Journal of Textiles, Coloration and Polymer Science
https://jtcps.journals.ekb.eg/
Egyptian Society for Textile Science and Technology
الجمعية المصرية لعلوم وتكنولوجيا النسيج

Importance of Colours in Industrial Design

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Abstract

Colors play a vital role in human existence, conveying meaning and emotions. Despite cultural variations, colors serve similar purposes across countries, adding aesthetics, status, and religious connotations. Color's significance in design as a global language grew with advancements in communication technology and the Industrial Revolution. The changing identities of household appliances throughout the 20th century highlight the importance of color in determining their status. In conclusion, color schemes correspond to the nature of work, with black and dark colors representing strength and elegance, pastel colors symbolizing collaboration, bright colors attracting attention, and white conveying sterility and hygiene.

Keywords: Colour Theory, Colour Psychology, Colour Wheel, Colour Coordination, User Experience, Natural Tones

Introduction

The use of colour is essential to the appearance and performance of electrical household equipment. Beyond aesthetic concerns, it fulfills a number of useful roles that help users discover features, guarantee safety, and improve the+ir entire experience. This thorough investigation explores the importance and use of colour on these appliances, looking at how manufacturers deliberately employ colour to convey information and enhance usability.

Colour on electrical equipment serves several purposes, chief among them being identification and safety enhancement. Power buttons from different manufacturers usually have different colors that indicate whether the device is on or off. For example, an appliance that has a bright red power button is usually in active condition; on the other hand, a muted hue, such as black or Gray, indicates that the device is off. By reducing the possibility of unintentional usage, this color-coded scheme aids users in rapidly determining the operating state. On household equipment, colours are frequently used to distinguish between different settings or functions. Digital displays, knobs, and buttons are frequently color-coded to correlate with different operations. For example, a microwave's start function may be indicated by a green button, whereas defrosting is shown by a blue button. The user interface is made more straightforward with this visual signal, especially for people who might not be familiar with the device.

Beyond practicality, colour is important for building a company identity and following consumer trends. Well-known companies frequently use trademark colours for their product lines, which helps consumers associate the item with the brand visually. This helps customers rapidly identify and choose items from their chosen manufacturers while also promoting brand loyalty. Furthermore, producers closely monitor consumer tastes and market trends, modifying colour schemes to conform to modern aesthetics. Appliances' capacity to adapt guarantees that they will always be aesthetically pleasing and competitive in the ever-changing consumer market.

The use of colour on electrical appliances has expanded in recent years to take accessibility and environmental factors into account in addition to beauty and usefulness. Appliances that are energy-efficient and environmentally friendly may have blue or green accents to show their dedication to sustainability. Furthermore, there is a rising understanding of the need to design appliances with

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Receive Date: 25 December 2023, Accept Date: 06 February 2024
DOI: 10.21608/JTCPS.2024.258182.1248

people with visual impairments in mind. These appliances are more accessible thanks to features like tactile indications, high-contrast colors, and well-thought-out interface designs, which enable a wider spectrum of people to engage with and take advantage of the technology. [1-4]

This review serves as a springboard for a more in-depth investigation of the several facets of this subject by offering a look into the complex function that colour plays in the world of electrical household appliances.

Color use in design

There are many dimensions in design, ranging from two to four, and each field of design is unique in how it uses color. In creative painting, the aesthetic value of color is growing; in graphic design, color practicality is equally as important as aesthetics. Architecture and industrial design are two examples of three-dimensional designs that highlight utility and strive to highlight dimension and usefulness. Zelenskiy and Fisher explore the potential of color as an artistic medium in their work Color, observing that "it affects our emotions beyond thought and can convey any mood, from delight to despair." [1-3, 5-19]

The fact that color preferences have always been a social factor makes color in design a "must considered" element. The style of living greatly influences color. Color and design choices reflect any sociologic shifts in lifestyle, whether psychological or financial. The impact of geography on cultural differences is another significant factor to consider. Different civilizations flourish in different parts of the world (such as the Nile Delta and Mesopotamia), and they interpret the same colors differently. The biggest disparity in color choices, however, emerged when individuals were unable to communicate with one another across the globe. individuals' color choices and lifestyles are becoming increasingly alike as technology makes it easier for individuals to engage with one another. [3, 4, 20-26]

Colour Theory: Basic Knowledge of Colour

A key component of design, colour affects how viewers and interact with visual compositions. It is crucial for establishing visual hierarchy, expressing emotions, and enhancing aesthetic appeal in general. I'll discuss colour utilization in design in my answer, including both practical and psychological aspects. Remember that although I am unable to offer references that are current, I can still provide broad information based on my training through September 2021. [27, 28]

Colour Psychology

The study of how colours influence human behavior and emotions is known as colour psychology. Designers can leverage the psychological reactions that different colours generate to communicate particular meanings. The following are some typical feelings connected to different colours: [14, 29, 30]

- Red: This colour stands for Vigor, intensity, and urgency. It may also arouse sensations of exhilaration or danger.
- Blue: Calm, trust, and stability are often linked to this colour. While deeper blues might imply command, lighter blues can communicate tranquillity.
- Yellow: This hue is associated with happiness, optimism, and inventiveness. It can also draw attention, but because it can be overpowering, it should be used sparingly.
- Green: This hue stands for harmony, growth, and the natural world. It is often linked to peace and environmental sustainability.
- Orange: Radiates warmth, Vigor, and vibrancy. It is commonly utilized to draw attention and has the power to inspire creativity.
- Purple: This hue is often linked to creativity, nobility, and luxury. It may also evoke thoughts of mysticism or mystery.
- Pink is a symbol of tenderness, femininity, and romance. Vibrant pinks are more energizing, while lighter pinks are more feminine.
- Black: Suggested power, refinement, and sophistication. It's commonly employed to imply formality or mystery.
- White: This hue stands for simplicity, cleanliness, and purity. It may provide the impression of space, which is why minimalist designs usually utilize it.

Colour and colour Wheel*:*

Color

The visual impression that arises from an object's light reflection or emission is called colour. It is distinguished by attributes including brightness, saturation, and colour. [29]

Our ability to comprehend depth, length, and other visual information is facilitated by colours. In the words of "Petit Larousse," colour refers to "the impression made on the eye by the various radiations that form light." Light, or more accurately, distinct electromagnetic wave wavelengths spaced at observable intervals, is what colour is. These wave-lengths work together to create light; when they are absent, darkness prevails. In fact, we can determine that colour is

necessary for eyesight since without it, we are unable to perceive anything.[31]

We can distinguish the colours of objects by the wave lengths they reflect back to us. If an item reflects the blue wave length, we see it as blue, and so on. We see an item as white when it simultaneously reflects all wave lengths and as black when it absorbs all wave lengths.

While illustrates the physical range of colours, colour theory for painters and designers is based on a colour wheel. Whelan describes the colour wheel as "Designed in an orderly progression, the colour wheel enables the user to visualize the sequence of colour balance and harmony" in his book Colour Harmony.[32]

Colour Wheel

A circular pattern of colours arranged according to their chromatic relationships is called a colour wheel. It's a tool for understanding colour connections and harmony in art and design.

The three fundamental colours, as well as the secondary and tertiary hues that arise from their combination, make up the colour wheel. The main colours—red, yellow, and blue—cannot be converted to another hue or created by combining additional colours, much like chemicals. Primary colours like green, orange, and purple can be combined to form secondary colours. One main colour and one secondary colour are combined to make tertiary colours. (Figure 1) [33]

Figure 1. Color wheel by Johannes Etten

Characteristics of Colours in Colour Wheel

Hue, shade, and saturation are the three unique characteristics of each colour in the spectrum. Hue refers to the true colour or the way that colours vary from one another.

Twelve hues make up the colour wheel; colours can be categorized in several ways according on how they differ from one another. There are two types of colours: cold colours and warm colours. Light and dark hues relate to their shade, and depending on saturation, we may categorize them as brilliant or bland. [34]

The first half of the colour wheel (red, yellow, orange, pink, and brown) contains warm hues. They evoke thoughts of warmth. Compared to other colours, warm hues are more attention-grabbing and progressive. They have a striking colour palette. They give the colour scheme a bold, joyous, and exuberant aspect since they are vivid, flamboyant, tasty, and assertive.

Conversely, chilly colours (Gray, blue, green, and violet) have the opposite effects of warm colours and make us think of a winter setting. They slow down the body's metabolism and are introverted. Despite the fact that they can be quite depressing and oppressive, they have a calming influence on people's emotions.

Colour Coordination

Though each colour has unique qualities and differences from the others, nothing in nature is monochromatic. In nature, colours blend together smoothly, even in the most surprising combinations.

Colour harmony is the artistic arrangement of colours to produce a calming whole.

Colour harmony

is the process of combining colours to create visually appealing effects. It is achieved by putting colours in a pattern that is both aesthetically pleasing and well-balanced. Harmony is achieved by a variety of colour schemes, such as triadic, analogous, complimentary, and others. Here's a brief summary Harmony that Complements:

- On the colour wheel, complementary colours are those that are opposite one another. Together, they produce contrast and have the potential to be visually pleasing. [35]
- What is meant by analogous harmony? On the colour wheel, analogous hues are next to one another. Typically, they complement one another nicely and result in calm, cozy designs.
- Split-Complementary Harmony Definition: This colour scheme is an alternative to the complementing one. It is made up of two nearby complimentary colours and a base colour. [36]
- Definition: Consists of two pairs of complimentary colours that give rich colour variation and harmony.

For painters, fashion designers, and interior designers, colour harmony is crucial. The above texts offer in-depth explanations of colour harmony's theoretical underpinnings and real-world applications.

Colour spaces

Colours are represented as tuples of numerical values in colour spaces, which are mathematical models. There are several colour spaces, and each has a distinct function in diverse contexts.

- Definition: Red, Green, and Blue are combined to represent colours in the RGB colour space. Digital images and electronic displays frequently use it. [37]
- What CMYK colour space is defined as: Cyan, Magenta, Yellow, and Key (Black) is what CMYK stands for. It is frequently employed in colour printing, where different ink mixtures yield a range of hues. [38]
- The colour spaces known as HSL (Hue, Saturation, Lightness) and HSV (Hue, Saturation, Value) are cylindrical coordinate representations of colour. They are often employed in graphic design to choose colours. [39]
- Perceptually uniform, or having a consistent perceptual difference between colours across the space, is the goal of CIELAB, sometimes known as Lab.
- What the CIE 1931 XYZ colour space is defined as: It is a basic colour space derived from visual perception in humans. It serves as the basis for every other colour space. [40]

Accurate colour representation in a range of applications depends on an understanding of various colour spaces. (Figure 1)

Colour and society

colours and civilizations

Ancient Egypt

Colours were very important in ancient Egyptian culture. They have strong ties to cultural customs, symbols, and religious beliefs. The following colours were prominent in ancient Egypt: [41, 42]

- **Red (iwen)**: The colour red was connected to the deity Seth, who stood for anarchy and turmoil. It also represented strength and vigor and was connected to the sun's ability to sustain life.
- **Blue (irtyu)**: The sky and the Nile River were symbolized by blue. It represented rebirth, creation, and fertility and was connected to the god Amun.
- **Yellow (khenet)**: Gold, which stood for the sun and the holy, was connected to yellow. It stood for prosperity, eternity, and the pharaoh's might.
- **Green (wadj)**: Associated with the rich flora found along the banks of the Nile, green represented fertility and renewal. It was also connected to the deity of the afterlife, Osiris.
- **White (hedj)**: White was a colour of cleanliness and purity. It was frequently employed in religious rites and funeral customs, and it was connected to the goddess Isis.

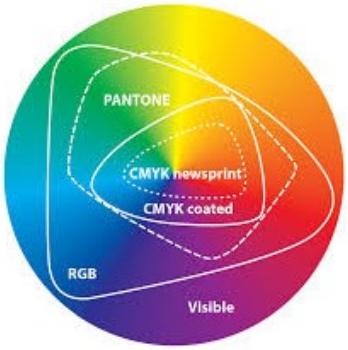

Figure 2. Representation Of Different Color Spaces

Ancient Greece

Greek mythology and society placed a great emphasis on colour. They were connected to emotions, gods, and social ideals. The following colours were common in ancient Greece: [43, 44]

- **White (leukos)**: White was the colour of innocence, purity, and divinity. It was connected to the gods Athena and Apollo. When performing religious rites and sacrifices, white clothing was used.
- **Black (melas)**: Black was the colour of grief, death, and the hereafter. It was also connected to the deity of the underworld, Hades. Black was seen as a hue of mourning and was frequently worn to funerals.
- **Red (eruthros)**: This colour represented love, passion, and conflict. It was connected to the deity Ares and the goddess Aphrodite. Red was a frequent colour for battle and love scenes in ceramic decorations.
- **Blue (kyaneos)**: Blue was a symbol of the immensity of the sea and was connected to the deity Poseidon. It stood for serenity, steadiness, and peace.
- **Purple (porphura)**: Historically, purple was connected to power and royalty and was regarded as a royal hue. It stood for power, elegance, and prosperity. Purple clothing was only worn by the wealthy and powerful.

Ancient China

In ancient Chinese culture, colours were highly valued and connected to the five elements, philosophy, and cosmology. The following colours were prominent in ancient China: [45, 46]

- **Red (hóng):** Red was a colour associated with joy, prosperity, and festivities. It stood for strength and energy and was connected to the element of fire. Red was frequently utilized for significant rituals and festivities.
- **Yellow (huáng):** Yellow symbolized the universe's core and was the colour of the emperor. It represented royalty, power, and wealth and was connected to the element of earth.
- **Blue (lán):** Associated with growth, energy, and spring, blue signified the element of wood. It was frequently used to adorn temples and other hallowed places as a sign of immortality.
- **White (bái):** This colour represented sadness, innocence, and purity. It stood for the west and was connected to the metal element. White was symbolic of death and the hereafter and was worn during funerals.
- **Black (hēi):** Black denoted mystery, obscurity, and the unknown and was associated with the element of water. It was connected to the north, knowledge, and reflection.

Ancient India

In ancient Indian culture, colours were very symbolic, especially in relation to religion and spirituality. They were connected to customs, ceremonies, and deities. The following colours were significant in ancient India: [47, 48]

- **Red (rakta)**: Power, passion, and fertility were associated with red. It stood for heavenly energy and was connected to the goddess Durga. Red was frequently utilized in festivals and religious events.
- **Yellow (pīta)**: This colour stood for enlightenment, knowledge, and purity. It was connected to the deities Krishna and Vishnu. Spiritual searchers and ascetics wore yellow clothing.
- **Blue (nīla)**: Blue was the colour of Krishna, the deity of the divine. It stood for eternity, transcendence, and spirituality. Krishna's heavenly playfulness was linked to the colour blue, which was frequently portrayed in religious imagery and artwork.
- **Green (hara)**: Symbolizing rebirth, fertility, and the natural world. It was connected to the deity Shiva and his wife Parvati. Green represented life and the earth's capacity for regeneration.
- **Saffron/Orange (kesari/naranga)**: In ancient India, saffron or orange was revered as a holy colour. It stood for spirituality, renunciation, and the pursuit of truth. It was connected to the monastic and renunciant traditions of sages.

Colour and culture

Of course! The following are some examples of how the significance of colours vary throughout cultures

White [49, 50]

White is frequently connected to marriage, innocence, and purity in Western cultures.

White is connected to funerals, grief, and death in many Asian countries, including China and Japan.

Red [51, 52]

Red is typically connected to passion, love, and vitality in Western cultures. Red is a colour associated with luck, happiness, and success in Chinese culture. It is frequently observed during joyous occasions like Chinese New Year.

Blue [53]

Blue is frequently connected to stability, tranquillity, and quiet in Western societies.

Blue is said to bring good fortune and protection from the evil eye in many Middle Eastern civilizations.

Green [54, 55]

In Western societies, green is frequently connected to growth, the natural world, and environmental consciousness.

Green is regarded as a holy hue in Islamic civilizations and is connected to fertility and heaven.

Yellow [56, 57]

Yellow is frequently connected to happiness, optimism, and sunlight in Western cultures.

Certain African societies identify yellow with gold, riches, and regal status.

Colour in industrial design

Beyond aesthetics, colour has several vital purposes in industrial design. An outline of colour's function in industrial design is provided below:

- **Brand Identity:** The establishment and reinforcement of a brand's identity depend heavily on colour. Products that employ a

certain hue consistently convey a company's values and aid in brand awareness. [58]

- **User Experience:** A product's colour affects how a user perceives and interacts with it. Well-considered colour selections improve usability, direct attention, and indicate functionality to provide a good user experience.
- **functioning and Safety:** Colour is frequently used to convey safety information or to indicate functioning. For instance, color-coded buttons or indications make it easier for users to comprehend the functions of various gadget controllers. [59]
- **Market Trends and Differentiation:** To remain relevant, it's critical to stay on top of colour trends in the marketplace. Additionally, in a crowded market, items might stand out by utilizing distinctive or creative colour schemes.
- **Emotional Impact:** Colours may affect how consumers feel about a product by evoking certain emotions in them. Industrial designers exploit this to their advantage by producing goods that emotionally connect with consumers and raise their level of pleasure overall.
- **Material Selection:** The selection of materials can have an impact on colour. Industrial designers have to think about how colours work with various finishes, textures, and materials in order to get the right tactile and visual effects. [60]
- **Cultural Aspects:** Different cultures have different ideas about colour, and what is seen beautiful or significant in one culture may not be in another. Industrial designers should consider cultural quirks when choosing colours for international markets.
- **Sustainability:** Sustainability factors might also have an impact on colour selections. Designers can choose recyclable or ecologically friendly materials, and they can use colours that reflect their commitment to environmental consciousness. [61]

In conclusion, colour has a variety of functions in industrial design, including branding, user experience, functionality, safety, and cultural concerns. It is not only about aesthetics. It necessitates a methodical approach that takes into account both the functional and aesthetic elements of design.

Aesthetics and Ergonomics:

With the turn of the century, people's expectations of design have drastically changed. They choose things not just based on functionality but also on the enjoyment they may bring. These days, a successful design must satisfy both functional and emotional demands.

In industrial product design, technology, ergonomics, and aesthetics are the cornerstones. Scientific investigations have demonstrated that, despite their apparent differences, aesthetics and ergonomics are becoming more closely related because aesthetic considerations are crucial for productive workplaces.

Two crucial factors in design are ergonomics and aesthetics, each of which adds differently to the total user experience. [62]

Aesthetics in Design

- **Visual Appeal:** A design's visual appeal is referred to as aesthetics. It entails the use of hues, forms, and general composition to produce an atmosphere or product that is aesthetically pleasant and harmonious.
- **Emotional Impact:** Aesthetic design has the power to arouse feelings in consumers and change their opinions of a product. The emotional bond that beauty fosters can increase user engagement and pleasure. [63]
- **Brand Identity:** Establishing and maintaining a brand's identity is greatly influenced by aesthetic decisions. Recurring graphic components help distinguish and build brand identification.
- **Cultural Aspects:** There are cultural influences on aesthetics. Users from certain locations or demographics are more likely to accept and respond favourably to designs that align with their cultural preferences. [64]

Ergonomics in Design

- **User-Focused Design:** The goal of ergonomics is to create systems or products that are tailored to the abilities and needs of their intended users. Its goal is to maximize how well the human body interacts with the intended environment.
- **Physical Comfort and Efficiency:** The goal of ergonomic design is to make products that are both physically comfortable and efficiently used. Anthropometrics is one aspect of this, making sure that things are appropriate in terms of size and proportion for the human body.
- **Reducing Strain and tiredness:** In order to improve user well-being and avoid pain or injury, ergonomic factors work to decrease physical strain and tiredness during use.

- **Functional Efficiency:** The goal of ergonomics is to make items more functionally efficient. To improve usability and performance, this entails optimizing the placement of controls, interfaces, and other components.
- **Flexibility:** Ergonomic design takes into account the variety of users and their differing requirements. It aims to provide flexible designs that can be used by a variety of people, including individuals with varying physical capabilities. [65]

In conclusion, ergonomics focuses on the physical and functional parts of design, making sure that designs are efficient, pleasant, and user-friendly, while aesthetics concentrates on the visual and emotional components of design, adding to the overall appeal and brand identity. Both are essential to building settings and products that provide users a satisfying and productive experience.

Colour Preferences In Housewares

For several home appliances, there are conscious and unconscious preferences for particular hues. The designer's intent governs unconscious colour choices, accounting for practical actions and avoiding deception, such useful buttons and signal bulbs. The customer's will, likes, dislikes, and needs—which are driven by psychological and/or aesthetic factors—determine their conscious colour choices. In his psychology book Colour and Human Response, physician Felix Deutsch, whom Biren quoted, wrote, "These superficial associations lead to deeper lying memories, which explain the affective emphasis of attitudes toward colours." Psychologists claim that 60% of consumers' decisions to purchase or return a product are influenced by its colour. [66]

When it comes to housewares, colour decisions can represent personal preferences, societal influences, and design trends. The following are some broad observations:

- **Neutrals for Versatility:** Because they are adaptable and go well with a variety of kitchen or home design styles, neutral colours like white, beige, and Gray are popular for housewares.
- **rich Accents for Interest:** To add a flash of colour and intrigue, a lot of individuals choose housewares with rich accent hues. Small appliances, tableware, and cooking utensils are examples of products that exhibit this.
- **Natural Tones for a peaceful Effect:** Earthy tones, such as green and brown, are frequently used in housewares to evoke a feeling of nature and create a peaceful ambiance, especially in goods that are linked to relaxation, such bathroom accessories or bedding. [67]
- **Modern Metallics:** Copper, rose gold, and stainless steel are common metallic finishes for cookware and appliances in the kitchen today. These coatings provide a clean, modern appearance.
- **Pastel hues for a Soft Look:** Light blues, pinks, and mint greens are examples of soft pastel hues that are frequently used for linens, kitchen appliances, and tableware to create a calming and cozy atmosphere.
- **Cultural Influences:** Local aesthetics and cultural customs can have an impact on houseware colour choices in a variety of geographical areas. Vibrant colours, for instance, may be more common in some cultures.
- **Seasonal Variations:** Seasonal colour trends may be followed by some items. For example, warmer fall colours or pastel spring colours may be in style for specific things. [68]

When creating houseware items, producers may better accommodate a wide range of consumer preferences by taking into account colour psychology, design trends, and cultural influences. Meeting the changing needs of consumers requires conducting market research and remaining aware of shifting consumer preferences.

Summary

The purpose of this study is to investigate the factors that go into selecting the colours of each electrical home appliance.

Understanding why some colours work well with some devices but not others is important in order to respond to this issue. It's also important to understand how individuals relate to colour psychology.

This study examined the rationale behind the colour selections for each household device by taking into account a number of variables, such as the meanings associated with colour, cultural diversity, the evolution of colour throughout history, and the social standing of individuals in society. It is feasible to determine the reasoning behind any product's colour selection by looking at these variables.

The first chapter of the research examines colours and design, including how colours are used in design, colour theories, colour spaces, and colour forecasting techniques. In the second chapter, "Colour and Society," the links between colours and their many meanings throughout historical periods, cultures, and locations were examined.

However, as time went on and the Internet grew, things became simpler as civilizations became more

tolerant of one another. Additionally, the term "fashion" and its adherents from most societal groups brought these hues closer together in many contexts.

The connection between colours and industrial design was discussed in the third chapter.

It focuses on how pots are used in electrical household devices by studying consumers, learning about their preferences, and incorporating customization. In the last chapter, he provides an explanation of the rationale behind the colour selection of household electrical equipment to determine the optimal hue for user comfort, in terms of the best application and how that affects the product, the nature of the labour it does, and the purpose it fulfils

These chapters led to the following ultimate conclusions:

1. Neutral colours, like white and Gray, are excellent at blending in with their surroundings.

   Additionally, it is one of the ideal periods for producing electrical household products. White signifies this and conveys a suitable image of the nature of the product's work since it is a hue that is good for the creation of devices connected to cold and cleanliness.
2. On the other hand, black is associated with heat-producing appliances like ovens and heaters.
3. When making cooking equipment, pastel hues are preferred since they are soothing and cozy.
4. The bright colours are clear and prominent in place so they are used in personal care tools.

Through these results, the role of the designer is clear, where he must follow and observe all the psychological, environmental, cultural and historical aspects of the place and the user directed to the product to finally come up with an appropriate design.

Conflict of Interest

The authors declared no competing interests in the publication of this article

Acknowledgment

The authors are gratefully grateful to acknowledge the Faculty of Applied Arts, Benha University. Furthermore, the authors are gratefully grateful to acknowledge the Central Labs Services (CLS) and Centre of Excellence for Innovative Textiles Technology (CEITT) in Textile Research and Technology Institute (TRTI), National Research Centre (NRC) for the facilities provided.

Funds

The authors are declare that there is no funding sourse

References

1. Elemam, Y.A., Subaih, R.A., Elhefnawy, H.I., Saada, M.A., Abdelkareem, S.T. and Hassabo, A.G. The usage of modelling and polymers in industrial design, *J. Text. Color. Polym. Sci.*, - (2024).
2. Hassan, S.S., Elgohary, R.M., Eldesoky, A.R., Metwaly, H.A. and Hassabo, A.G. The effect of using smart materials to improve the efficiency of industrial products, *J. Text. Color. Polym. Sci.*, - (2024).
3. Mohammed, N., Nawar, S.H., Etawy, M.S., Nassar, G.E. and Hassabo, A.G. Nanotechnology and its applications in industry and product design, *J. Text. Color. Polym. Sci.*, - (2024).
4. Nawar, S.H., Etawy, M.S., Nassar, G.E., Mohammed, N. and Hassabo, A.G. The impact of cmf design on product design, *J. Text. Color. Polym. Sci.*, - (2024).
5. Zelinsky, W. The enigma of ethnicity: Another american dilemma, University of Iowa Press, (2001).
6. Abdel Wahab, S.S.M., Atallah, H.A.A., Saleh, Y.D.M., Glal El-Den, R.E. and Hassabo, A.G. Challenges and unsustainable practices in the apparel sector, *J. Text. Color. Polym. Sci.*, - (2024).
7. Ahmed, E.a., Fahmy, A.E., Mohammed, M.A. and Hassabo, A.G. Some uses of knitted fabrics in medical field, *J. Text. Color. Polym. Sci.*, - (2024).
8. Al-Minyawi, O.M.A., Mahmoud, M.N.I., Ragab, A.G., Al-Gizawy, A.S.H. and Hassabo, A.G. Smart technology and materials in the clothing industry, *J. Text. Color. Polym. Sci.*, - (2024).
9. Alaswad, M.H., Fiad, N.S., Muhammad, R.R., Muhammad, K., Farghaly, S.T. and Hassabo, A.G. Achieving environmental sustainability using the art of patchwork in contemporary clothing design, *J. Text. Color. Polym. Sci.*, - (2024).
10. Ali, S.M., Ghoneim, E.H.s., Zein El dein, E.A. and Hassabo, A.G. The revolutionary impact of composite materials, *J. Text. Color. Polym. Sci.*, - (2024).
11. Atallah, H.A.A., Saleh, Y.D.M., Glal El-Den, R.E., Abdel Wahab, S.S.M. and Hassabo, A.G. Importance of thermal insulation in sportswear design, *J. Text. Color. Polym. Sci.*, - (2024).
12. Eida, M.A., Soliman, H.S., Alkaramani, M.A., Elbadwy, I.G., Awad, Z.A. and Hassabo, A.G. The impact of modern printing techniques on the attractiveness of advertisements, *J. Text. Color. Polym. Sci.*, - (2024).
13. El-Shafey, F.K., Mohamed, E.L., Fouad, A.M., shamiea, M.M., Elkhayat, A.S. and Hassabo, A.G. The influence of nature on art and graphic design:

The connection with raw materials and prints, *J. Text. Color. Polym. Sci.*, - (2024).

14. Elhawary, D.M., Maghraby, T.M., Elhag, A.E., Romeh, R.M. and Hassabo, A.G. The psychology of color in psychotherapy in psychiatric rehabilitation hospitals, *J. Text. Color. Polym. Sci.*, - (2024).
15. Etawy, M.S., Nassar, G.E., Mohammed, N., Nawar, S.H. and Hassabo, A.G. 4d printing of stimuli-responsive materials, *J. Text. Color. Polym. Sci.*, - (2024).
16. Farghaly, S.T., Alaswad, M.H., Fiad, N.S., Muhammad, R.R., Muhammad, K. and Hassabo, A.G. The impact of fast fashion on sustainability and eco-friendly environment in fashion design world, *J. Text. Color. Polym. Sci.*, - (2024).
17. Fiad, N.S., Muhammad, R.R., Muhammad, K., Farghaly, S.T., Alaswad, M.H. and Hassabo, A.G. Transforming fashion: The influence of technology, smart clothing, and historical costumes, *J. Text. Color. Polym. Sci.*, - (2024).
18. Ghoneim, E.H.s., Zein El dein, E.A., Ali, S.M. and Hassabo, A.G. The impact of technology on jewellery design and manufacturing: Exploring traditional and modern techniques, *J. Text. Color. Polym. Sci.*, - (2024).
19. Mohamed, E.L., Fouad, A.M., shamiea, M.M., Elkhayat, A.S., El-Shafey, F.K. and Hassabo, A.G. A fusion of creativity and technology: The art of design and the role of printing materials in the digital transformation, *J. Text. Color. Polym. Sci.*, - (2024).
20. Muhammad, K., Farghaly, S.T., Alaswad, M.H., Fiad, N.S., Muhammad, R.R. and Hassabo, A.G. Functional design methods for elderly clothes, *J. Text. Color. Polym. Sci.*, - (2024).
21. Saada, M.A., Abdelkareem, S.T., Elemam, Y.A., Subaih, R.A., Elhefnawy, H.I. and Hassabo, A.G. Evolution and importance of materials in industrial design, *J. Text. Color. Polym. Sci.*, - (2024).
22. Saleh, Y.D.M., Jalal al-Din, R.I.M., Abdel Wahab, S.S.M., Atallah, H.A.A. and Hassabo, A.G. Exploring innovative techniques for formation on mannequins: Incorporating optical fibers for aesthetic enhancements, *J. Text. Color. Polym. Sci.*, - (2024).
23. shamiea, M.M., Elkhayat, A.S., El-Shafey, F.K., Mohamed, E.L., Fouad, A.M. and Hassabo, A.G. The psychological impact of color on the recipient through fixed advertising, *J. Text. Color. Polym. Sci.*, - (2024).
24. Subaih, R.A., Elhefnawy, H.I., Saada, M.A., Abdelkareem, S.T., Elemam, Y.A. and Hassabo, A.G. Achieving sustainability within industrial design, *J. Text. Color. Polym. Sci.*, - (2024).
25. Tantawy, R.R., Muhammad, K., Farghaly, S.T., Alaswad, M.H., Fiad, N.S. and Hassabo, A.G. Advancements in 3d digital technology for virtual fashion design and education, *J. Text. Color. Polym. Sci.*, - (2024).
26. Zein El dein, E.A., Ali, S.M., Ghoneim, E.H.s. and Hassabo, A.G. Enamel materials and its relation with jewellery and metal products field, *J. Text. Color. Polym. Sci.*, - (2024).
27. Othman, H., Reda, E.M., Mamdouh, F., Yousif, A.a.R., Ebrahim, S.A. and Hassabo, A.G. An eco-friendly trend of jute fabric in wet processes of textile manufacturing, *J. Text. Color. Polym. Sci.*, - (2024).
28. Elhefnawy, H.I., Saada, M.A., Abdelkareem, S.T., Elemam, Y.A., Subaih, R.A. and Hassabo, A.G. Color theory and semiotics: Exploring the relationship between visual semiotics and color, *J. Text. Color. Polym. Sci.*, - (2024).
29. Maghraby, T.M., Elhag, A.E., Romeh, R.M., Elhawary, D.M. and Hassabo, A.G. The psychology of color and its effect on branding, *J. Text. Color. Polym. Sci.*, - (2024).
30. Romeh, R.M., Elhawary, D.M., Maghraby, T.M., Elhag, A.E. and Hassabo, A.G. Psychology of the color of advertising in marketing and consumer psychology, *J. Text. Color. Polym. Sci.*, - (2024).
31. Yan, X., Olson, N.H., Van Etten, J.L., Bergoin, M., Rossmann, M.G. and Baker, T.S. Structure and assembly of large lipid-containing dsdna viruses, *Nature structural biology*, **7**(2) 101-103 (2000).
32. Whelan, B.M. Color harmony, 2: A guide to creative color combinations, Rockport publishers, (1994).
33. Barsan, V. and Merticariu, A. Goethe's theory of colors between the ancient philosophy, middle ages occultism and modern science, *Cogent Arts & Humanities*, **3**(1) 1145569 (2016).
34. Chijiiwa, H. Color harmony: A guide to creative color combinations, Rockport Pub, (1987).
35. Albers, J. Interaction of color, Yale University Press, (2013).
36. Pile, J.F. Color in interior design, McGraw-Hill New York, (1997).
37. Encarnação, J. Computer graphics education in germany, *ACM SIGGRAPH Computer Graphics*, **28**(3) 193-197 (1994).
38. Fraser, B., Murphy, C. and Bunting, F. Real world color management: Col mgmt realw epub _2, Pearson Education, (2004).
39. Hill, F.J. Computer graphics using opengl, Prentice Hall PTR, (2000).
40. Sharma, G. and Bala, R. Digital color imaging handbook, CRC press, (2017).
41. Wilkinson, R.H. Symbol & magic in egyptian art, Thames and Hudson, (1994).
42. Lesko, B.S. The great goddesses of egypt, University of Oklahoma Press, (1999).
43. Higgs, P. John boardman. Greek sculpture: The late classical period. 248 pages, 247 illustrations. 1995. London: Thames & hudson; 0-500-20285-0 paperback£ 6.95, *Antiquity*, **70**(268) 484-486 (1996).

44. Neils, J. Goddess and polis: The panathenaic festival in ancient athens:[exhibition], (1992).
45. Robertson, I. Understanding international art markets and management, Routledge London, (2005).
46. Huang, S.-S.S. Summoning the gods: Paintings of three officials of heaven, earth and water and their association with daoist ritual performance in the southern song period (1127-1279), *Artibus Asiae*, **61**(1) 5-52 (2001).
47. Harle, J.C. The art and architecture of the indian subcontinent, Yale University Press, (1994).
48. Dehejia, V. Looking again at indian art, Publications Division Ministry of Information & Broadcasting, (1978).
49. Batchelor, D. The luminous and the grey, Reaktion Books, (2014).
50. Eysenck, M.W. Simply psychology, Routledge, (2022).
51. Gage, J. Color and culture: Practice and meaning from antiquity to abstraction, Univ of California Press, (1999).
52. Qi, S., Hua, F., Zhou, Z. and Shek, D.T.L. Trends of positive youth development publications (1995–2020): A scientometric review, *Applied Research in Quality of Life*, 1-26 (2020).
53. Pastoureau, M. Blue: The history of a color, Princeton University Press, (2023).
54. Rublack, U. Befeathering the european: The matter of feathers in the material renaissance, *The American Historical Review*, **126**(1) 19-53 (2021).
55. Bhardwaj, A.K., Garg, A., Ram, S., Gajpal, Y. and Zheng, C. Research trends in green product for environment: A bibliometric perspective, *International Journal of Environmental Research and Public Health*, **17**(22) 8469 (2020).
56. Allan, K. The connotations of english colour terms: Colour-based x-phemisms, *Journal of pragmatics*, **41**(3) 626-637 (2009).
57. Adegbite, A.E. The child care system under the customary law of the yoruba people in southwestern nigeria, (2018).
58. Lancelot Miltgen, C., Pantin Sohier, G. and Grohmann, B. Communicating sensory attributes and innovation through food product labeling, *Journal of food products marketing*, **22**(2) 219-239 (2016).
59. Green, W. and Jordan, P.W. Human factors in product design: Current practice and future trends, CRC Press, (1999).
60. Meng, K., Qian, X., Lou, P. and Zhang, J. Smart recovery decision-making of used industrial equipment for sustainable manufacturing: Belt lifter case study, *Journal of Intelligent Manufacturing*, **31** 183-197 (2020).
61. Bohemia, E., de Bont, C. and Holm, L.S. Conference proceedings of the design management academy.
62. Haydaroğlu, E.Y. A study of colour use electrical domestic appliance, Izmir Institute of Technology (Turkey), (2006).
63. Norman, D.A. and Ortony, A. Designers and users: Two perspectives on emotion and design, Interaction Design Institute, pp. 1-13.
64. Heskett, J. Toothpicks and logos: Design in everyday life, Oxford University Press, (2002).
65. Pheasant, S. and Haslegrave, C.M. Bodyspace: Anthropometry, ergonomics and the design of work, CRC press, (2018).
66. Noble, C. Empowering education through the built environment: Towards a proposed integrated skills development centre for durban, (2014).
67. Berleant, A. and Carlson, A. The aesthetics of human environments, Broadview press, (2007).
68. Singh, S. Impact of color on marketing, *Management decision*, **44**(6) 783-789 (2006).

أهمية الألوان في التصميم الصناعي

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المستخلص:

تلعب الألوان دورا حيويا في الوجود الإنساني ، حيث تنقل المعنى والعواطف. على الرغم من الاختلافات الثقافية ، تخدم الألوان أغراضا متشابهة عبر البلدان ، مما يضيف جماليات ومكانة ودلالات دينية. نمت أهمية اللون في التصميم كلغة عالمية مع التقدم في تكنولوجيا الاتصالات والثورة الصناعية. الهويات المتغيرة للأجهزة المنزلية طوال القرن 20 تسليط الضوء على أهمية اللون في تحديد وضعها. في الختام ، تتوافق أنظمة الألوان مع طبيعة العمل ، حيث تمثل الألوان السوداء والداكنة القوة والأناقة ، وترمز ألوان الباستيل إلى التعاون ، والألوان الزاهية التي تجذب الانتباه ، والأبيض ينقل العقم والنظافة.

الكلمات المفتاحية: نظرية الألوان ، علم نفس الألوان ، عجلة الألوان ، تنسيق الألوان ، تجربة المستخدم ، النغمات الطبيعية.