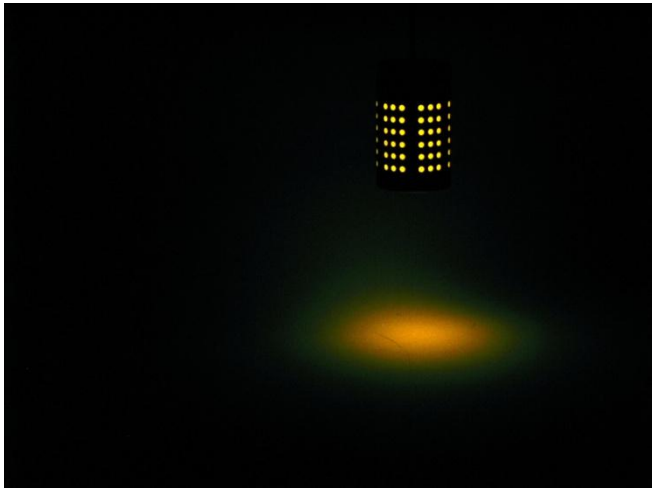
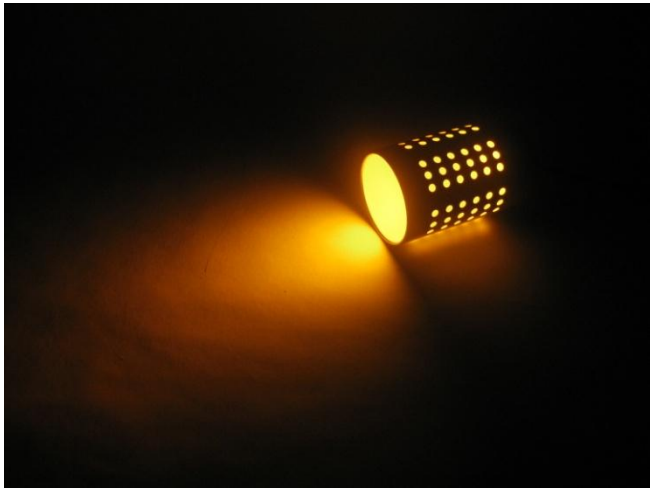
Light using single led, goose pipe for easy adjustment:



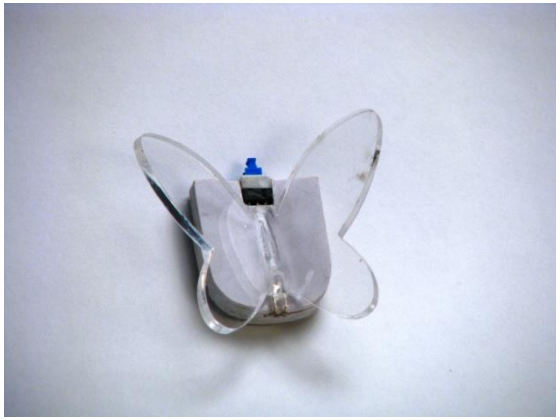
Various shapes from the same category which is shown above:

Translucent paper and led, holes are provided on circumference gives good effect:

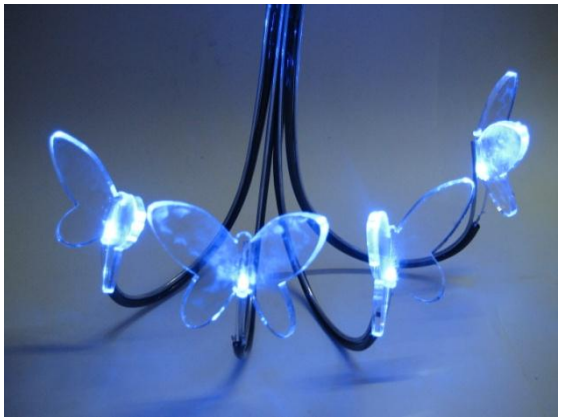



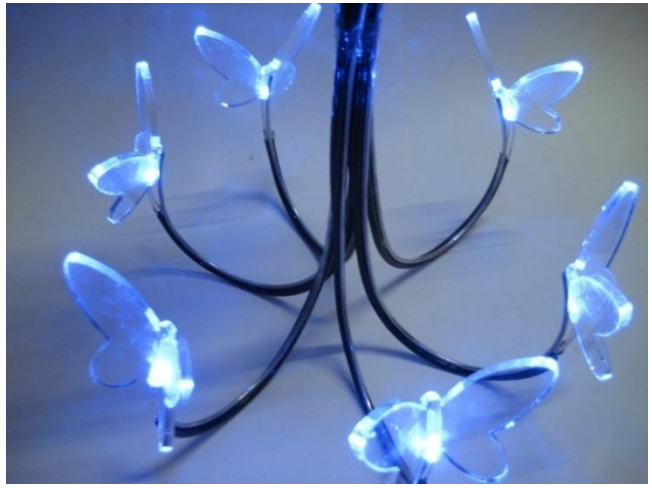
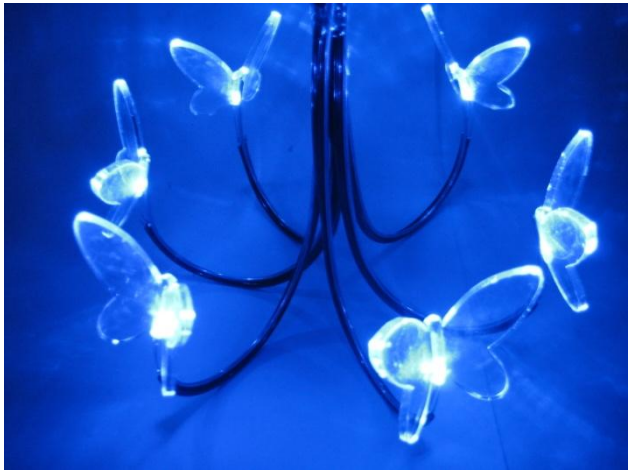

Light butterfly: Butterfly with light and a globe a butterflies as below:







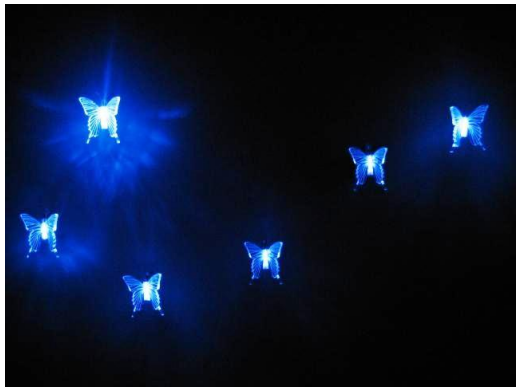



Tried out butterfly in other form with itching, gives good effect. In this case the battery casing is kept vertical to the wall. And considering butterfly as a single element various pattern can be created on the wall as below:

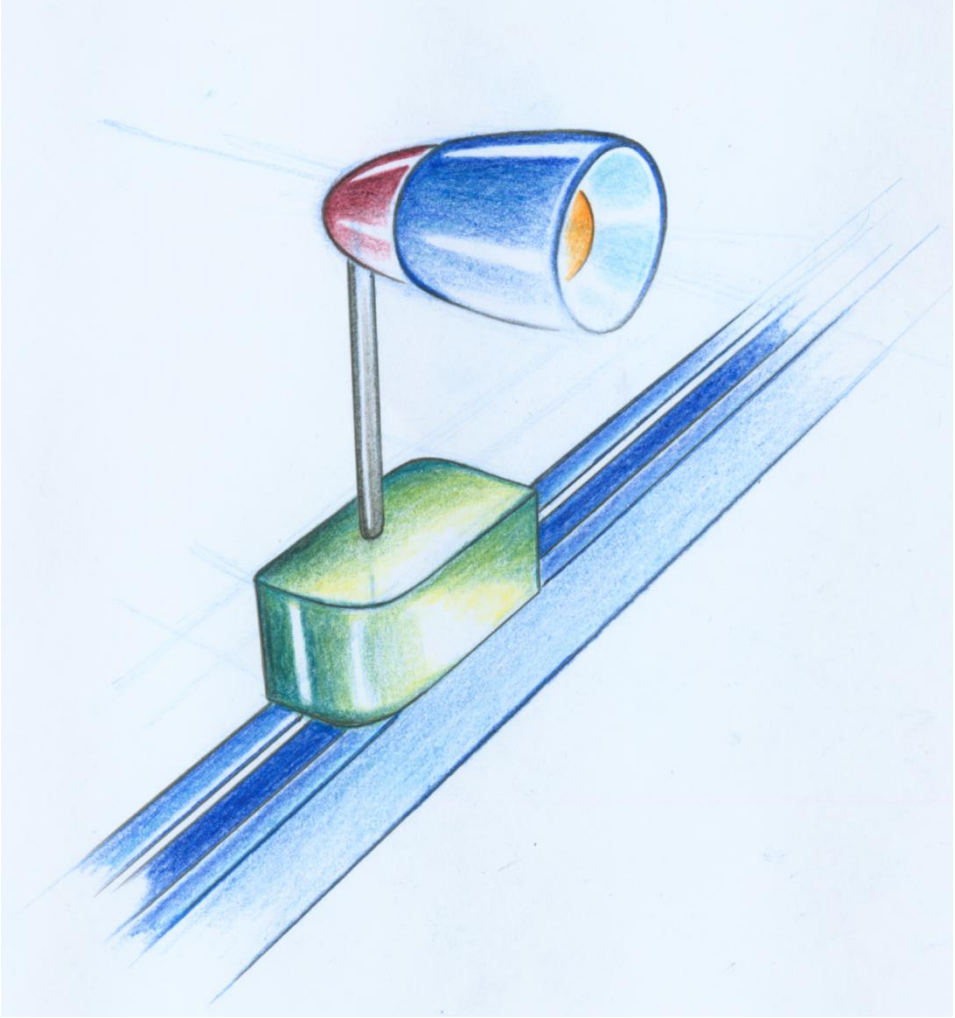




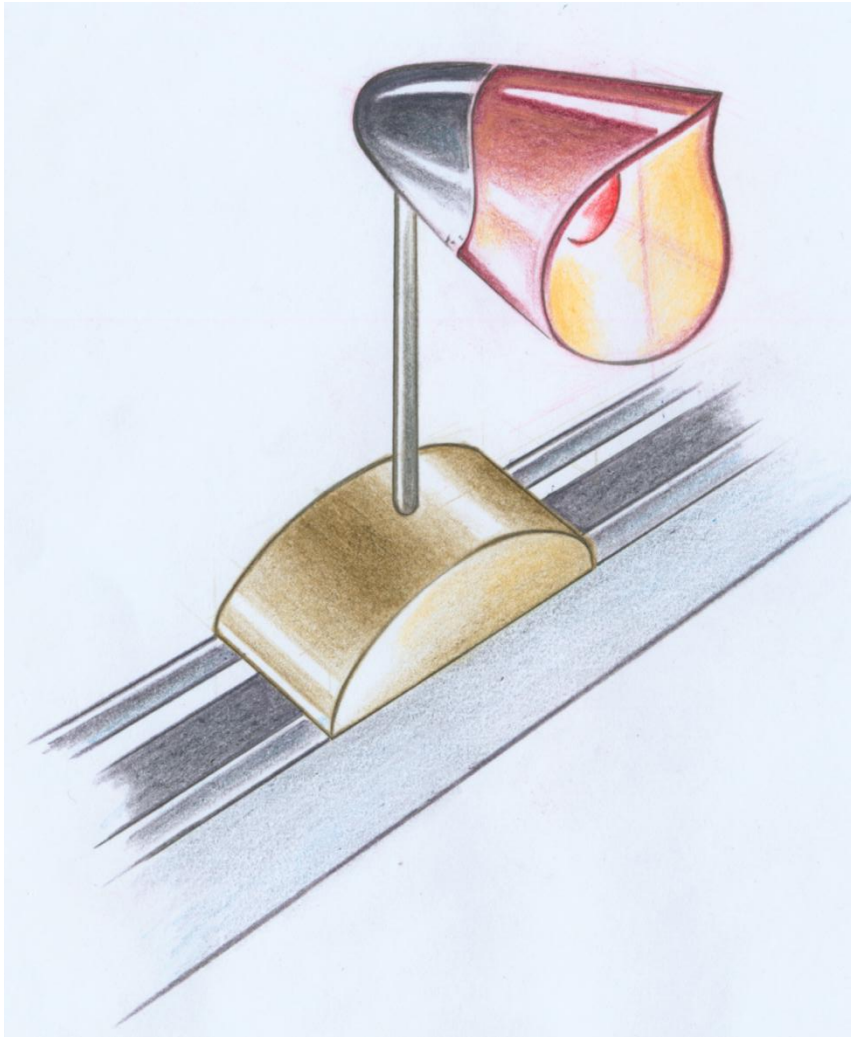



Concepts:

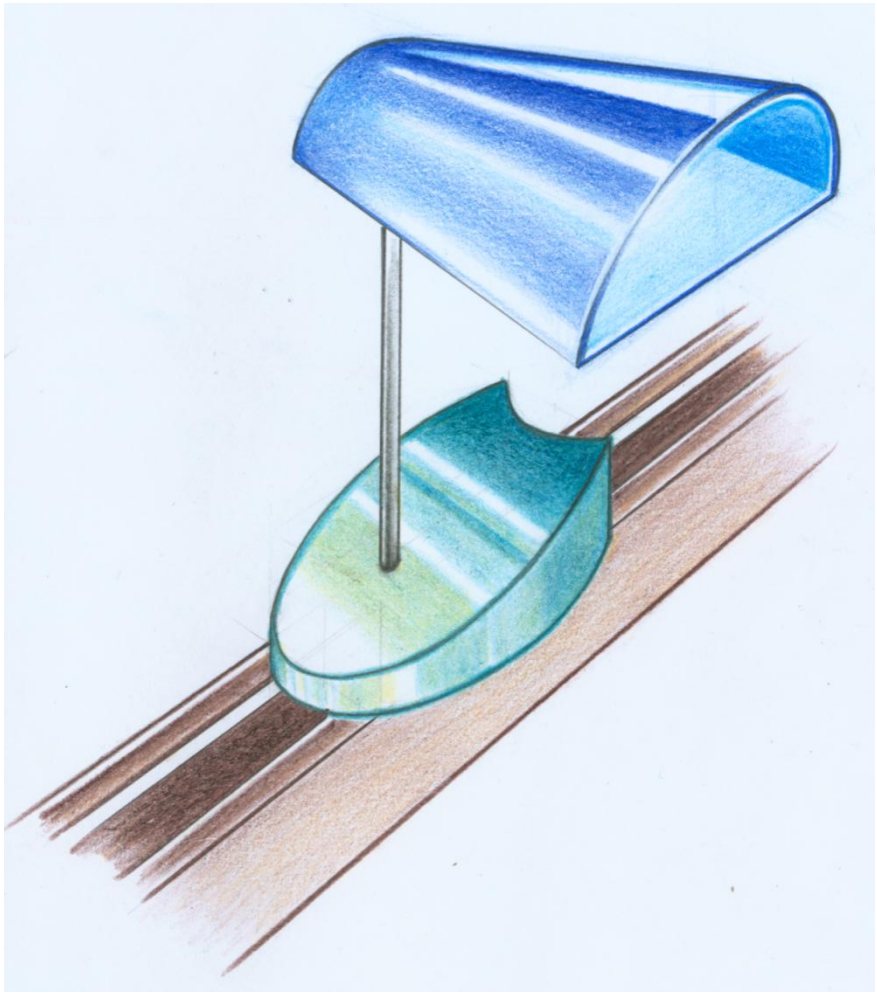
Concept 1-A:



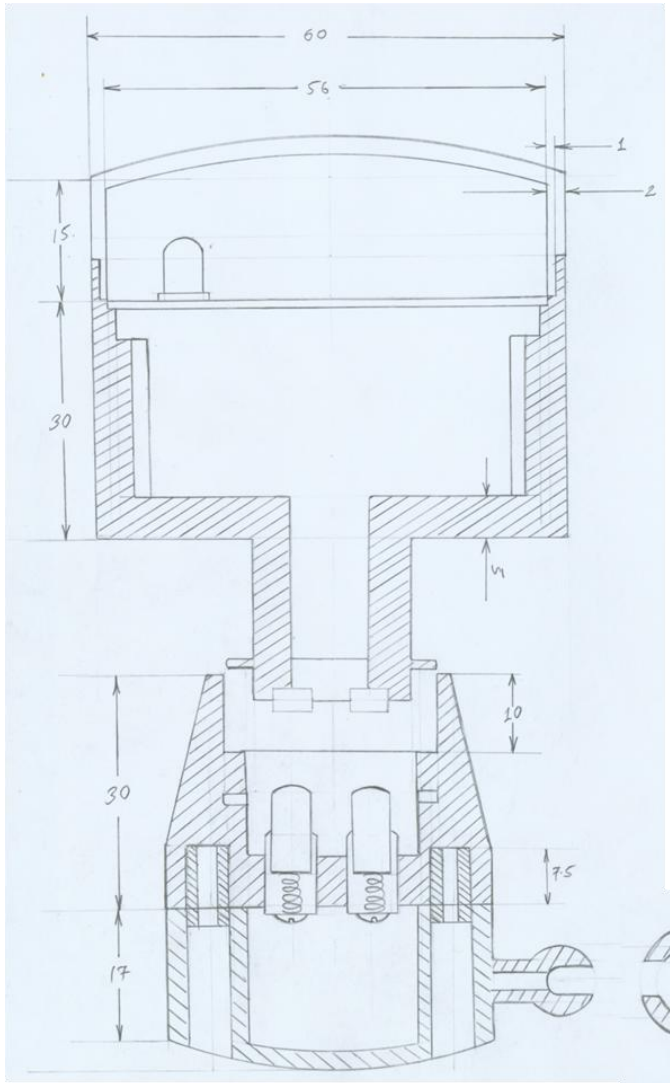
Concept 1-B:

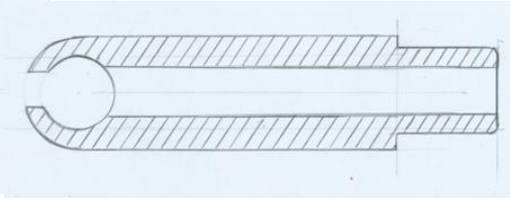


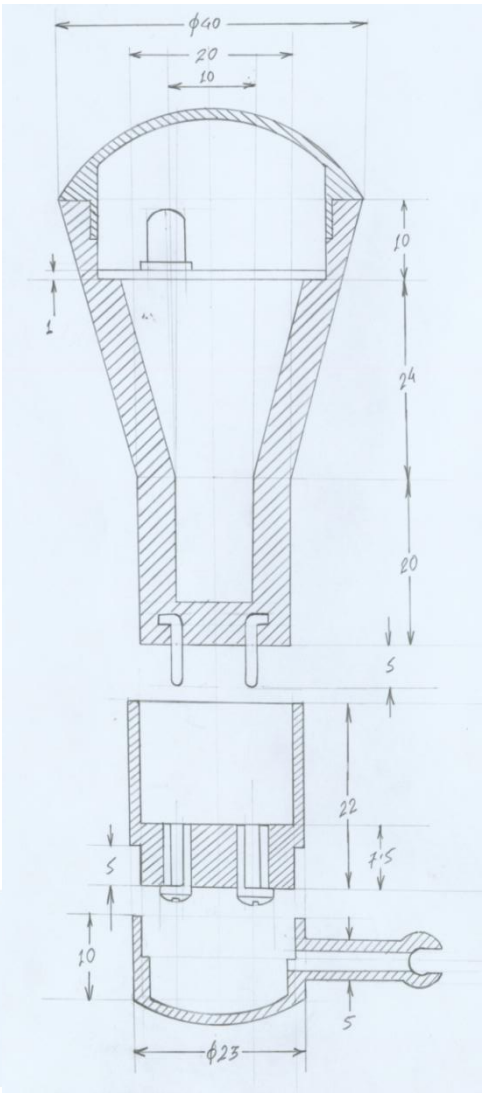
Concept 1-C:

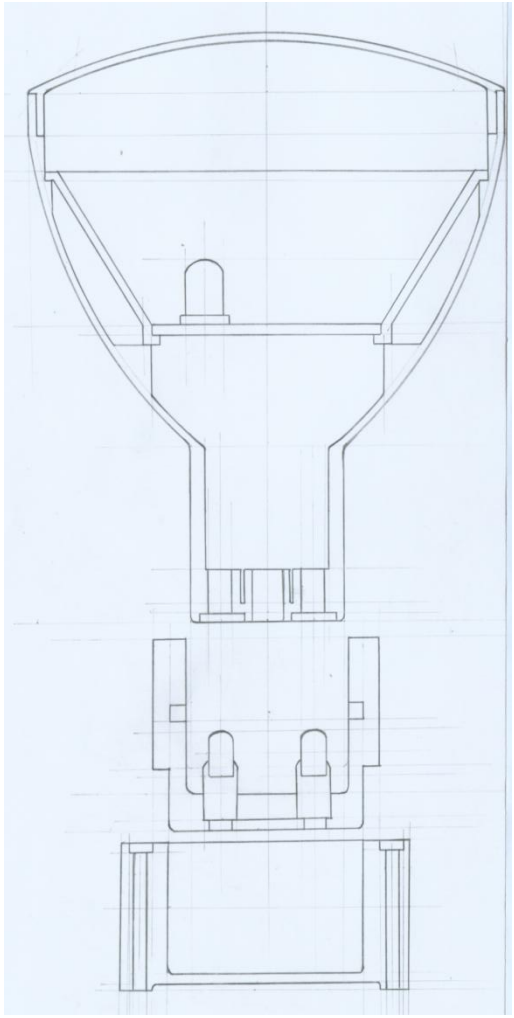


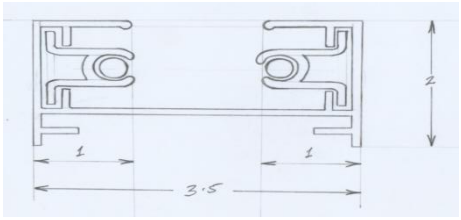
Detailing for led light and holder:

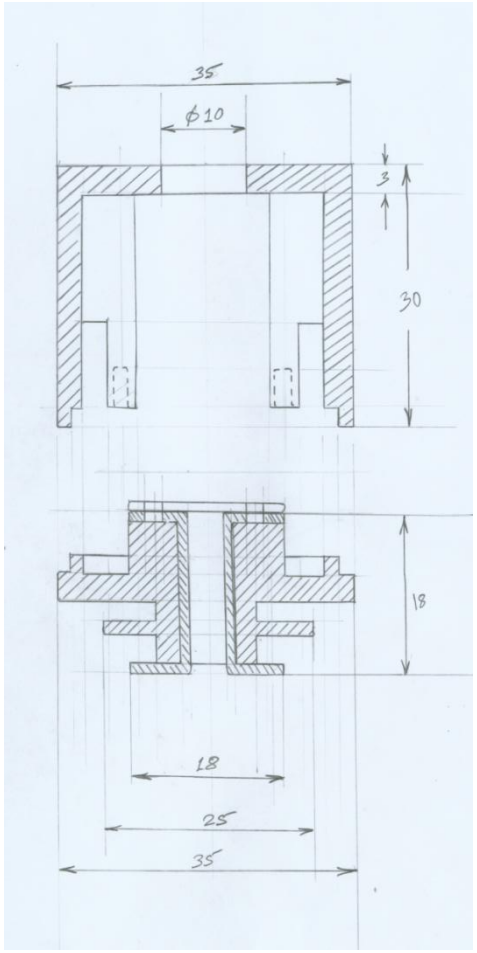




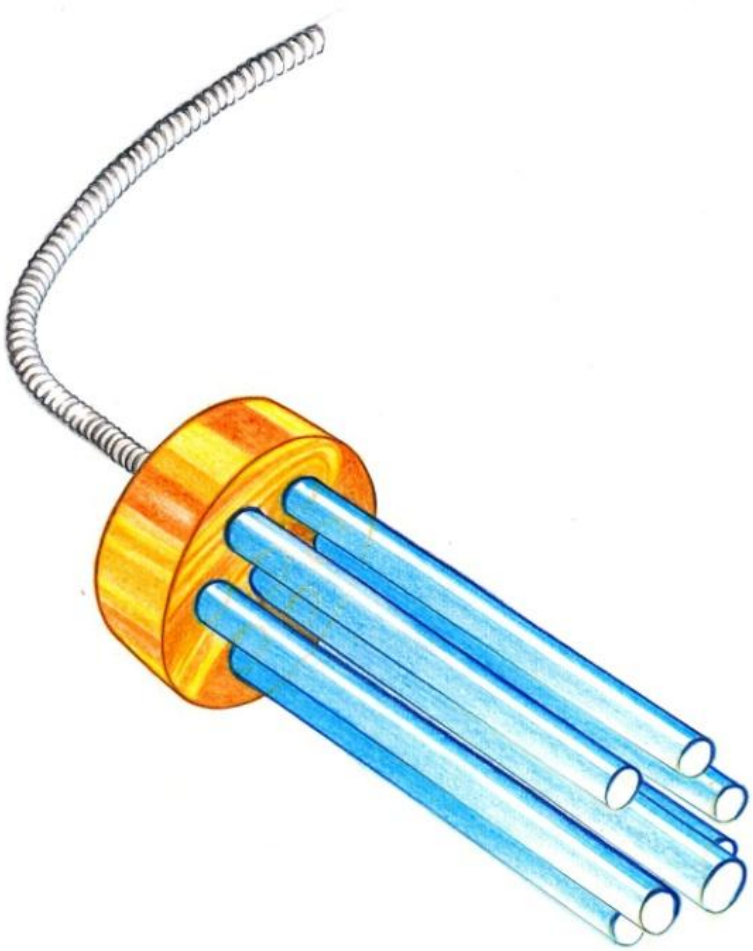




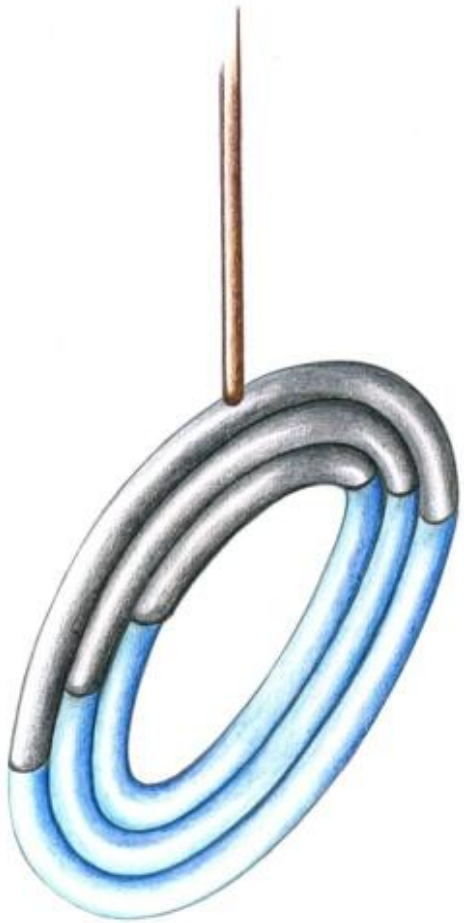

2
1
1
3.5


35
ϕ10
3
30
18
18
25
35

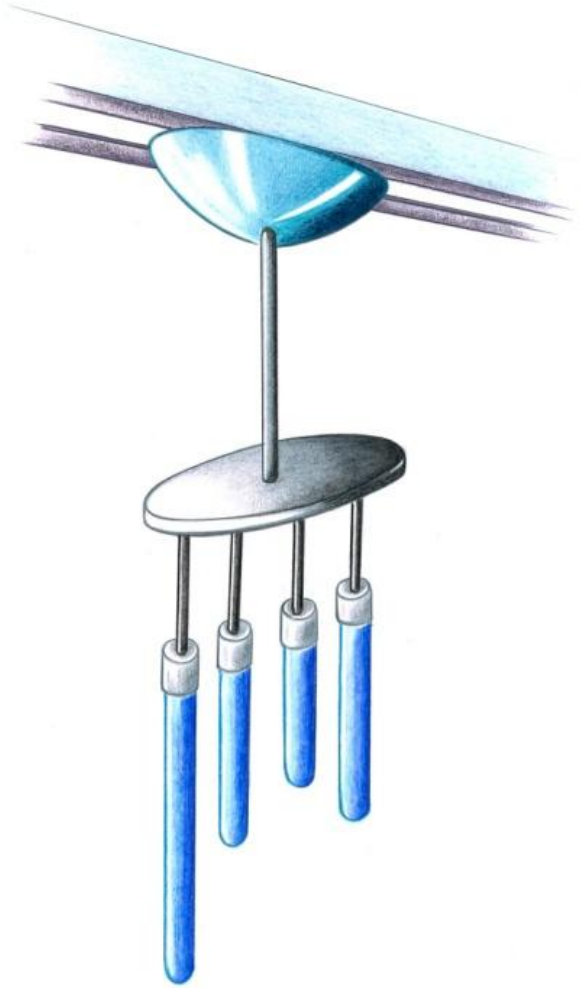
Concept 2-A:



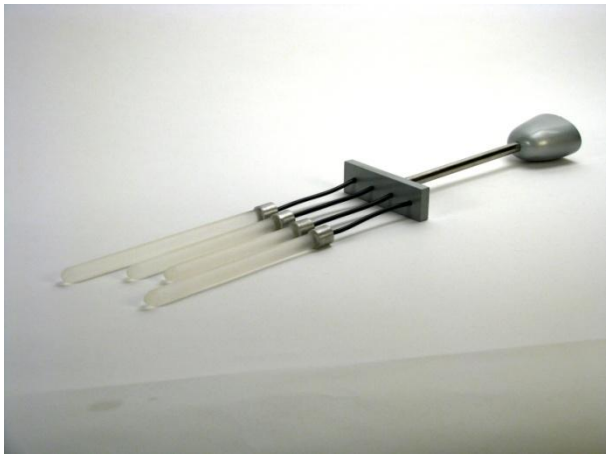
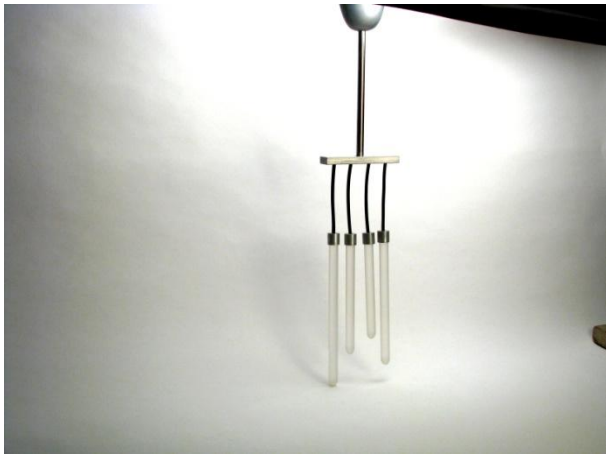
Concept 2-B:

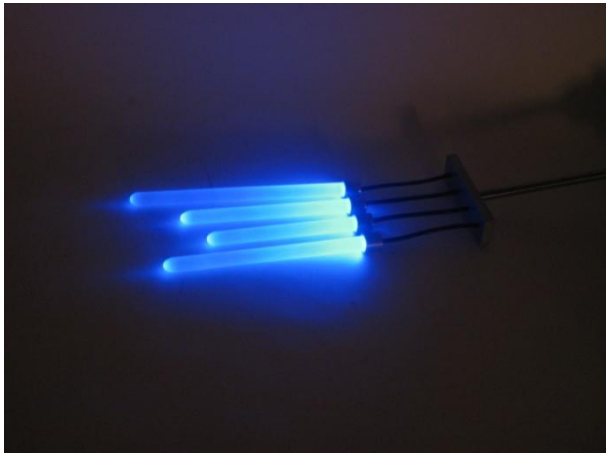
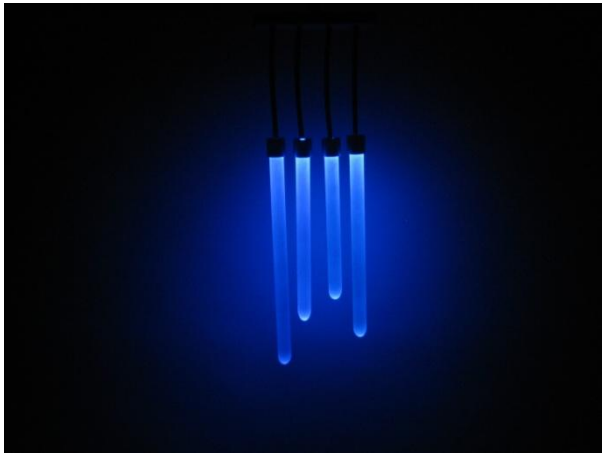
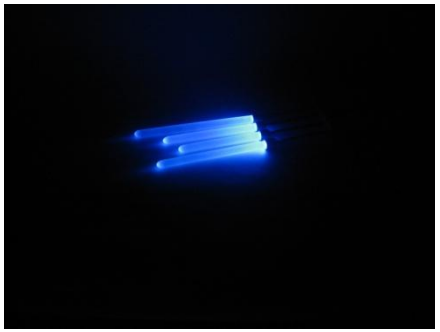


Concept 2-C:



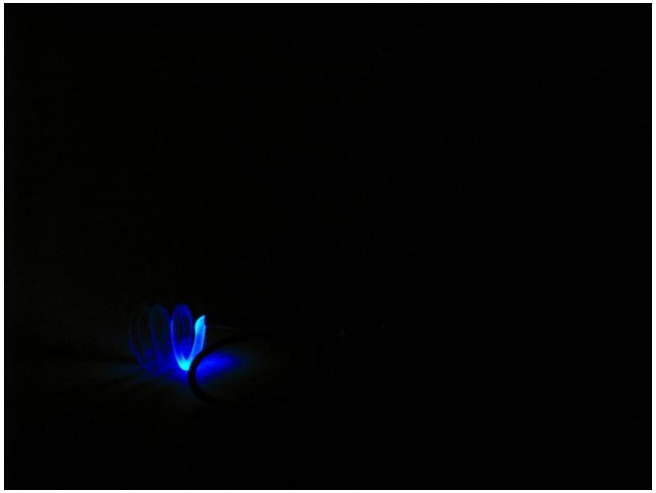
Acrylic rods and led's, track light for ceiling:

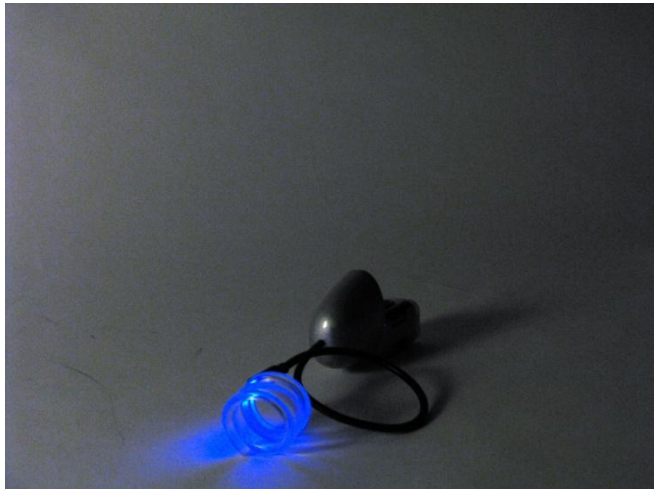



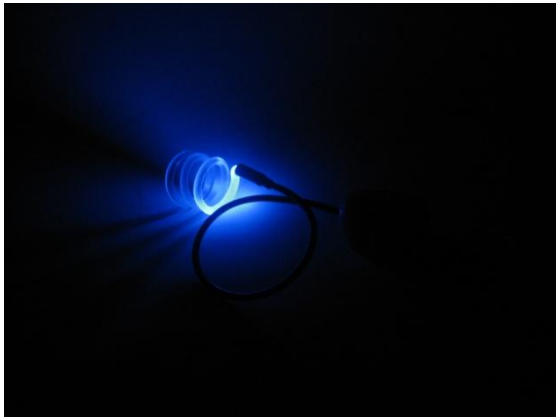




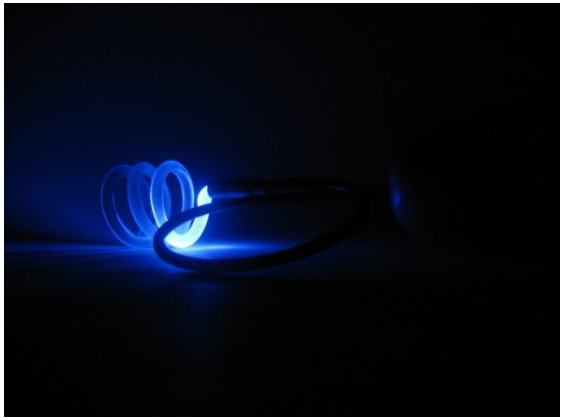
Concept 3:

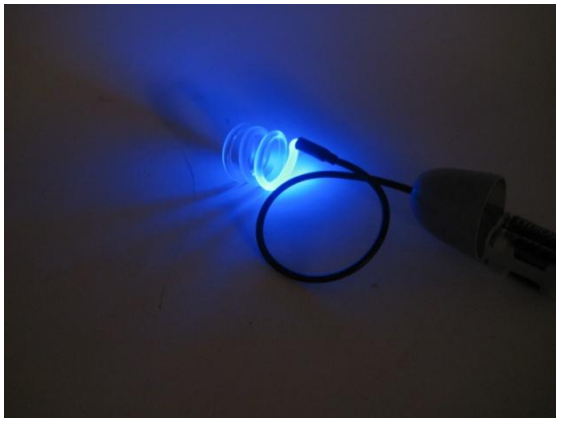
Spiral acrylic rod and single led, track light can be mounted on ceiling or wall:



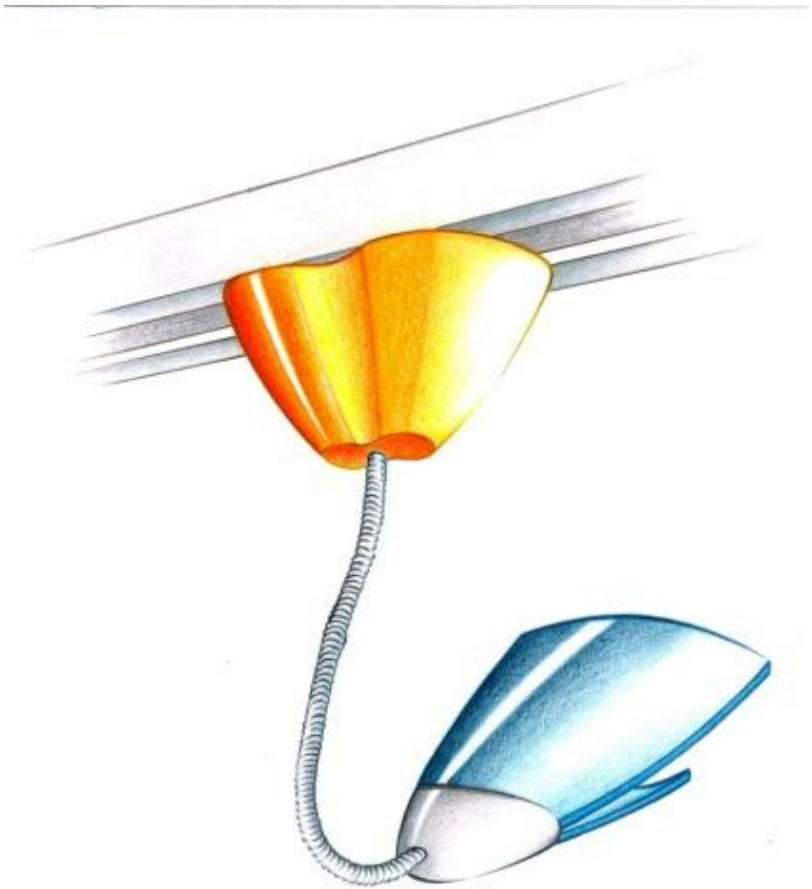




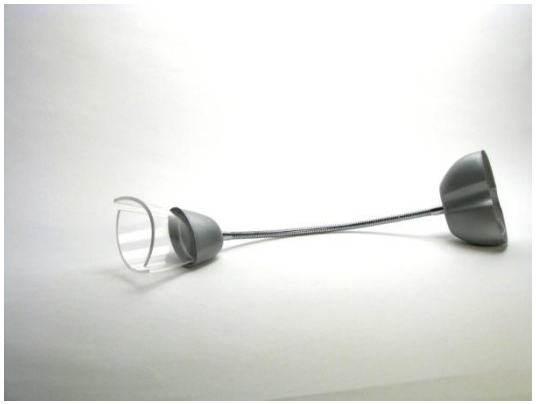


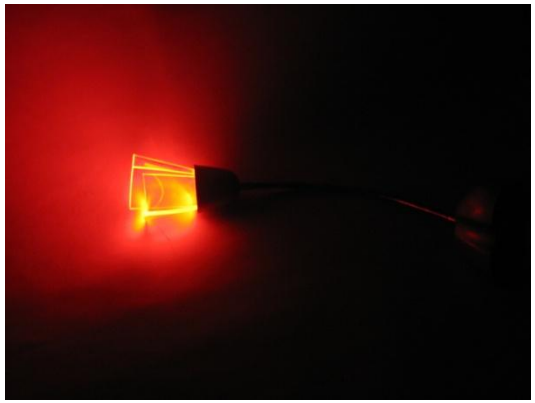
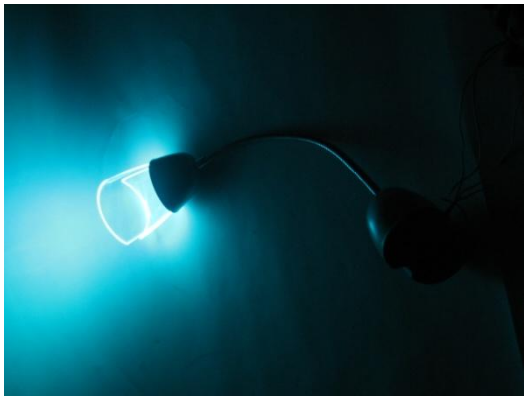
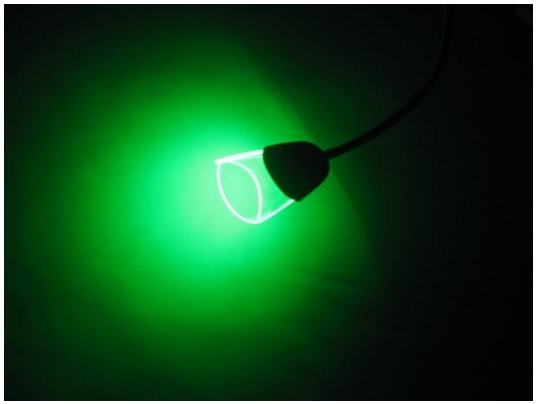


Concept 4: Final Concept

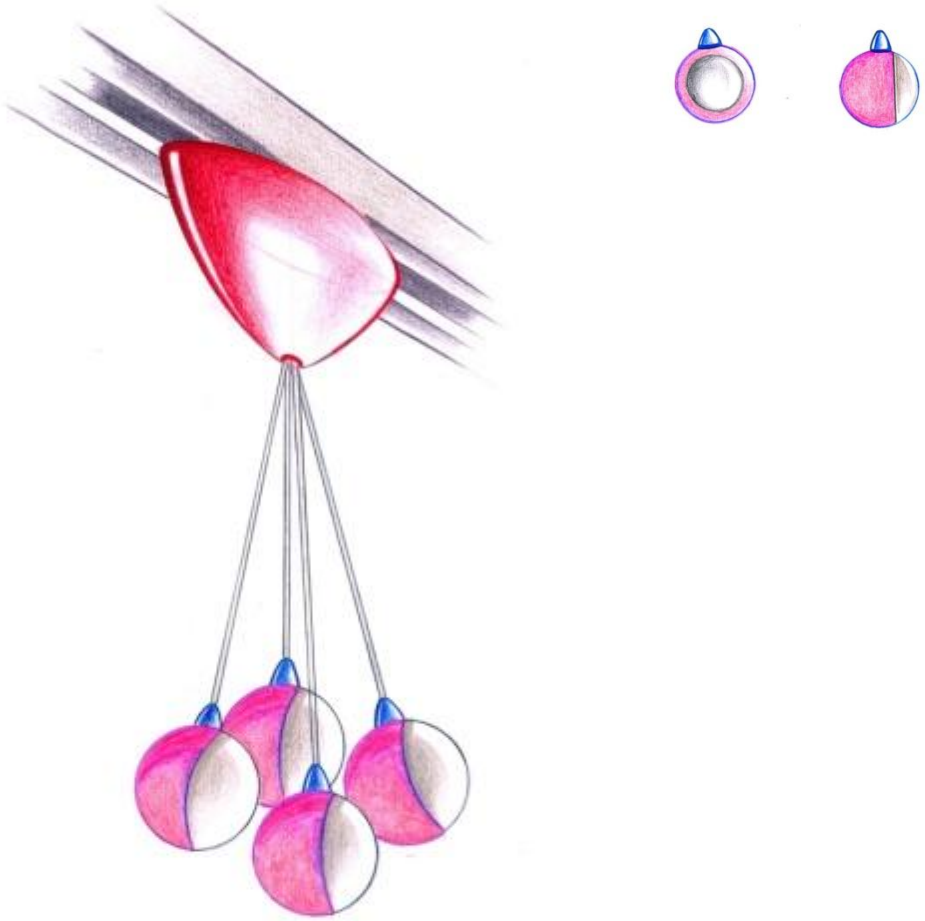


Formed acrylic sheets and RBG controlled led’s, track light which can be fixed on a track on wall:

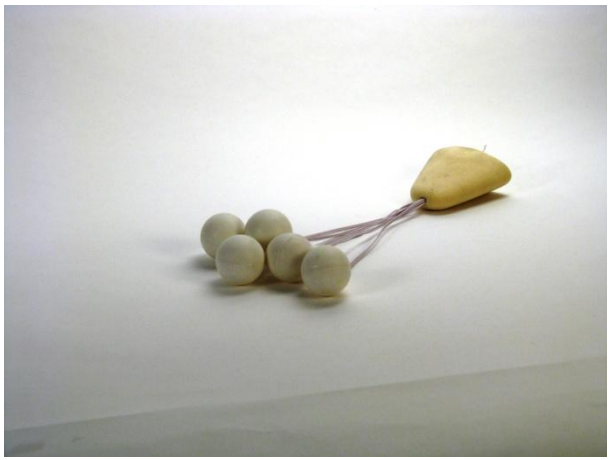



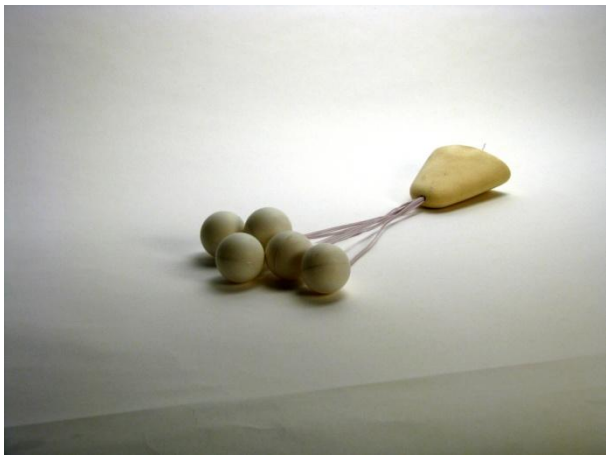




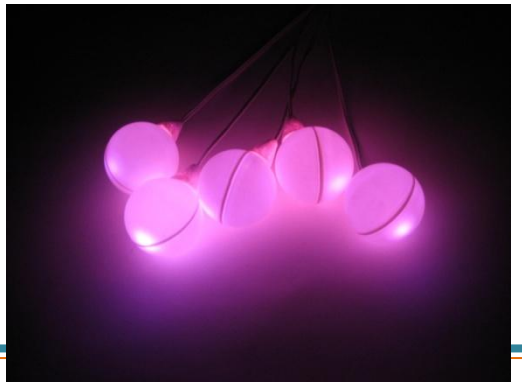
Concept 5:



Track light using light balls, pink coloured led's used. It gives good light effect and this is ceiling track light:







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