DANIELA NICOLA

Student no. : 2611976

Design Project 3

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Product Design Specification and Time Plan Version 2

Unit Coordinators: **Jo Joelson, Andrew Forkes**

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Faculty of Engineering, Science and the Built Environment

London South Bank University

LIGHTING DESIGN

Task Table Lamp Design

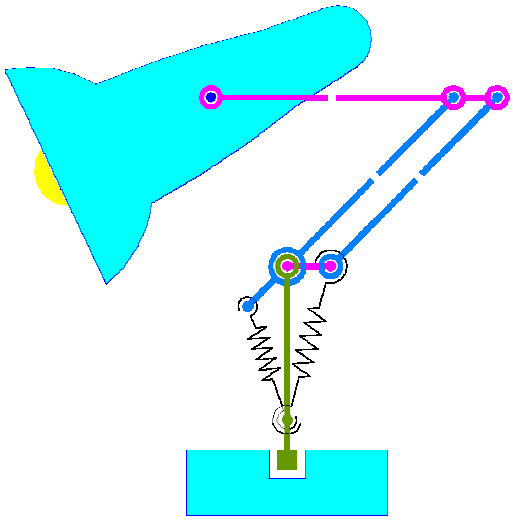


Fig.1 ***General Task lamp elements***

<u>Brief/intent</u>: based on principles of inclusive design, conceptualize a table lamp with very good colour rendition qualities, ergonomic and modern.

Facts:

- **For the same luminance white light sources with higher correlated colour temperature (CCT) will appear brighter than those with lower CCTs**

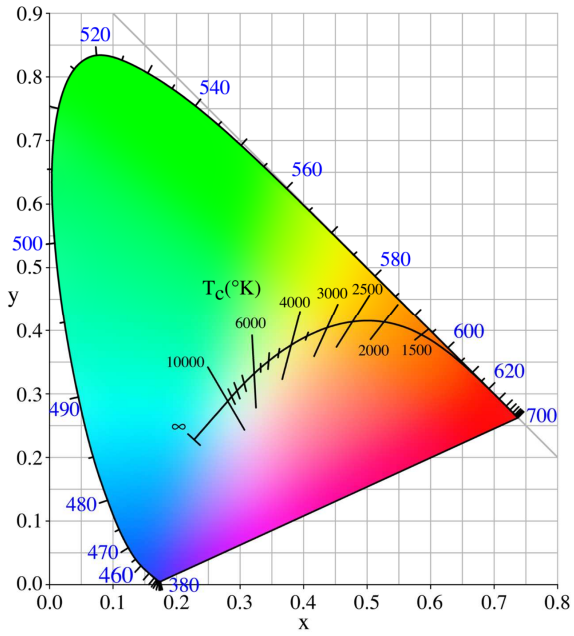
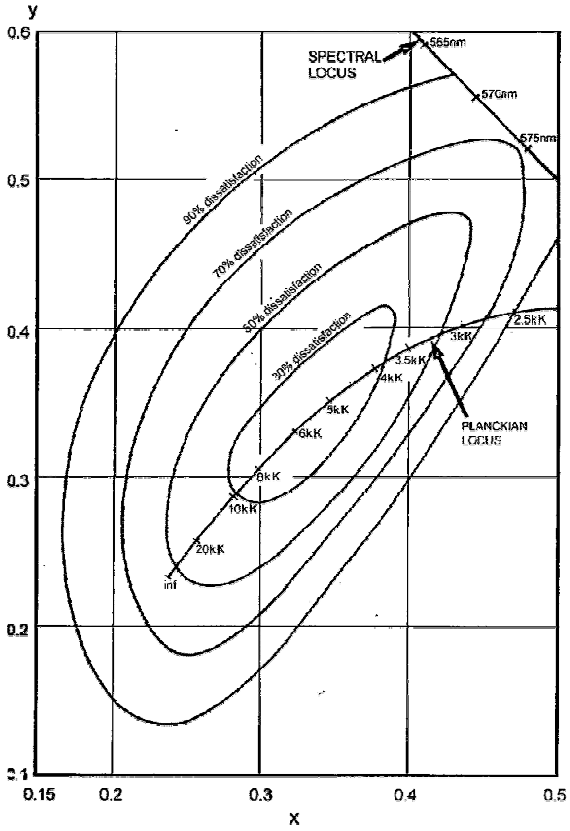


Fig.3 *Plankian Locus (colour temperature in the visible spectrum)*



Percent dissatisfaction contours for the chromaticity of glazing plotted on the CIE 1931 (*x*, *y*) chromaticity diagram (after Cuttle, 1979).

Fig.4 *Satisfaction/dissatisfaction factor related to the colour temperature: the preferred 'white' of light is between 3200°K (white) and 10 000°K (very cool white) (Boyce, 2003)*

- **Eye's peak sensitivity is at 555nm (green), whereas at 400nm is 1000 times less.**

Table 12.4 Median preferred illuminance and the 10th and 90th percentiles for reading high contrast printing of line width subtending 4.4 min arc at 30 cm, under three different types of fluorescent lamp (from Lindner *et al.*, 1989)

State of vision	*Number of subjects*	*Fluorescent lamp type*	*Median preferred illuminance* (lx)	*10th and 90th percentile of illuminance* (lx)
Emmetropic 20–30 years	50	White	900	329–2,072
		Warm-white	1,000	600–2,127
		Daylight	1,055	426–2,090
Emmetropic 40–79 years	50	White	268	75–817
		Warm-white	260	105–1,527
		Daylight	315	162–1,753
Cataract – pre-operative 40–80 years	75	White	325	98–1,800
		Warm-white	300	45–1,496
		Daylight	448	52–1,450
Cataract – post-operative with intra-ocular lens	50	White	121	70–1,162
		Warm-white	123	50–939
		Daylight	140	60–1,197
Cataract – post-operative with spectacle correction	25	White	119	75–439
		Warm-white	128	39–629
		Daylight	195	54–656
Glaucoma 40–82 years	50	White	596	100–1,071
		Warm-white	480	85–1,278
		Daylight	675	67–1,866

Fig.5 *Preferred illuminance in lux for different age and vision abilities groups (Boyce, 2003). To summarize: light need/preference varies very much in colour and light output.* ***Solution: adjustability / modularity***

- **Another important factor is Colour Rendition Index (CRI) basically how saturated and natural colours appear under artificial light. Choosing a light source with a CRI above 80 will produce more saturated surface colours and a perception of greater brightness.**
- **The recommended maintained horizontal illuminance (lx) for general tasks, in U.K. is 500.(Boyce,2003)**

Market Research:

Analysis of existing and similar products

1. <u>The big 'classics':'Anglepoise' and 'anglepoise' like task lamps:</u>

Fig.6 *Polished chrome task lamp: a combination of joints springs and tilting head gives a high adjustability, heavy flat base gives stability.*
Incandescent reflector light used.

Fig.7 *Polished chrome task lamp with up/down balancing and adjustable head. The head has a handle for protecting the user from heat when adjusting lamp. Halogen bulb used (mains). On/off switch on the base.*

Fig.8 *Task lamp with adjustability up/down a sustaining rod. Frosted aluminium finish. Exposed cable. Tilting head. Simplicity.*

2. 'Alternative' design task lamps, 'designer' task lamps

Fig.9 *Adjustable by direct handling of the sustaining cables. Highly unsafe by UK standards but very beautiful Italian design table lamp.*

Fig. 10 *Zaha Hadid prototype for a task lamp: polished chrome, highly architectural and organic, high-end.*

Fig. 11 *Polypropylene shades and L.E.D. enclosed in pvc tubing. Highly sculptural floor lamp*

Fig.12 *Strip light table lamp. Strong colour*

Fig.13 *Details of another classic, high end task lamp. Joe Colombo's sleek and simple system is inspired from industrial light projectors*

Fig. 14 *Task lamp: combination of torch light and base acting as a charger.*

3. Future possibility

At the Wall Street Journal CEO Forum that took place in London, the UK, a panel of industry leaders predicted that LEP technology would storm the market in the next few years.
(http://www.electronicsforu.com/efylinux/efyhome/cover/APR%202002/dewljk.pdf, 28/12/2009)

Fig.15 *The ilamp is made of white silicon with an electroluminescent polymer screen. Both the lamp and the screen are flexible which makes it possible to shape and take any given form. By combining new technology we have been able to design this super slim flexible lamp. This lamp gives one a tactile feel different from other lamps.*

Summary of research:

1. **Most of the task lighting seems to be based on only one type of light source e.g. low voltage, replacement parts and repairing costs making them throw away items rather than long life items.**
2. **There is a need for customized lighting and reliable, easy to use, adjustable task lamps.**
3. **The quality of light per se seems to be secondary to the aesthetics.**
4. **The 'Morito' factor: ".. the customers cannot say they want a product which they have never imagined before". (Baxter, 1995)**

How my product fits into the market

Safe design can be attractive. Universal design that uses sophisticated design elements while still incorporating safety features can improve the quality of life and serve young and old without regard to whether it was designed for age specific issues.

The overall task lamp design will carefully try to be based on "Inclusive Design".
The British Standards Institute defines **inclusive design** as "The design of *mainstream* products and/or services that are accessible to, and *usable* by, *as many people* as reasonably possible ... without the need for special adaptation or specialized design.".

A lot of research has be done into the characteristics and quality of the light source itself and the effects of different light sources on human eyes of different abilities

Opportunity specification

A PEST analysis will confirms the business environment has been analyzed and it is favorable and welcoming this product.

Political – Changes in law or regulations by Governments or political agencies. In this case The Eco Design of Energy – Using Products Directive will restrict the manufacture and import of incandescent light bulbs before imposing a full ban in 2012 (Council of Europe Directive adopted in September 2009) the aim being the overall reduction of energy consumption with 20% by 2012.
The EU regulations are likely to lead to wider adoption of innovative low-energy lighting technologies, such as halogen bulbs and LEDs (or in the future, electroluminescence)

Better design of energy-using products could save the economy £900m.

This opens a market in saving energy products and encourages investments in new technologies that will make this possible.

Economic – Macro – economic issues will have a strong influence on business. Due to present recession the availability of grants, awards, subsidies or unsecured loans is very limited. Economical recovery is being predicted for 2010 so we expect better bank lending rates and other incentives to be promoted in order to sustain economic growth. There is an availability of skilled workforce. The level of salaries is lower than in previous years. Investments costs should be lower.

Social – "Social awareness of environmental issues has had a profound effect on purchasing habits in many market sectors" (Baxter, 1995). Due to almost aggressive advertising in promoting saving energy the level of awareness is increasingly higher and the purchasing habits are changing in favour of products with low energy consumption. From this point of view our product fits the market perfectly.

Technological – Materials, processes, control and information systems are becoming more reliable and better predictions of profits could be made.

Providing high luminosity output uniformly distributed (with filters) white illumination in panels as small as a single button or as large as a billboard LED can replace incandescent and fluorescent light sources with a durable and lightweight alternative.

With an operational lifetime of at least 10 years, the RoHS-compliant LED is cool to the touch and flame resistant, with almost zero heat emissions.

Profit Opportunity

The core benefit proposition is manufacturing a very low consumption task lamp (more than 70% energy saving compared with incandescent lighting), long life (30 000 hours for LED), easy to use (dimmer with memory), reliable and stylish. Easily taken apart and recycled components.

Product Design Specification

Product: Task lamp

Performance:

- **Medium luminous output 500lx (min. requirement for general tasks by U.K. standards)**
- **Dimming and increasing luminous output up to 2000lx by mechanical (dials/switches) and electronic components.**
- **Colour rendition control through mechanical (dials/switches)**
- **Adjustments memory: the desired set-up will be stored as a ready to option button**
- **Two light sources. To choose between LED (R.G.B. channels available) + halogen, and CFL + halogen.**
- **Heavy base for stability. It will contain the ballast/electronic gear and other electronic components.**

Safety:

- **It will be rated for indoor use conforming to British Quality Standards.**
- **Only components conforming to this standard will be used.**
- **The heat issue from the halogen lamp will be diffused away from the adjustment handle.**
- **Noise level from electronic components will be kept under the audible range.**
- **Low voltage is preferred.**

User:

- **'Silver surfers' enjoying reading or craft hobbies (painting, embroidering, modeling, sewing), requiring good rendition of coulour or just having a very good, 'personalized' task light. Any person with colour perception difficulty due to vision degradation.**

Life in Service:

- **5 years guarantee and 10 years lifespan due to the electronic components.**
- **Electronic components, ballasts and holders and other major components supply information to be added to the instructions leaflet.**
- **The task lamp could be re-wired as a 2 switches on/off, by-passing the electronic components in case of non-availability of spares.**

Materials:

- **Aluminium casing due to high perceived value,**
- **Clear cable, clear plug.**

Finish:

- **Couloured powders could be applied through anodizing: satin finish.**

Shape/Size:

- **Ergonomic principles will be applied.**
- **Geometric proportions (the golden ratio, Fibonacci series will be taken into consideration.**
- **Bisociative attraction factor will be taken into consideration.**

Value opportunity:

- **USE VALUE : £ 20**
- **ESTEEM VALUE: £ 30**
- **EXCHANGE VALUE : U V + E V = £50**
- **COST VALUE (to be estimated)**

Pricing policy decision:

- **Because it is an innovative, high quality new product, the price could be increased to £60/ per unit and a larger sale target could further increase the profit margins.**

Shelf life:

- **We expect the demand to be higher due to the novelty of the product followed by a peak profit in the following year and a decrease of sales after these two years due to alternative products on the market.**

Documentation:

- **British Standards Institutes (BSI) regarding lighting from the point of view of safety and manufacturing standards.**
- **The Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2002/95/EC (on short RoHS).**
- **The previous is closely linked with the Waste Electrical and Electronic Equipment Directive (WEEE) 2002/96/EC which sets collection, recycling and recovery targets for electrical goods. Recycling instructions will be added as a separate page on the general Instructions leaflet.**
- **Consumer Protection Act 1987**
- **Electrical equipment (safety) Regulations 1994**
- **CE mark (by the manufacturer) and EC declaration of Conformity (failure to do so could amount to an offence under the Consumer Protection Act).**
- **Technical documentation of the product.**

Manufacturing;

- **L.S.B.U. prototyping facilities workshops will be used in order to achieve the desired shape.**
- **Electronic laboratory will be contacted in order to have a qualified supervision and guidance for the electronic part of the task lamp.**

Packaging:

- **Recyclable, compostable packaging to be used. Light but strong.**

Timetable for developing and finalizing design for task lamp:

(Choosing a name for the product in progress)

Semester 2

- **Week 2 (1st -7th Feb): concept sketches + components? (hospital week)**
- **Week 3 (7th -14th Feb): rough prototyping to check scale /dimensions. Updating project report.**
- **Week 4 (15th -21st Feb.): Check efficiency and dimensions of electronic components. Final decision on components. Questionnaire results to be included in the report.**
- **Week 5 (22nd – 28th Feb.): Technical drawings, dimensions to be decided. Final layout. Updating project report.**
- **Week 6 (1st -7th March): new models reflecting updated design; concept boards / presentation boards International Workshop on New Product Development**

  (01-05 March 2010 at Oulu University of Applied Sciences)
- **Week 7 (8th -14th March): wiring schemes, ergonomics; Visual presentation hand in. Updating project report.**
- **Week 8 (15th – 21st March): updated technical drawings. Calculations.**
- **Week 9 (22nd -28th March): Alias model**
- **Week 10 (29th March – 4th April): selection of materials and manufacturing details**
- **Week 11 (5th – 11th April): Updating project report. Holiday.**
- **Week 12 (12th - 18th April): Ordering parts, writing 'Instruction leaflet'.**
- **Week 13 (19th - 25th April): Wiring, testing of components.**
- **Week 14 (26th April - 2nd May): Aesthetics to be finalized. Methods of assembly to be finalized. Final model.**
- **Week 15 (3rd – 9th May): Testing**
- **Week 16 (10th May – 16th May): updating report; boards**
- **Week 17 (17th May – 23rd May): hand in report 18th May , finishing touches for boards and final presentation of prototype**
- **Week 18 (24th May – 30th May): Design Project Deadline 25th May**

List of Figures:

http://www.alternativeconsumer.com/wpcontent/uploads/Ross/2009/Summer09/trask_task_all_zoom.jpg, 27/12/2009

12. Fig.12 Strip light table lamp. Strong colour, http://farm4.static.flickr.com/3622/3642967788_58d515f089_o.jpg, 27/12/2009

13. Fig.13 Details of another classic, high end task lamp.
Joe Colombo's sleek and simple system is inspired from industrial light projectors
http://3.bp.blogspot.com/_U7N6CH5mIhQ/Sckh1c8S5nI/AAAAAAAABZ8/5Nn62hNplDU/s400/joe-colombo-design.jpg, 27/01/2009

14. Fig. 14 Task lamp: combination of torch light and base acting as a charger.
http://imagesme.net/igreenspot/torch-light1.jpghttp://2.bp.blogspot.com/_9ZRPtq-XNoU/RuIapE_tDjI/AAAAAAAAAgI/oZPaRyhtlks/s400/colortemp_chart2.jpg, 27/12/2009

Fig. 15 The 'ilamp' – it is made of white silicon with an electroluminescent polymer screen.
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