COLOUR ASSOCIATED THERMAL PERCEPTION: MANIFESTATION AND CONTRIBUTING FACTORS WITH REFERENCE TO RED AND BLUE

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Degree of Doctor of Philosophy

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Sri Lanka

June 2014

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Abstract

Theory of colour, a long-established tradition of artists, differentiates between warm and cool colours. The lack of scientific and statistically substantiated knowledge on aforesaid colour associated thermal perception (CTP) deems to hinder its optimum integration in built environment.

Current investigation seeks scientific explanation on manifestation and contributing factors of CTP with reference to a warm colour (red) and a cool colour (blue). Hypothesised potentials of CTP to manifest as a psychological response, a biological response altering core body temperature or an actual thermal sensation caused due to heat radiation emitted via coloured surfaces were tested. A crossover experiment was executed with a sample of healthy, normal sighted, male undergraduates (n=111) selected via stratified simple random sampling (age 19 – 30) using two colour workstations (red and blue) under controlled laboratory conditions.

CTP was rated in a 5- point Likert scale while the induced feelings, emotions and preference to each colour treatment were recorded via a questionnaire survey. Temporal artery temperature (TAT) of subjects and the surface temperature of work stations (SFT) were recorded through infrared thermal monitoring.

Substantiating colour theory, subjects demonstrated a propensity to perceive red as warm/hot (64.2%) and blue as cool/cold (59.3%). As revealed by logistic regression, CTP neither manifests due to a fluctuation in core body temperature nor as an actual thermal sensation. CTP is a psychological response characterised by common as well as colour specific factors. CTP of both red (RTP) and blue (BTP) are statistically explained by the psychological state induced by each colour, pre-conceived learnt ideas influenced by education, and subjects' preference. One's favourite colour and religion are found to influence RTP while age and surface temperature of the applied colour are revealed to influence BTP.

Integration of CTP in built environment to psychologically manipulate the perceived thermal environment against the actual thermal condition to achieve the desirable thermal milieu is highly recommended.

Key words: Colour associated thermal perception, Infrared thermal monitoring, Likert Scale, Temporal artery temperature,

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LIST OF ABBREVIATIONS

Abbreviation	Description
ANSI	American National Standards Institute
AOA	American Optometric Association
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ATS	Actual Thermal Sensation
BBC	British Broadcasting Corporation
BMI	Body Mass Index
BS EN	British Standard European Norm
BTP	Blue colour associated Thermal Perception
BWS	Blue Workstation
CBT	Core Body Temperature
CCR	Correct Classification Rate
CFL	Compact Fluorescent Light
CO	Carbon Monoxide
CSOLRM	Complex Sampling Ordinal Logistic Regression Model
CTP	Colour associated Thermal Perception
DOP	Dermo-optical perception
DV	Dependant Variable
EM	Electromagnetic
FIT	Faculty of Information Technology
FLIR	Forward-Looking Infrared
FOA	Faculty Of Architecture
FOE	Faculty Of Engineering
HSQ	Hypothetical Sub question
INTIDYN	Integrated Tissue Dynamics
IR	Infrared
IV	Independent Variables
LED	Light Emitting Diode
NASA	National Aeronautics and Space Administration

OLS	Ordinary Least Square
PAC	Pulmonary artery catheterization
PMV	Predicted Mean Vote
RGB	Red Green Blue
RTP	Red colour associated Thermal Perception
RWS	Red Workstation
SCENIHR	Scientific Committee on Emerging and Newly Identified Health Risks
TAT	Temporal Artery Temperature
TC	Thermal Comfort
TCP	Town and Country Planning
TP	Thermal Perception
UV	Ultraviolet
V1	Visual area one (Primary Visual Cortex)
V4	Visual area four
WS	Workstation
WWS	White Workstation

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