UNIVERSAL PERCEPTION, CULTURAL INTERPRETATION
A CROSS-CULTURAL COMPARATIVE UX STUDY OF COLOUR PERCEPTION IN AUSTRALIA AND INDIA

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ABSTRACT

This study investigates the strength of correlation between colour categories and emotional or behavioural responses across cultural contexts, focusing on primary (red, blue, yellow) versus secondary colours (green, orange, purple) in populations from India and Australia. Using parallel online surveys, participants from both countries reported their emotional associations and cultural symbolism for each colour. Analysis demonstrates that primary colours have a higher degree of cross-cultural alignment than secondary colours, indicating stronger correlational stability. In contrast, secondary colours exhibit greater variation in meaning, shaped by culturally specific interpretations. These results support the hypothesis that while both colour categories evoke shared emotional responses, the correlation between primary colours and their associated emotions is more robust across national contexts. The findings offer practical guidance for User Experience (UX) designers in global and culturally sensitive colour system design.

Keywords: Primary colours, Secondary colours, Correlational Research, Cultural Relativity, Proportional Divergence

1 INTRODUCTION

This research paper essentially tries to understand the correlational value between primary colours and the universality of the emotional and/or behavioural responses they elicit from people across cultures and similarly for the secondary colours. In today's times when globalisation is leading to universality in almost every sector and industry, finding cultural commonality rooted in biology becomes very important for User Experience (UX) Research.

Colours open an accessible gateway to universal design that can transcend cultural barriers especially in the context of UX. This paper attempts to assess whether primary colours offer a higher consistency in their associated meanings or connotations across cultures as compared to secondary colours making our CORE RESEARCH QUESTION the following: -

"Is there a higher correlational value between primary colours and the emotional or behavioral responses they elicit as compared to secondary colours?"

1.1 Objectives

- Firstly, to analyse whether primary colours and their associated meanings can help us shape the future of Universal Human Design.
- Secondly, to understand how cultural variations in psychological appraisals by individuals affect the way different colours represent different emotions.
- Lastly, to provide UX design reccommendations on when to use colours with universal connotations and when to localize colour choices for culturally diverse users.

1.2 Scope of Research

The main focus is to understand how culture and visual context affect perception of primary and secondary colours and in doing so, the scope spans over the following fields: -

1. Psychology

The research paper heavily incorporates a study of behavioural science and emotional responses to visuals of a colour. It tries to understand how common are the meanings associated with certain colours in different cultural and geographical contexts. The study has also been conducted keeping in mind the biological and societal influences of colour perception on the human mind. However, the paper does not cover any clinical psychological implications like colour therapy, etc.

2. Cognitive Science and Biology

As stated earlier, biology does play an important role when it comes to colour perception. For example, red has always been known to have a warning effect on the human mind due to multifarious reasons like its natural association with fire, blood or injury (Science Focus, n.d.) (Mather, 2020). Moreover, red has the highest wavelength of all the colours meaning it can be seen over greater distances as well. Secondly, the L-cones or the red receptors in our retina are located more centrally in the fovea of the eye, making red a more visually striking colour (Bosten & Boehm, 2015).

Furthermore, evolutionarily, bright colours are associated with danger like in the coloration of animals such as certain poisonous dart frogs, the blue ringed octopus, etc which use aposematism as a predator-warning system of their bad taste and toxicity (Bosten & Boehm, 2015). However, the study is limited to general cognitive-emotional reactions, not neurological imaging or medical-level biological analysis.

3. Cultural Studies

The paper also examines how cultural context influences colour meaning, symbolism, and emotional associations. Societal elements like history, economic status and access due to power have historically affected the way colour is perceived. For instance, the general association of purple to luxury or royalty comes from the fact that in ancient times, even before the renaissance, the colour purple was available in its natural form only as the Tyrian purple extracted from the glands of the Murex snails. The process of

extraction was so difficult that only the rich could afford to use the colour and thus with time it was solely associated with them (Refashioning Renaissance, 2023).

Thus, the paper tries to analyse how cultural context and use of a colour in a certain way can affect the way it is perceived because it is generally agreed upon that while biology sets certain fixed constraints, the environment of an individual determines several of their characteristics (including their perception) within those constraints. However, the paper focuses on comparative patterns across geographical regions rather than deep ethnographic studies of individual cultures.

4. Design Studies

The findings of this paper attempt to stretch across the scope of several design domains including visual design, user experience and interaction design. Essentially trying to understand how colour universality or cultural specificity should inform interface design, branding, and user engagement strategies. Furthermore, it aims to identify when designers should rely on colours with universal emotional connotations versus when local cultural adaptations are required. The scope in this field is though limited to interface design and branding, not material colour science in industrial design.

2 LITERATURE REVIEW

Studies in psychology, anthropology, and design show that colours influence emotion and behaviour, but the consistency of these reactions varies (Ou, Luo, Woodcock, & Wright, 2004). Primary and secondary colours both show stable interpretations across cultures because they correspond to distinct wavelengths that the human eye processes with greater clarity, while also carrying more culturally shaped meanings since they are also learned through social and historical associations. This provides the foundation for examining the degrees to which primary colours and secondary colours elicit universal responses each and then finding the difference between them to prepare a comparative study, particularly for global UX design.

2.1 Existing Theories on Colour Perceptions

1. Basic Colour Term Theory (Berlin & Kay, 1969)

This theory states that certain colours, especially primary ones, appear consistently across languages. The authors describe these colours as having strong focal clarity, supporting the idea of universal emotional responses. In essence, first there is a separation of light and dark, then red, then yellow or green and finally blue. This order is consistent due to the fact that biological human visual systems (cones in the retina, etc) are similar across cultures. This indicates that linguistically at least, primary colours seem to have a greater consistency across cultures as compared to other colours.

2. Opponent Process Theory (Hurvich & Jameson, 1957)

This biological model explains that the visual system interprets colour in opposing pairs such as red versus green and blue versus yellow. Since these processes are physiological, interpretations of basic colours show some universal tendencies.

3. Ecological Valence Theory (Palmer & Schloss, 2010)

This theory argues that people prefer colours based on the objects they associate them with. Since objects differ across cultures, secondary and complex colours vary more in meaning.

4. Universalists Vs. Relativists Theories (Adams & Osgood, 1973)

Universalists argue that colour meanings arise from biological perception, while relativists argue that meaning is culturally constructed. This distinction is central to comparing primary and secondary colour interpretations.

2.2 Gaps in Current Research and Theories

There are several gaps in the current theories and research that this paper attempts to bridge. Firstly, there are no studies that deal with primary and secondary colours separately and attempt to draw a comparative analysis between the two. This research paper, on the other hand, is clearly defining the two as separate variables to draw on their predictability for design.

Secondly, theories like the EVT, OPT and BCTT all explore HOW colour is perceived across cultures but relational studies regarding colour perceptions still lack depth and have not been touched upon. This paper however, clearly tries to quantitatively analyse the relativity or universality of primary and secondary colours separately.

Thirdly, previous theories are based highly on outdated contexts and are West focussed. This paper however, takes India and Australia as the two main focal points, trying to study a greater cultural diversity and taking away the focus from the already deeply studied west.

3 PROPOSED HYPOTHESES

Keeping the literature review in mind, this paper attempts to prove the following hypotheses: -

3.1 Hypothesis 1

The correlation between primary colours and the emotional or behavioural responses they elicit will be stronger across cultures than the correlation observed for secondary colours.

3.2 Hypothesis 2

Both primary and secondary colours will show some degree of shared emotional associations across cultures, but primary colours will demonstrate a higher level of consistency in these shared responses.

3.3 Hypothesis 3

Participants from different cultural backgrounds will exhibit more similar emotional interpretations for colours regardless of whether they are primary or secondary, indicating a stronger cross-cultural alignment for hues.

3.4 Hypothesis 4

Variations in responses to secondary colours will be greater than variations in responses to primary colours, resulting in a lower correlational strength for secondary colours across cultural groups.

4 METHODOLOGY

This paper uses a correlational research design to examine the strength of the relationship between colour categories and the emotional or behavioural responses they elicit across two cultural contexts. Correlational research is appropriate because the variables are not manipulated.

Instead, naturally occurring responses from participants are measured to determine whether the relationships between colours and emotional interpretations are stronger for primary colours than for secondary colours. The aim is to calculate the degree of association between the two variables in each colour category and compare the correlational strength across cultures. For a hypothetical example,

Blue shows the highest association with “X” emotion.
What percentage of Indians agree with the statement?
What percentage of Brits/ Australians agree with the statement?
What is the proportional divergence/similarity?

Orange shows the highest association with “X” emotion.
What percentage of Indians agree with the statement?
What percentage of Brits/ Australians or Brits agree with the statement?
What is the proportional divergence/similarity?

Then, we compare the two results and try to understand whether the primary colour affords a higher correlation between the two elements or a secondary colour.

4.1 Sample Size

Two independent samples were collected, one from India and one from Australia. The sample size for each one was 20 participants making the total sample size 40. Each sample completed an identical Google Form that measured emotional and cultural responses to both primary and secondary colours. The dual-form approach ensured cultural specificity while maintaining question consistency for accurate comparison. Participants represented a general population sample and were recruited organically through personal networks and online sharing.

4.2 Tools Used

Both primary and secondary colours will show some degree of shared emotional associations across cultures, but primary colours will demonstrate a higher level of consistency in these shared responses. Two Google Forms were designed with identical structures and questions. Each form included four sections: -

1. Emotional responses to primary colours,
2. Emotional responses to secondary colours,
3. Use of colour in UX design,
4. Cultural and symbolic associations with colours.

All questions were closed-ended (MCQ or MSQ), in line with correlational methodology and quantitative analysis requirements. Some questions included colour-based image prompts to standardise visual perception across respondents.

4.3 Variables

There are two variables in the study, the dependent and the independent variable: -

1. Independent Vatiable: Colour Category (primary or secondary colours)
2. Dependent Variable: Emotional responses (e.g., calm, happiness, confusion, alertness, sadness, energy). Behavioural interpretations (e.g., danger, celebration, caution). Cultural and symbolic associations (e.g., mourning, auspiciousness, positivity).

The purpose is to determine the correlational strength between each colour category and the consistency of responses across cultures.

4.4 Data Analysis

Correlational analysis forms the core method of interpretation. The study examines: -

- The degree of similarity between Indian and Australian responses for each primary colour and secondary colour.
- The consistency of emotional associations within each culture for both colour categories.
- The comparative correlational strength between primary colour responses and secondary colour responses.

Although statistical correlation coefficients (r values) have not be generated numerically due to categorical variables and responses rather than numerical ones, conceptual correlation has been derived by examining response frequencies, proportional similarity, and cross-cultural alignment in selected options. Patterns that repeat strongly across both cultural samples indicate higher correlational strength.

5 RESULTS AND ANALYSIS

This paper now presents the comprehensive findings from the cross-cultural survey administered to participants in India and Australia, followed by a quantitative analysis of the data to test the four proposed hypotheses regarding the universality and cultural relativity of colour perception.

5.1 Sample Demographics

The study collected a total of N=40 complete responses, comprising two independent samples of N=20 participants, each from India and Australia. This balanced sample size allows for a direct proportional comparison between the two distinct cultural groups.

5.2 Cross-Cultural Consistency in Primary Colour Perception (Hypotheses 1.2 and 3)

Analysis of responses related to primary colors (Red, Blue, Yellow) showed a significantly high degree of proportional similarity in both emotional and functional associations, supporting the biological and universal roots of primary color meaning.

Table 1. Analysis of Primary Colours

Primary Colour	Most Associated Emotion	India (N=20)	Australia (N=20)	Proportional Similarity
Red	Anger	11 (55.0%)	13 (65.0%)	High
Blue	Sadness	9 (45.0%)	8 (40%)	High
Yellow	Happiness	9 (45.0%)	9 (45.0%)	Perfect

Yellow: The association of Yellow with Happiness was statistically identical in both samples (45.0% each).

Red & Blue: The leading emotional responses were consistent, with minimal proportional difference (less than 10 percentage points).

Functional Alignment (Positive and Trust)

Consistency extended into functional domains related to User Experience (UX) and branding, further reinforcing the universal interpretation of primary colors (supporting Hypothesis 2).

Table 2. Analysis of Functional Alignment

Functional Question	Top Response	India (N=20)	Australia (N=20)	Proportional Alignment
Most universally positive	Yellow	19 (95.0%)	14 (70.0%)	Strong Alignment
Trust Most in a Brand logo	Blue	12 (60.0%)	11 (55.0%)	Strong Alignment

Universal Positivity: Yellow was overwhelmingly selected by both groups as the most universally "positive" colour, with a remarkable 95.0% consensus in India.

Trustworthiness: Blue was the top choice for the colour to trust MOST in a brand logo for both groups (60.0% India vs. 55.0% Australia), indicating a globally shared connotation of reliability and security for this hue in UX design, thus supporting the higher consistency for primary colours (H1).

5.3 Cross-Cultural Variability in Secondary Colour Perception (Hypothesis 4)

Responses for secondary colours (Orange, Green, Purple) showed significantly greater proportional divergence when analyzing general and culturally specific associations, indicating that secondary hues are more heavily influenced by contextual and historical factors (supporting H4).

General and Cultural Association Divergence (Green, Purple, Orange)

The consistency for secondary colours was markedly lower than for primary colours across all metrics. The general association for Green showed the largest proportional divergence.

Table 3. Analysis of Secondary Colours

Secondary Colour	Top Response	India (N=20)	Australia (N=20)	Proportional Divergence
Green	Nature	11 (55.0%)	5 (25.0%)	High (30.0% difference)
Purple	Royalty/ Luxury	15 (75.0%)	10 (50.0%)	High (25.0% difference)
Orange	Religious/ Sacredness	6 (30.0%)	4 (20.0%)	Low (10% difference)

Green: The association of Nature with green is highest in both the countries but there is a high difference (30%) in the percentage of people agreeing with it with 25% of Australians and 55% Indians supporting Hypothesis 1 and 2.

Purple: Similarly, the association of Royalty/ Luxury with Purple is highest in both the countries but there is a high difference (25%) in the percentage of people agreeing with it with 50% of Australians and 75% Indians supporting Hypothesis 1 and 2.

Orange: However, in the case of Orange, while the divergence is low (10%) and the highest voted emotion is religious/sacredness across cultures, the overall response for the orange is low and below 50% on both surveys (30% and 20%) in general. This indicates lower agreement on the meaning of orange in both cultures.

5.4 Reversing Emotion-Colour pair for UX Analysis

In this section, rather than giving colours and asking for the emotions associated with it, the survey presents emotions in the context of UX choices that better help in understanding colours associated with certain emotions.

Table 1. UX Analysis

UX Metric	Top Response	India (N=20)	Australia (N=20)
Banking App Interface	Blue	14 (70.0%)	5 (25.0%)
Health and Wellness	Green	13 (65.0%)	9 (45.0%)
Attention Grab	Red	14 (70.0%)	6 (30.0%)
Luxury or Sophistication	Golden (India) Black (Australia)	Golden (9, 45.0%)	Black (7, 35%)

Agreement: Blue, Green and Red all seem to be the top choice for Trust (in banking interfaces), Health and Wellness and Attention-Grabbing (in website banners), respectively. This shows a level of agreement cross culturally regarding the colours associated with certain emotions supporting regardless of them being secondary or primary, limitingly supporting Hypothesis 2.

Divergence: Luxury and Sophistication however, are completely different in the two cultures being represented by golden in India and Black in Australia, demonstrating cultural influence on colour perception supporting Hypothesis 3.

5.5 Cultural and Symbolic Colour Analysis

When it comes to cultural and symbolic questions, they demonstrated the greatest cross-cultural divergence, particularly for ritualistic or emotional concepts like mourning and auspiciousness.

Table 1. Cultural Symbolism Analysis

Cultural Metric	India's Top Response	Australia's Top Response	Proportional Divergence
Auspicious or Lucky	Yellow (6, 30.0%)	Red (5, 25.0%)	Complete Divergence
Mourning or Loss	White (8, 40.0%)	Black (11, 55.0%)	Complete Divergence
Calmness or Peace	White (9, 45.0%)	White (11, 55.0%)	Low (10.0% difference)

Auspiciousness: Different colours are highly associated with auspiciousness in the two countries, Yellow in India and Red in Australia. It can be noted that both the colours are primary.

Mourning: There is diametric divergence when it comes to mourning or loss where in India, White is associated with the concept the most and Australia it is Black.

Peace: However, in the case of peace, there is a higher symbolic similarity and the divergence is low. Both cultures associate white with it the most, suggesting that the achromatic colour's purity and simplicity holds a universally positive association with tranquility.

6 DISCUSSION

This cross-cultural study comparing color perceptions in India and Australia supports a hierarchical model of color meaning: universal cognitive mechanisms dominate primary hues, while cultural relativity shapes secondary, symbolic, and application-specific meanings. These findings refine debates in color psychology and provide practical guidance for global design.

6.1 Contributions to Academic Colour Theory

This research provides quantitative evidence that helps reconcile the universalist–relativist debate in color psychology by identifying where universality holds and where cultural influence dominates.

- Refining Universalism (Primary Colours): Very low divergence (0–10%) in primary color responses supports Basic Colour Term Theory (BCTT) (Berlin & Kay, 1969), confirming that cognitively fundamental hues like red, yellow, and blue show strong cross-cultural stability.

- Relativity Begins with Secondary Hues: Divergence increases significantly for secondary colors (e.g., Green/Nature at 30%), indicating that cultural influence emerges beyond the primary set, where meanings are more open to historical and environmental shaping.

- Cultural Inversion in High-Context Domains: Symbolic and application-specific colors (e.g., mourning, banking trust) show extreme divergence, including complete

oppositions (White vs. Black for mourning), demonstrating that cultural coding can override universal perceptual tendencies.

6.2 Contribution to Practitioner Knowledge and Global Design

The findings offer actionable insights for practitioners in branding, marketing, UX, and interface design across culturally distinct markets.

- **Strategy 1: Universal Cores, Local Shells:** Primary colours provide a stable, low-risk foundation for cross-cultural communication. High shared consensus (e.g., Yellow for positivity, Blue for trust in logos) confirms their value as global functional anchors.

- **Strategy 2: Navigating High-Risk Symbolic Divergence:** Symbolic colours cannot be used interchangeably. Complete inversions (e.g., mourning colours) and EVT-based splits (Palmer & Schloss, 2010) in luxury perception (Golden in India vs. Black in Australia) show that high-context and prestige applications require careful cultural alignment.

- **Strategy 3: The Need for Contextual Certainty:** Differences in consensus levels (e.g., stronger functional colour coding in India vs. lower standardization in Australia) indicate that some markets demand stricter adherence to established colour codes, while others allow greater flexibility.

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